COVERAGE REQUIREMENTS FOR THE POST-EPS RADIO OCCULTATION MISSION

Christophe Accadia, Peter Schluessel

EUMETSAT

ABSTRACT

EUMETSAT is currently preparing for the next generation of polar satellites with the Post-EUMETSAT Polar System (Post-EPS) activities. Initial requirements have been established for the different missions within the framework of Post-EPS. Among the various candidate missions there is the Radio Occultation (RO) mission, devoted to atmospheric sounding.

The work presented analyses the various possibilities of fulfilment of the coverage requirements of the RO mission in the framework of Post-EPS. The analysis is performed assuming various scenarios from one to eight RO receivers and considering different Global Navigation Satellite Systems (GNSS).

The End-to-end Generic Occultation Performance Simulator (EGOPS) Version 5.2, from the Institute for Geophysics, Astrophysics, and Meteorology, University of Graz (IGAM/UG), Austria, is used to simulate the various RO scenarios and assess the degree of fulfilment of RO mission coverage requirements. The Mission Analysis/Planning (MAnPl) tool, included within EGOPS, allows for the analysis and planning of single LEO satellites and LEO constellations carrying L-band occultations of GPS, GLONASS and simulated Galileo GNSS. This tool has been used as a stand-alone, for assessment of the occultation events coverage and related relevant statistics.

ALADIN INSTRUMENT: DEVELOPMENT STATUS AND PERFORMANCE VALIDATION

Didier Morancais[1], **Frederic Fabre**[1], **Marc Schillinger**[1], **Jean-Claude Barthes**[1], **Martin Endemann**[2], **Alain Culoma**[2]

(1) EADS Astrium, (2) ESA-ESTEC

ABSTRACT

The Atmospheric Laser Doppler Instrument (ALADIN) is the payload of the ADM-AEOLUS mission, which will make direct measurements of global wind fields. It will determine the wind velocity component normal to the satellite velocity vector. The instrument is a direct detection Doppler Lidar operating in the ultraviolet, which will be the first of its kind in space.

ALADIN will be the first instrument to provide direct measurement of wind profiles from space. This complex payload is in its final integration stage and performance validation is well advanced, both for measurement and lifetime aspects. Most of the subsystems have been integrated; the payload performance and qualification test campaign will commence.

This paper describes the ALADIN the development status and the results obtained at this stage. This regards the receiver performance, the telescope development and the challenges of the laser. A special emphasis is placed on the performance consolidation, as expected from space, with regards to the meteorological users requirements.

The ALADIN instrument is developed for the European Space Agency with EADS Astrium Satellites as prime contractor.

FIRST RESULTS OF THE MTG GROUND SEGMENT PHASE A STUDY

Stephan Recher[1], Peter Scheidgen[1], Richard Corkill[2]

(1) VCS Aktiengesellschaft, (2) VEGA GmbH

ABSTRACT

Following successful MOP, MTP and MSG programmes, EUMETSAT is preparing the future geostationary meteorological programme to succeed the MSG series of satellites. The Meteosat Third Generation (MTG) is planned to be operational by 2015. A ground segment must be designed for the new programme. Pre-phase A studies have already established preliminary mission concepts and requirements. Phase A feasibility studies, including this study for the ground segment, will further refine the concepts and analyse trade-offs between alternative options.

The new ground segment needs to be capable of supporting the MTG spacecraft over a period of at least 15-20 years and therefore needs to be designed to be "future-proof". The MTG mission has a number of aspects which make the design of a ground segment more complex than that of previous EUMETSAT geostationary meteorological programmes. For example:

- The MTG spacecraft will be 3-axis stabilised, rather than spin stabilised, which is new for EUMETSAT and leads to increased complexity in spacecraft navigation and imaging stability
- Significantly higher data rates from the spacecraft lead to increased bandwidth requirements for data acquisition, throughput and dissemination. This leads to a requirement for parallel processing and optimal ways to receive, distribute and archive the data. This implies a corresponding processing power for product generation and large archive capacity.
- Mission continuity - in the event of loss of a major facility, it should be possible to not only keep the spacecraft alive but also to continue the provision of meteorological services. This is complicated by the number of active satellites and parallel sensor data streams.
- Impact of coordination with GMES – use of standardised HMA services for data retrieval and a possible Sentinel-4 payload on the MTG platform.

The focus of the study is to critically review the current MTG requirements and concept documents, and existing ground segments, in order to recommend an MTG ground segment concept. Particular emphasis is placed on the identification of critical aspects (focus areas) and the need for flexibility to concentrate analysis on these as required, in order to ensure that the architecture models are optimised and complete as far as possible at this early stage. A key aspect of the work is performing trade-offs, isolating assumptions and open issues, and using these to identify the high level ground segment architectural models.

The study will investigate all elements of the ground segment and conclude on a technically feasible ground segment design which can be developed, integrated and validated within the constraints of EUMETSAT in terms of cost, suitability for purpose, adherence to standards and timescales.

In order to best meet EUMETSAT's study requirements, the study is performed by a European consortium headed by VEGA as Prime Contractor. The main goal is to publish first results of the study to the user community.

THE "BOREAS" CONCEPT FOR IMAGING POLAR WINDS FROM THE IRIDIUM-NEXT CONSTELLATION

Lars Peter Riishojgaard[1], **Dennis Chesters**[2]

(1) JCSDA, (2) NASA

ABSTRACT

The Iridium communications satellite constellation is a swarm of 66 LEO satellites in 11 LEO pole-crossing orbits. Iridium LLC plans a NEXT generation to be launched in 2013-16. Iridium LLC has invited secondary payloads from Earth-observing customers who can use frequent overpasses by nadir-pointing satellites. The impact of satellite-based polar wins data assimilation into ECMWF medium-range weather forecasting has already been demonstrated by tracking water vapor features in successive overpass images from NASA's MODIS instruments. Infrared imagers on Iridium-NEXT could take advantage of the convergence of polar orbits above 60N to provide frequent, real-time cloud-tracked winds operationally in 2015-2030. A design is proposed for a small, robust, pushbroom imager with autonomous attitude knowledge that could be a "bolt and go" secondary payload on the Iridium-NEXT constellation. This "Boreas" instrument would use the Iridium constellation itself to relay of the raw imagery to user ground stations that would navigate the data to "level-1b" quality and extract polar winds from a succession of 3 images. The wind vectors would be sent to in near real-time to numerical weather models, and prevent medium-range forecasts from being "busted" by the effect of otherwise unobserved disturbances in the arctic.

CLOUDDETECTION AND CLASSIFICATION WITH THE VIIRS INSTRUMENT

Ronald Scheirer

SMHI

ABSTRACT

The new Visible/Infrared Imager/Radiometer Suite (VIIRS) onbord the future National Polar-orbiting Operational Environmental Satellite System (NPOESS) and NPOESS Preparatory Project (NPP) will provide new opportunities for the global observation of clouds and their properties.

In order to take advantage of the extended spectral features, the Polar Product System (PPS), an automatic cloud identification system, that was originally designed to process AVHRR measurements, has been adapted to this new task. The concept of dynamic thresholds which is used here, is based on a huge amount of clear-sky radiative transfer calculations under varying conditions.

It will be shown how this pre-launch algorithm should be expected to perform in general. Additionally, potential error sources as well as critical environments will be discussed.

GEO-OCULUS: A MISSION FOR REAL-TIME MONITORING THROUGH HIGH RESOLUTION IMAGING FROM GEOSTATIONARY ORBIT

Ulrich Schull, Thiemo Knigge

Astrium GmbH

ABSTRACT

Geo-Oculus is an independent mission with the objective to enable observations of the Earth so far not feasible with current or planned systems or missions. Among the wealth of EO-activities on European and international level, ESA has identified the lack of the capability for a combination of fast-response, high-revisit, near-real-time and high-resolution observations (e.g. disaster monitoring, algal blooms, and fire detection).

Therefore the Geo-Oculus study performed under ESA contract investigates the user needs and analyses at Phase-0 level the feasibility of an agile satellite in geostationary orbit offering a high to medium resolution (10-200 m) in frequency bands from visible to infrared.

The study starts with a survey of the potential applications and their related product requirements. The identification of the applications covers the political framework in terms of ongoing or future European initiatives, especially the GMES initiative, as well as international treaties and European and national directives, policies and protocols. Synergies with European and international Earth observation systems and missions, like the Sentinels, MTG and EPS are identified and contribute to the identification of suitable applications for Geo-Oculus. The range of applications is chosen to be categorized into four fields of services, the:

- Land Applications, covering all services related to the Earth's solid surface, including the land part of the coastal zones and disaster monitoring;
- Marine Applications, covering the services related to the marine ecosystem, hydrology, oceanography, sustainable exploitation of marine resources and anthropogenic forcing and threat to the environment;
- Traffic and Security at Sea Applications, covering marine operations, natural threat to the citizen and law enforcement related to the oceans;
- Earth Science Applications, covering climate research (esp. role of the ocean), the Earth's radiation budget, monitoring of rapid events and data assimilation.

Based on considerations regarding the "Political Importance", the "Institutional / Non-Profit Importance", the "Commercial Importance" and the "Suitability of Geo-Oculus" a ranking of the applications is provided. Among the most promising candidates are applications such as disaster monitoring including fires, harmful algal bloom detection and monitoring as well as monitoring of erosion and sediment transport on the European shorelines. It is also investigated if Geo-Oculus could be a good system for early warning of heavy rain events by cloud observation hat high resolutions above those available by MSG or later also MTG.

After selection of a set of mission requirements, trade-offs will be performed covering orbit selection, instrument, spacecraft design and ground segment to propose a feasible mission concept.

The main drivers will be:

- The design of a large optical instrument to provide the required resolution on ground. Assuming a satellite position over the equator the resolution decreases signifficantly with higher latitudes of the observed area compared to the resolution at sub-satellite point. At the same time the aperture needs to be limited to a reasonable size (in the order of 1.5 m).
- as well as ensuring the line of sight stability during image acquisition.

A summary of the investigated options and technologies will be given and a possible implementation scenario will be outlined.

MONITORING THE CALIBRATION OF METEOSAT FIRST AND SECOND GENERATION RADIANCE DATA USING HIRS MEASUREMENTS

Bertrand Theodore, Thomas Heinemann

EUMETSAT

ABSTRACT

The archive of METEOSAT first Generation (MTP) and METEOSAT second generation (MSG) images is a unique source of data for long term climate studies. However, a comprehensive and consistent accurate absolute calibration of the observed raw radiances for the 7 satellites from METEOSAT-3 to METEOSAT-8 is necessary to exploit these data effectively. The calibration of METEOSAT images relies either on a vicarious method or, from METEOSAT-7 onwards, on an on-board blackbody. Although these methods have proven successful, calibration with respect to an independent stable reference provides the basis for a normalized calibration. This is a prerequisite for derivation of long-term products from different satellites as well as increasing confidence in the calibration of the individual satellites.

Therefore in the MSG ground segment the operational monitoring of the MSG IR-channel calibration via cross-calibration was implemented in the MPEF environment. To cover also the MTP calibration history, a cross-calibration of MTP IR and WV channels with HIRS measurements has thus been set up in the frame of the EUMETSAT reprocessing project.

This paper will present the details of the MSG and MTP cross-calibration: determination of measurement matchups, impact of clouds on calibration errors, as well as a comparison with the calibration coefficients obtained operationally.

DIAGNOSIS OF THE COLD BIAS OF THE 13.3 ÌM CHANNELS ON GEOSTATIONARY SATELLITE USING GSICS TOOLS

Xiangqian Wu

NOAA/NESDIS

ABSTRACT

Cold bias has been noticed since early 2007 for the 13.3 µm channel, including Channel 6 of Imager onboard GOES-12/13 and Channel 11 of SEVIRI onboard METEOSAT-8/9. The magnitude of the bias, however, varies among researchers at the University of Wisconsin and at EUMETSAT. At NESDIS, we found different bias for different dates. In addition to the magnitude, the cause of the bias is also in question. While uncertainty in spectral response function is suspected, other factors such as radiometric calibration and nonlinearity correction have not been convincingly cleared. With the tools developed for the Global Space-based Inter-Calibration System (GSICS), we now are able to identify the cause and explain the difference among the early results.

VALIDATION OF SURFACE TEMPERATURE RETRIEVALS WITHIN IASI L2 PPF

Thomas August, Tim Hultberg, Xavier Calbet, Peter Schlüssel, Olusoji Oduleye, Arlindo Arriaga

EUMETSAT

ABSTRACT

The surface temperature is one of the physical parameters retrieved by the Infrared Atmospheric Sounding Interferometer (IASI) Level 2 Product Processing Facility (PPF), operated at EUMETSAT. In a nominal mode, this is achieved with an optimal estimation method based on RTIASI as a forward model and climatology as a-priori background. It is initialised with a statistical retrieval.

This product is distributed in a NRT via EUMETCAST on a pixel basis, together with vertical temperature and humidity profiles to support various applications like NWP. This paper presents and discusses the validation of intermediate and final retrieval of surface temperature within IASI L2 PPF, using ECMWF analysis data as well as products from other instruments and possibly in-situ measurements.

STATUS OF OSI SAF SEA ICE PRODUCT DEVELOPMENT

Lars-Anders Breivik[1], **Steinar Eastwood**[1], **Rasmus Tonboe**[2], **Leif Toudal Pedersen**[2]

(1) Norwegian Meteorological Institute, (2) Danish Meteorological Institute

ABSTRACT

The poster gives an overview of the sea ice product portfolio in the OSI SAF. The current operational sea ice edge, concentration and type products will be shortly described. Emphasize will be on results from the on-going development of the products and evaluation of their quality.

This covers:

* Use of ASCAT for ice edge and ice type.
* New ice drift products.
* Regional sea ice using AVHRR.
* Reanalysis of SMMR and SSMI data back to 1978.

ASSIMILATION OF SATELLITE DATA INTO THE ICE-OCEAN MODEL AT THE NORWEGIAN METEOROLOGICAL INSTITUTE.

Lars-Anders Breivik, Ingunn Burud

Norwegian Meteorological Institute

ABSTRACT

Satellite data of sea surface temperature and sea ice concentration are assimilated into a coupled sea ice-ocean model covering the Nordic Seas and Arctic Ocean at the Norwegian Meteorological Institute. Morever, sea ice drift is being derived from satellite data and will also be assimiliated into the coupled ice-ocean model.

The data are assimilated using the SEIK (Singular 'Evolutive' Interpolated Kalman) filter, an ensemble-based Kalman filter developed for sequential data assimilation with large-scale non-linear numerical models. A localized variant of the SEIK has also been implemented which proved to improve the model simulation.

Once validated, this assimilation scheme will be set in operational mode at the Norwegian Meteorological Institute, producing daily forecasts for the Arctic Ocean.

AN ANGULAR AND EMISSIVITY-DEPENDENT ALGORITHM FOR AN ACCURATE DETERMINATION OF SEA SURFACE TEMPERATURE

Raquel Niclos[1], Maria Jose Estrela[2], Jose Antonio Valiente[2], Maria Jesus Barbera[2]

(1) Mediterranean Centre for Environmental Studies (Fundación Centro de Estudios Ambientales del Mediterraneo, CEAM), (2) Mediterranean Centre for Environmental Studies (Centro de Estudios Ambientales del Mediterraneo, CEAM)

ABSTRACT

Sea Surface Temperature (SST) is a key magnitude for climate and meteorological studies. A high-accurate determination of SST would permit a better monitoring of the climate change evolution and also to improve the forecast of natural hazards, such as torrential rain events. The operational algorithms for the determination of SST from satellite do not use the Sea Surface Emissivity (SSE) as input, since the sea surface has been assumed similar to a blackbody surface for years. Only algorithms for the retrieval of land surface temperature include emissivity-dependent terms. However, the variability of SSE within a satellite image, which depends on observation angle and surface wind speed, is similar to the emissivity variation for land surfaces. Therefore, the SST determination can improve taking into account the effect of the SSE variation with angle and wind speed in the SST algorithms, at least for the image sections with large observation angles, for which the SSE differs widely from the unity. An angular and emissivity dependent split-window equation is now proposed with the aim of determining the SST to a reasonable level of accuracy for any observation angle, including large viewing angles at the image edges of satellite sensors with wide swaths. This is the case of the radiometers on board polar-orbiting satellites such as the MODIS or AVHRR/3, with observation angles of up to 65º at the surface, but mainly of sensors such as the SEVIRI on board the geostationary METEOSAT Second Generation. The algorithm takes into account the angular dependence of both the atmospheric correction (due to the increase of the atmospheric optical path with angle) and the emissivity correction (since sea surface emissivity decreases with observation angle). The proposed algorithm requires as input data at-sensor brightness temperatures for the split-window bands (i.e. SEVIRI channels 9 and 10), the observation angle at each pixel, an estimate of the water vapour content and accurate SSE values for both channels. Simple methods are also proposed for the estimate of the required SSE and water vapour content data. Preliminary results using SEVIRI and MODIS data show a good agreement between SSTs estimated by the proposed equation and in situ SST measurements from oceanographic buoys, even for off-nadir viewings, which proves the soundness of emissivity-dependent SST algorithms.

METOP ASCAT SEA ICE EDGE AND TYPE DETECTION

Rasmus Tonboe[1], **Lars-Anders Breivic**[2], **Steinar Eastwood**[2]

(1) Danish Meteorological Institute, (2) met.no

ABSTRACT

Sea ice is a significant climate change indicator. Over the last 30 years the sea ice covering the Arctic Ocean has been reduced dramatically. The ice edge and the ice thickness are the most important parameters. While the edge is detectable with various microwave satellite sensors at different resolution the thickness is not measured systematically by satellite today. However, ASCAT onboard MetOp can detect at least two different thickness categories, i.e. first-year ice and multiyear ice. Here an analysis of ASCAT for sea ice detection is presented. The analysis is focussed on implementation of the scatterometer data into EUMETSAT's OSISAF ice product. The ice products (edge, ice-type, concentration) are in the cases where useful a combination of different data types i.e. microwave radiometers and scatterometers. The data are combined using Bayes probability classification. Initial classification results are presented and compared to satellite SAR.Sea ice is a significant climate change indicator. Over the last 30 years the sea ice covering the Arctic Ocean has been reduced dramatically. The ice edge and the ice thickness are the most important parameters. While the edge is detectable with various microwave satellite sensors at different resolution the thickness is not measured systematically by satellite today. However, ASCAT onboard MetOp can detect at least two different thickness categories, i.e. first-year ice and multiyear ice. Here an analysis of ASCAT for sea ice detection is presented. The analysis is focussed on implementation of the scatterometer data into EUMETSAT's OSISAF ice product. The ice products (edge, ice-type, concentration) are in the cases where useful a combination of different data types i.e. microwave radiometers and scatterometers. The data are combined using Bayes probability classification. Initial classification results are presented and compared to satellite SAR.Sea ice is a significant climate change indicator. Over the last 30 years the sea ice covering the Arctic Ocean has been reduced dramatically. The ice edge and the ice thickness are the most important parameters. While the edge is detectable with various microwave satellite sensors at different resolution the thickness is not measured systematically by satellite today. However, ASCAT onboard MetOp can detect at least two different thickness categories, i.e. first-year ice and multiyear ice. Here an analysis of ASCAT for sea ice detection is presented. The analysis is focussed on implementation of the scatterometer data into EUMETSAT's OSISAF ice product. The ice products (edge, ice-type, concentration) are in the cases where useful a combination of different data types i.e. microwave radiometers and scatterometers. The data are combined using Bayes probability classification. Initial classification results are presented and compared to satellite SAR.

QUALITY OF HIGH RESOLUTION ASCAT WIND FIELDS

Jur Vogelzang, Ad Stoffelen, Marcos Portabella, Anton Verhoef, Jeroen Verspeek

KNMI

ABSTRACT

The Advanced Scatterometer (ASCAT) carried by Metop-A delivers high resolution measurements of the ocean surface vector winds. Level 2 processing is done with the ASCAT Wind Data Processor (AWDP). This software was developed within the Satellite Application Facility for Numerical Weather Prediction (NWPSAF) funded by EUMETSAT. AWDP builds upon the experience gained with the European scatterometers on board ERS-1 and ERS-2 as well as the American SeaWinds scatterometer carried by QuikSCAT.

AWDP features several advanced processing options. In the Multiple Solution Scheme (MSS) the processor retains 144 solutions with their probabilities. The two dimensional variational ambiguity removal (2DVAR) method selects a wind solution that obeys basic physical laws, taking the probability into account. It is known from SeaWinds data that 2DVAR in combination with MSS is effective in removing white noise in the resulting wind field, but at the cost of larger background influence. Since ASCAT has a much more favorable measurement geometry than SeaWinds, ASCAT data are expected to contain less noise. This will affect the error model underlying 2DVAR.

AWDP delivers vector wind fields at resolutions of 25 km by 25 km (operational) or 12.5 km by 12.5 km (experimental). In this paper we will address the quality of the AWDP wind fields. This is done in two ways: a statistical way and by triple collocation. In the statistical approach the properties of the AWDP generated wind fields are studied. Analysis of the autocorrelation of the wind field gives information on the white noise content, while comparison with model predictions yields information on accuracy and bias. In the triple collocation method, the scatterometer winds are compared with simultaneous model predictions and in-situ wind measurements from buoys. If the error characteristics of the in-situ measurements and the model predictions are known, the accuracy of the scatterometer winds can be calculated.

The results of these analyses and their impact on the optimal processor settings will be presented at this conference.

SEASONAL FORECAST AND WATER RESOURCES MANAGEMENT IN THE SAHEL AND SUDAN SAVANNA REGIONS OF NIGERIA.

Ifeoluwa Balogun, Samuel Gbuyiro

Federal University of Technology, Akure

ABSTRACT

West African and particularly Nigerian economy are Agriculture and Water Resources. However, agriculture and available water resources are highly dependent on rainfall. Consequently, in view of the high variability in the onset of rainfall, it cessation, and amount in space, from month to month and year to year, the critical questions frequently asked by agriculturist, water resources managers and other users include "when can we expect the rain to begin, or are we going to have plenty of rain this year? What will be the impact on surface and groundwater water storage?

Rainfall prediction methods in the past for onset and annual estimates have been based on rainfall data alone, Inter Tropical Discontinuity, rainfall models and Pen man methods. All the above methods could not effectively address the problems of seasonal rainfall (e.g. April - October, June – September and July - September periods), which is needed for effective energy and water supply planning.

In the last few years there has been much investigations of the possibilities of forecasting rainfall months to seasons ahead. Most of this work has focused on finding Empirical relationships between rainfall observed at a given time and one or more other variables observed some months earlier. The earliest work focused on relationships between some representation of the El Nino - Southern Oscillation (ENSO) phenomenon and rainfall. Later other variables like North Atlantic Oscillation (NAO) and Equatorial Atlantic Oscillation (EQO) were used.

In this work, rainfall data set was derived from the database of the National Meteorological Service of Nigeria. The data cover the period 1921 to 2005. 18 stations with less than 5% of missing data, which represented as much as possible the greater part of the Sahel and Sudan Savannah regions of Nigeria (two out of the four regions in Nigeria), were used. The Sea Surface Temperatures (Pacific and North Atlantic Oceans) SSTA and SOI's were obtained from the National Weather Service (NWS) of the United States. The methodology involves standardizing both the rainfall and global SSTs; and then computing the correlation between each of the time series in the 2 regions used and the global SSTs. The correlation technique involves both zero and lag correlations.

Result showed that;

1. The SST for Indian Ocean and central Pacific Ocean (called El Nino 3 region) for the month of March/April, April/May and July-Sept can be used to predict the seasonal rainfall (April- October, June – September and July-September) for the two climatic regions.
2. The North Atlantic and South Atlantic oceans SSTs equally showed positive and negative correlations with the seasonal rainfall in the two regions with higher correlation over the Sahel region.

The ability to predict the seasonal rainfall will go a long way in determining the available water and hence effective water resources management - in terms of energy and water supply needs.

SATELLITE-BASED CLIMATE PRODUCTS FOR ALPINE STUDIES WITHIN THE SWISS GCOS ACTIVITIES

Nando Foppa, Andreas Asch, Gabriela Seiz

Federal Office of Meteorology and Climatology MeteoSwiss

ABSTRACT

The Global Climate Observing System (GCOS) was established in 1992 to ensure that the observations necessary to address climate-related issues are defined, obtained and made available to all potential users. Primarily, the GCOS observations should assist Parties in meeting their responsibilities under the UN Framework Convention on Climate Change (UNFCCC), as well as provide the systematic observations needed by the World Climate Research Programme (WCRP) and the Intergovernmental Panel on Climate Change (IPCC).

The Swiss GCOS Office at the Federal Office of Meteorology and Climatology MeteoSwiss has the task of coordinating all climate relevant measurements in Switzerland. This includes both atmospheric and terrestrial measurements. Switzerland has a long tradition in climate observation, ranging from temperature and precipitation series of more than 150 years to glacier measurements since the end of the 19th century. In 2007, the Swiss GCOS Office published the first complete inventory of Swiss climate measurement series. The report also includes an assessment of the future prospects of these long-term climatological data series, as well as international data centres hosted by Switzerland. For each specific climate variable, the role of satellite observations is mentioned, emphasizing the importance of Earth observation data for climate monitoring.

Within alpine regions, satellite data contribute for example to the determination of climate variables such as clouds, radiation, snow cover, glaciers and vegetation properties. The poster will give an overview of satellite products for climate monitoring in Switzerland, covering both research projects and operational services.

GLOBAL CLIMATOLOGIES BASED ON RADIO OCCULTATION MEASUREMENTS BY THE GRAS/METOP INSTRUMENT

Hans Gleisner, Kent B. Lauritsen, Stig Syndergaard, Frans Rubek, Martin B. Sørensen

Danish Meteorological Institute

ABSTRACT

The GNSS (Global Navigation Satellite System) radio occultation (RO) technique utilizes the refraction of radio waves to probe the Earth's atmosphere through satellite-to-satellite limb sounding. The phase delays as a function of time – which is the fundamental observable – can be converted to bending angle, refractivity, pressure, temperature, and humidity as a function of height. Many of the characteristics of RO data suggest them as a near-ideal resource for climate studies, particularly the global coverage, the all-weather capability, and the self-calibrated nature of the data. The latter property should allow for relatively easy inter-comparison of data from different satellites and RO instruments, which is required to construct long time series covering many years and even decades.

The GRAS RO instrument onboard EUMETSAT's polar orbiting meteorological satellite MetOp now provides an opportunity to create RO based climatologies of high quality, adding to data from other RO missions. For these purposes, we are currently undertaking studies on how to best exploit the GRAS RO data, both for construction of an accurate single-source climate data base with known error characteristics of the data and for provision of global climate monitoring.

We present the first climate data derived from GRAS/MetOp measurements within the GRAS Satellite Application Facility. We discuss the relative merits of using standard (pressure, temperature, humidity) versus non-standard (bending angle, refractivity) geophysical variables to produce the climatologies. We also discuss how to estimate the error characteristics – random observational/sampling errors and systematic biases – of the GRAS RO data and their consequences for the construction of accurate climatologies.

RETRIEVAL OF CLOUD TOP HEIGHT FROM SCIAMACHY USING BROAD BAND SPECTROMETERS AND ABSORPTIONS OF O2 AND O4

Michael Grzegorski[1], Tim Deutschmann[1], Ulrich Platt[1], Marloes Penning de Vries[2], Thomas Wagner[2]

(1) University of Heidelberg, (2) Max Planck Institute for Chemistry, Mainz

ABSTRACT

The SCanning Imaging Absorption spectrometer for Atmospheric ChartographY (SCIAMACHY) on ENVISAT allow measurements of different tropospheric trace gases (e.g. NO_2, SO_2, CH_4, HCHO, CO, BrO, H_2O) using the DOAS technique. Cloud retrieval algorithms are essential for the calculation of precise vertical column densities.

This presentation describes the concept, validation and application of the Heidelberg Iterative Cloud Retrieval Utilities (HICRU), which retrieves cloud parameters directly from SCIAMACHY data. The already well-validated HICRU algorithm, which successfully retrieves effective cloud fraction using the Polarization Monitoring Devices from SCIAMACHY and GOME, is extended by a new algorithm, which allows the retrieval of cloud top height. The retrieval of cloud top height is based on the DOAS evaluation of O_2 and O_4 at 630nm. The results of the DOAS evaluation are combined with calculations of the McArtim Monte-Carlo model and the effective cloud fraction retrieved by the HICRU algorithm. The algorithm is validated through intercomparison with other cloud algorithms for GOME and SCIAMACHY as well as cloud information received from other satellite platforms.

PLANS FOR THE REPROCESSING OF METEOSAT IMAGE DATA

Christopher Hanson, Volker Gärtner

EUMETSAT

ABSTRACT

This paper present the medium- and long-term plans for reprocessing of Meteosat First Generation (MFG) and Second Generation (MSG) Level 1.5 image data stored in the EUMETSAT archive. The Level 1.5 image data stored in the archive has been generated almost since the beginning of Meteosat operations in the early 80ties of the last century. The algorithms used to generate the Level 1.5 image data from the raw image data have evolved considerably over the lifetime of the Meteosat missions. Further evolutions of these algorithms can be expected since algorithmic changes are likely to be required to improve the processing quality further. This is necessary to compensate for instrument anomalies or to meet new or modified user requirements. The Level 1.5 image data in the EUMETSAT archive is of significant importance for climate studies. However, its use for this purpose requires that the data have been consistently processed. Hence, periodic reprocessing campaigns, using the latest processing algorithms and sensor calibration information, are essential to ensure that the image data in the archive is of optimal quality.

The first reprocessing campaign for the MFG image data has already taken place. The first reprocessing of MSG image data is planned to start in 2008. The main driver for initiating the reprocessing of MSG image data is the change of the Level 1.5 radiance definition from spectral radiance to effective radiance. This will be introduced during the first half of 2008. This change has to be applied to the whole set of MSG image data in the archive to ensure that the archived data are based on physically correct definitions. Since the MSG image processing algorithms have improved in several respects since the launch of the first MSG spacecraft, this reprocessing will also improve the overall quality of the MSG image data in the archive. An analysis of the results of the reprocessing is also expected to provide new insights into the behaviour of the SEVIRI instrument and will suggest ways to improve the MSG Level 1.5 image processing further.

In the longer term, also another reprocessing of the MFG image archive data is anticipated, both to ensure the optimal quality of the MFG image archive and to ensure a consistent level of processing over the duration of the MFG mission and furthermore between the MFG and MSG missions.

A key aim of these and subsequent image reprocessing campaigns will be to ensure that the reprocessed data is making use of the best available set of sensor calibration data. This effort will greatly benefit from the results of the Global Space Based Satellite Intercalibration System (GSICS) - a project of the WMO – to which EUMETSAT contributes as well.

SYNERGETIC OPERATIONAL EARTH OBSERVATIONS WITH METOP-A

Dieter Klaes

EUMETSAT

ABSTRACT

The Metop-A satellites is the first European contribution to the polar-orbiting part of the space-based global observing system and to the joint European/US operational polar satellite system. Metop-A supports the mid-morning (9:30) orbit, whereas the US continues to cover the afternoon orbit with the NOAA satellites. Metop-A provides advanced observations of temperature and humidity profiles, wind, ozone and other trace gases. The instrumentation of Metop, a judicious balance between continuity of known instruments and novel observations, has a great potential to provide synergetic measurements, which may provide advantages for climate monitoring. Some of the instruments are synchronized (IASI, AMSU, MHS) or co-registered (AVHRR via the Integrated IASI-Imager).

By flying different instruments on the same platform a large potential exits to combine measurements from different instruments and improve products. An example could be Ozone vertical information with GOME/IASI, the combination of IASI/GRAS (high vertical sampling at high accuracy) and others.

The poster will give an overview on the EPS/Metop system and show the synergetic potential of the instruments with an example case.

A SATELLITE BASED REFERENCE CLIMATOLOGY FOR THE SURFACE RADIATION BUDGET

Steffen Kothe[1], **Bodo Ahrens**[1], **Sophie Casanova**[1], **Rainer Hollmann**[2], **Richard Müller**[2], **Helga Nitsche**[2]

(1) Institute for Atmosphere and Environment, Johann Wolfgang Goethe-University, Frankfurt am Main, Germany, (2) Deutscher Wetterdienst, Department of Climate Monitoring, Offenbach, Germany

ABSTRACT

In the framework of the "SAT-KLIM" project, the German Meteorological Service is aiming at the operational use of satellite based data for climate monitoring. In order to prepare an operational monitoring of surface radiation products this study presents the computation of anomalies of the shortwave and longwave components of earth radiation budget at the surface. The fundament for the computation of anomalies is the creation and test of a longtime reference climatology. In the future it is aspired to use products for radiation budget components of the CM-SAF (Satellite Application Facility on Climate Monitoring) at the German Meteorological Service, as basis for this climatology. As long as CM-SAF products are not processed in a sufficient length, the NASA Langley SRB surface radiation budget dataset is used to create a reference climatology and to test different methods. For the characterisation of the anomalies we chose the terzile illustration, which is often used for seasonal predictions. From the more than 20 years radiation datasets an upper and lower terzile is determined for every month of the year. This allows to say that the compared monthly average lies within, above or under these terzile limits. Because of the sampling problem the determination of terziles from a 22 years dataset is afflicted with some uncertainties, as shown with longterm ground station data. For that reason we use a bootstrap technique to determine the 90% confidence intervals of the terziles for every pixel of the investigation area. The developed anomaly product offers the possibility to get a fast survey about the regions where a particular component of the radiation budget of a month is higher, lower or within average. With the help of some examples we show in what way this product could be a useful instrument for climate monitoring.

COMPARISON OF SATELLITE DERIVED SURFACE RADIATION PRODUCTS WITH GROUND MEASUREMENTS

Oleksiy Kryvobok

Ukrainian Hydrometeorological Institute

ABSTRACT

This paper presents the results of a comparison between satellite derived radiation products and ground based measurements of short wave-and long-wave radiation over Ukraine. Ukrainian surface radiation network consists from 15 points of measurements of surface radiation fluxes. They are located in different parts of the country. The standard every day measurements include: - surface incoming solar radiation, albedo; - surface outgoing long-wave radiation, surface net long wave radiation; - surface radiation budget. Surface downward long wave radiation is calculated from surface net and outgoing long-wave radiation. Satellite derived radiation products are SAF's products, which were obtained from Eumetcast dissemination system (OSI-SAF, LSA-SAF) and from DWD archive (CM-SAF). We used OSI-SAF and LSA-SAF product for comparison of simultaneous satellite and ground data and CM-SAF radiation products for comparison between monthly means satellite and ground data. In our analysis we used two radiation products: SIS - surface incoming short-wave radiation; SDL – surface downward long-wave radiation. For comparison analysis we calculate two statistical measures: bias and standard deviation. The analysis shows that average (for all stations) standard deviation for SDL of different SAF's are almost the same and are in the range of 43-45 (W/m**2). For SIS this measures are in the range of 58-60 (W/m**2). So the same radiation products, which produced from different SAF's give the same results over Ukraine. For some stations the comparison results are worth than for other stations. One of the reason is that the equipment does not work properly (it is very old), so ground measurements are not correct. The standard deviation for SIS is higher than for SDL, because clouds are very dynamical in time and space and they have a larger effect on SIS than on SDL. Variations in temperature are less than variation in cloud patterns, consequently variations in instantaneous SIS values are much higher than that of SDL. This leads to a higher value of standard deviation. This effect is reduced if monthly means are compared. The standard deviation is 31.26 W/m**2 and much less than in instantaneous SIS values.

COMPARISON OF SEVIRI-BASED CLOUD FRACTIONAL COVERAGE AND CLOUD TOP PRESSURE WITH SYNOPTIC MEASUREMENTS AND CORRESPONDING MODIS PRODUCTS

Maarit Lockhoff[1], Maximilian Reuter[2], Werner Thomas[1], Ralf Weber[1]

(1) Deutscher Wetterdienst, Offenbach, Germany, (2) Institute of Environmental Physics, University of Bremen, Bremen, Germany

ABSTRACT

The Satellite Application Facility on Climate Monitoring (CM-SAF) is aiming to retrieve satellite-derived geophysical parameters suitable for climate monitoring. CM-SAF started routine operations in early 2007 and provides a climatology of cloud parameters, radiation fluxes, surface albedo, and atmospheric water vapor, temperature and humidity profiles on a regional and partially on a global scale. Here we focus on the validation of cloud products derived from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) on-board the METEOSAT Second Generation (MSG) geostationary spacecraft. The time period studied covers the years 2006 and 2007. Cloud fractional coverage (CFC) products were validated against synoptic measurements, whereas SEVIRI cloud top pressure (CTP) results were compared with corresponding results derived from Moderate Resolution Imaging Spectrometer (MODIS) observations. Bias and Kuipers Skill Score (KSS) are used as quality indicators on pixel basis, while bias and standard deviation are used for the respective monthly mean values with 15x15 km² resolution. Additionally, results of regional bias monitoring of the seasonal variability will be presented. The validation results show that CFC products from CM-SAF agree well with synoptic data over midlatitudes but SEVIRI overestimates the cloudiness towards the edges of the visible earth disk. Furthermore, we found that CM-SAF satellite measurements tend to overestimate the cloud coverage over sea whereas some underestimation is found over land. CTP validation results show that the cloud top pressure is generally considerably underestimated by SEVIRI, i.e. the cloud-top height is higher than that for corresponding MODIS observations. The bias is however remarkably small if only those pixels are analyzed where both cloud masks indicate a fully cloudy pixel. We conclude that a comparison of cloud-top pressure retrievals from different satellite sensors is mainly sensitive to cloud recognition which in turn is a function of spectral sampling, viewing geometry and the ground pixel size.

CREATING SURFACE ALBEDO MAPS FROM METEOSAT-5 IMAGES

Isaac Moradi[1], **Richard Mueller**[2]

(1) Faculty of Geography, University of Tehran, Tehran, Iran, (2) Satellite Application Facility on Climate Monitoring (CM-SAF), DWD, Germany

ABSTRACT

Land surface albedo maps are a prerequisite for describing the properties of the Earth's surface in a variety of research areas such as classifying the ecosystem, studying the radiative properties of the Earth, energy budget studies, general circulation models (GCMs) and hydrological properties of the Earth. The aim of this study was to create albedo maps of Iran from Meteosat-5 images and the method developed during Heliosat project. The irradiance acquired by sensors which are active in visible bands show the reflected radiation by the Earth's surface, clouds as well as atmosphere. The two first parts are more dominant. Solar radiation when impinging the clouds is partitioned into two parts: forward and backward scattering. The backward scattering to the space is dominant and so the clouds are more bright phenomena in the satellite images. The Heliosat method is developed based on this theory. This method computes the reflectance for a time series of satellite images and then sorts the time series of computed albedo. The second reflectance shows, after correction of the clear sky atmospheric reflection, the earth's reflectance for clear-sky. These computations could be in daily, monthly or yearly for a specific times or log-term data. In this study we computed the monthly surface reflectance maps of the country for the year 2004. The retrieved surface reflectances are compared with a relevant map of long-term albedo. The results of the retrieval and analysis are discussed in the presentation.

SAT-KLIM: USING SATELLITE-DERIVED CLOUD PRODUCTS FOR OPERATIONAL CLIMATE MONITORING

Helga Nitsche[1], **Ute Maier**[2]

(1) Deutscher Wetterdienst, (2) Marburg, Germany

ABSTRACT

SAT-KLIM is a programme of Deutscher Wetterdienst to develop and to present operational climate monitoring products derived from satellite data. Based on monthly values the mean state and the anomalies from a long-term reference are calculated. Presently the cloud cover and precipitable water are considered, a product for the surface radiation budget is under development.

For the calculation of monthly anomalies of the cloud cover amount a reference data set for the period 1971-2000 of monthly cloud cover amount on a 0.25x0.25 degree grid was derived from ISCCP- and SYNOP-data in 2003. The two data sets have been examined more closely now with respect to the annual variability. Results of this study will be presented.

In order to characterize the monthly cloud situation better we developed a routine to calculate the number of days as well as the maximum length of the period per month for a daily cloud amount of less than 2 octa (nearly clear sky) or more than 6 octa (nearly overcast sky). The definitions are common in climatology and more adequate to cloud amount than a mean value. Results will be presented and discussed for different input data ("satellite weather", CM-SAF-data, SYNOP).

BULK AEROSOL OPTICAL PROPERTIES OVER THE NORTHWESTERN PACIFIC ESTIMATED BY MODIS AND CERES MEASUREMENTS: COASTAL SEA VERSUS OPEN SEA

Hye-Ryun Oh, Yong-Sang Choi, Chang-Hoi Ho, Rokjin Park

Seoul National University

ABSTRACT

Aerosol radiative forcing may play a significant role in altering regional radiation budget because aerosols have various quantities of optical properties such as single scattering albedo (ω), asymmetry factor (g), and extinction coefficient (Q). The aerosol optical properties differ by region depending on emission and transport of aerosols, so it is difficult to quantify the optical properties that can be representative of specific regions. Since aerosols from East Asian continent transport seaward due to a prevailing westerly wind, the optical properties of aerosols over the coastal sea in the northwestern Pacific should be different from open sea. However the bulk aerosol optical properties over the coastal sea remain unclear. Here we estimate the bulk aerosol optical properties over the coastal and open sea in the northwestern Pacific(110°–180°E and 20°–50°N) by using aerosol radiative forcing efficiency (ARFE, defined as aerosol radiative forcing per optical depth) obtained from Cloud and the Earth's Radiant Energy System (CERES) and the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments from June 2000 to December 2005. A pair of the averaged ω and g in each region is obtained via matching satellite-observed ARFE with simulated ARFE-ω (or ARFE-g) relationship by the Santa Barbara DISORT Atmospheric Radiative Transfer (SBDART) model at both the surface and the top of the atmosphere (TOA). As results, the averaged ω (g) are 0.93±0.02 (0.50±0.20) and 0.95±0.02 (0.56±0.18) over the coastal and open sea, respectively. Both ω and g are the lowest in spring, while the values are the highest in summer.These results imply that more solar-absorbing aerosols are included in the atmosphere over the coastal sea than the open sea, particularly in spring. The aerosol radiative forcing for the northwestern Pacific with regard to the coastal sea is stronger by approximately 3.0 (0.9) W m^{-2} at the surface (TOA) than that without regard to the coastal sea. The present method applying satellite data provides a convenient solution to estimate regional and/or global aerosol optical properties, and to quantify the direct effect of aerosols on the Earth's energy budget.

FIRST RESULTS OF METOP-DERIVED SURFACE BROADBAND ALBEDO FROM THE CLIMATE-SAF PROJECT

Aku Riihelä[1], Karl-Göran Karlsson[2], Terhikki Manninen[1]

(1) Finnish Meteorological Institute, (2) Swedish Meteorological and Hydrological Institute

ABSTRACT

Surface albedo is one of the most important physical quantities related to the study of climate and its change. It controls Earth's radiation budget and its changes have a key role in the positive feedback loops evident in the recent record melting of the Arctic sea ice during summer months. Both the immediate and the long-term monitoring of surface albedo on a global scale require satellite observations, the most viable method of collecting surface albedo data on a large temporal and spatial scale. Geostationary satellites such as the Meteosat-series cover the equatorial regions, but coverage of the vulnerable Arctic and Antarctic require satellite observations from a polar orbit. The new MetOp satellite answers this need, carrying among others an AVHRR legacy instrument well suited for surface albedo observations.

The purpose of this study is to demonstrate the capabilities of EUMETSAT's Climate-SAF project in producing high quality products from MetOp in the near future. Climate-SAF is expanding its area coverage to include the Arctic regions; MetOp and NOAA's polar satellites will combine forces to provide contemporary surface albedo data to help predict the consequences of climate change in the high latitudes. A scientific goal in this study is to analyse the first MetOp-derived surface albedo data against Meteosat-derived surface albedo products from both Climate-SAF and Land-SAF. This analysis could aid in the validation of both MetOp's AVHRR instrument calibration and the quality of the Meteosat-derived products.

Preliminary MetOp albedo swaths are first compared with corresponding Meteosat data to determine whether there are any systematic inaccuracies between the products. Ground truth data from reliable ground stations in Europe is then used to analyse the MetOp product quality further. Climate-SAF product quality standards demand a relative accuracy of 25% for its surface broadband albedo products. First results of the study against ground station data at Lindenberg meteorological station showed the ground truth albedo to be 19.3%, whereas the MetOp-derived surface albedo was 21.7%. These results indicate that the MetOp-derived surface albedo satisfies this requirement, although more ground truth data is required from other stations to verify this.

More research is needed to verify the quality of MetOp's surface albedo product, but the results appear promising. Should additional data confirm the first results, Climate-SAF will be prepared to fully begin exploiting MetOp in the future. The increased coverage in the Arctic regions will be of significant scientific importance to the climate science community and in the future, therefore studies on the quality of MetOp as a data provider are required.

DIURNAL CYCLE AND SPATIAL DISTRIBUTION OF OUTGOING LONGWAVE RADIATION IN THE (SUB)TROPICS AND THE DEPENDENCE ON DEEP CONVECTION AND HUMIDITY

Marc Schroeder[1], Marianne König[2], Johannes Schmetz[2]

(1) Deutscher Wetterdienst, (2) EUMETSAT

ABSTRACT

There is a controversial and ongoing discussion about the link between deep convection, water vapour transport into the upper troposphere/lower stratosphere, and the combined net effect on outgoing longwave radiation (OLR) and related physical processes. We analyse the spatial distribution and the diurnal cycles of deep convection, upper troposheric humidity (UTH), and OLR over the tropics and subtropics in June 2006 and utilise SEVIRI and GERB observations, both onboard Meteosat-8. Convective activity is defined by BT10.8<230 K. UTH and OLR are retrieved following EUMETSAT, 2007 and Harries et al., 2005, respectively. Diurnal cycles are determined as domain averages, on pixel basis and as function of distance to nearest convection. The analysis further separates pixels affected and unaffected by deep convection.

Pronounced minima in the spatial distribution of OLR correlate with maxima of convective activity and orography. The analysis of OLR also shows distinct diurnal cycles over coastal areas and lakes, in agreement with osbervations related to deep convection. The domain average diurnal cycle of OLR exhibits a maximum at 12:30 LST. While the maximum of the diurnal cycle stems from the observations over land surfaces, the average level of the diurnal cycle is dominated by ocean pixels. The effect of deep convection on the domain average diurnal cycle is of minor relevance (~2% or ~5.3 W/m^2).

In the tropics maxima of UTH correlate with minima of OLR, in several regions in conjunction with orography and maxima of convective activity. UTH and OLR exhibit an exponential decrease, respectively increase, with distance from nearest deep convection. The time shift between the maximum of the diurnal cycle of convective activity and of UTH is ~4 hours and increases with increasing distance from convection. Furthermore, minima of OLR occur at later times of the day with increasing distance from deep convection, with very similar temporal sequence as it is observed for the maxima of the diurnal cycle of UTH. The release of water vapour into the upper troposhere / lower stratosphere by deep convection leads to a traceable signal in OLR that vanishes at a distance of ~700-1000 km.

ESTIMATION OF ATMOSPHERIC RADIATIVE HEATING RATES WITH SEVIRI-DATA

Oliver Sievers

Deutscher Wetterdienst

ABSTRACT

Since the presentation of the concept of available potential energy (APE) some 50 years ago, this term is known as the only source of kinetic energy which quantifies atmospheric dynamics. Generation of APE, on the other hand, is linked to increasing temperature differences caused by differential diabatic heating rates. Besides conversion of latent heat, radiative heating is the dominating term on the global scale.

APE and its source terms are dependent on global mean values over isothermal surfaces, for which satellite observations are essential to estimate either APE or its source terms. To detect fast changes, geostationary satellites have to be used. 20 Years ago, the possibility of using METEOSAT first generation for these estimations was investigated by Smith and Stuhlmann. Based on this, a similar approach is presented here for the METEOSAT Second Generation.

For a huge set of atmospheric conditions, radiative heating rates in three altitude levels were simulated with a radiative transfer model. The corresponding measurements of SEVIRI channels were simulated as well. A neural network is used to link these two vectors. The narrowing to three levels only is due to the known limitations of the passively sensing SEVIRI instrument with regard to vertical sounding.

Two main fields of application can be identified. On the one hand, the radiative heating rate alone is an important value for climate applications. On the other hand, the estimation can be combined with other products such as stability indices to get a nowcasting application. The presentation shows the method, achieved accuracy, shortcomings of the method and some examples of implementation.

LIFE CYCLE OF CONTRAILS: CONTRAIL TRACKING FROM MSG DATA

Margarita Vazquez-Navarro, Hermann Mannstein, Bernhard Mayer

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)

ABSTRACT

A new method of contrail tracking has been developed. The method is based on the Meteosat Second Generation (MSG) rapid scans and on a combination of MSG infrared channels, so it can be used at day and nighttime. The tracking is automatic and uses as input the result of a contrail detection algorithm run, for instance, on a polar orbiting satellite dataset. The method allows us to study, throughout its life cycle, the evolution of a number of MSG data-retrieved physical and radiative properties of the contrail, such as: temperature, optical depth, outgoing radiative flux density. It is, thus, a very useful tool to assess the impact of such anthropogenic cloudiness in the climate system.

THE SATELLITE CLIMATOLOGY OF SOUTH FOEHN EVENTS IN CARPATHIAN MOUNTAINS IN THE PERIOD 1999 - 2007

Artur Widawski

University of Silesia Faculty of Earth Sciences

ABSTRACT

The Aim of this paper is to present the temporal and spatial dynamics of different weather elements connected with south foehn in Carpathian Arc using AVHRR (NOAA) and MODIS (TERRA, AQUA) satellite information. Lee cloudiness, stau cloud, orographic cirrus and foehn gate were detailed analysed. The spatial distribution of those elements were calculated from satellite image day by day. Such analyses were compared with in situ synop observations (GTS) for precise results. The maps of temporal and spatial distribution of analysed cases in all period 1999 - 2007 for all Carpathian Arc will be presented as the result. The same maps will be presented for each year or different season or day. The sequence of analysed satellite images were computed by GIS software for the best results.

QUANTIFYING THE IMPACT OF CLOUD HORIZONTAL INHOMOGENEITY ON SATELLITE CLOUD PHASE CLIMATOLOGY USING SEVIRI AND MODIS DATA

Erwin Wolters, Hartwig Deneke, Jan Fokke Meirink, Rob Roebeling

Royal Netherlands Meteorological Institute

ABSTRACT

The effect of clouds on the Earth's radiation budget is partly determined by their thermodynamic phase. Therefore accurate and spatially continuous information on cloud phase is of key importance for climate monitoring. The accuracy of cloud phase retrievals from satellite is reduced if clouds are broken or horizontally inhomogeneous. This presentation quantifies the effect of cloud horizontal inhomogeneity on a cloud phase climatology from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) onboard METEOSAT-9, using high spatial resolution cloud phase retrievals from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Terra satellite.

Visible and near-infrared (0.6 μm and 1.6 μm) spectral channel reflectances from MODIS and SEVIRI are used to prepare three-month cloud phase climatologies over Europe applying an updated version of the Cloud Physical Properties algorithm (CPP).

This presentation addresses three research questions. First, the relative occurrence of horizontal cloud inhomogeneity for SEVIRI over Europe and the effect on the obtained SEVIRI cloud phase climatology using CPP is evaluated, using different cloud phase climatologies for overcast cloud fields with stepwise increasing horizontal heterogeneity. Second, the relative contribution of broken cloud fields to the SEVIRI derived cloud phase climatology is estimated by including non-overcast cloud flagged pixels into the cloud phase climatology datasets, using the MODIS fine resolution cloud phase climatology as reference. Finally, we quantify the impact of total horizontal inhomogeneity and broken cloudiness on the Earth's radiation budget calculations. This quantification will be obtained from regional climate model runs with the SEVIRI cloud phase climatology derived from both homogeneous overcast clouds and all clouds.

SEPARATION MAINLY LIQUID-DROP FRONTAL CLOUDS FROM MIXED CLOUDS GIVING PRECIPITATION (BASED ON RADIOMETRIC SATELLITE DATA)

Vladimir Bakhanov, Oleksiy Kryvobok, Boris Dorman

Ukrainian Hydrometeorological Research Institute

ABSTRACT

The paper is devoted to: 1) the consecutive numerical simulation of the satellite signal (or cloud reflectance (CR) of solar radiation) for mixed frontal clouds ; 2) the improvement of the separation mainly liquid-drop from nearly ice mixed clouds using multispectral radiometric data.

The simulation is based on the next models: 1) the realistic microphysical model of mixed stratiform clouds with several crystal forms; 2) algorithms of optical characteristic calculations for drops (based on the Mie theory) and crystals (based on the geometric optic approximation); 3) the discrete ordinate method for simulation of the solar radiation transfer in a not uniform cloud. Computations were realized for the wave lengths: 0.55; 1.6; 3.6 mkm (corresponded to channels of the AVHRR radiometer).

Simulation depicts that if the cloud top temperature T(ctt) < - 30… -35 grad C in most cases nearly ice clouds are formed. These clouds give substantial precipitation. If T(ctt)> - 25 grad C in most cases mainly liquid-drop clouds are formed with great values of the liquid water content (LWC). Rations of the cloud optical thickness (COT) values in the channels 1.6 and 0.55 mkm correlate with the ratios of liquid water content to ice content in a cloud.

Calculations also depict that diapasons of COT values and CR values almost do not overlap for mainly liquid-drop and nearly ice clouds with the high cloud top. So for these clouds it is possible to use more simple criteria for separation liquid-drop clouds from clouds giving substantial precipitation. If T(ctt)> -25 grad C diapasons of COT and CR substantially overlap for mainly liquid-drop and nearly ice clouds. Therefore in this case it is necessary to use more informative parameters: simultaneously determined values of COT and effective dimension of cloud particles.

The results of the numerical simulation were used for the development of the procedure of the COT and cloud particle effective radius retrieval (from observed CR values in the channels 0.6 and 1.6 mkm) and for the development of the procedure of separation nearly liquid-droplet clouds from clouds of highly crystallization and precipitation. Some examples show that our separation procedure gives results corresponding to ground-based precipitation data.

VALIDATION OF THE MULTI-SENSOR PRECIPITATION ESTIMATE (MPE) PRODUCT OVER TURKEY

Fatih Demir, Ibrahim SONMEZ, Erdem ERDI, Ahmet Emre TEKELI, Hakan KOCAK

TSMS Remote Sensing Division, 06120 Kalaba Ankara TURKEY

ABSTRACT

For the researchers, the limited spatial and temporal resolutions of the precipitation observations from ground observation sites have been a challenging issue for a long time. Denser observation networks are designed and deployed to overcome such limitation as part of the solution. Significant improvement was obtained with the availability of the derived precipitation products from satellite data. From this point of view, satellite observations are promising to fulfill the spatial and temporal gaps of the ground observation systems.

Multi-sensor Precipitation Estimate (MPE) product is released by EUMETSAT's MPEF (Meteorological Product Extraction Facility) by using a blending technique to combine geostationary IR data of METEOSAT and the polar orbiting DMSP satellite's microwave data of Special Sensor Microwave/Imager (SSM/I). SSMI/I and METEOSAT dataset are used to derive look-up tables to correlate the brightness temperatures and the rain rate amounts. Currently, MPE product within the METEOSAT (at 0 Degree) full disc cover area is available via EUMETCast.

In this study, MPE products are validated by using 204 automated weather observing sites (AWOS) concentrated on the western part of Turkey. December 2006-April 2007 time period is considered for the comparison. In the first part of the study, the MPE product is validated by considering zero/non-zero rainrate amounts. Secondly, the validation is performed by considering the rain rate intensity by using contingency tables. In additional to time domain, the performance of the product is validated in spatial domain as well to be able to examine the product validity with varying geographical conditions.

COMBINED USE OF MSG IMAGES AND PRODUCTS AND OTHER DATA FOR OPERATIONAL FORECASTING AT INM-SPAIN: APPLICATION TO FOG AND IN-FLIGHT AVIATION

Jose Miguel Fernandez Serdan

INM

ABSTRACT

For many years forecasters could only use Meteosat images (IR, VIS, WV). MSG is providing new channels, and many products are now available to the meteorological community, as those in the Satellite Application Facility in support to Nowcasting (SAFNWC). But in order to have these actually used, it is important to both propose them in an attractive way, and to be able to determine adequate field-oriented displays and products.
A real-time visualisation combining Cloud Type (CT) product, IR window channel, and in-situ observations, has proven at INM to be useful to monitor and nowcast fog coverage. At twilight when CT performs worse, channel-differences are also displayed. As the vertical description in the CT is too coarse, the introduction of Cloud Top Temperature and Height (CTTH) SAFNWC product to refine description of the layer of potential fog, is being studied.

Observation of phenomena affecting in-flight aviation, as icing, is always a challenge: no or no distribution of aircraft reports over Europe, no products like cloud-water phase already proposed by the SAFNWC. Focusing on icing, at INM a well known product developed for GOES (ICECAP), has been adapted to MSG and is displayed to aviation forecasters, with addition of CTTH, CT and NWP information. The product is kept close to the ICECAP (checked where both satellites overlap, in the Atlantic), which is shown in the web with coincident observations over the USA: this has allowed to set-in some indirect, subjective verification method (the goal is of course, to get those icing reports over our region).

Fog and icing examples, and icing verification results, will be shown in the poster.

MSG PRODUCTS IN THE EUSKALMET SURVEILLANCE PANEL

Santiago Gaztelumendi, Kepa Otxoa de Alda, Roberto Hernandez, Joseba Egaña, ivan R. Gelpi

EUSKALMET - EUVE

ABSTRACT

In Basque Meteorology Agency (EUSKALMET) we have a lot of information available for Basque country area coming from different systems (Meteosat, Radar, AWS, Wind Profiler …) and from external sources (mainly internet). With this information we generate several products in real time basis for surveillance purposes.

One of the most important applications of Meteosat data in EUSKALMET is weather surveillance and monitoring in severe weather cases, especially in heavy precipitation events. In our case, an effective technique for operational surveillance, is the real time monitorization of weather elements for human consideration. For this purpose, the most relevant monitoring tool available in EUSKALMET office is the so-called “visualization panel” (or “surveillance panel”). This panel is a Display Wall of 10 meters broad by 3 meters high, conformed with 16 DLP Mitsubishi Display Wall.

In this paper we present how MSG information is included into the system and the intranet for different purposes. Information coming from the METEOSAT system is presented in different ways and combined with other information available in the Basque Country area, mainly with the automatic weather station network and Kapildui Doppler weather radar.

The system has diverse monitoring capabilities. All information is showed in real time. Several graphical outputs have been specially designed for qualitative use and to improve monitoring of severe weather scenarios.

THE USE OF SATELLITE IMAGERY IN FORECASTING AND ANALYZING INSTABILITY WITHIN TROPICAL AIR MASSES AND FRONTAL INSTABILITY IN ROMANIA

Florinela Georgescu, Gabriela Bancila, Viorica Dima, Doina Banciu

National Administration of Meteorology, Bucharest, Romania

ABSTRACT

The summer of 2007 has been featured by an unusual frequency of the tropical air invasions that resulted in periods of extremely high temperatures and a record for the absolute high temperature in the month of July. These periods have been followed by short episodes of severe atmospheric instability. Such an event occurred between 10 and 12 of July, when the atmospheric instability affected the entire country and the heavy rains, strong winds and suddenly floods produced damages particularly in the eastern part of the country. Using satellite imagery products, three stages of this episode were pointed out and analyzed:

1. the existence of a tropical origin air mass over the Romanian territory
2. instability within the tropical air mass (deep convection associated with heavy rainfalls and wind gusts)
3. frontal instability.

There have been picked out satellite imagery products from EUMETSAT (METEOSAT 9), that are usually used at the operational service of National Administration of Meteorology (WV 6.2 - channel 5, IR 10.8 - channel 9 - enhanced, RGB Composite (Air mass RGB) WV 6.2 – WV 7.3, IR 9.7 – IR 10.8, WV 6.2; RGB Composite WV 6.2 – WV 7.3, IR 3.9 – IR 10.8, NIR 1.6 – VIS 0.6 and RGB Composite IR 12.0 – 10.8, IR 10.8 – IR 3.9, IR 10.8), to monitor the convection processes (day and night time), the behavior of the atmospheric fronts and to identify the air masses origin.

The manner of using the satellite products to issue nowcasting warnings for severe meteorological phenomena (thunderstorms, hail, wind gusts) was especially focused in this paper.
Soundings, radar imagery and also outputs of a limited area numerical model (ALADIN) were used to validate the reasoning.

COMBINATION OF RADAR PRODUCTS WITH METEOSAT-9 IMAGERY

Roberto Hernández, Santiago Gaztelumendi, Kepa Otxoa de Alda, Iván R. Gelpi, Joseba Egaña

EUSKALMET - EUVE

ABSTRACT

This paper shows a first try to combine radar products and Meteosat-9 imagery for meteorological surveillance and nowcasting purposes at Basque Meteorology Agency (Euskalmet).

In this work an intensive use of meteorological satellite and radar data is done. We use different products from Kapildui radar data, a METEOR 1500 Doppler Weather Radar with Dual polarization capabilities operating in C-band, in combination with different Meteosat-9 channels.

A simple loop of the Radar Plan Position Indicator (PPI) - IR Channel composition for itself is a valuable tool to get a general survey of a precipitation event. The combination with other radar products offers to the forecaster additional information for a better interpretation. For example, the echotop heights (ETH) and the vertically integrated liquid (VIL) content delimit the convective development maximum and areas of heavy precipitation associated to deep convection, respectively.

The synergies between both sources of information also are shown useful in order to find spurious echoes in weather radar imagery. As daily routine the compositions are inspected to get an expertise of radar errors. Some examples of clutter detection are given.

The new derived products and diagnosis images are part of the Surveillance Panel installed at the Euskalmet's office, a Mitsubishi's Display Wall Cube monitoring hidrometeorological information in real time.

A CATASTROPHIC FLOODING IN SLOVENIA AND THE BENEFIT OF ADVANCED NOWCASTING PRODUCTS

Mateja Irsic Zibert

Environmental Agency of the Republic of Slovenia

ABSTRACT

A case of 18 September 2007 with catastrophic flash-flooding in Slovenia is presented in detail. The flooding appears to be due to pre-frontal stationary convection with local maximums of precipitation in excess of 400 mm in 24 hours. The event caused great damage on property including loss of life.

Due to flash floods in mountainous regions of Slovenia which are a typical response to large amounts of precipitation in a very short time, it is very important to recognize accurately the time of maximum intensity of precipitation and the start of the flooding. The events are of relatively short duration and this is why advanced nowcasting tools are so important. It is in principle not yet possible to quantitatively accurately forecast such heavy precipitation with the current operational NWP models (e.g. ECMWF, ALADIN, etc.). There had been only indications that the precipitation accumulation of more than 100 mm/24h wass probable. This makes nowcasting and monitoring of the atmosphere in such situations even more important.

The paper presents the operational nowcasting tools and products that were available to the forecaster on the day of the flooding , together with some tools and products that were implemented after the “September case” and are now already incorporated in the operational or pre-operational chain (INCA, NWCSAF products, cold-ring features, etc.).

It is important to emphasise the importance of all remote sensing data (satellite, radar and lightning data) as well as automatic measuring stations to support the decision process of the warnings issued by the forecaster on duty as well as the monitoring and verification of the forecasted and nowcasted scenarios in this and similar situations. There is a high demand to continuously develop and upgrade the existing nowcasting tools because of such extreme cases as the one analyzed here.

ANALYSIS OF THE QUALITY OF NWC SAF CLOUDS MASK USING STANDARD SURFACE OBSERVATIONS IN POLAND

Bozena Lapeta, Monika Pajek, Danuta Serafin-Rek

Institute of Meteorology and Water Management

ABSTRACT

The standard surface measurement network (SYNOP) provides detailed however, localised information about the cloud cover. On the other hand, the satellite data provide the continuous information on the state of the atmosphere for much larger area. Geostationary meteorological satellite METEOSAT-8 and 9 with the excellent temporal resolution as well as with well suited spectral channels of SEVIRI instrument is a useful source of the information about cloud cover.

The paper presents the work aimed at the validation of the cloud mask derived from MSG/SEVIRI data with the use of the NWC SAF software in Poland. The total cloudiness amount obtained from satellite data for each Polish synoptic station was compared with the simultaneous surface observation. The analysis was performed for three hourly SYNOP observations and for 50 stations. The preliminary results show a good coherence of satellite derived cloudiness with ground observations for the day time conditions and reasonably worse during night time and twilight. During night, especially in winter conditions, the cloudiness can be grossly overestimated by the satellite. Detailed comparative analysis will be shown in the paper. Moreover, the results of the clouds' mask quality for different regions (lowlands, mountains and sea shore) as well as in presence of snow and fog will be presented.

THE USE OF SURFACE EMISSIVITY INFORMATION WITHIN THE METEOSAT SECOND GENERATION METEOROLOGICAL PRODUCT GENERATION

Hans-Joachim Lutz, Marianne König

EUMETSAT

ABSTRACT

The knowledge of the surface emissivity is an important condition for all IR radiative transfer (RT) calculations and thus important for all satellite products that are based on RT calculations. A variety of the Meteosat Second Generation (MSG) algorithms use techniques which are based on the RT results, e.g. the cloud and dust storm detection, the active fire monitoring, the derivation of instability indices, and of total columnar ozone content. Emissivity information has been derived from the University of Wisconsin - CIMSS global infrared land surface emissivity database with its high spectral and high spatial resolution. This data has been re-mapped in space and spectra to the Meteosat-8/9 SEVIRI channel definition. This poster presents the inclusion of the emissivity information in the product generation process, and its impact on the final products.

DETECTION OF LIGHTNING INITIATION USING GEOSTATIONARY SATELLITE DATA

Wayne Mackenzie, Christopher Siewert, John Mecikalski

University of Alabama in Huntsville

ABSTRACT

Lightning is well known as one of nature's deadliest forces, and prediction of lightning has been fairly limited. Our goal is to use geostationary satellite data from GOES-12 to determine what satellite signatures in growing cumulus lead to lightning initiation (LI), or the first occurrence of lightning within a storm. Mecikalski and Bedka (2006) showed that convection initiation (CI) can be forecasted within a 0-1 timeframe using GOES infrared (IR) fields. The techniques used in that study may also have uses in the study of LI as well on similar 0-1 h or 0-90 min timescales. Recent research has shown that LI exhibits similar signatures to CI in GOES-12 and recently in MSG data. Utilizing channel differences from GOES IR including 6.5-10.7 um and 13.3-10.7 um, as well as their trends and cloud top cooling rates, has yielded promising results that predicting LI may be possible. Our search for a new channel difference that could be used on the current GOES platform to further separate LI and CI has led us to the 3.9-10.7 um indicator, which can provide information into cloud top thermodynamic phase. Correlation analysis over four cases in North Alabama/South Tennessee USA, in which co-located GOES-12 and the University of Alabama in Huntsville (UAH) Northern Alabama Lightning Mapping Array (NALMA) ground-based VHF "total" lightning mapping system, has provided this study an unique data base from which to develop key IR-LI relationships. This is especially the case for rapidly growing cumulus on their way towards a thunderstorm. New research is focusing on use of MSG (as well as MODIS in a non-time dependent way) to capitalize on the abilities of added IR channels. With the new ability to detect cloud phase in developing cumulus (Rosenfeld et al. 2008), along with updraft strength and width from other IR channel fields, work is proceeding to determine how accurately LI may be predicted up to 1 hour in advance. The ability to predict LI from a geostationary satellite will provide forecasters with a high temporal and spatial tool for decision-making processes, and a strong EUMETSAT-UAH collaboration will help develop these capabilities over Europe.

USE OF MSG/SEVIRI IN THE WMO SAND AND DUST STORM WARNING SYSTEM (SDS-WS) FOR EUROPE, NORTH AFRICA AND MIDDLE EAST

Miguel Angel Martinez, Juan Ruiz, Mercedes Velazquez, Emilio Cuevas, Gabriela Cuevas

INM (Instituto Nacional Meteorologia)

ABSTRACT

Sand and dust storms represent serious natural hazards, causing numerous negative impacts on aviation safety, health, ground transport, agriculture and climate. Therefore, the World Meteorological Organization (WMO) has established the Sand and Dust Storm Warning System (SDS WS) to improve the capabilities for more reliable sand and dust storm forecasts and monitoring. The main objective of this project is to establish a WMO-coordinated global network of SDS forecasting Centres, which will deliver useful products to a wide range of users in order to reduce the impacts of SDS. Spain is implementing the WMO SDS WS Regional Centre for Europe, North Africa and Middle East. This Regional Centre will deal with both operational and scientific aspects related to atmospheric dust monitoring and forecasting. SEVIRI (Spinning Enhanced Visible and Infrared Imager), on board Meteosat Second Generation (MSG), provides 15-minute loop images that allow to identify dust source regions by means of subtle changes from one image to the next. Even though, SEVIRI (with only three narrow bands in the solar spectrum placed at 0.63, 0.81 and 1.64ìm, in addition to the wide HRV band) is not as optimal for the viewing of dust as other multi-spectral sensors, such as SEAWIFS or MODIS. Moreover, SEVIRI images present the same problems detected in other satellites when the information provided is used to detect dust. The main ones are the confusion of dust with water/ice clouds and that the reflectivity on visible wavelengths is hampered by the fact that land surfaces are characterized by a wide range of albedos. Over Africa, SEVIRI solar bands contain the information related to the presence of the dust mixed up with the ground information. In order to detect the presence of dust in SEVIRI visible images, it is necessary to detach the information of the background introduced by the textures of the desert, and to enhance the information concerning the dust. Two different steps have been established to tackle the problem: first of all, to normalize the visible channels radiance and later, to build the monthly cloudless normalized radiance masks for each channel. In this paper it will be presented the current state of the developments together with their application to a study case (the 21st February 2007 dust event).

RETRIEVAL OF CONVECTIVE MOMENTUM FLUXES USING TRMM AND CLOUDSAT

John Mecikalski, Christopher Jewett

University of Alabama in Huntsville

ABSTRACT

Research and case studies have shown that convection plays a large role in large-scale environmental circulations. Convective momentum fluxes (CMFs) have been studied for many years using in-situ and aircraft measurements, along with numerical simulations. However, despite these successes, little work has been conducted on methods that use satellite remote sensing as a tool to diagnose these fluxes. Uses of satellite data have the capability to provide continuous analysis across regions void of ground based remote sensing. Therefore, the overall project's goal is to develop a synergistic approach to retrieving CMFs using a collection of instruments including GOES, TRMM, CloudSat, MODIS, and QuikScat. However, this particular study will focus on the work using TRMM and CloudSat. This research represents ongoing work supported by NASA's Earth and Space Science Fellowship, as granted to Mr. Jewett. Sound research has already been conducted for computing CMFs using the GOES instruments (Jewett 2007). Using satellite-derived winds, namely mesoscale atmospheric motion vectors (MAMVs) as described by Bedka and Mecikalski (2005), one can obtain the actual winds occurring within a convective environment as perturbed by convection. Surface outflow boundaries and upper-tropospheric anvil outflow will produce "perturbation" winds on smaller, convective scales. Combined with estimated vertical motion retrieved using geostationary infrared imagery, CMFs were estimated using MAMVs, with an average profile being calculated across a convective regime or a domain covered by active storms. Current work involves estimating draft-tilt from CloudSat and TRMM PR radar reflectivity. Computing draft-tilts enables for estimates of u' and v', as seen in 915 MHz profiler data by Mecikalski (2004). However, with CloudSat located in space and pointing only at nadir, it is limited in its abilities to compute a three-dimensional draft-tilt. However, this instrument can provide critical information toward estimating CMFs. Determining storm motion from a cloud-resolving model could supply the needed information to determine the updraft tilt. As a start, research will primarily be focused on the Huntsville area where substantial ground-based instrumentation (dual-polarimetric radar, WSR-88D, X-band radar, 915 MHZ profiler) already exist towards validating and developing a satellite-based methodology of estimating CMFs. Other work involves determining several ways to improve our estimates of perturbation vertical velocities (w'). Level 2 products of CloudSat provide droplet size profiles and number concentrations of hydrometeors. Therefore, it would be reasonable that a determination of the mass condensate could be made, which can be related to vertical mass transport similar to the algorithm used in TRMM (i.e. in which w' was estimated via a measure of updraft strength and drop size). Also, with the mass condensate and entrainment rates known, it is possible then to estimate vertical motion within the cloud (Austin and Houze 1973).

INTEGRATED INFORMATION TO SUPPORT DECISION MAKERS

Davide Melfi, Francesco Zauli, Daniele Biron

Centro Nazionale di Meteorologia e Climatologia Aeronautica, Pratica di Mare, Italy

ABSTRACT

Remote sensing from space plays an important role to known the environment. Today a lot of human activities look at satellite data to understand the situation and take decisions. For example the knowledge of meteorological conditions allow to plane civil protection missions and military campaign.

We can retrieve from satellite data series of parameters that can be used for different applications and then we have to build applications to manage derived information. Decision makers have to take resolutions based on the information and they ask only useful parameters. A possible tool could supply pictures to visualize the situation or messages to initialize a numerical model of decision.

The present work wants to describe a possible application to give an efficient instrument to military decision process. We simulated some possible missions and have designed an instrument to select and present environment parameters.

The paper illustrates the concept of our application and shows some examples of output. The application is very flexible because it manages parameters retrieved from other applications. We show the integration of different SAF products, application of IMS and conventional observations.

In particular we have resolved some problems as: ingesting of user's requirements (parameters and geographical area), the retrieving of parameters in the database, optimization of spatial resolution.

RETRIEVAL OF LOW STRATUS CLOUD PROPERTIES DURING NIGHTTIME - A SENSITIVITY STUDY FOR METEOSAT SECOND GENERATION GROUND FOG DETECTION

Cornelia Merk, Jan Cermak, Jörg Bendix

Universität Marburg - Germany

ABSTRACT

Recently, CERMAK and BENDIX proposed a new scheme for the delineation of low stratus clouds (no ground contact) and fog (ground contact) using Meteosat Second Generation SEVIRI data. The scheme utilizes cloud liquid water path and a subadiabatic cloud water model to estimate cloud geometrical thickness which – along with cloud-top height - can be used for ground contact detection. Currently, the scheme can only be applied during daytime since no cloud property retrievals for nighttime scenes are at hand.

A sensitivity study was carried out to investigate the potential of different infrared channel combinations with respect to their use in the retrieval of microphysical cloud properties. To simulate the response of the Meteosat Second Generation infrared channels, the plane-parallel radiative transfer model STREAMER (KEY and SCHWEIGER 1998) was set up for varying cloud properties (i.e. optical thickness, effective droplet radius), cloud-top heights, ground temperatures, and satellite observation angles.

This data was then used to build lookup tables. Microphysical parameters can be derived from these tables using brightness temperatures observed by SEVIRI as an input. Liquid water path is an input variable for the cloud thickness model (CERMAK 2006) used to delineate ground fog from other low stratus clouds. In this way, operational ground fog detection at night could become feasible.

CERMAK, J. 2006: SOFOS – A new Satellite-based Operational Fog Observation Scheme. PhD thesis, Marburg

KEY, R. K. and A. J. SCHWEIGER 1998: Tools for atmospheric radiative transfer: STREAMER and FLUXNET. Computers and Geosciences 24/5, 443-451.

MERGED USE OF SATELLITE, RADAR AND LIGHTNING DATA TO INVESTIGATE CONVECTIVE SYSTEMS

Maria Putsay, Kornél Kolláth, Ildikó Szenyán, Eszter Lábó

Hungarian Meteorological Service

ABSTRACT

METEOSAT single channel data, different types of RGBs and Nowcasting SAF products together with Hungarian radar network data and lightning data from the SAFIR detection system are used to investigate severe convective systems in the Central European region.

Visible images of METEOSAT satellite are used to recognize the thin and thick parts of the anvil and to identify the overshooting tops. Structures like cold rings and cold-U/V shapes detected from infrared imagery indicate possible penetration of the storm top into the tropopause or lower stratosphere. The near and medium infrared solar channels (and some thermal IR channel differences) provide information on cloud top microphysics. The spatial distribution of the cloud top ice crystal size is investigated with use of the so called “convective storms” composite imagery obtained from brightness temperature and reflectivity differences of water vapor, infrared and short-wave channels.

The visible channel may show gravity waves generation at the top of the thunderstorm cloudiness, what could be possibly connected with the strength and pulsations of the updraft. Satellite images were superimposed with radar reflectivity. It is concluded that composites of satellite, radar and lightning data help to assess relative locations of main up- and downdrafts and important features of the storm severity.

PARALLAX APPLICATIONS WHEN COMPARING RADAR AND SATELLITE DATA

Michaela Radova[1], **Jakub Seidl**[2]

(1) Czech Hydrometeorological Institute, (2) Institute of Theoretical Physics, Faculty of Mathematics and Physics, Charles University

ABSTRACT

This poster addresses parallax computation and its application when comparing radar and satellite data. Parallax is an apparent displacement of cloud location with regard to the Earth's surface on satellite imagery which results from nonzero viewing angle of the satellite. This poster focuses on parallax for geostationary satellites. Dependence of the parallax on height of cloud top as well as on geographical location of cloud in the Czech Republic was documented.

Parallax correction is important when comparing satellite and radar data, especially for high Cumulonimbus clouds. Two ways of the correction are possible. In first case each cloud pixel on satellite imagery is shifted by a corresponding value of parallax. In this case it is necessary to know accurate heights of cloud top. The second possibility which is used in this poster is based on transformation of data that we compare with satellite imagery (in our case radar data) to geostationary projection i.e. their shifting in particular height levels by computed values of parallax. Application of parallax correction to comparison of radar and satellite data is shown on one case of cold-ring shaped storm above central Europe using MSG/SEVIRI observations.

The results confirm the importance of the parallax correction, especially for higher heights of cloud top. The parallax values used throughout this poster are based on our own parallax computations.

CONVECTION WORKING GROUP - THE DETECTION AND NOWCASTING OF SEVERE CONVECTION WITH MSG

Jarno Schipper[1], Marianne Koenig[2], Volker Gärtner[2]

(1) ZAMG, (2) EUMETSAT

ABSTRACT

After five years of operational service of Meteosat Second Generation, a number of satellite applications in the area of severe convective storm detection and nowcasting have been developed by users in and outside Europe.

To make an inventory of all available applications a workshop was organised in late 2007. This workshop, organised by the Polish Institute of Meteorology and Water Management (IMGW) in cooperation with EUMETSAT, was aimed to get a deeper insight into the differences and commonalities of the available techniques and products, and their specific area of application.

These can be divided into:

- Use of satellite derived air stability indices to describe pre-storm conditions.
- Use of information on cloud cooling rates and other cloud microphysical parameters to identify clouds of severe storm potential at an early stage.
- Use of satellite based information on cloud microphysics to monitor storm conditions and identify the severest area within the storm.

During the workshop the advantages and deficiencies of existing methods were discussed and areas of improvements were addressed, to meet the common goal to develop a 'best practice' in the use of the MSG spectral, temporal, and spatial information for severe storm nowcasting. It is especially important that such methods must be usable in a highly automated and thus objective way. Future developments, based on the existing methods, were discussed, and potential fields of coordination, cooperation, and validation have been identified.

To achieve the common goal a set of recommendations were set to delineate the future activities. The recommendations can be categorised in three groups, addressing user needs for new/advanced products, useful tools and training aspects. To maintain and stimulate the cooperation between partners a working group has been formed which will also coordinate the validation of the existing methods to detect and nowcast convection.

Case studies for validation were selected by the working group. All the methods are applied to a single date and the results are documented and evaluated. The benefit of such case studies is not only to stimulate scientific cooperation and validation, but also for training purposes. Results of such validation processes are found on the working group's website (http://convection.satreponline.org.) and will also be made available as a comprehensive set of training material with the support by EUMeTrain.

In this poster we will highlight the activities of the convection working group. Information will be given on several of the common applications to detect and nowcast convection and the results of these methods, applied to one case study, are presented.

VALIDATION OF SATELLITE-BASED SNOW COVER PRODUCTS WITH RESPECT TO AUTOMATIC SURVEILLANCE SYSTEMS FOR SOLAR POWER PLANTS

Marion Schroedter-Homscheidt[1], **Georg Wirth**[2]

(1) DLR, (2) University of Applied Sciences München

ABSTRACT

Satellite based Earth Observation allows the detection of snow cover and the discrimination of cloud and snow cover using multi-spectral measurements. Using this nowcasting information for automatic photovoltaic power plant surveillance enables the plant management to determine failures which are 'only' due to snow coverage on the photovoltaic system and not caused by any technical malfunction. Correct snow cover information can avoid that maintenance staff is falsely alarmed and increase the reliability of automatic and satellite-based surveillance systems.

Snow detection services using satellite nowcasting are available from NOAA, LSA SAF, Carlo Gavazzi Space S.p.A, DLR and Carl-von-Ossietzky University Oldenburg on a routinely basis. Their coverage is ranging from regional to world-wide scales. This paper will present results of a validation study comparing to ground measurement data from meteorological stations. The validation approach is defined suitable for energy meteorology users and photovoltaic power plant operators. Quality measures introduced are the „false alarm rate" leading to false alarm for the maintenance staff in case of undetected snow and therefore misinterpreted system failures. Secondly, an „error due to underestimation" is defined as error due to overestimation of snow which causes an underestimation of available solar irradiance. Finally, the „availability of data records", and the „correct classification rate" is assessed.

The results depend upon the analysis area. There is a higher accuracy in southern Germany than in Switzerland due to the more homogenous land surface in Germany. The numbers of false alarm events show the difference in the method of the respective data provider. Depending upon how defensively the value recognized by the sensor is handled, the error shifts from too much recognized snow (error due to underestimation), on to too few recognized snow (false alarm rate). For pure photovoltaic power plant operation monitoring the data record of LSA SAF is the most suitable. This data record has a symmetrical and small error pattern (false alarm rate 26 % / error due to underestimation 23 %), but the data availability is low (65 %). The IMS data set has a low false alarm (4 %) rate and good data availability (100 %), but a large error due to underestimation (59 %). Also the DLR data set has a rather small symmetrical error pattern (false alarm rate 37 % / error due to underestimation 26 %) and a good availability (99 %).

CLOUD TOP TEMPERATURE AND HEIGHT PRODUCT OF THE NOWCASTING SAF APPLIED TO TROPOPAUSE-PENETRATING COLD-RING SHAPED STORMS

Jindrich Stastka, Martin Setvák

Czech Hydrometeorological Institute

ABSTRACT

The Cloud Top Temperature and Height (CTTH) products of SAFNWC represent important characteristics of convective storm tops, and are frequently used as an indicator of possible storm's activity or severity. While these products are quite reliable for a majority of storms, we can anticipate certain problems when the storms are vertically extensive and their cloud tops penetrate high above the tropopause. In such extreme cases non-adiabatic processes may be involved, forming a cloud top brightness temperature (BT) field, which may not be directly linked to their height. Among these cases belong storms, exhibiting at their cloud tops cold-U or cold-ring shaped features, with warm embedded areas. While the former are well known since early 1980's, the latter have been documented only recently and are addressed by other paper submitted to this conference (Setvak et al.: Cold-ring shaped storms in Central Europe).

While the other paper (Setvak et al.) focuses at general characteristics of this type of storms, in this poster we examine how do the SAFNWC CTTH products interpret the cold ring structure, and namely the central warm spot (CWS) embedded by the cold ring. Since this type of storms (with the cold-ring feature) seems to be accompanied by a severe weather, proper interpretation of its BT field by the SAFNWC products is essential for any nowcasting applications.

THE PERSIAN GULF 12TH APRIL2007 DUST STORM: OBSERVATION AND MODEL ANALYSIS

Farahnaz Taghavi

Institute of Geophysics,University of Tehran

ABSTRACT

The frequency and intensity of extreme weather events such as dust storm may likely to change in southwest of Iran .Changes in the occurrence of extreme events can often have far greater detrimental impacts on ecosystems and human societies than a change in average climate conditions .In this study, the behavior of a complex dust storm is investigated using extreme climate index software (ECIS). The approach is using the observations of SLP, satellite images, radiosonde data and satellite data. The Meteorological observations and numerical models are used in order to investigate evolution and mechanism of this phenomenon. This dust storm occurred on 12th April2007 in southwest of Iran(north of Persian Gulf), caused severe red sky in that region .The aim of this research is comparing the characteristics of this storm with which occurred during 23-25 March 2003 that was analyzed by the Operation Iraqi Freedom dust storm (OIF) . In this project, the effective parameters in evolution of dust storm is studied in order to predict them and their physical effects such as visibility reduction, heavy winds, red sky, hailstone, and severe lightning.

APPLICATION OF SATELLITE IN AVIATION METEOROLOGY

Nigisiti W.tensae

National Meteorologicl agency

ABSTRACT

Satellite is used to exchange information actual and forecast, for the use of flight or aviation purpose, the actual that is observed by observers gets transmitted through satellite the other part that is observed through the picture is assessed and used for forecast or direct use for flight. Dry or wet areas can be observed from satellite.

As we or Ethiopia is a high range of mountain and remote areas that can not be reached by observers satellite information is highly needed and important for aviation purpose. In addition to could pictures upper wind and temperatures can be assessed, low level significant can be observed and pilots are briefed in our aeronautical meteorological office. Since I am working in aeronautical meteorology being senior meteorological officer. I have the interest to benefit to more from your conference

NEW SATELLITE-BASED PRODUCT TO AIMED AT FORECASTING CONVECTIVE INITIATION IN THE 1-6 HOUR TIMEFRAME

John Walker, John Mecikalski, Wayne Mackenzie

University of Alabama in Huntsville

ABSTRACT

Forecasting convection initiation (CI) has been a difficult problem in the Atmospheric Sciences today. There are several means (via radar and satellite) that can attempt to nowcast CI within the 0-1 hour timeframe. Forecasting CI within the 1-6 hour timeframe remains very challenging, due to the frequent inability of numerical weather prediction (NWP) models to "spin up" the important gradients in a timely fashion, and because simple time extrapolation fail beyond ~2 hours when attempting to predict convective initiation. Use of observation-driven methods (in addition to NWP), namely those from geostationary satellite, offers us the ability to improve upon 1-6 hour convective weather forecasts, on the time and space scales meaningful to the general population (i.e. ~1 km, and <6 h). The hypothesis that is being tested via this product is that under synoptically "calm" conditions, when surface winds are generally <5 m/s and baroclinicity is weak, thermal circulations will form along differential heating gradients, similar to "inland sea-breezes". In the past, these thermals have been termed "Nonclassical Mesoscale Circulations", or simply, NCMCs (Segal and Arritt, 1992). Given enough atmospheric instability, the location of these circulations will act as source regions for updrafts and, eventually, deep convection. We will present a new product that will assist with the forecasting of air mass thunderstorm development within 6 hours by identifying potential sources of updrafts near differential heating boundaries. The product will be easily generated daily, and in a very timely fashion, so that it could be used as a tool by operational forecasters to assess regions of preferred CI each day. This product heavily leverages satellite fields: Remotely-sensed vegetation from MODIS Level 3, 16-day composites, recent rainfall estimates observed from radar and NOAA/NWS, and GOES-derived insolation are used to create differential heating indices that will help identify these source regions. Currently this product is being developed in a case-study mode, yet the immediate plans are to begin real-time evaluations, using the U.S. National Weather Service Office in Huntsville, Alabama, as the operational test-bed. Future plans, into later 2008 and 2009, are to develop this 1-6 hour CI-prediction product using (a) GOES IR-retrieved soil moisture as a background input field, (b) GOES IR-estimated energy and water flux information as indicators of vegetation contributions to low-level moisture, and (c) with data from MSG, in a test-mode simulation over portions of Europe.

ON THE USE OF COMPLEX EMPIRICAL ORTHOGONAL FUNCTIONS FOR THE TEMPORAL INTERPOLATION OF SATELLITE DATA

Andreas Wirth, Alexander Jann, Barbara Zeiner

ZAMG

ABSTRACT

For the merging of satellite and radar data, for example, it may be necessary to interpolate the satellite image data in order to obtain simultaneous imagery (even if the data sources were available in the same temporal resolution, the problem is still relevant in cases of data outage). Simple interpolation approaches tend to fail in case of noticeably propagating features (the meteorological systems then do not actually move, but slowly vanish at the first location while gradually appearing at the target location). Therefore - following suggestions of earlier publications where such a technique was used for the temporal interpolation of NWP fields in order to get higher-frequency data - complex empirical orthogonal functions are extracted from a series of a 2-dimensional image arrays. This method can be used to detect propagating features in time when each eigenmode is interpreted as a wave function with amplitude and phase. After interpolating the phase and amplitude components of the resulting eigenvectors, fields of the variable under consideration (i.e. brightness temperature in the present context) can be reconstructed for every intermediate point of time. The capabilities of the technique are demonstrated in this paper through interpolation of MSG satellite imagery to obtain an image loop with 1-minute resolution.

EUMETSAT PRODUCTS FOR PREDICTING NOCTURNAL AND EARLY MORNING RAIN IN NORTHEASTERN AND CENTRAL HIGHLANDS SO AS TO MONITOR FLASH FLOOD EVENTS

Amanuel Woldeselassie

National Meteorology Agency

ABSTRACT

As per the seasonal classification of the National Meteorological Agency (NMA) of Ethiopia, Ethiopia has three seasons. The seasons are: the dry season (Bega), from October to Mid-February, the small rainy season (Belg) from mid-February to mid-May and the main rainy season (Kiremt) from June to September.

NMA of Ethiopia has been principally using the EUMETSAT outputs for various purposes. The main concern of this paper is to show the use of EUMETSAT products for predicting nocturnal and early morning rain over northeastern and central highlands of Ethiopia during the main rainy season (Kiremt).

Most flash floods in Ethiopia result from localized heavy rainfall due to single cell thunderstorm or group of thunderstorms. During Kiremt season, the convective clouds formed over Yemen highland, which are visibly tracked by infrared 10.8 channel, could result heavy rainfall across northeastern, eastern and central Ethiopia. In this regard, METEOSAT, infrared channel, provides the opportunity to quickly and precisely monitor areas that are going to be flooded following the thunderstorm events.

Hence, the EUMETSAT products are very helpful in identifying the areas to be affected by the flash flood incident. Accordingly, warnings will be broadcasted to the public through the National Television and Radio so as to reduce the impact of the flood.

ATOVS/AVHRR ONBOARD METOP-A: DEVELOPMENT AND STATUS OF DAY-2 PRODUCTS

Jörg Ackermann, Dieter Klaes, Francois Montagner, Thomas Heinemann, Peter Schlüssel

EUMETSAT

ABSTRACT

After successful commissioning and transition to routine operations, EUMETSAT has kicked-off several Day-2 product processing activities for the ATOVS (Advanced TIROS Operational Vertical Sounder) /AVHRR (Advanced Very High Resolution Radiometer) instruments onboard Metop-A.

The poster will present both, an overview of the progress in future operational products' development within the EPS (EUMETSAT Polar System) Ground Segment and recent achievements made in the prototype processing. The first category of products mainly consists of NDVI (Normalized Differential Vegetation Index) and polar AMV (Atmospheric Motion Vectors) derived from full resolution AVHRR measurements. In the second category, synergetic effects are investigated by using e.g. scatterometer data for microwave emissivities over water, or by generating actual sea ice and snow coverage from microwave measurements to improve retrievals of infrared sounders.

BETTER USE OF CORRELATION INFORMATION IN AMV EXTRACTION SCHEME

Regis Borde, Arthur De Smet

EUMETSAT

ABSTRACT

The Height Assignment (HA) is currently the most difficult task in the Atmospheric Motion Vectors (AMV) extraction scheme. Several sources of error can be introduced at the height assignment step, but one of the main difficulties is to clearly identify the pixels that lead the tracking process in the tracer box, in order to select them for the HA calculation. A good pixel selection process should ensure to keep a direct link between the feature really tracked and the calculation of the height. The most common method sorts the coldest pixels in the target box and uses them to calculate the AMV height. However, recent work showed that some of the coldest pixels can have very small and/or negative contribution to the cross correlation process. Indeed, it is then proposed to use individual pixel contribution to cross correlation coefficient information in the pixel selection process, in order to get a closer link between the feature tracked and the HA. This paper will present and discuss the last results that have been investigated at EUMETSAT, in order to improve this pixel selection process in AMV extraction algorithms.

IMPLEMENTATION, SETTING AND VALIDATION OF THE OEM WITHIN IASI L2 PPF

Tim Hultberg, Xavier Calbet, Peter Schlüssel, Thomas August, Olusoji Oduleye, Arlindo Arriaga

EUMETSAT

ABSTRACT

Based on RTIASI as a forward model and using climatology as a-priori background, the optimal estimation method constitutes the core of the nominal temperature and humidity profiles retrieval within the Infrared Atmospheric Sounding Interferometer (IASI) Level 2 Product Processing Facility (PPF). Surface temperature and cloud height and coverage are also outputs of this algorithm. It takes its inputs for a first-guess from various pre-processing steps like statistical retrievals and a cloud characterisation scheme based on a CO2 slicing method.

The implementation, setting and validation of this process within IASI L2 processor will be described and discussed here.

VALIDATION OF THE CO2 SLICING METHOD IN THE IASI L2 PROCESSOR

Arlindo Arriaga[1], Xavier Calbet[1], Peter Schlüssel[1], Thomas August[1], Olusoji Oduleye[1], Tim Hultberg [1], Bernd Stiller [2], Klemens Barfus[2]

(1) EUMETSAT, (2) Deutscher Wetterdienst Meteorologisches Observatorium Lindenberg

ABSTRACT

EUMETSAT operational IASI Level 2 Processor makes use of the CO_2 slicing method to support the retrieval of the cloud top pressure, as well as the estimate on effective cloud cover, within IASI fields of view. The respective algorithm works with a fixed pre-selected set of 41 sampling frequencies between 707.5 and 756.0 cm^{-1}, and applies several tests to further refine the selection of sampling frequencies and for quality control of results. Temperature and water vapour profiles are nominally taken from ECMWF forecasts. The fractional surface types and wind speed at 10m height support the modelling of the surface emissivity, and the outgoing cloud free synthetic radiance is computed with the radiative transfer model RTIASI-4.

Retrievals using IASI radiance and co-located forecasted atmospheric profiles, surface emissivity and topography are computed with a stand alone version of the operational algorithm. Results over a variety of cloud fields show good consistency with the respective co-located AVHRR images within channels in the visible or infrared window. The retrieval error is evaluated with measurements from a cloud-radar and an all-sky camera, during the atmospheric sounding campaign at Lindenberg, Germany, from June to September 2007, in support of the validation of Metop products.

VALIDATION OF TEMPERATURE AND HUMIDITY VERTICAL PROFILES RETRIEVALS WITHIN IASI L2 PPF

Thomas August[1], Tim Hultberg[1], Olusoji Oduleye[1], Xavier Calbet[1], Peter Schlüssel[1], Arlindo Arriaga[1], Nikita Pougatchev[2]

(1) EUMETSAT, (2) Space Dynamics Laboratory

ABSTRACT

The Infrared Atmospheric Sounding Interferometer (IASI) Level 2 Product Processing Facility (PPF), operated at EUMETSAT, retrieves vertical profiles of temperature and water-vapour. In a nominal mode, this is achieved with an optimal estimation method based on RTIASI as a forward model and climatology as a-priori background. It is initialized with a statistical retrieval.

Available at a full vertical resolution of 90 levels on UMARF, these products are distributed in an NRT via EUMETCAST on sub-sampled profiles of half the size to support various applications like NWP. The retrieval accuracy for temperature is expected to be better than 1.7K in the troposphere and 2K in the stratosphere while the requirement is of 20% for humidity.

This paper presents and discusses the validation of intermediate and final retrieval of temperature and water-vapour profiles within IASI L2 PPF, using ECMWF analysis data as well as campaign data at various Earth locations.

TOWARDS A SCENES ANALYSIS FOR THE METEOSAT THIRD GENERATION INFRARED SOUNDER OBSERVATIONS

Jochen Grandell, Stephen Tjemkes, Phil Watts, Rolf Stuhlmann

EUMETSAT

ABSTRACT

EUMETSAT prepares for the next generation of geostationary satellites. Among the three candidate missions is an infrared sounder. The preparatory activities for especially this candidate mission will greatly benefit from exploring the hyperspectral IASI observations.

The MTG-IRS candidate mission observations would be used to monitor vertical distributions of temperature and moisture. Although there are a number of promising activities, regarding the retrieval of thermodynamical properties from all sky observations, initially these temperature and moisture profiles will be derived from cloud free spatial samples. Thus an accurate scenes analysis is required to classify each observation according to its cloud amount.

McNally and Watts (2003) described a cloud detection algorithm for high spectral resolution infrared sounders. To understand the performance of this algorithm in relation to a possible application to MTG-IRS observations, a number of tasks have been performed. First, in order to increase the confidence in the performance of this cloud detection algorithm, it was applied to IASI observations and compared to results of other scenes analysis methods like the CO2 slicing method and the operational cloud mask derived from collocated AVHRR observations. Results of this comparison will be presented during the presentation, as well as results of the method when applied to IASI as a proxy for MTG-IRS. This means that the spectral coverage of the original IASI data is reduced to match the MTG-IRS coverage, and also the spectral sampling is modified according to the MTG-IRS specifications. The effect of these modifications on the performance of the cloud detection is presented.

THE NOAA/NESDIS/STAR IASI OPERATIONAL PRODUCT PROCESSING SYSTEM

Thomas King[1], Zhaohui Cheng[1], Haibing Sun[1], Peter Keehn[1], Lihang Zhou[1], Qingzhao Guo[2], Walter Wolf[3], Chris Barnet[3], Mitch Goldberg[3]

(1) PSGS, (2) IMSG, (3) NOAA/NESDIS/STAR

ABSTRACT

The NOAA/NESDIS/STAR IASI product processing system was made operational in April 2008. The system ingests near-real time IASI level 1C granule data from EUMETSAT as well as AMSU-A and MHS level 1B orbital data from NOAA/NESDIS/OSDPD. These data are used to produce thinned radiance and NOAA unique products. The thinned radiance products consist of 616 channel subsets of IASI level 1C radiances for all fields of view (FOVs) and for the warmest FOV within the IASI field of regard. The subsetter system can be easily modified to produce different subset configurations to fulfill new user product requests. The NOAA unique products consist of reconstructed radiances, cloud-cleared radiances and trace gas profiles. The trace gas products contain profiles of H_2O, CO_2, CO, O_3, CH_4, N_2O, SO_2, and HNO_3 at 100 levels. IASI data products from NOAA are made available in BUFR and NetCDF format to NWP (Numerical Weather Prediction) centers in the United States through the NOAA/NESDIS/ESPC data distribution server. The system also produces gridded and radiosonde collocation data sets that are used for science monitoring, product validation, verification, and reprocessing efforts. The EUMETSAT level 1C, 3X3 gridded radiance, NOAA unique products, and associated metadata are archived to NOAA/NESDIS/CLASS. Presented here are aspects of the system design, the output products and formats, and the current status of the operational system.

THE ADM-AEOLUS MISSION - THE FIRST WIND LIDAR IN SPACE

Phil McGoldrick[1], **Richard Wimmer**[1], **Didier Morancais**[2], **Martin Endermann**[3]

(1) Astrium Satellites Ltd, (2) Astrium Satellites SAS, (3) European Space Agency ESA-Estec

ABSTRACT

Currently under manufacture by Astrium Ltd and due for launch in late 2009, ADM-Aeolus is ESA's second Earth Explorer Core Mission within its Living Planet programme. The mission is designed to make direct measurements of global three-dimensional wind-fields in order to significantly improve weather forecasting and climate research. The aim of the mission is to provide global observations of wind profiles with a vertical resolution of 0.5km up to 2km Altitude, 1km up to 16km and 2km above 16km in line with the requirements of the World Metrological Organisation (WMO). ADM-Aeolus will be the first satellite to directly observe the Earth's wind profiles from space.

Aeolus will carry just one large instrument – the Atmospheric Laser Doppler Lidar Instrument (ALADIN). This is a direct detection lidar operating in the eye-safe UV spectral region (355nm), using a frequency tripled Nd-YAG transmitter laser, a 1.5m receiver telescope and two spectrometer receivers to determine the Doppler shift of the signal from both the aerosol and the molecular back scatter. This way, wind profiles can be determined throughout the atmosphere up to the lower stratosphere (30km).

The presentation will give an overview of the mission objectives and the system requirements together with an update on the development status of the satellite currently being assembled on various Astrium sites across Europe. In addition outline proposals for a subsequent operational mission compatible with ensuring data continuity from Aeolus1 will be presented.

ATMOSPHERIC SOUNDING WITH IMAGING FTS: SCIENTIFIC PERSPECTIVES FOR AIRBORNE AND SATELLITE SENSORS

Hermann Oelhaf[1], Peter Preusse[2], Martin Riese[2], Herbert Fischer[3], Felix Friedl-Vallon[3]

(1) Forschungszentrum Karlsruhe, (2) Forschungszentrum Jülich, Inst. für Chemie und Dynamik der Geosphäre (ICG-I-Stratosphäre), (3) Forschungszentrum Karlsruhe, Inst. für Meteorologie und Klimaforschung

ABSTRACT

Recent significant advances in detector array technology and in the performance of read-out circuits and data processing/storage systems allow for developing infrared remote sensing devices that are capable of boosting the sampling density by at least an order of magnitude when compared to classical limb scanning instruments. Such *Imaging* Fourier transform spectrometers (FTS) may have the potential to form the next generation of IR remote sensing techniques in atmospheric science both for limb and nadir geometries. The potential of imaging spectroscopy for nadir sounding from geostationary orbits is being explored in the US and in Europe since a couple of years.

An airborne version of this new instrument class is currently developed by the research centres Karlsruhe and Jülich. The instrument will be deployed first on board the new German research aircraft HALO and is in consideration for short and long-duration stratospheric balloon flights. The airborne version is designed to allow both nadir and limb sounding. First scientific missions are planned for the second half of the year 2009. The technical concept is presented by Friedl-Vallon et al. (same conference). A similar concept (but confined to limb sounding) was proposed to ESA as part of the PREMIER proposal and is currently being studied within the Earth Explorer Programme.

This paper will illustrate the scientific potential of such an instrument. In general terms, the major issue to be addressed is the role of mesoscale processes for the global scale. Mesoscale processes like gravity waves and overshooting of large convective systems are often not captured by state of the art global models for weather forecast and climate research. A special benefit to be explored with the airborne instrument version is the synergy between nadir and limb sounding. This may be exploited e.g. for providing new insights into atmospheric processes controlling the budget of methane, the evolution of tropospheric ozone, and the impact of the transformation in agriculture (triggered by production of biofuels) on the atmosphere.

A CLEAR SKY RADIATIVE TRANSFER MODEL FOR METEOSAT THIRD GENERATION INFRARED SOUNDER CANDIDATE MISSION

Stephen Tjemkes, Jochen Grandell, Rolf Stuhlmann

EUMETSAT

ABSTRACT

In support of the development of an end-to-end processing chain for METEOSAT Third Generation Infrared Sounder (MTG-IRS) candidate mission EUMETSAT has procured the radiative transfer model based on the Optimal Spectral Sampling (OSS) method from Atmospheric and Environmental Research, Inc.

To build confidence in this radiative transfer code, a comparison has been performed involving results generated by OSS and results generated by LBLRTM for real IASI observations, and for MTG-IRS simulations for a number of atmospheric clear sky conditions. In addition to results for the upwelling radiance at top of the atmosphere, also jacobians for a number of state variables are included in the comparison.

DEVELOPMENT OF THE NOAA CRIS AND ATMS PRODUCT PROCESSING AND DISTRIBUTION SYSTEM

Walter Wolf[1], Thomas King[2], Kexin Zhang[2], Haibing Sun[2], Zhaohui Cheng[2], Lihang Zhou[2], Mitch Goldberg[1]

(1) NOAA/NESDIS/STAR, (2) PSGS

ABSTRACT

The Cross-track Infrared Sounder (CrIS) and Advanced Technology Microwave Sounder (ATMS) product processing and distribution system is under development at NOAA/NESDIS/STAR. The product processing system consists of the creation of both Level 1C tailored radiance files and NOAA Unique Level 2 products. To prepare for the distribution of the Level 1C products and the testing of the NOAA Unique Level 2 algorithms, a CrIS/ATMS simulation system has been developed. The simulation system creates CrIS radiances and ATMS brightness temperatures at the locations of their footprints determined by orbital simulations. The data are produced at the frequency that will be received from the NPOESS ground system. The ATMS data have been resampled to the CrIS footprint and are to be used in the Level 2 retrieval system. The Level 1C CrIS data are placed into BUFR format for distribution to the global Numerical Weather Prediction Centers. Initial Level 2 cloud cleared radiance and trace gas products have been created using the simulated data. The details of the system will be discussed.

THE OCCURRENCE OF FAIR WEATHER CUMULUS CLOUDS ACROSS A HETEROGENEOUS LANDSCAPE IN LOWER MISSISSIPPI RIVER VALLEY

Valentine Anantharaj[1], Udaysankar Nair[2], Denise Berendes[2], QiQi Lu[1]

(1) Mississippi State University, (2) University of Alabama in Huntsville

ABSTRACT

The distinct difference in landscape heterogeneity across the *Lower Mississippi River Valley* (LMRV) can be readily seen in satellite imagery due to the different vegetation and soil types. The Geostationary Operational Environmental Satellite (GOES) data, for a time period spanning 2004-2006 are being used to analyze cloudiness patterns over the LMRV. Cloudiness analysis is focused on fair weather cumulus clouds, since this cloud type is the most affected by local and mesoscale effects of the heterogeneity of land use.

Data from the visible channel of the GOES-12 satellite have been used to derive the occurrence of cumulus clouds during the months of March – September for the years 2004-2006 at times 1400, 1500, 1600, 1700, 1800, 2000, 2100 and 2200 UTC. The detection of cumulus clouds is based on *Structural thresholding*, an automated algorithm which uses the spatial structure of the cloud elements. We used the results of the cloud classification to compute the frequency of occurrence of cumulus clouds for every month at a given time. We then aggregated and averaged the computed frequencies of occurrence for a given land cover, based on the IGBP Land Use and Land Cover (LULC) maps, derived from MODIS data. In general, (a) in most instances, there is increased cumulus cloudiness over forested areas than across agricultural lands in the LMAV; and (b) there are less cumulus clouds over the urban areas in our domain. We have not been able to confidently identify systematic instances of more cumulus clouds in agricultural lands than forests. We intend to reanalyze the GOES-12 data using *Interactive Visualizer and Image Classifier for Satellites* (IVICS) software which incorporates more sophisticated techniques for cloud detection and classification.

LAND SURFACE TEMPERATURE RETRIEVED FROM SEVIRI /MSG2 DATA: ALGORITHM AND VALIDATION

Mariam Atitar, José Antonio Sobrino, Juan Carlos Jiménez-Muñoz, Yves Julien, Ana Belen Ruescas, Guillem Soria

University of Valencia, Global Change Unit, Valencia, Spain

ABSTRACT

The main purpose of this paper is to give an operational algorithm for retrieving the land surface temperature (LST) using the Spinning Enhanced Visible and Infrared Imager (SEVIRI) data on board of MSG2 (Meteosat Second Generation) Satellite. The algorithm is a split window method using the two thermal infrared channels (IR10.8 and IR12.0). MODTRAN 4.0 code was used to obtain numerical coefficients of the algorithm proposed. The results show that the algorithm is capable to produce LST with a standard deviation of 0.7K and a root mean square error (RMSE) of 1.3K, both of them, for viewing angle lower than 50º. The algorithm has been applied to a series of MSG2 images obtained from a MSG antenna system installed at the IPL (Image Processing Laboratory) in the University of Valencia. The LST product has been validated using in *situ* data from an ESA (European Space Agency) field campaign named CEFLES2 (CarboEurope, FLEx and Sentinel-2) carried out in 2007 in Bordeaux (France) and MODIS LST products over different surfaces and under different viewing angles. The results show a RMSE of 1.9K for *in situ* data, and the comparison with MODIS LST products shows a RMSE of 1.2K.

STUDY OF THE RELATIONSHIP BETWEEN SURFACE NET RADIATION AND SOIL HEAT FLUX BY USING VALENCIA ANCHOR STATION GROUND MEASUREMENTS AND GERB/SEVIRI DATA

Antonio Geraldo Ferreira[1], **Almudena Velázquez Blázquez**[2], **Ernesto Lopez-Baeza**[2], **Javier Sanchis Muñoz**[2], **Emilio Soria**[3]

(1) University of Valencia, (2) University of Valencia Faculty of Physics - Department of Physics of the Earth and Thermodynamics, (3) University of Valencia Faculty of Physics - Department Ingenieria Electronica

ABSTRACT

Remote sensing techniques can be used to retrieve surface parameters and other quantities and properties at regional scales. One of these parameters is soil heat flux, (G), a significant term of the surface energy balance equation, Rn = H + LE + G, mainly in semi or arid regions. In that equation, Rn represents net radiation, H the sensible heat flux and LE, the latent heat flux. In this work, the relationship between Rn and G is studied over vineyard crops, by using micrometeorological observations and METEOSAT Second Generation (MSG) images. Originally, we used micrometeorological data from the EFEDA (ECHIVAL Field Experiment in a Desertification Threatened Area, Castilla-La Mancha, Spain) experiment, for which we obtained linear models to derive G directly from Rn with a Pearson correlation coefficient (r) between 0,94 and 0,98 and a root mean square error (rmse) of about 0,98 Wm^{-2}, depending on the site measurements. These linear models have been the driving mechanism to apply and extend the analysis to longer time series of *in situ* data during the field campaigns carried out between 2004 and 2007 at the Valencia Anchor Station in the framework of the SCALES (SEVIRI/GERB Cal/val Area for Large scale field ExperimentS) Project. The results shows that both, net radiation and soil heat flux are dominated by the daily cycle (fundamentally in cloudless sky conditions) and that the solar radiation levels, intercepted by the crop under study, are affected in cloudy days. We try now to extend and extrapolate these G estimations to larger areas, at satellite observation scales, to provide reliable estimations of G, directly derived from net radiation measurements, at adequate regional scales. This extension of the methodology to remote sensing data is being carried out through the application of the synergy between GERB (Geostationary Earth Radiation Budget) and SEVIRI (Spinning Enhanced Visible and Infrared Imager) data to provide estimates of net radiation and surface temperature with unprecedented frequency of 15 min intervals.

TOWARDS AN ACTIVE FIRE MONITORING PRODUCT FOR THE METEOSAT-8 RAPID SCANNING SERVICE

Sauli Joro, Hans-Joachim Lutz, Leo van de Berg, Ahmet Yildirim

EUMETSAT

ABSTRACT

The Active Fire Monitoring Product has been created in summer 2005 on request of the Portuguese Meteorological Service. Since then it has evolved to a full operational product that is disseminated via EUMETCast as a text and GRIB encoded product. The algorithm is based on a threshold technique using the 3.9 µm, 8.7 µm and 10.8 µm channels of SEVIRI on board the Meteosat Second Generation Spacecrafts. The algorithm uses Meteosat full disk imagery and is applied for cloud-free land surfaces. It has been improved and optimized to reduce the number of false fire alarms. The Meteosat-8 Rapid Scanning Service will start in 2008 and provide an opportunity to fine tune the algorithm to a regional application.

The poster shall present the basic operational algorithm together with the potential modifications done for limited area product. The impact of these modifications shall be demonstrated with test cases. It is also planned to validate the results of these modifications with the actual fire reports available from national agencies around the Mediterranean Area.

EVALUATION OF THE GEOSTATIONARY SATELLITE BASED SNOW AND SEA ICE DETECTION ALGORITHM

Jung-Rim Lee, Chu-Yong Chung, Mi-Lim Ou

METRI/KMA

ABSTRACT

This paper presents the algorithm to derive snow cover and sea ice extent using geostationary satellite data and the validation results with other products such as MODIS, Interactive Multi-sensor Snow and Ice Mapping System (IMS) from NOAA/NESDIS and Near Real-Time Ice and Snow Extent (NISE) from DMSP/SSMI. The data used in this algorithm are MTSAT-1R imagery data which include only 5 channels such as visible (0.675 μm), shortwave infrared (3.75 μm) and infrared (6.75 μm, 10.8 μm and 12.0 μm).

The difference between 3.75 μm and 10.8 μm is used to distinguish snow and cloud, and the visible reflectance is used to detect snow from cloud free land as well. Then, infrared channel data are utilized for cloud and surface corrections. We also apply Normalized Difference of Vegetation Index (NDVI) for forest area in which underestimation has been caused and Sea Surface Temperature (SST) for elimination of the ocean's cloud contamination.

The validation results show that this algorithm matches with MODIS product with the accuracy of 80 percents and more than 70 percents with IMS and NISE during 2007 January. In the future, more cases with longer period will be examined by extending the research area, and the results will be presented by using the Meteosat and GOES data.

ON THE USE OF MIR REFLECTANCE FOR BURNED AREA IDENTIFICATION

Renata Libonati[1], Carlos DaCamara[1], José Miguel Cardoso Pereira[2], Alberto Setzer[3], Leonardo F. Peres[3]

(1) University of Lisbon, CGUL, IDL, (2) Departamento de Florestas, ISA, (3) Centro de Previsão do Tempo e Estudos Climáticos, INPE

ABSTRACT

An accurate identification of burnt areas is of paramount importance in a wide range of studies ranging from the greenhouse effect, the destruction of stratospheric ozone and land emissivity up to ecosystem stability and biodiversity. Current methods for detecting burned areas have mainly relied on information in the red and near infrared regions of the electromagnetic spectrum. However, both red and near-IR channels are especially sensitive to aerosol scattering and absorption in the atmosphere. Usage of these two regions of the spectrum for burned area detection may therefore bring unsatisfactory results over tropical regions such as Amazonia, because of the presence of heavy smoke layers due to the biomass burning. A possible way to mitigate the aerosol effects associated to biomass burning is by using the middle infrared (MIR) part of the spectrum, since it is also affected by vegetation changes but is not sensitive to the presence of most aerosols. However usage of the MIR region brings up the hard problem of distinguishing, in a single measurement, between a diversity of radiance sources, namely the thermal emission and the solar reflection from the atmosphere and the surface. Methods that take into account the major components of the MIR signal have to rely on information from auxiliary datasets (e.g. atmospheric profiles) and require large computational means (e.g. for radiative transfer computations). A simple method was proposed by Kaufman and Remer in 1994 where different assumptions are made to separate the thermal and solar components of the MIR signal.This method do not require heavy numerical computations and present the major advantage of avoiding the use of auxiliary datasets. It was first designed to identifiy dense, dark vegetation areas in mid-latitude environments and has been widely used in burned area discrimination. However, to the best of our knowledge, no assessment has been made on the required accuracy of the MIR reflectance retrievals to adequately identify burnt areas in tropical environments. Accordingly, in this work we perform a sensitivity study to assess the performance of existing methods, using simulations of observed radiances from MODTRAN-4 radiative transfer model. Obtained results suggest that the above-mentioned method is not feasible to determine MIR reflectance for burned area determination in tropical environments. More studies are being carried out in order to optimize theses results.

AGROMETEOROLOGICAL LAND USE MONITORING IN ZAMBIA

Oliver Mudenda

Zambia Meteorological Dept.

ABSTRACT

What is Agrometeorology? Agrometeorology is the study and use of weather and climate information to enhance or expand agricultural crops and/or to increase crop production. The climate has a lot of influence on what you use the land for if the intended purpose has to be successful and conserve the environment. A good example is limitations that climate imposes on the use of land in deserts, polar and sub-polar regions where snow, ice and low temperatures prevail. Agrometeorological data and information is vital for one to provide recommendations about the potential of a particular zone of the country, area or piece of land. In quantifying these capabilities of a piece of land, particular agro-ecological information is necessary as well. Agrometeorology mainly involves the interaction of meteorological and hydrological factors on one hand and agriculture, which encompasses horticulture, animal husbandry and forestry on the other. Agricultural production in Zambia has always been dependent on weather and climate despite the impressive advances in agricultural technology over the last decades. The benefits of understanding these events help in the establishment of techniques and controls that foster a healthier agricultural industry. It is therefore very important for farmers, researchers or persons interested in agriculture to know that there are daily, seasonal, and annual variations that play a vital role in crop response and production. Knowledge of available environmental resources and conditions from below the soil surface through the soil-air interface to the lower atmosphere provides guidance for strategic decisions in long-range planning of agricultural systems. Agrometeorological information is used for a wide range of activities such as planning and evaluating crop production, determining maturity dates early and late frost occurrences. Because of the need to monitor crops, livestock and rangeland at both national and regional level, it becomes imperative that our Agromet Bulletin contains basic standard information that is used to monitor the food security and rangeland situation in the country. There are basically three types of information that are contained in the Zambia Agrometeorology bulletin. These comprise; meteorological information, Agrometeorological information and remote sensing information. When these three different pieces of information converge to tell a story, only then is the story complete. This paper is a working guide used in the preparation of Agrometeorological bulletins and special updates not only in Zambia but the whole Southern African Development Community (SADC) region.

REPRESENTING EUMETSAT□S ACTIVE FIRE MONITORING PRODUCT BY GOOGLE EARTH OVER TURKEY

Ahmet Tekeli, Ibrahim Sönmez, Erdem Erdi , Fatih Demir, Murat Arslan, Meral L. Cukurcayir, Hakan Koçak, Serkan Eminoðlu

TSMS

ABSTRACT

Operational meteorological satellites have proven their usability for fire monitoring. Images and products derived from these data sets are important for keeping track of active fires and monitoring fire prone areas. MSG with its 15-minute full disc cycle time provides excellent opportunity for fire monitoring. EUMETSAT's Meteorological Operations Division (MOD) provides Active Fire Monitoring (FIR) product under Meteorological Products Extraction Facility (MPEF) based on MSG images since 2006. FIR is produced for full disc and distributed to all users via a dedicated distribution system called EUMETCAST.

Timely reception of the FIR data and distribution of the corresponding products to the related fire departments are vital issues. Unfortunately technological difficulties faced within different organizations (met offices and fire departments) prevent a direct data transfer. To overcome these difficulties, Google Earth is considered to be as an appropriate tool since all fire departments had internet connectivity and access to Google Earth.

This paper summarizes the early findings and some problems encountered during operational mode. Despite its shortcomings, illustration of the FIR products in Google Earth environment provides invaluable information about the timing and location of actual fires. Studies to get the utmost benefit from the derived products are performed within Turkish State Meteorological Service for helping the fire fighters as much as possible.

Keywords: MSG, FIR product, Google earth

SIMULTANEOUS ESTIMATING OF LAND SURFACE TEMPERATURE AND EMISSIVITY FROM SEVIRI/MSG

Serge Uspensky, Valery Solovjev

SRC Planeta

ABSTRACT

Land surface temperature (LST or Ts) is an important geophysical parameter and its knowledge at a variety of spatial and temporal scales is of considerable interest for many applications, such as hydrology, agrometeorology, and climate studies. Together with the surface spectral emissivity (SSE) the LST affect the heat and water transport between the surface and the atmosphere. There is a strong need in the remote sensing of Ts, since the conventional surface temperature observations are rather sparse (in space and time). The measurements of outgoing thermal infrared (IR) radiances in the 10,5-12,5 μm atmospheric window from polar-orbiting environmental satellites (AVHRR/NOAA, MODIS/EOS Aqua, Terra) are commonly used to get the surface temperature data. The clear sky IR brightness temperatures are converted to surface skin temperatures using well-known Split Window Method (SWM) to account for the atmospheric attenuation effect. It gives accurate estimates of sea surface temperature, but generally this is not so for LST. The quality of Ts retrievals suffers from the coupling between LST and SSE and inaccurate knowledge of surface emissivities. The launch of the European meteorological geostationary satellites of MSG series with SEVIRI instrument on board provides enhanced ability for getting information on Ts including its diurnal cycle, and SSE. The LST products are currently being derived at LSA SAF from MSG/SEVIRI thermal IR images (channels IR 10,8 and IR 12,0) using the Generalized SWM and global emissivity data base (the retrieval algorithm employs so called Vegetation Cover Method for improved SSE specification). This presentation will include the description of our approach, developed for concurrent retrieval of LST and SSE from SEVIRI data (multiple image cycles). The approach employs the hypothesis that the changes in channel emissivities are negligible across the sampling interval (the time between the first and last image cycles comparing to changes in Ts). Its key features are as follows: the method combines the SWM and so called Two Temperatures Method (TTM) for estimating LST and adjusting a priori specified SSE; there is no need in specification of actual atmospheric models for sounding point. The coefficients in the SWM formula have been derived by regression analysis. The training sample was formed using the RTTOV-7 simulations of SEVIRI/Meteosat-9 clear-sky measurements in channels IR 10,8 and IR 12,0 (for the large range of climate atmospheric models, varying Ts and surface channel emissivities as well as several viewing angles). The retrieval algorithm starts with SWM-based generation of initial guess for LSTs at each cycle using a priori specified SSE values (extracted from global emissivity data base). Then we refine the SSE in sounding point with help of our combined SWM and TTM algorithm. Here we are using the modified version of TTM, not similar to the one used before (in particular, we are not limited to use only two image cycles, in fact there is at least four for the algorithm to be efficient; the iterations should be performed without accurate knowledge of the atmospheric model in sounding point). The performance of developed algorithm and potential accuracy of LST products (RMS error of order 2K) have been evaluated at first on the base of synthetic clear sky SEVIRI measurements depending on the starting time of image cycles used and time sampling interval between them. Finally, the retrieval technique has been tested using real SEVIRI/Meteosat-9 measurements for European region and several dates in 2007. Validation of LST retrievals has been performed via comparison with synchronous and collocated MODIS-based LST estimates and LSA SAF products. The results show a RMS deviation in the range 2,0 – 3,0K for various dates and sounding areas in Europe that seems promising.

HIGHT DEMANDS ON FUTURE TRAINING AT BTZ LANGEN

Hans Bauer

Deutscher Wetterdienst

ABSTRACT

The Meteorological Training and Conference Centre (BTZ) in Langen is the main venue for the training of DWD's staff and also for special national and international seminars.

It was founded as early as 1958 in Neustadt an der Weinstrasse, so we are celebrating 50th years of experience in meteorological training this year.

Since 1981 the BTZ has been part of the Meteorological Department of the Federal University of Applied Administrative Sciences (FH-Bund), these days with two full-time teachers of the FH-Bund and nine lecturers.

Although mainly teaching meteorology, the BTZ is also a place for training in a wide range of skills including Management and IT. But our principal duty is the basic education of new staff, esp. forecasters, in a 3-year course according to WMO 258. This course ends with general examination and diploma. Because forecasters need a special license to work on their own authority, a further 1-year specialization combined with on-the-job training is required.

We are recently preparing for the changes that the Bologna Process has brought. This includes a reform of the study regulations of the Universities and Universities of Applied Sciences, which will convert the German Diploma and Magister degrees to Bachelor and Master degrees.

In my poster presentation I will describe how we will transform the 4-year forecaster training to the training of new staff with a Bachelor degree, inviting all Meteorological Services with newly recruited, German speaking staff to attend these new courses.

ACTIVITIES OF THE INTERNATIONAL (A)TOVS WORKING GROUP (ITWG)

Hung Lung Allen Huang[1], **Steve English**[2]

(1) Univ. of Wisconsin - Madison, (2) Met Office, United Kingdom

ABSTRACT

The International TOVS Working Group (ITWG) is convened as a sub-group of the Radiation Commission of the International Association of Meteorology and Atmospheric Sciences (IAMAS). ITWG organizes the International TOVS Study Conferences (ITSC), which have met every 18-24 months since 1983. Through this forum, operational and research users of TIROS Operational Vertical Sounder (TOVS) and Advanced TOVS (ATOVS) data from the NOAA series of polar orbiting satellites and other atmospheric sounding data have exchanged information on methods for extracting information from these data on atmospheric temperature, moisture and other fields, and on the impact of these data in numerical weather prediction and in climate studies. The ITWG meetings also result in recommendations to guide the directions of future research and to influence relevant programs of WMO and satellite provider agencies (e.g. NASA, NESDIS, EUMETSAT, NSMC, JMA).

An important part of the Group's work has been to foster and participate in the generation of software to be shared throughout the community to enable use to be made of these data for operations and research. The Group also has an important education and training role through the WMO. The next ITSC meeting, ITSC16 will be held, for the first time, in South America. In this paper we will present ITWG mission, activities of working groups and technical sub-groups and the report result generated from ITSC15, ITSC16 conference topics and ITWG future plan.

THE EUMETCAL INTERNATIONAL COOPERATION NETWORK FOR METEOROLOGICAL AND HYDROLOGICAL TRAINING

Jaakko Karppanen

Finnish Meteorological Institute

ABSTRACT

The EUMETNET training programme Eumetcal is a network of 23 NHMSs with shared training goals and interests. Eumetcal is dedicated to serve training needs of its 23 member institutions especially in the field of computer assisted learning. Eumetcal provides a valuable connection from research to operational weather forecasting through cooperation in meteorological continuous professional training and training development. The Eumetcal community is open to willing participants and offers great potential to researchers and operational meteorological professionals alike.

In 2007 Eumetcal launched seven Themed Resource Working Groups with the task to define and develop a syllabus for the continuous professional development of meteorological and hydrological staff of the specific theme. The Eumetcal working groups deal with radar, hydrology, NWP, climate and climate change, aviation, severe weather, ocean and maritime and satellite meteorology. One working group is also tasked to keep abreast in advances in modern training technology.

From 2007 onwards Eumetcal offers blended learning courses delivered by a designated NHMS. In 2008 Eumetcal blended learning courses will be offered in aviation and radar meteorology. The courses consist of a classroom and a distance learning phase and usually last for up to seven weeks. The courses are managed through a Moodle eLearning platform and the distance learning phases consist of weekly online lessons from leading expert throughout Europe.

METEOROLOGICAL VIRTUAL TRAINING LABORATORY (VTL) AT THE WMO RTC IN THE RUSSIAN FEDERATION

Maria Mamaeva[1], **Anatoly Bogush**[1], **Grigory Chichasov**[2]

(1) WMO RTC in St. Petersurg, Russia, (2) WMO RTC in Moscow, Russia

ABSTRACT

In general there are three types of VTLs, namely: procedural, declarative and hybrid. Let's consider the first type. Basis of procedural VTL as applied to meteorological education and training is training packages of application software for automation of meteorological calculations and forecasts. Usually mathematical modeling, methods of statistical analysis, optimization of studied objects or processes are the main component of such VTL.

However automation of meteorological calculations and forecasts in training purposes not always leads to improvement of educational and training quality. The high training potential of VTL consisting in possibility to study properties of various objects and processes by means of mathematical modeling and computing experiments remains non-realized often since work with VTLs demands certain knowledge and considerable high qualification of trainee. In this case, to our mind, specially developed didactic interface can help which is based on the following principles:

• definition of interesting typical and instructive tasks
• organisation of appropriate management and control of cognitive activity of trainee
• obligatory heuristic solution of problems with subsequent comparison with computer variant of the solution
• organization of competitive situations for promotion of trainee cognitive activity

Experience of realization of these principles in educational and training process at the WMO RTC in Russia on programs of improvement of professional skill of meteorologists and meteorological technicians has shown high didactic efficiency. Studying of hydrometeorological equipment and devices, including satellite meteorological systems have a great value. For this purpose creation of virtual training facilities are foreseen at Roshydromet IQI which can be classified as a systems of declarative type. It is supposed to provide them with virtual analogues of hydrometeorological devices, systems, complexes and devices.

The structure of VTL includes sections with description of technical objects including graphic illustrations (photos, schemes, pictures etc.) and hyperlinks to video- audio- materials and animations. For raising efficiency of perception of teaching material, to our minds, use of such technical means as flash-animations is expedient. At the end of each section it is expedient to ask questions for self-control with the short comments "hidden" under hyperlinks that allow to make training process interactive. Such electronic support of training process will allow:

• to raise activity of trainee by promoting their self-study process
• to improve perception of teaching material through multimedia capability
• to provide the full control of knowledge digestion by each trainee
• to make easier the process of preparation for examinations and tests
• to use out-of-class time for studying of devices, systems, complexes, etc.
• to introduce and facilitate distance learning

Besides of this, use of VTL facilities will essentially make lower expenses for acquisition of the expensive equipment, devices etc.

Further it is supposed also to introduce the hybrid approach to construction of VTL with use of imitating modeling. At that the control panel of meteorological device is displayed visually adequately to its real analogue, and various natural processes or phenomena might be investigated in their development by means of mathematical or imitating models.

Consecutive realization of various approaches to creation of meteorological VTL at WMO RTC in Russia will allow to realise the most effective, in didactic terms, complex approach when support of training all target groups on all stages of educational and training process is provided.

WMO FOCUS GROUP OF THE AMERICAS & CARIBBEAN

Anthony Mostek[1], **Michel Davison**[1], **Bernadette Connell**[2], **Wilma Castro** [3]

(1) NOAA/NWS, (2) Cooparative Institute for Research in Atmosphere (CIRA), (3) University Costa Rica/ WMO RMTC

ABSTRACT

A report will be provided on the latest status of the WMO Focus Group of the Americas and Caribbean. This Focus Group has been doing monthly weather briefings using VISITview (developed by NOAA and the Cooperative Institute for Meteorological Satellite Studies (CIMSS)) and YAHOO Voice since March 2004. The briefing will provide an update on the latest activities of the WMO Focus Group and the WMO Space Programme's efforts to expand the Focus Group concept to other regions.

METEOCAL: A TOOL FOR INTERACTIVE HTML-BASED TRAINING ON METEOROLOGY

Jose Prieto

Eumetsat

ABSTRACT

The Meteocal tool was created in 2001 as a learning formula suitable for the development of Meteosat Second Generation (MSG) skills in meteorological offices and training schools. The tool provides the mechanism for generating interactive modules by creative users, typically National Meteorological Services (NMS). The basis of the Meteocal tool is a java converter acting on XML. Typical interaction includes question and answer with feedback, drag-and-drop exercises for text or image, hotspots on images with feedback, slideshows and animations.

BASIC RADAR ALTIMETRY TOOLBOX & TUTORIAL

Vinca Rosmorduc

CLS

ABSTRACT

The Basic Radar Altimetry Toolbox is a collection of tools, tutorials and documents designed to facilitate the use of radar altimetry data. It is able to read most distributed radar altimetry data, from ERS-1 & 2, Topex/Poseidon, Geosat Follow-on, Jason-1, Envisat, and the future Cryosat and Jason-2 missions, to perform some processing, data editing and statistic, and to visualise the results.

As part of the Toolbox, a Radar Altimetry Tutorial gives general information about altimetry, the technique involved and its applications, as well as an overview of pas present and future missions, including information on how to access data and additional software and documentation. It also presents a series of data use cases, covering all uses of altimetry over ocean, cryosphere and land, showing the basic methods for some of the most frequent manners of using altimetry data.

BRAT has been developed under contract with ESA and CNES.

The Basic Radar Altimetry Toolbox has been available (http://www.altimetry.info) since more than a year, and demonstrated since about six months earlier, including during training courses and scientific meetings. Quite a large number of people downloaded it. Users' feedbacks, developments in altimetry, and practice, show that some new interesting features could be added.

THE TRAINING ACTIVITIES OF THE SATELLITE APPLICATION FACILITY ON CLIMATE MONITORING

Christine Traeger-Chatterjee, Rainer Hollmann, Richard W. Mueller

Deutscher Wetterdienst

ABSTRACT

The Satellite Application Facility on Climate Monitoring (CM-SAF) is part of the EUMETSAT groundsegment and provides satellite-derived geophysical parameter datasets that are suitable for climate monitoring. CM-SAF provides climatologies of several cloud parameters, surface radiation fluxes and surface albedo, radiation fluxes at the top of the atmosphere, and atmospheric water vapour, temperature and humidity profiles. All considered variables are listed as GCOS Essential Climate Variables. They are derived from measurements of the SEVIRI and GERB instruments on Meteosat Second Generation Satellites as well as from AVHRR, ATOVS and SSM/I instruments on the polar orbiting NOAA and DMSP platforms, respectively.

Understanding the need and the request of its users for more background information and training opportunities CM-SAF started its training activities during the Initial Operations Phase (IOP). With the beginning of the Continued Development and Operations Phase (CDOP), the CM-SAF training activities have been intensified. The goals of the CM-SAF training activities are an improved visibility of CM-SAF and to inform (potential) users and atmospheric scientist (esp. climatologists) about CM-SAF products and activities. To achieve these goals it is necessary to train an appropriate handling of satellite data and usage of information derived from satellite data

- to enhance the use of satellite data in climate monitoring and climate analysis
- to intensify a widespread use and knowledge of the CM-SAF products
- to enhance and establish international networks on a working level
- to establish a lively dialogue with users

Since March 2007 a five-day workshop on “The Use of Satellite Data for Climate Applications” has been held and further workshops are planned, a showcase on the „The Use of CM-SAF data for operational Climate Applications“ has been initiated, and as a contribution to EUMeTRAIN an e-learning module on “Climate and Environmental Application(s) of CM-SAF data” is currently developed.

The poster will give an insight on past, current, and future training activities of the SAF on Climate Monitoring.

THE USE OF SATELLITE IMAGERIES FOR HYDRO-METEOROLOGY FORECAST

Geremew Aragaw

National Meteorological Agency of Ethiopia

ABSTRACT

Ethiopia gains 100% of its electric power from its rivers but the rainfall amount, distribution and intensity are highly variable both in time and space. The main rainy season is from June to September and the amount of water entering in to dams (reservoirs) increase in amount and depth. As a result, flash flood that causes the dams filled with delta that affects the normal distribution of electric power through out the country and cause damage to property as well as livestock lose and crop field in the low-lying flood prone areas. On the other side, when the amount of water enters in to dams decrease in amount, which limits the distribution of electric power through out the country. In order to alleviate the above problems, satellite data has great role to supplement the gauge information for a reliable hydro meteorological forecast. Currently, we use satellite data to give hydro meteorological and flood forecast from the type of cloud using Cold Cloud Duration and we got remarkable enhancement on our hydro meteorological forecast. Therefore, the technique using satellite data assimilation would give better hydro-meteorological forecast and advisory to minimize the expected catastrophe over the aforementioned areas.

THE PRECIPITATION PRODUCTS GENERATION CHAIN FOR THE EUMETSAT HYDROLOGICAL SATELLITE APPLICATION FACILITY AT C.N.M.C.A.

Daniele Biron, Francesco Zauli, Davide Melfi

Centro Nazionale di Meteorologia e Climatologia Aeronautica, Pratica di Mare, Italy

ABSTRACT

The EUMETSAT Satellite Application Facility in support to Hydrology (H-SAF) focuses on the development of new geophysical products on precipitation, soil moisture and snow parameters and the utilisation of these parameters in hydrological models, NWP models and water management. The development phase of the H-SAF started in September 2005 under the leadership of Italian Meteorological Service.

The Centro Nazionale di Meteorologia e Climatologia Aeronautica (C.N.M.C.A.), the Italian National Weather Centre, that physically hosts the generation chain of precipitation products, developed activities to reach the final target: development of algorithms, validation of results, implementation of operative procedure to supply the service and to monitor the service performances.

The paper shows the architecture status of the H-SAF precipitation group and stress the component of operations. It is shown the full correspondence with the EUMETSAT approved H-SAF documents, in particular the Algorithm Theoretical Design Document (ATDD), where products characteristics are referenced.

Are also reported the first results, produced during the first H-SAF Workshop, held in Rome in October 2007, of validation activities performed on version 1 products, and last results of products distribution to beta-users in preparation of distributing version 2.

SOME MICROPHYSICAL AND OPTICAL CHARACTERISTICS OF FRONTAL CLOUDS (NUMERICAL SIMULATION)

Boris Dorman, Vladimir Bakhanov

Ukrainian Research Hydrometeorological Institute

ABSTRACT

It has been developed the numerical time-dependent model of frontal mixed, stratiform clouds with detailed microphysics description and with 3 forms of ice crystals: needles, plates, columns. The 4 kinetic equations for dimension distributions for drops and crystals are included in the equation system. The ice nucleation on sublimation nuclei and sorbtion ("condensation - freezing") nuclei as well as the metamorphosis of ice particle shapes has been considered.

In addition to microphysical characteristics we calculated all optical characteristics of cloud particles: the single scattering albedo, the coefficients of scattering and extinction, the phase functions, the cloud optical thickness (COT). Optical characteristic calculations of drops are based on the Mie theory, of crystals - on the geometric optics approximation.

We will give the main attention in this presentation on ice clouds (with the liquid water content under 0,005 g/kg).

Most often ice clouds arise when their cloud top height is above the level of 5 km and cloud top temperature is below of -35…-30 grad C. Columns are the main form in such clouds. The efficiency of precipitation in these cases is very great (the intensity of precipitation formation is equal the thermodynamical condensation rate). These clouds with columns have a not great COT - under 10 - 15.

If the nucleation rate (or concentration of active nuclei) increases, a cloud may crystallize in the case of the more lower cloud top height (cloud top temperature T > - 25 grad C). Plates prevail in these clouds and the COT can rise to values of 40 - 45. The crystal concentration in ice clouds is more than 10 per litre, the modal radius of plates is equal 300 - 400 mkm, the modal dimension of columns 100 - 200 mkm.

The particular feature of optical properties of ice clouds is as follows: COT does not depend on the radiation wave-length. So this property and high values of effective radius of cloud particles form the informative criteria for distinguishing cloudiness regions with highly developed crystallization and precipitation formation.

EVALUATION OF THE TAMSAT RAINFALL ESTIMATION TECHNIQUE OVER ETHIOPIA MSC THESIS BY: G.J. ENDALEW (NMA, ETHIOPIA) SUPERVISION: LEO KROON (METEOROLOGY AND AIR QUALITY WAGENINGEN UNIVERSITY) FEBRUARY 2007

Gebru Endalew

NMA of Ethiopia

ABSTRACT

The aim of this study is to classify Ethiopia in to homogeneous rainfall zones, calibrate and validate the Tropical Applications of Meteorology using Satellite (TAMSAT) technique of rainfall estimation for each month and zone during the summer season especially over the summer (Kiremt) rain benefiting areas of the country. Infrared images from the Meteosat satellite are used for rainfall estimation using this technique with the assumption that convective clouds are the main source of rain.

Ten-day cumulative gauge data and Cold Cloud Duration with threshold temperatures of -30,-40,-50 and -60°C from 1995-2005 for 97 stations are used in this study. Ethiopia is divided in to two different zones in all months. For most parts of the western half of the country, including central Ethiopia, a significant intraseasonal variability is not observed. For instance, the optimum threshold remains the same and is -30° C throughout the season. But for most of the northeastern lowlands and adjoining escarpments of the country, including parts of eastern highlands, it varies from -30°C during August to -60°C during July. A change in threshold from -30°C to -50°C was observed during August over the southern and parts of southeastern places of the Kiremt rain benefiting areas of the country.

The intercept (a_o) and the slope (a_1) have been calculated via regression of the gauge data and the CCD. This has been done by extending the rainfall and CCD data from 2001-2005. The interannual variation for a $_o$ is observed especially in the middle of the season during July and August, when maximum rainfall is recorded, with a general decreasing trend. Where as, a_1 shows an increasing trend. But during the onset and cessation, it varies from year to year.

Both the actual and estimated rainfall values have a similar pattern for most of the stations used in this study. However, the method has a drawback in detecting heavier rainfall amounts. Mostly it underestimates rainfall amounts, which are greater than 100mm and overestimates for rainfall less than 50mm. For Zone-B of June, under normal conditions, it is dry period. Hence, as can be seen from the results above, it is not important and reliable to do estimation during this period for this area. For Zone-B of August, as stated above, under normal condition, the rainfall distribution is weak and most of the statistical indices show that the estimation output is not a reliable one.

Combining both zones for the season a general decreasing trend for bias and root mean square difference (Rmsd) and increasing trend for explained variance (R^2), correlation coefficient (α) and skill is observed. However, the method has a drawback in detecting heavier amounts. Even if convective type of rain is common during the season over most of the area, the occurrence of convergent type of rain from warm clouds is also possible. Hence, there is a need to include other methods that can estimate rain from warm clouds in order to increase the quality of the rainfall estimation.

Keywords: Cold Cloud Duration (CCD), Rainfall, homogeneous, calibration, validation, threshold temperature, satellite rainfall estimation.

APPLICATION OF SATELLITE RAINFALL ESTIMATION WITH TAMSAT METHOD IN ETHIOPIA

Kassa Fekadu

National Meteorological Agency

ABSTRACT

The methods use is Cold Cloud Duration derived from the Thermal Infrared images (TIR) of the METEOSAT satellite with which the rainfall is related. A simple linear relationship of the following form is assumed between CCD and rainfall (R):

$$R = f(CCD) = b_0 + b_1 . CCD$$

The methodology is based on the assumption that in the tropics most of the rainfall comes from convective clouds. Such convective clouds, because of their great vertical extent have very low temperatures. The higher the cloud, the colder it is and the more rainfall it would produce. Thus in this assumption the rainfall from a particular cloud is related to its temperature.

The assumption that most of the rain comes from convective clouds might not be true some times, in a mountainous country like Ethiopia. It is shown that topography also plays significant role in influencing the rainfall pattern.

This paper is give an idea about how can harmonize the topographical effect and the TAMSAT method generates rainfall estimation, calibration and validation in Ethiopia.

INTEGRATING RS/GIS IN THE ANALYSIS OF THE RELATIONSHIP BETWEEN RAINFALL, NDVI AND SST PATTERNS OVER CENTRAL AND WESTERN OROMIYA IN ETHIOPIA

Mulugeta Gessei

National Meteorological Agency

ABSTRACT

This study incorporates the use of Remote Sensing and GIS in investigating the relationship between rainfall, NDVI and SST patterns over Central and Western Oromiya administrative zones in Ethiopia during selected El Niño/La Niña periods. The main objective of the study was to obtain a good insight into the climate of rainfall and NDVI on seasonal basis over the study area as SST patterns change in the Pacific Ocean during El Niño/La Niña periods. The study was also aimed at providing effective methodology for the monitoring and preventions of natural hazards in relation to El Niño/La Niña occurrences. Anomalies and correlations of 200 meteorological rainfall stations, NDVI datasets of 21 years from AVHRR sensor and 53 years of Nino-3.4 region SST datasets were computed.

With the exceptions of some areas, the rainfall patterns in all the selected administrative zones are irregular for Belg, relatively normal during Kiremt and no or low patterns during Bega seasons over the study area during normal years. During El Niño periods, high amount of rainfall is experienced during Belg; while low and significant patterns are observed during Kiremt and Bega seasons respectively. During La Niña years, low and high rainfall patterns are observed during Belg and Kiremt respectively. However, nearly equal or less patterns following each previous El Nino periods are observed during Bega. With some exceptions, similar patterns were observed on NDVI during normal, El Niño and La Niña periods. The correlation of rainfall and NDVI patterns are strong during Belg; while the correlation of rainfall and SST are strong during Kiremt. Most parts of West and some parts of Central Oromiya experience moderate correlation of rainfall and SST during Bega. However, NDVI and SST have no direct, influential and significant correlation in all seasons.

SST occurred on the central Pacific Ocean affects the rainfall and the NDVI patters over Ethiopia through teleconnections. NDVI patterns are also vital to understand the upcoming extreme weather effects of SST along with the rainfall patterns over the country. And, by disseminating this information to the society on local and national level, the risk of extreme weather effects can be reduced.

EXAMINING THE QUALITY OF MODIS CLOUD PRODUCTS FROM RADIANCE SIMULATIONS OF FIFTEEN MODIS SPECTRAL BANDS

Seung-Hee Ham[1], Byung-Ju Sohn[1], Ping Yang[2]

(1) School of Earth and Environmental Sciences, Seoul National University, Seoul, South Korea, (2) Department of Atmospheric Sciences, Texas A&M University, College Station, Texas, USA

ABSTRACT

Radiances for fifteen MODIS spectral bands were simulated using MODIS-derived cloud products as inputs to a radiative transfer model in order to examine the quality of MODIS cloud products. Simulated radiances were compared with observed values which were originally used for retrievals of cloud parameters such as cloud optical thickness, effective size and cloud top height. Cloud top temperature was used to determine whether clouds are in ice and water phases, and then Mie and Baum scattering database were used for calculating scatterings by water and ice clouds, respectively. Mixed-phase clouds were not included because the height showing phase transition was not available. Provided scattering databases include extinction efficiency, single scattering albedo, and phase function for given wavelength and particle effective size. Cloud optical thickness was scaled using extinction efficiency for each band because MODIS data only provide cloud optical thickness for 0.65 μm band.

Simulation results show that MODIS visible channel measured radiances can be calculated within a 5% error range when cloud conditions are specified with MODIS cloud products. As expected, simulated 0.65, 0.86, and 2.16 μm band radiances are in good agreement with observed values probably because these bands were used for the retrievals of optical thickness and effective radius. On the other hand, simulated radiances are larger for NIR water vapor channels (0.90 and 0.93 μm) and smaller for infrared window channels (8.5 to 12 μm). These suggest that column-integrated cloud properties are not enough for the NIR water vapor and window channel simulations, instead interpreting MODIS cloud products are not relevant for the radiance simulation.

H-SAF PRECIPITATION PRODUCT - CONTRIBUTION OF SLOVAKIA TO CALIBRATION AND VALIDATION ACTIVITIES

Jan Kanak

Slovak Hydrometeorological Institute

ABSTRACT

Calibration and validation activities in the frame of H-SAF project from the beginning were focused on common validation methodology developed by the Precipitation Products Validation group. The processing chain for intercomparison of satellite precipitation and radar based precipitation fields was developed in Slovak Hydrometeorological Institute. Full automation of this processing chain enabled us to perform intercomparison of full data sets repeatedly with slightly changed parameters and/or input data as a result of different algorithm's versions.

The latest statistical results showed that quality of reference data is very important and statistical parameters per se are not sufficient to evaluate and calibrate new precipitation products based on satellite data. Very important information can be obtained from case studies which must be differenced according to cloud types, meteorological situations and seasons. Understanding and specification of errors of reference data is crucial.

Our work will present analyses of all possible errors of precipitation intensities measured by Slovak meteorological radars. Developed correction techniques are applied to radar data to correct effects of beam shielding, bright band, attenuation of signal on distance and in heavy precipitation.
Special attention is focused on calculation of cumulative precipitation, in which forcing of all types of errors is observed. The latest case studies will show the impact of corrected reference data in calibration/validation of H-SAF precipitation products derived from satellites.

VALIDATION OF THE NOAA/AMSU SATELLITE-DERIVED RAINRATE PRODUCTS IN THE WEST BLACK-SEA BASIN IN TURKEY

Ali Umran Komuscu[1], Ýbrahim Sönmez[2], Ahmet Öztopal[3], Ali Ü. Kömüþcü[4], Aydýn G. Ertürk[4], Fatih Demir[4], Zekai Þen[5], Erdem Erdi[6]

(1) Turkish State Meteorological Organization, (2) State Meteorological Service, Remote Sensing Division, Kalaba, Ankara, (3) ITU, Department of meteorological Engineering,, Maslak, Ýstanbul, (4) State Meteorological Service, Remote Sensing Division, Kalaba, Ankara, (5) ITU, Department of Civil Engineeringi, Hydraulic Lab, Maslak Ýstanbul, (6) State Meteorological Service, Remote Sensing Division, Kalaba, Ankara,

ABSTRACT

The H-SAF is an initiative of EUMETSAT, aiming at extending its application ground segment by a de-centralised "Satellite Application Facility" (SAF) dedicated to the generation of satellite-derived products specifically designed as to comply with requirements for operational hydrology and water management. Turkey takes part in this initiative through research and product development in snow and rainfall parameters. For the rainfall parameters, Turkey is responsible for the validation of the instant and cumulative rain rate amounts and experimentation of advanced product generation methods in mountainous regions.

Precipitation products are generated by using various satellite sensors such as, NOAA/AMSU and MSG/SEVIRI. For this reason, the areal representation of products varies depending on the footprint of the corresponding satellite data. From the validation standpoint, the most challenging issue is to determine the areal representation of the rainfall amount especially when rain gauges are used as the ground observations. In this study, Point Cumulative Semi-Variogram (PCSV) methodology is introduced to overcome such difficulty. The automated weather observation sites (AWOS) in the West-Black Sea basin are used for the applications. The spatial dependent functions are obtained geostatistically by using the precipitation data. The areal representation corresponding to the satellite footprint area is determined by PCSV to be able to compare with the precipitation product. The error statistics for the selected case studies are analyzed both in temporal domain and respect to sub-groups of the rain rate amounts.

METHODS USED FOR THE VALIDATION OF THE SATELLITE-DERIVED PRECIPITATION PRODUCTS, PART OF THE HYDROLOGY SAF IN HUNGARY

Eszter Lábó[1], Judit Kerényi[1], Silvia Puca[2]

(1) OMSZ-Hungarian Meteorological Service, (2) Dipartimento della Protezione Civile (DPC), Italy

ABSTRACT

In the frame of the Hydrology SAF project, the OMSZ-Hungarian Meteorological Service participates in the Calibration/Validation activity of the Precipitation Products. The methods for the developement of Precipitation Products are very divesified, there are four algoritms for producing instantenous precipitation rates, and one more product for estimating the accumulated precipitation fields, each based on even different satellites.

The OMSZ-Hungarian Meteorological Service has developped validation techniques in collaboration with the HSAF Precipitation Products developers and validation group for characterising the different precipitation products. These methods allow us to compare the precipitation rates based on satellite measurements with Hungarian ground truth data. Also, the comparison of the different satellite products is performed. The ultimate goal is obviously to determine the error structure and reliability of such products.

The validation is preformed basically in two different ways: first, by the investigation of single cases through case studies, and secondly, for a longer periods in order to have statistical characterization. The results show that even single case studies can demonstrate the basic characteristics of the products in hydrological use.

In my poster, I will present different kind of validation techniques which are used in Hungary for the characterization of the different precipitation products. Each satellite products differ in resolution, time sampling, so individual methods are needed to be worked out when validating. I will equally present both the results of the case studies performed through visual validation of all kind of precipitation measurementas, and the results of the statistical calculation on the products. The visualization software used for validation purposes in Hungary is the home-developped HAWK (Hungarian Advanced WorKstation) displaying system.

VARIABILITY OF WARM SEASON CONVECTIVE CLOUDS OVER EUROPE AND THE MEDITERRANEAN

Vincenzo Levizzani[1], Francesca Pinelli[1], Roberto Ginnetti[1], Samantha Melani[2], Andrea Antonini[2], Massimiliano Pasqui[2], Alberto Ortolani[2], Arlene G. Laing[3], Richard E. Carbone[3]

(1) ISAC-CNR, (2) LaMMA-IBiMet-CNR, (3) NCAR

ABSTRACT

A dataset consisting of 10 years of Meteosat IR data every half hour has been exploited to investigate the span and duration of convective systems over Europe and the Mediterranean during summer months (May-August). The European domain spans a latitude belt 30 - 54 N and a longitude domain 15 W – 40 E to capture the North Atlantic jet and the circulation from North Africa which interests the western and central Mediterranean. May to August data were considered. Hovmöller longitude-time diagrams are used to retrieve the span, duration and phase speed of the convective systems. A Fourier power spectrum analysis is used to identify daily cycles and propagation features of the systems.

The role of orography in determining the convection strength and propagation comes out quite evident. The Atlas, Pyrenees, Alps and Carpathians heavily influence the circulation and convective cloud development. Sea-land effects appear also responsible of convective development along the Atlantic French coast and over the Black Sea. At the same time, the propagation and convective re-generation component of the mesoscale systems is observed. NCEP reanalysis data for the period are also used to identify the relevant mesoscale features together with simulations from the Regional Atmospheric Modeling System (RAMS) on a shorter time span.

These results show a potential for the improvement of NWP models and for a regional climate characterization in the Mediterranean area, which is a clear hot spot in a changing climate scenario.

THE IMPLEMENTATION OF A SATELLITE-BASED THERMAL INFRARED SURFACE ENERGY BALANCE MODEL OVER EUROPE

John Mecikalski[1], **Christopher Hain**[1], **Martha Anderson**[2]

(1) University of Alabama in Huntsville, (2) USDA-ARS Hydrology and Remote Sensing Lab

ABSTRACT

The Atmosphere-Land Exchange Inversion (ALEXI) model was initially developed as an extension of the Two-Source Balance Model (TSEB; Norman et al., 1995; Anderson et al., 1997). The TSEB addressed many of the issues dealing with the monitoring of surface fluxes from satellite-based platforms. The main issue was the misrepresentation of the radiometric surface temperature as the equivalent to the aerodynamic temperature of the surface, which plays a pivotal role in the computation of sensible heat flux. ALEXI consists of two atmospheric components, a surface layer component and an atmospheric boundary layer component (ABL). The addition of an ABL component was motivated by the documented relationship between the rise in surface temperature and height of the mixed layer to the time-integrated influx of sensible heat (Tennekes, 1973; Diak, 1990). Flux partitioning within ALEXI is guided by time changes in surface brightness temperature, where the amplitude of the diurnal surface temperature wave has been found to be a good indicator of the partitioning between sensible and latent heat fluxes (Anderson et al., 1997). Mecikalski et al. (1999) implemented ALEXI on a continental scale over the United States. The necessary inputs needed by ALEXI include thermal-IR satellite data (~11 um) from a geostationary platform, a vegetation cover and characteristic dataset, a cloud-masking routine, and several meteorological inputs. Extensive validation studies over the United States have shown that ALEXI surface flux estimates compare well to both ground and tower-based flux observations (Anderson et al., 2004; Anderson et al., 2007). Additionally, ALEXI provides unique opportunities to diagnose root-zone soil moisture conditions based on relating a fraction of actual to potential evapotranspiration (fPET) to a fraction of available water (fAW; Hain et al., 2008). The availability of Metosat Second Generation (MSG) satellite products provides a unique opportunity to implement ALEXI over western and central Europe. Time-differential surface brightness temperatures, which are a main driver to ALEXI, will be provided by MSG Channel 9 (10.8 μm). The cloud-clearing routine will be based on a series of threshold tests developed by Jedlovec and Laws (2003) and will use MSG Channel 4 (3.9 μm) and Channel 9 (10.8 μm). The fraction of vegetation cover, along necessary vegetation characteristics, will be provided by global-scale MODIS products. Several surface meteorological inputs and the initial 1200 UTC ABL profile of potential temperature will be provided by a mesoscale numerical model (MM5 or WRF) simulation over the ALEXI domain. The implementation of ALEXI over the European domain will be tested during several case study days during the 2008 warm season (May-August).

OPERATIONAL MAPPING OF SNOWCOVER USING MSG/SEVIRI DATA

Niilo Siljamo, Otto Hyvärinen

Finnish Meteorological Institute

ABSTRACT

Hydrological processes and climate are highly affected by the seasonal snow cover. Snow areal extent is essential information both for hydrology and climatology. Promising research results have indicated for a long time a possibility to provide operational snow information based on EO-data. NOAA/NESDIS operates one of the first snow services that employ both optical and microwave satellite data and in situ observations. However, the algorithm is not fully automatic and it sometimes needs human interpretation. EUMETSAT's Land Surface Analysis Satellite Applications Facility (LandSAF) has been producing daily snow cover products for two years with a baseline algorithm (version 1.12).

New version 2 of the algorithm is now in operational use. We compare both versions of LandSAF snow cover product to NOAA/NESDIS snow cover product in Europe. Our analysis shows that the new version is significantly better than the old version and agrees reasonably well with NOAA/NESDIS IMS product. However, detailed comparison show that in case of forested areas our product seems to yield better results. Both products present a reasonable and realistic snow cover analysis in clear sky conditions, particularly during the winter season.

BELGIAN CONTRIBUTION TO THE VALIDATION OF THE PRECIPITATION PRODUCTS OF THE HYDROLOGY-SAF: METHODOLOGY DEVELOPED AND PRELIMINARY RESULTS

Hans Van de Vyver, Emmanuel Roulin

Royal Meteorological Institute of Belgium

ABSTRACT

The Royal Meteorological Institute of Belgium is taking part to the Hydrology SAF development phase, and in particular, in the Precipitation Products calibration/validation and in the hydrological demonstration activities. This poster presents the methodology developed and preliminary results obtained for the validation of instantaneous precipitation rates and accumulated precipitation products by comparison with raingauge-adjusted radar data.

The instantaneous rain rates are produced on the base of different satellites and at different projections and spatial resolutions. Methods and tools have been developed taking the recommendations of the product developers into account and with a special attention to the characterization of the products through the time but also with regards to the spatial structure of the rainfall. The accumulated precipitation fields are the ultimate products to be used in hydrological models. Validation of these latter products has been tackled with both the point of view of the product developers and their subsequent use of in hydrological modeling at different scales.

Preliminary results will be presented for the validation of the already processed satellite data, as time series of selected indices as well as summary statistics and, with more detail, for the validation of selected test cases.

HELLENIC CONTRIBUTION (LAP AND HNMS) IN THE PROGRAM OZONE MONITORING SATELLITE APPLICATION FACILITY OF EUMETSAT

Anastassios Anthis[1], **D. Balis**[2], **Ch. Zerefos**[2], **B. Amoiridis**[2], **Mariliza Koukouli**[2]

(1) HNMS, (2) University of Thessaloniki / LAP

ABSTRACT

The Laboratory of Atmospheric Physics (LAP) of the Aristotle University of Thessaloniki in cooperation with Hellenic National Meteorological Service (HNMS) are participating in the research program "Ozone Monitoring Satellite Application Facility" (O3M SAF), financed by the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

LAP and HNMS are responsible for the part of the program related on "Validation of total ozone". More precisely, for the design and development of the total ozone validation procedure between ground-based measurements and satellite derived measurements.

Ground-based measurements are obtained from the World Ozone Data Centre and the World Ozone Mapping Centre. Satellite derived measurements are obtained from DLR (Deutschen Zentrum für Luft- und Raumfahrt). The proper algorithms have been developed for the validation services.

VALIDATION OF ANN TRACE GASES RETRIEVAL WITHIN IASI L2 OPERATIONAL PROCESSOR.

Thomas August[1], Olusoji Oduleye[1], Peter Schlüssel[1], Rosemary Munro[1], Xavier Calbet[1], Arlindo Arriaga[1], Juliette Hadji-Lazaro[2], Solène Turquety[2], Cathy Clerbaux[2]

(1) EUMETSAT, (2) Service d'Aéronomie, Université Paris 6

ABSTRACT

Among other atmospheric parameters, the Infrared Atmospheric Sounding Interferometer (IASI) Level 2 Product Processing Facility (PPF), operated at EUMETSAT, retrieves integrated amounts for several trace gases, namely CO, CH_4, CO_2, N_2O and O_3. For the latter, a total column as well as three partial columns (<6km, <12km and <16km) are retrieved.

Of direct importance for NWP activities and climate monitoring, these products are being distributed to users via EUMETCAST in NRT. They can also be used internally to the PPF as input parameters to the iterative retrieval responsible for the nominal temperature and humidity profiles production.

The potential of the methodology has been proven in different studies in the past years and the IASI L2 PPF is expected to deliver total columnar amounts with an accuracy better than 5% for O_3 and 20% for CO, N_2O and CH_4 with 250 km horizontal resolution. Validation results obtained with other products from other instruments, possibly flying on-board other platforms, and ground-based measurements as well as inter-comparison with IASI L2 PPF O_3 retrievals based on an EOF regression method will be presented and discussed.

COMPARISON OF TOTAL OZONE FROM THE SATELLITE INSTRUMENTS HIRS AND GOME WITH WOUDC AND SAOZ GROUND-BASED OBSERVATIONS IN 2007

François Borchi, Fernand Karcher

cnrm-meteo france

ABSTRACT

The purpose of the present study is to investigate on possible systematic errors in the total ozone column from HIRS (High-resolution Infrared Radiation sounder) on board polar orbiting satellites. Comparisons are performed over the year 2007 in the northern hemisphere by using SAOZ (Analyzed system by Zenithal Observation) and WOUDC (World Ozone and Monitoring Experiment) ground-based, and space GOME instrument (Global Ozone Monitoring Experiment) measurements. The Total HIRS relative difference, with the present calibration, shows a positive bias of 5 ± 10 % with ground-based and GOME data, depending of latitude and season.

MEASUREMENTS OF OZONE WITH IASI/METOP: FIRST COMPARISONS WITH GOME-2 AND SONDE DATA

Cathy Clerbaux[1], A. Boynard[2], S. Turquety[2], M. George[2], J. Hadji-Lazaro[2], P. Coheur[3], P. Coheur[3], D. Hurtmans[3], M. Beekmann[4]

(1) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France, (2) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France, (3) Spectroscopie Atmosphérique, Université Libre de Bruxelles, Belgium, (4) Université de Créteil, CNRS, LISA, France

ABSTRACT

Ozone plays a key role in the photo-chemical processes occurring in the atmosphere, with strong consequences for air quality and climate. It is highly variable, particularly in the troposphere, and needs to be monitored as accurately as possible over the globe in order to provide a better insight into, for example, pollution episode development and pollution transport on regional to global scales.

The recently launched METOP European satellite carries the Infrared Atmospheric Sounding Interferometer (IASI) instrument which provides near real-time measurements of ozone with an excellent geographic coverage since May 2007, opening new perspective for chemical forecasting with an unprecedented amount of data. In particular, significant improvements for ozone peaks forecasting are awaited, through data assimilation of IASI ozone measurements into a three-dimensional chemistry-transport model.

Ozone concentrations are retrieved from the IASI Level 1 radiance data using two complementary tools. On one hand, a neural network algorithm (SA-NN) allows to provide global distributions of ozone total and partial columns on a near real time (T+3h) mode. On the other hand, a sophisticated radiative transfer and retrieval software (Atmosphit) is used to measure vertically resolved ozone distributions in the troposphere and the stratosphere in some interesting areas. The latter also provides a better insight of the IASI sensitivity and accuracy for providing ozone concentration profile.

Early results of global distributions of ozone will be presented, as well as tentative validations with distributions obtained from other space borne instruments such as GOME-2. We will also present first validation of the ozone profile retrievals against ozone soundings available from several stations around the globe.

CO GLOBAL DISTRIBUTIONS FROM THERMAL INFRARED MEASUREMENTS: COMPARISON OF IASI AND MOPITT OBSERVATIONS

Cathy Clerbaux[1], M. Pommier[2], S. Turquety[2], P Coheur[3], D. Edwards[4]

(1) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France, (2) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France, (3) Spectroscopie Atmosphérique, Université Libre de Bruxelles, Belgium, (4) National center for Atmospheric Research, Boulder, CO, USA

ABSTRACT

Carbon monoxide is a reactive toxic gas, mainly produced by the combustion of fossil fuels and vegetation burning. A better understanding of photochemistry and transport of this gas will allow to determinate its impact on pollutants transport and climate change. CO is measured since several years by a number of satellite instruments, allowing a global monitoring of its distributions. The most recent mission dedicated to the observation of the troposphere is IASI (Infrared Atmospheric Sounding Interferometer), launched on October 19, 2006 onboard the MetOp-A satellite. It uses an accurately calibrated FT spectrometer and an associated infrared imager to sound the atmosphere, with a global coverage two times per day and a horizontal resolution of 12 km.

The aim of this study is to compare the CO data values observed by IASI to those observed by MOPITT (Measurements Of Pollution In The Troposphere) instrument, launched in December 1999 onboard the US TERRA satellite, and widely used by the scientific community. We will present systematic comparisons between IASI and MOPITT CO total columns characterized in terms of vertical sensitivity (DOFS) and errors budgets, with examples above specific regions.

ASSESSMENT OF METHANE USING THE IASI INSTRUMENT

Cathy Clerbaux[1], **A. Razavi**[2], **P. Coheur**[2], **D. Hurtmans**[2], **J. Hadji-Lazaro**[3]

(1) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France, (2) Spectroscopie de l'Atmosphère, Service de Chimie Quantique et Photophysique, Université Libre de Bruxelles, Brussels, Belgium, (3) Université Paris 6, CNRS, Service d'Aéronomie/IPSL, France

ABSTRACT

Methane (CH_4) plays a key role in the atmosphere due to its strong absorption in the infrared region (making it the second most important anthropogenic greenhouse gas after carbon dioxide). Moreover, its reaction with the hydroxyl radical affects the cleansing power of the troposphere. Owing to the fact that its sources and tropospheric variability are still not well determined, uncertainties are introduced in its global budget and its impact on climate change is poorly quantified. Satellite observations are able to provide global distribution in a short lap of time and therefore help us to detect spatial and temporal variation of atmospheric methane concentrations.

The recently launched Infrared Atmospheric Sounding Interferometer instrument (IASI) has begun to release its huge flow rate of data in May 2007. This Fourier Transform interferometer, which measures the thermal infrared radiation in a nadir-like geometry provides a global Earth coverage twice a day. Owing to the extended spectral range of IASI (from 645 to 2760 cm^{-1}), methane can be retrieved from the radiance spectra in two different absorption bands (the v_4 bending mode around 1306 cm^{-1} and the v_3 stretching mode around 3020 cm^{-1}).

We present global distributions of methane retrieved from level 1 IASI data by using the Optimal Estimation Method. We show that the inclusion of some absorption lines belonging to the CH_4 v_3 mode in the retrieval process provides enhanced sensitivity near the Earth's surface. Characterizations in terms of vertical sensitivity and errors are also discussed.

GLOBAL DISTRIBUTIONS OF NITRIC ACID FROM IASI/METOP MEASUREMENTS

Pierre-François Coheur[1], Catherine Wespes[1], Daniel Hurtmans[1], Cathy Clerbaux[2], Solène Turquety[2]

(1) Université Libre de Bruxelles, (2) Université de Paris6, CNRS

ABSTRACT

Reactive nitrogen compounds play an essential role in processes that control the ozone production in the lower atmosphere. Except for tropospheric NO_2, which is well monitored from UV satellites, there is a lack of observations of the other nitrogen oxides in the troposphere, in particular HNO_3. The concentration distributions of this compound, which is one of the principal reservoir species for the nitrogen oxides in the lower atmosphere, can be accessed using infrared satellite measurements. Day-to-day global distributions of HNO_3 will greatly improve our knowledge of its sources, transport and sinks in the troposphere.

The *Infrared Atmospheric Sounding Interferometer* (IASI) instrument, launched onboard the MetOp platform in October 2006, is a nadir-looking Fourier transform infrared spectrometer providing atmospheric radiance spectra at 0.5 cm^{-1} spectral resolution. The benefit of the IASI/MetOp mission lies on the continuous measurements of temperature and infrared absorbing gas concentration profiles with global Earth coverage twice daily. The analysis in terms of information content demonstrates the possibility of retrieving a total column for HNO_3 at all latitudes. We present the first near real-time retrievals of HNO_3 on the global scale from IASI measurements in the atmospheric window. The retrievals are performed using a fast radiative transfer model and an inversion software relying on the Optimal Estimation Method. Preliminary tropospheric column distributions, obtained after subtracting the stratospheric contribution from the total columns are also presented and discussed, with emphasis given onto the identification of NOy sources and long-range transport in the troposphere.

IASI/METOP MEASUREMENTS OF TROPOSPHERIC WATER VAPOUR ISOTOPOLOGUES (H216O, H218O AND HDO) AND THEIR RATIOS

Pierre-François Coheur[1], **Hervé Herbin**[1], **Daniel Hurtmans**[1], **Cathy Clerbaux**[2]

(1) Université Libre de Bruxelles, (2) Université Paris 6, CNRS

ABSTRACT

Water vapour is involved in many key atmospheric processes, in particular in the troposphere, where it is an essential component of the global climate system. It acts on clouds, precipitations and also plays a major role in the greenhouse effect. The measurement of the water isotopologic composition is a well-known powerful tool to study transport and chemistry of atmospheric water vapour and the knowledge of the vertical and horizontal distribution of the different isotopologues gives insight onto the hydrologic processes. However, the quick changes of water concentration in space and time, associated with the very important concentration decay with altitude represent a major difficulty, and very few measured profiles of the heavier isotopologues of water vapour have been reported (Worden et al., 2006; Zahn et al., 2006, and references therein).

In a previous work, we have presented, for the first time, simultaneous profile retrievals of the main water isotopologues (i.e. $H_2{}^{16}O$, $H_2{}^{18}O$ and HDO) and their ratios on a quasi-global scale (Herbin et al., 2007). These results were obtained by exploiting infrared spectra recorded by the Interferometric Monitor for Greenhouse gases (IMG) instrument.

Here, we present retrievals of $H_2{}^{16}O$, $H_2{}^{18}O$, and HDO vertical profiles from IASI (Infrared Atmospheric Sounding Interferometer) onboard the first European meteorological polar-orbiting METOP-A satellite. Characterizations in terms of vertical sensitivity and error budget are provided for each isotopologue. In addition, we show that the high spatial and temporal sampling of IASI/METOP allows obtaining unprecedented information about distributions of $H_2{}^{16}O$, HDO and their ratios on local and global scales. The latter is illustrated by an analysis of their concentration distributions and spatio-temporal variations during some of major climatic events. The Krosa typhoon that occurred in October 2007 is presented as a case study.

References

Herbin, H., Hurtmans, D., Wespes, C., Barret, B., Turquety, S., Hadji-Lazaro, J., Clerbaux, C., and Coheur, P.-F.:Global distributions of water vapour isotopologues retrieved from IMG/ADEOS data, Atmos. Chem. Phys. 7, 3957-3968, 2007.

Worden, J., Noone, D., and Bowman, K.: Importance of rain evaporation and continental convection in the tropical water cycle, Nature, 445, 528- 532, 2006.

Zahn, A., Franz, P., Bechtel, C., Grooß, J.-U., and Röckmann, T.:Modelling the budget of middle atmospheric water vapour isotopologues, Atmos. Chem. Phys., 6, 2073– 2090, 2006.

VALIDATION OF GOME2 OZONE PROFILES FOR MID- AND NORDIC LATITUDES, USING BALLOON SOUNDING DATA

Andy Delcloo, René Lemoine, Hugo De Backer

Royal Meteorological Institute of Belgium

ABSTRACT

A validation of the GOME2 ozone profiles has been carried out. This has been done by using ozone sounding data, which have a vertical resolution of about 100 m and is measuring ozone from the surface up to about 34 km. GOME2 ozone data was made available by KNMI at pre-selected sites. The reference data which was available limited this study to the European mid-latitudes and European Nordic region. The algorithm version used for this retrieval of GOME2 ozone profiles is 3.2. For this study, data from other ozone sounding stations besides Uccle have been used (De Bilt, Hohenpeissenberg, Payerne, NY -Alesund, Sodankyla, Lerwick). GOME2 ozone profiles show sensibly better results at European mid-latitudes than at Nordic latitudes, especially in the tropopause region. Preliminary data analysis over the time period April-August 2007 has shown that the *threshold* accuracies for the GOME2 ozone profiles (30% in the stratosphere and 70% in the troposphere) are met in all studied regions. The *target* accuracies for the ozone profiles are respectively 20% in the troposphere and 10% in the stratosphere. This accuracy is reached at least partially in the stratosphere. These poorer comparisons around the top of the ozone soundings can be attributed to degradation of the sounding accuracy at low pressures (certainly for Hohenpeissenberg) and must be taken into account with care. More recent data will be included in the analysis and will be discussed in further detail.

WORLD DATA CENTER FOR REMOTE SENSING OF THE ATMOSPHERE (WDC-RSAT)

Thilo Erbertseder[1], **Kathrin Höppner**[2], **Beate Hildenbrand**[2], **Michael Bittner**[2]

(1) DLR (German Aerospace Center), (2) German Aerospace Center (DLR)

ABSTRACT

Since 2003 the Applied Remote Sensing Cluster of DLR has hosted and operated the World Data Center for Remote Sensing of the Atmosphere (WDC-RSAT, http://wdc.dlr.de) under the non-governmental auspices of the International Council of Science (ICSU).

WDC-RSAT offers scientists and the general public free access to a continuously growing collection of satellite-based atmosphere-related data sets and services. These data holdings range from raw data collected by remote sensors, to information products derived from the raw data ("value adding"). The current WDC-RSAT data holding contains data and information products addressing atmospheric trace gases, clouds, surface parameters, solar radiation, and special services as near-real time (NRT) information related to e.g. European air quality, UV radiation forecasts, global ozone level maps. In addition to archiving data sets, WDC-RSAT cooperates with other data centers and strives to provide additional services, which include

- data analysis and value adding
- data summaries
- campaign planning support
- data set validation and publication.

In support of its data provision activities WDC-RSAT utilizes decentralized on-line robot-driven technology with a storage capacity of more than 300 Tbytes, as well as electronic interfaces (EOWeb, interoperable catalogues, interactive post-processing and processing on demand).

In Germany, three current ICSU World Data Centers, namely WDC-Climate (hosted by the German Climate Computer Center, DKRZ), WDC-MARE (co-hosted by AWI and the University of Bremen), WDC-RSAT (hosted by DLR), and the pending WDC-Terra (to be hosted by GFZ) founded in 2004 the German WDC cluster for "Earth System Research", in order to promote Earth System Science and Research in Germany and abroad. This Cluster is actively pursuing a strategy, using information technology, to make data related to Earth Systems available to an as wide and as interdisciplinary possible audience.

In early 2006 a scientific advisory committee for WDC-RSAT was established. External experts representing space agencies, weather services, atmospheric remote sensing technologies, and atmospheric science help to guide WDC-RSAT in setting and reaching its goals.

In cooperation with the World Meteorological Organization (WMO), WDC-RSAT is aiming to become part of a data integration center to be created within the WMO program Global Atmospheric Watch (GAW). This center would concern itself with linking different GAW-relevant data sets both with each other and with models. In this context WDC-RSAT will also handle non-satellite based data which is relevant within the context of validation.

AEROSOL MONITORING OVER LAND USING MSG/SEVI

Dominique Jolivet[1], Emilien Bernard[1], Didier Ramon[1], Pierre-Yves Deschamps[2], Jérôme Riedi[2], Jean-Marc Nicolas[3]

(1) HYGEOS, (2) Laboratoire d'Optique Atmosphérique, (3) ICARE

ABSTRACT

An algorithm has been developed for the daily monitoring of aerosol properties, optical thickness and type, from MSG/SEVIRI.

The SEVIRI sensor has several advantages for the aerosols retrieval over land. Under cloudless condition, its time sampling at 15 minutes intervals allows us to observe the diurnal cycle of the aerosol loading and to monitor its rapid changes. Under cloudy condition, the chance to acquire a cloudless observation is dramatically increased. The thermal infrared channels can be used for efficient cloud masking. The fixed viewing geometry and target localisation give an easy co-registration of images. Eventually, the daily course of the sun provide some angular sampling of the surface BRDF and/or aerosol scattering phase function.

The first step of the algorithm is the creation of a time series of images data set during daytime over a period of moving 14 days interval) at 635nm, 810nm and 1640nm. Minimum cloud condition is selected from the lowest value at 635 nm to derive a reference map of surface reflectances in the 3 channels. Eventually, the SEVIRI radiances are matched with computed TOA radiances for the different aerosol models. The retrieved AOTs over land have been compared with AERONET measurements for several months of 2006. Aerosol parameters are given every 15 minutes at the SEVIRI spatial resolution. Over the day, synthesis are produced at optimized space and time resolutions.

NNORSY-GOME OZONE PROFILE RETRIEVAL

Anton Kaifel, Jasmine Kaptur

Center for Solar Energy and Hydrogen Research

ABSTRACT

The Neural Network Ozone Retrieval System (NNORSY) for GOME is a very fast ozone profile retrieval scheme based on neural network technique. For training, ozone measurement data from ground based (e.g. ozone sondes and lidar) and satellite (e.g. SAGE, HALOE, POAM) based ozone profile measurements are used. The disadvantage using real measurement training data is that single measurements are usually not available for the full height range (ground to 61 km) for which NNORSY is setup and that the measurement data has to be as accurate as possible. First this implies that the neural network training algorithm has to deal with incomplete training information for each target profile and that the training data requires a high level of quality control. In the first step we developed a special training procedure based on RPROP which is able to deal with incomplete target data without loss of generalization ability during application and in the second we established a two stage quality control (QC) procedure for ozone profile measurement data where the second stage is based on partial neural network training to find outlier and additional measurement errors that passed the first QC stage. After training which takes up to 10 days computation time application to GOME data is very fast. A whole GOME orbit with full spatial resolution can be processed in less than 1 minute and therefore NNORSY-GOME ozone profile retrieval can easily be applied in real-time with minimal costs on a simple workstation computer. NNORSY-GOME was already implemented in near-real-time at DLR-DFD but the service was stopped in June 2003 when the data recorder on ERS2 failed.

Within the ESA project CHEOPS-GOME ZSW further developed and optimized NNORSY-GOME including reprocessed of all available GOME Level 1 data at full spatial and temporal resolution up to June 2003 yielding to NNORSY-GOME Version 3 global 8 year ozone profile data. Beside the ozone profile information from ground up to 61 km height with a sampling rate of 1 km the data comprises for each profile level an ozone profile error estimation and contains temperature profile data derived from GEOS 4 model data.

The presentation will show the basic approach of NNORSY-GOME compared to classical ozone profile retrieval schemes based on optimal estimation and comparison of derived ozone profile data with independent data sources for single measurements as well as for long term time series of different regions and ozone profile regimes. Sensitivity studies for various used input parameters of neural networks will be presented. It can be shown that the neural networks are able to compensate for GOME instrument degradation and calibration uncertainties if parameter(s) about the GOME instrument (e.g. time in orbit) are supplied as input to the neural network trained with real ozone profile measurement data.

Beside ozone profile data various total column ozone data products like total stratospheric and tropospheric column and different total tropospheric ozone residual column data sets using TOMS or GDP4 data are also derived during processing. Comparisons and validation of different tropospheric ozone column data sets are show as well.

Current developments for NNORSY are underway for ozone profile retrieval and near-real-time application from SCIAMACHY data and we are looking forward to implement NNORSY for the new atmospheric sounding instruments IASI and GOME-2 MetOp satellite.

VALIDATION OF VERTICAL OZONE PROFILES FROM GOME-2 ON METOP-A WITH LIDAR AND MICROWAVE RADIOMETERS

Lucia Kins[1], **Olaf Tuinder**[2]

(1) DWD, (2) KNMI

ABSTRACT

We present initial validation results of vertical ozone profiles from GOME-2 on MetOP-A with lidar and microwave radiometers.

The Global Ozone Monitoring Instrument 2 (GOME-2) on board EPS/MetOp-A is the first instrument on a European operational meteorological platform aimed at sensing ozone and other trace gases in the Earth's atmosphere. GOME-2 measures UV-VIS backscattered solar light with a relatively high spectral resolution (0.2-0.4 nm). From these measurements, vertical profiles of the ozone concentration are retrieved.

As part of the validation activities of EUMETSAT's Ozone and Atmospheric Chemistry Monitoring SAF (O3M-SAF), DWD has developed an operational validation procedure. The goal is to assure high and known quality of ozone profiles throughout the lifetime of the GOME-2 instrument. For the stratosphere, O3M-SAF has set a threshold of ± 10% as largest acceptable difference between GOME-2 and reference profiles. To check this requirement, near real time and offline GOME-2 ozone profiles are regularly compared with ozone profiles from quality approved ground based lidars and microwave radiometers. We investigate the dependence of these differences on meteorological and geophysical parameters, such as seasonal variation, geographic location, cloud cover and solar zenith angle. The first GOME-2 ozone profiles generated, date from April 2007 to August 2007. The initial comparison with lidar and microwave ozone profiles shows that between 15 km and 35 km altitude the differences are within the given threshold of ± 10%. Above 35 km altitude the differences are increasing, with GOME-2 profiles always lower than the reference profiles. Currently, the GOME-2 spectral measurements of 2007 are reprocessed by EUMETSAT. It is expected that with the new data set the comparison results above 35 km will improve.

Once that the GOME-2 ozone profiles are in fully operational status, the validation results will be regularly published on the O3M-SAF validation web page:

(http://lap.physics.auth.gr/eumetsat/index.php) to help further improving the retrieval algorithm and to inform ozone profile users about the product quality.

VALIDATION OF IASI ATMOSPHERIC CHEMISTRY PRODUCTS WITH FTIR GROUND-BASED DATA: METHANE ABOVE REUNION ISLAND

Michel Kruglanski[1], Ann-Carine Vandaele[1], Martine De Mazière[1], Corinne Vigouroux[1], Nicholas Jones[2]

(1) Belgian Institute for Space Aeronomy (BIRA-IASB), (2) University of Wollongong

ABSTRACT

The Belgian Institute for Space Aeronomy (BIRA-IASB) is involved in two EPS/MetOp Research Announcements of Opportunity (ID2904 and ID2913) for the exploitation of IASI observations. It has committed itself to validate IASI level-2 products for atmospheric species CO, O_3, N_2O, CH_4 and HNO_3. The validation part makes use of ground-based remote Fourier transform infrared measurements from 11 stations of the Network for the Detection of Atmospheric Composition Change (NDACC, formerly NDSC). The validation relates to total columns and/or vertical profiles according to the species.

In order to prepare this validation, a first validation exercise has been performed above Reunion Island, a complementary NDACC station. The exercise covers the retrievals of methane columns and profiles on the period from May 21 till October 18, 2007. Ground-based measurements have been recorded by a remotely controlled Bruker 120M spectrometer located at Saint-Denis. The methane retrievals are achieved with ASIMUT and SFIT2 codes. Both codes implement an optimal estimation algorithm based on a line-by-line forward model. SFIT2 is a code routinely used at various NDACC FTIR stations but limited to the analysis of ground-based measurements. ASIMUT is a code developed at BIRA-IASB and accepting observation geometries from space or ground. It has been used to retrieve methane profiles from IASI Level-1 products. The two codes allow carrying out detailed comparisons of the retrievals using averaging kernels and error covariances.

Results from this first validation exercise will be presented.

O3M SAF SURFACE UV PRODUCT: THE FIRST YEAR RESULTS

Jukka Kujanpää, Niilo Kalakoski, Tapani Koskela

Finnish Meteorological Institute

ABSTRACT

The offline surface UV product of the Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF) is produced operationally during the 15-year EUMETSAT Polar System programme using the measurements of the three Metop satellites. The surface UV product is global in coverage and contains the most important quantities of the Solar radiation harmful to life and materials on the Earth. These quantities include daily doses and maximum dose rates of integrated UV-B and UV-A radiation together with values obtained by different biological weighting functions. These quantities are calculated in a 0.5-degree grid and stored in a HDF5 file.

The UV product is based on the O3M SAF near real time total column ozone product derived from Metop/GOME-2 measurements. The diurnal cloud cycle, which is needed in calculating the daily UV doses, is sampled using Metop/AVHRR level 1b products in the morning side and NOAA/AVHRR level 1b products in the afternoon side, thus exploiting the synergy between these two satellites in the Initial Joint Polar-Orbiting Operational Satellite System.

In this paper, we present the validation results for one year of surface UV products from June 2007 until June 2008. The products are compared against ground-based Brewer spectroradiometer measurements in Sodankylä and Jokioinen, Finland, and SUV-100 spectroradiometer measurements in the National Science Foundation (NSF) UV Network. In addition, the contributions of errors in ozone, clouds, aerosols and surface albedo to the product error are discussed.

USING CLOUDS AS LITMUS PAPER FOR DETECTING MAJOR EMISSION SOURCES OF AIR POLLUTION

Martina Lacinova[1], **Daniel Rosenfeld**[2]

(1) Czech Hydrometeorological Institute, (2) The Hebrew University of Jerusalem

ABSTRACT

The MSG multispectral capabilities allow the detection of cloud drop size both during day and night. The cloud drop size is determined, to a large extent, by the concentration of air pollution particles. Therefore, low level clouds can reflect the concentrations of particulate air pollution at the boundary layer. This is often manifested as "pollution tracks" that emanate from emission sources such as power plants.

We have documented such pollution track emanating from power plants. When watching the clouds during inversion situations we noticed a different influence of different kinds of power plants to the layer clouds. While most power plants produce pollution tracks, above nuclear power plant Temelin in southern Bohemia inversion clouds do not have any pollution tracks, and can be sometimes dissolved.

The present study tries to find situations when the effect occurs. Comparison with sounding might show level of inversion when it may occur. For selected cases, the MSG products are also compared to similar products based on the AVHRR data, which might have a bit better horizontal resolution, but they do not provide data as continually as MSG.

The comparison between coal and nuclear power plants will disentangle the effects of the cooling towers and dispensed heat from the effect of aerosols. This will help testing the extent that satellites can be used to monitor emissions of air pollution by their impact on the cloud composition.

GOME-2 LEVEL 1B OPERATIONAL PRODUCT VALIDATION STATUS

Ruediger Lang, Rosemary Munro, Yakov Livschitz

EUMETSAT

ABSTRACT

The Second Global Ozone Monitoring Experiment (GOME-2) performs operational global monitoring of ozone column densities and ozone profiles, and column densities of other atmospheric trace gases such as NO_2, BrO, OClO, HCHO, and SO_2. GOME-2 is an improved version of the Global Ozone Monitoring Experiment (GOME-1) launched 1995 onboard the second European Remote Sensing Satellite (ERS-2). It was launched on the first of the METOP series of polar-orbiting operational meteorological satellites on 19th October 2006. The remaining two satellites in the series will be launched in 2010 and 2014.

GOME-1 Level 1b products are produced centrally at EUMETSAT in the Core Ground Segment and were declared operational in March 2008. Before this status can be achieved a full assessment of product quality is required, including radiometric calibration, spectral calibration, cloud information, and polarisation data and products. The results of this validation and the overall product quality status will be presented.

RELATIONSHIP BETWEEN FIRE COUNT AND CO VERTICAL COLUMN DENSITY RETRIEVED FROM SCIAMACHY ONBOARD ENVISAT

Cheng Liu[1], Christian Frankenberg[2], Ulrich Platt[3], Thomas Wagner[4]

(1) Max Planck Institut fuer Chemie, (2) SRON, Netherlands Institute for Space Research, Earth Oriented Science Division, (3) nstitute for Environmental Physics, University of Heidelberg, Germany, (4) Max Planck Institut fš¹r Chemie

ABSTRACT

SCIAMACHY is the first instrument that allows retrieval of CO by measuring absorption in the near infrared observing reflected and scattered sunlight instead of thermal emission. Thus, in contrast to thermal-infrared satellites (MOPITT), SCIAMACHY is highly sensitive to lower layers of the troposphere where the sources are located such as Biomass burning and the bulk of the CO VCD is usually found.

The burning of vegetation has a repeating seasonal pattern, but the CO emitted from biomass burning varies considerably from season to season and place to place. Here we present a study on the relationship between fire counts and CO vertical column densities in different regions and seasons.

INTER-COMPARISON OF IASI L2 PROCESSOR EOF-RETRIEVED OZONE COLUMNAR AMOUNTS, OZONESONDE AND BREWER SPECTROMETER MEASUREMENTS FROM VALIDATION CAMPAIGNS AND GOME2-RETRIEVED OZONE

Olusoji Oduleye[1], Thomas August[1], Xavier Calbet[1], Arlindo Arriaga[1], Peter Schluessel[1], Rosemary Munro[1], Mark Weber[2], Pepijn Veefkind[3], Pawan Bhartia[4], Bernd Stiller[5], Aulamo Osmo[6]

(1) EUMETSAT, (2) University of Bremen, (3) The Royal Netherlands Meteorological Institute, (4) Goddard Space Flight Center, NASA, (5) Deutsche Wetterdienst , (6) Finnish Meteorological Institute

ABSTRACT

The geophysical parameters retrieved by the operational level 2 product processing facility (PPF) of the Infrared Atmospheric Sounding Interferometer (IASI) include total and partial (0-6km, 0-12km and 0-16km) columnar amounts of ozone. The retrieval methods used in the IASI L2 PPF include statistical retrievals and an optimal estimation method based on RTIASI-4 as a forward model and climatology as a priori background. The optimal estimation process is initialised with the results from the statistical retrievals.

Two validation campaigns for IASI measurements were carried out at Lindenberg (14.1° E, 52.2° N) between June and October 2007; and at Sodankylä (26.6° E, 67.4° N) between June and September 2007. During these periods ozone sondes were launched three times per week for each campaign. Here we present the results of IASI L2 processor EOF-retrieved total and partial columnar amounts of ozone with measurements from these campaigns. A further comparison of total global ozone coverage is made, in particular with GOME2 (flying on the same platform); OMI and SCIAMACHY on other platforms; and Brewer spectrometer point-measurements at the campaign sites.

SATELLITE OBSERVATIONS OF TROPOSPHERIC FORMALDEHYDE (HCHO) SOURCES: REPARTITION AND TRENDS

Marloes Penning de Vries[1], **Steffen Beirle**[1], **Thomas Wagner**[1], **Thierry Marbach**[1], **Ulrich Platt**[2]

(1) Max-Planck Institute for Chemistry, (2) Institute of Environmental Physics Heidelberg

ABSTRACT

We present case studies for Formaldehyde (HCHO) source repartition and trends derived from satellite observations made by the GOME instrument. Launched on the ERS-2 satellite in April 1995, GOME has already performed continuous operations over 8 years providing global observations of different trace gases. This long term satellite observations provide unique opportunities for the identifications of the sources for various trace gases as well as the establishment of trends over specific regions.

The HCHO data can be compared with NO_2 and other trace gas results to identify more precisely the tropospheric sources (biomass burning events, human activities).

MONITORING OZONE PRECURSORS WITH GOME-2

Marloes Penning de Vries[1], **T. Marbach**[1], **T. Wagner**[1], **Steffen Beirle**[1], **U. Platt**[2]

(1) Max-Planck Institute for Chemistry, (2) IUP Uni Heidelberg

ABSTRACT

Satellite-borne UV-vis spectrometer, measuring the sunlight reflected by the Earth's ground and atmosphere, allow to quantify several important atmospheric trace gases like e.g. ozone, nitrogen dioxide, formaldehyde or glyoxal.

Here we present our latest results of trace gas retrievals using GOME-2 data. The combined analysis of NO2 and measurable VOCs (HCHO, CHOCHO) and comparisons to model data allow us to test and improve our knowledge on source distribution/strength and chemistry of ozone precursors.

NEAR-REAL-TIME ESTIMATION OF SPECTRAL SURFACE ALBEDO FROM GOME-2/METOP MEASUREMENTS

Bringfried Pflug, Bernd Aberle, Diego Loyola, Pieter Valks

DLR-Remote Sensing Technology Institute

ABSTRACT

An algorithm was developed for estimation of spectral surface albedo from top-of-atmosphere (TOA)-radiances measured by the Global Ozone Monitoring Experiment GOME-2 flying on-board MetOp-A. The algorithm estimates Minimum Lambert-Equivalent Reflectivity (MLER) for a moving time window of variable width. The time window gets smaller for varying surface conditions with time and larger for periods with a homogeneous surface. Different methods are used for computation of the MLER dependent on the amount of data available within the time window.

The surface albedo is an important input for GOME-2 trace gas retrievals, both for the near real time and the off-line operational products. Trace gas retrieval algorithms usually take surface albedo from a suitable climatolgical database, but the actual surface albedo can vary considerable, especially for snowing conditions.

The first version of the spectral surface albedo algorithm has been integrated into the operational Universal Processor for Atmospheric Spectrometer (UPAS) system. Examples of surface albedo will be presented demonstrating the impact on the retrieved GOME-2 trace gases, specially on the ozone and NO_2 column products. Further developments of the surface albedo algorithm are finally discussed.

ON THE USE OF THE MAXDOAS TECHNIQUE FOR THE VALIDATION OF TROPOSPHERIC NO2 COLUMN MEASUREMENTS FROM SATELLITE

Gaia Pinardi[1], Francois Hendrick[1], Katrijn Clémer[1], Jean-Christopher Lambert[1], Michel Van Roozendael[1], Jianhui Bai[2]

(1) BIRA/IASB, (2) Institute of Atmospheric Physics, Chinese Academy of Sciences

ABSTRACT

The MultiAxis DOAS (MAXDOAS) technique has been recently developed as a new remote sensing tool for the monitoring of tropospheric pollutants by means of the differential optical absorption spectroscopy (DOAS) method. In contrast to zenith-sky DOAS instruments which have been commonly used over the last decade for stratospheric monitoring and satellite validation, e.g. as part of the Network for the Detection of Atmospheric Composition Change (NDACC), MAXDOAS instruments are designed to allow the quasi simultaneous observation of the scattered sun light in a range of different line-of-sight (LOS) directions from the horizon to the zenith, which leads to increased sensitivity towards atmospheric absorbers present close to the surface. Through adequate retrieval process, the near-surface concentration of atmospheric pollutants like NO_2 can be determined, as well as their integrated tropospheric and stratospheric column abundances.

Owing to these capabilities, the MAXDOAS technique represents a very promising technique for the validation of tropospheric NO_2 column measurements that have been retrieved from UV-Visible nadir sounders such as GOME, SCIAMACHY, OMI and more recently GOME-2 onboard METOP.

In this work, we summarize the experience acquired at BIRA-IASB with tropospheric NO_2 validation using the MaxDOAS technique. Results from the DANDELIONS (Dutch Aerosol and Nitrogen Dioxide Experiments for validation of OMI and SCIAMACHY) campaign, from recent observations performed in China nearby Beijing as well as from longer-term measurements performed at the Observatoire de Haute Provence (OHP), in Southern France (43.94°N, 5.71°E) are discussed. Strengths and limitations of the MaxDOAS technique for satellite validate are highlighted and illustrations of achievements recently obtained are given with particular emphasis on the GOME-2 instrument.

IMPROVING CO2 RETRIEVALS FROM SCIAMACHY DATA FOR CLOUD CONTAMINATED PIXELS

Alexei Rublev[1], Alexander Uspensky[2], Tatiana Udalova[3], Evgeny Zhitnitsky[3]

(1) Russian Research Center "Kurchatov Institute", (2) Scientific Research Center on Space Hydrometeorology Planeta, (3) Russian Research Center "Kurchatov Institute"

ABSTRACT

For satellite instruments with the size of pixels similar to that of SCIAMÀCHY, the probability of complete absence of clouds for northern areas of the Earth such as territories of Russia or Canada does not exceed several percents. Despite the fact that SCIAMACHY data processing is preceded with cloudy pixels detection and their elimination, the efficiency of cloudiness selection procedures is low under conditions of broken (cumulus, altocumulus) or semitransparent (cirrus) clouds. For example, according to our estimates on ground-based sky observations in Western Siberia, such clouds are presented in 85-90 % of SCIAMACHY pixels identified as clear-sky. This means that practically all the SCIAMACHY measurement results in northern latitudes are received under conditions of the cloudiness missed by preliminary selection. Therefore, it is necessary to develop methods of estimating the content of minor atmospheric gases, CO_2 included, which could be more robust to cloud contamination.

Using mathematical modeling of measurements by the SCIAMACHY spectrometer on the ENVISAT satellite the special method of CO_2 concentration determination under conditions of the semitransparent and broken clouds has been developed. The method is based on simultaneous measurements of spectral reflection coefficients for the “underline surface +atmosphere” system within absorption bands of oxygen (near 760 nm) and carbon dioxide (near 1600 nm) for several channels pairs specially selected within each band. Criterion of their selection is the equality of change ranges of relative optical thickness of O_2&CO_2 absorption or their linear combinations by transition from clear sky conditions to cloud cover ones. There is given, for example, concrete choice of such channels pairs and accuracy estimates of CO_2 concentration determination achievable at their use under different atmospheric conditions. Verification of the method was made using independent radiative transfers models and real SCIAMACHY spectra over Western Siberia. It is shown, that under cloudy conditions, including cases with cumulus clouds, accuracy of the method equals to 1÷2 % depending on cloud amount and the Sun zenith angle. For example, similar XCO2 displacement, may be caused by the distinctions of actual vertical profiles of the atmospheric temperature from model profiles used in such estimates.

This research was carried out partially under INTAS project, Ref. Nr. 06-1000025-9145.

TOTAL AND TROPOSPHERIC BRO COLUMNS RETRIEVED FROM GOME-2: FIRST RESULTS AND VALIDATION USING GROUND-BASED DOAS OBSERVATIONS

Nicolas Theys[1], François Hendrick[1], Michel Van Roozendael[1], Quentin Errera[1], Pieter Valks[2], Nan Hao[2], Diego Loyola[2]

(1) Belgian Insitute for Spatial Aeronomy, (2) German Aerospace Centre, Remote Sensing Technology Institute (DLR-IMF)

ABSTRACT

Bromine monoxide (BrO) total columns are retrieved from one year of GOME-2 UV nadir backscatter radiance measurements using algorithms previously developed for the GOME and SCIAMACHY instruments. The presentation first focuses on the optimization of the DOAS retrieval settings for GOME-2 with the aim to optimize the S/N ratio of the GOME-2 BrO slant columns while minimizing bias due e.g. to interfering absorbers like HCHO. Through extensive comparisons with coincident measurements from the GOME and SCIAMACHY instruments, we show that GOME-2 provides the best ever obtained global mapping of BrO columns with a time resolution of 1.5 day or better at mid- and high latitudes. Retrievals from the scientific algorithm developed at IASB are compared with results from the GOME-2 operational processor at DLR.

In a second part of the work, we focus on the derivation of total and tropospheric BrO columns. The tropospheric BrO column inversion is based on a residual technique recently developed at BIRA-IASB which makes use of newly developed dynamical climatology of stratospheric BrO profiles that uses, as an input, ozone and NO_2 columns simultaneously measured by GOME-2.

This profile climatology is based on an analysis of the output from a version of the 3D chemical transport model BASCOE which has been fully optimized for bromine chemistry and budget, and validated through comparisons using an extensive data set of ground-based, balloon-borne and satellite limb (SCIAMACHY) stratospheric BrO observations. It is anticipated that this algorithm, once fully consolidated, will be implemented in the GOME-2 operational processor for the generation of the official O3M-SAF BrO products.

First results from the resulting total and tropospheric BrO column data set are presented and compared with correlative ground-based DOAS measurements performed at Harestua (60°N, Southern Norway) and Observatoire de Haute-Provence (44°N, Southern France).

EXTENDING ACCESS TO DATA AND PROCESSING WITH THE NASA ATMOSPHERIC COMPOSITION PROCESSING SYSTEM (ACPS)

Curt Tilmes[1], **Albert Fleig**[2]

(1) NASA Goddard Space Flight Center, (2) PITA

ABSTRACT

NASA's traditional science data processing systems have focused on specific missions, and providing data access, processing and services to the funded science teams of those specific missions. Recently NASA has been modifying this stance, changing the focus from Missions to Measurements. Where a specific Mission has a discrete beginning and end, the Measurement considers long term data continuity across multiple missions. Total Column Ozone, a critical measurement of atmospheric composition, has been monitored for decades on a series of Total Ozone Mapping Spectrometer (TOMS) instruments. Some important European missions also monitor ozone, including the Global Ozone Monitoring Experiment (GOME) and SCIAMACHY. With the U.S./European cooperative launch of the Dutch Ozone Monitoring Instrument (OMI) on NASA Aura satellite, and the GOME-2 instrument on MetOp, the ozone monitoring record has been further extended.

The Atmospheric Composition Processing System (ACPS) evolved from the heritage processing systems currently processing OMI and TOMS data at NASA, Goddard Space Flight Center. We have extended the system to include access to publically available data sets from other instruments where feasible, including non-NASA missions as appropriate. The heritage system was largely monolithic providing a very controlled processing flow from data ingest of satellite data to the ultimate archive of specific operational data products. The ACPS, however, allows more open access with very standard protocols to various modules within the system, including an extended data archive, metadata searching, production planning and processing. This enables researchers to download publically released versions of the processing algorithms and reproduce their processing remotely, while interacting with the ACPS. The algorithms can be easily modified allowing better experimentation and rapid improvement. The modified algorithms can be easily integrated back into the production system for large scale bulk processing to evaluate improvements.

The system includes complete provenance tracking of both algorithms and data. The origin of any data or algorithms is recorded and the entire history of the processing chains are stored such that a researcher can understand the entire data flow. Provenance is captured in a form suitable for the system to guarantee scientific reproducability of any data product it distributes even in cases where the physical data products themselves have been deleted due to space constraints.

The ACPS currently performs periodic reprocessing of the long term TOMS data record, and operational processing of the OMI data. In conjunction with the Royal Netherlands Meteorological Institute (KNMI), it hosts OMI Near Real Time (NRT) processing. It also provides the core of the Ozone Product Evaluation and Algorithm Test Element (PEATE) for NASA's Science Data Segment (SDS) that will be used by scientists to evaluate the performance of the next generation U.S. operational National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) satellite planned to launch in 2009. The ACPS will provide Ozone data and services from NPP to the atmospheric composition community.

A new web site focusing on consolidating information about the measurement, processing system, and data access has been established to encourage interaction with the overall scientific community. This session will describe the system, its data processing capabilities, and information the community can use to take advantage of the system.

ASSESSMENT OF ATMOSPHERIC CARBON DIOXIDE COLUMNS OVER WESTERN SIBERIA FROM SPACE-BORNE SPECTROMETERS DATA

Alexander Uspensky[1], Alexei Rublev[2], Anatoly Trotsenko[2], Tatiana Udalova[2], Natalia Zysina[2], Alexander Kukharsky[1], Sergey Romanov[1]

(1) SRC PLANETA, (2) RRC Kurchatov Institute

ABSTRACT

Carbon dioxide (CO_2) is a key species listed in the Kyoto Protocol that plays an essential role in climate change studies (global warming), carbon cycle etc.The ground-based sites of CO_2 measurements are sparsely distributed over the globe so the current observing system for carbonaceous gases has a significant gap. The only way to fill it is to develop the remote sensing techniques able to retrieve some characteristics of CO_2 abundance in the atmosphere, i.e. its column amounts Q_{CO2} from satellite-based measurements. New capabilities for remote sensing of carbonaceous gases are emerging with the development of advanced high-resolution solar (like SCIAMACHY/Envisat) and IR sounders (AIRS/EOS Aqua and IASI/MetOp).

This poster presents a description of our approaches to retrieve Q_{CO2}in the troposphere over Western Siberia from SCIAMACHY and AIRS data. Along with the analysis of SCIAMACHY- and AIRS-based Q_{CO2} retrievals we discuss how the methodology of AIRS data inversion can be applied to IASI data and provide some IASI-based Q_{CO2} example retrievals. We investigate also the benefits of concurrent Q_{CO2} retrieval from data in solar and in thermal IR regions (in synergy), as well as the advantages of using ancillary information on cloudy conditions from ground-based observations and employing some physical constraints. Retrieval experiments with real SCIAMACHY and AIRS measurements demonstrate that the synergetic use of both datakinds contributes to improving the accuracy of Q_{CO2} retrievals in the lower and mid-to- upper troposphere. Recommendations on the Q_{CO2} retrieval scheme aregiven based on mathematical simulations and experiments with real satellite- measured spectra. The final part of presentation addresses to the validation of retrieved Q_{CO2} against published data from aircraft flask measurements of CO_2 concentration over boreal ecosystems (Novosibirsk and Surgut areas).

This research was carried out partially under INTAS project, Ref. Nr. 06-1000025-9145.

OPERATION OF THE GOME 2 PROCESSING SYSTEM (G2PS)

John van de Vegte, Ian van der Neut

Royal Dutch Meteorological Institute (KNMI)

ABSTRACT

KNMI provides the L2 near-real-time ozone profile product from L1 data measured by the GOME2 instrument flying onboard the polar orbiting METOP spacecraft, as part of EUMETSAT's Ozone SAF (Satellite Application Facility). The development team at KNMI has developed a dedicated L1-2 processing system, evolving from years of experience in previous satellite data processing projects.

The development team has developed the Netherlands SCIAMACHY Data Center (NL-SCIA-DC) ; the Dutch interface to the SCIAMACHY derived products as a supplementary service to the DLR-DPAC. Another development conducted by this team was the OMI Dutch Processing System (ODPS), which was developed to generate the Dutch products from the OMI instrument flying onboard NASA's Aura spacecraft. The ODPS also takes care of interfacing to the Trend Monitoring and Calibration Facility (TMCF). This solid basis was used to develop the next generation processing system for GOME2.

The Processing facility is dealing with near-real-time (NRT) requirements to provide timely delivery of ozone profile data products to the community as input for weather/climate prediction models.
To ensure operational requirements are met the GOME2 Processing System (G2PS) has a double hardware configuration of which the developed G2PS control software is taking full advantage. In case of hardware failure the G2PS will still perform the operational task of delivering the ozone profile information to customers within its near-real-time requirements.

G2PS interfaces with many external parties, automatic data-transfers take care of product exchange and product generation. All is part of the fully automated system as there is no need for manual intervention during nominal operations.

Scalability, stability, ease of use and monitoring requirements are successfully being met during its operations phase.

G2PS has been realized in-house by KNMI using open source technologies. The usage of Linux, cluster technology, Python, MySQL, OpenSSH, Nagios, and RRDTool contributed to the success of the G2PS system.

SIMULTANEOUS RETRIEVAL OF OZONE VERTICAL COLUMN DENSITY AND CLOUD PROPERTIES FROM SATELLITE MEASUREMENTS BY USING THE RING EFFECT

Jeroen van Gent[1], Robert Spurr[2], Michel Van Roozendael[1], Christophe Lerot[1]

(1) Belgian Institute for Space Aeronomy, (2) RT Solutions, Inc.

ABSTRACT

The filling-in of solar Fraunhofer lines and telluric features by rotational Raman scattering (RRS, known as the Ring effect) needs to be taken into account when retrieving concentrations of ozone and other trace gases from ultra-violet and visual satellite observations. The RRS correction spectrum is known to depend on solar zenith angle, vertical trace gas density, and reflecting surface pressure and albedo. These characteristics can be used to derive cloud-top pressure and cloud cover fraction.

We use METOP-A GOME-2 ultra-violet observations for the simultaneous retrieval of vertical ozone and cloud properties. We describe the clouds as Lambertian reflecting surfaces and we use the independent pixel approximation to define an effective cloud cover fraction. Full (on-line) radiative transfer calculations of the filling-in correction spectrum within the retrieval process are not yet feasible, due to the inelastic nature of RRS. We therefore use extensive look-up tables of off-line calculated correction factors. The cloud properties obtained from the retrieval process are compared with those from algorithms that use observations in the O2-A band.

VOLCANIC ASH, AEROSOL AND SO2 CLOUD MONITORING VIA SATELLITE

Gilberto Vicente[1], G. Serafino[1], A. Krueger[2], S. Carn[2], K. Yang[2], N. Krotkov[3], M. Guffanti[4], P. Levelt[5]

(1) NOAA/NESDIS - Office of Satellite Data Processing and Distribution (OSDPD), USA, (2) Joint Center for Earth Systems Technology (JCET), University of Maryland Baltimore County (UMBC), Baltimore, MD, USA, (3) Goddard Earth Science and Technology (GEST) center, UMBC, USA, (4) US Geological Survey (USGS), (5) Royal Netherlands Meteorological Institute (KNMI)

ABSTRACT

The Ozone Monitoring Instrument (OMI) on the NASA EOS/Aura research satellite allows measurement of SO2 concentrations at UV wavelengths with daily global coverage. SO2 is detected from space using its strong absorption band structure in the near UV (300–320 nm) as well as in IR bands near 7.3 and 8.6 micron . Thirty years of UV SO_2 measurements with the Total Ozone Mapping Spectrometer (TOMS) and OMI sensors have shown that the highest concentrations of SO_2 occur in volcanic clouds produced by explosive magmatic eruptions, which also emit ash. However, icing of ash particles in water-rich eruption clouds, and/or suppression of the IR split-window signal by ambient water vapor or cloud opacity can inhibit direct detection of ash from space. Large SO2 concentrations are therefore a reliable indicator of the presence of airborne volcanic ash. UV SO_2 measurements are very robust and are insensitive to the factors that confound IR data. SO2 and ash can be detected in a very fresh eruption cloud due to sunlight backscattering and ash presence can be confirmed by UV derived aerosol index measurements. The lack of other large point sources of SO2 facilitates development and implementation of automated searches for volcanic clouds with a very low false alarm rate.

The NASA Earth Sciences Applications Office has funded a cooperative agreement between UMBC, NOAA, GSFC, and USGS to infuse research satellite SO_2 data products into volcanic hazard Decision Support Systems (DSSs) operated by the National Oceanic and Atmospheric Administration (NOAA) and the US Geological Survey (USGS). This will provide aviation alerts to the Federal Aviation Administration (FAA), that will reduce false alarms and permit more robust detection and tracking of volcanic clouds, and includes the development of an eruption alarm system, and potential recognition of pre-eruptive volcanic degassing. Near real-time (NRT) observations of SO_2 and volcanic ash can therefore be incorporated into data products compatible with Decision Support Tools (DSTs) in use at Volcanic Ash Advisory Centers (VAACs) in Washington and Anchorage, and the USGS Volcano Observatories.

In this poster we show the latest NOAA Office of Satellite Data Processing and Distribution (OSDPD) development of an online NRT image and data product distribution system that generates eruption alarms, allows the extraction of volcanic cloud subsets for special processing, and provides access to analysis tools and graphical products derived from the OMI and the Atmospheric Infrared Sounder (AIRS) Instrument. Products are infused into DSTs including the Volcanic Ash Coordination Tool (VACT), under development by the NOAA Forecast Systems Laboratory and the FAA's Oceanic Weather Product Development Team (OWPDT), to monitor and track, drifting volcanic clouds.

GLOBAL OBSERVATIONS OF OXYGENATED VOLATILE ORGANIC COMPOUNDS

Folkard Wittrock, Mihalis Vrekoussis, Andreas Richter, John P. Burrows

University of Bremen

ABSTRACT

This work focuses on global measurements of two oxygenated volatile organic compounds, formaldehyde (HCHO) and glyoxal (CHOCHO) with optical absorption spectroscopy from space and from the ground. Since both trace gases are important intermediates in the degradation of volatile organic compounds (VOC) in the troposphere these observations substantially add to our current knowledge on the emissions and the chemistry of VOC. Numerous VOCs, characterized by large temporal and spatial variability and having both anthropogenic and natural sources, are present in the atmosphere. They are related to air pollution, human health and climate change due to their importance for photochemical smog formation, changes of ozone levels and formation of secondary organic aerosol. But in spite of their significance, their global source and sink budgets are still not well understood.

Here for the first time global long-term observations of both HCHO and CHOCHO are presented. The results were obtained by applying the differential optical absorption technique (DOAS) to spectra measured by the satellite instruments GOME (since 1995), SCIAMACHY (since 2002), and GOME-2 (since 2006) covering more than one decade of observations. The annual and seasonal variation of these species is examined above some photochemical hot spots. Case studies illustrate the significance of biogenic emissions and of biomass burning for the global distribution of the OVOC. Furthermore, formaldehyde and glyoxal measurements with ground-based MAX-DOAS instruments have been used to validate the satellite observations and to investigate the diurnal variation of these important compounds.

VERIFICATION OF THE ZAMBIA RAINFALL SEASONAL FORECASTS USING METEOROLOGICAL PRODUCTS FROM METEOSAT

Ndui Aikayo

Zambian Meteorological Department

ABSTRACT

Rainfall Seasonal forecasts verifications have proved to be rather a difficult exercise in Zambia, given the fact that there are very few reports of surface data from the rainfall reporting stations. This is mainly attributed to poor communication facilities. The current methods being used are decadal totals and monthly rainfall totals. These methods have proved to be inadequate due to inconsistence reports or data from stations. In this paper an attempt has been done to use the Meteosat products such as: forecast surface charts, 850hpa, 700hpa, 500hpa winds, satellite images, precipitation charts etc. These products usually indicate convergence boundaries such as the Inter-Tropical Convergence Zone (ITCZ) and the moist Congo air boundaries, which are the major rain producing mechanisms in Zambia. The forecast precipitation charts also plays an important role in trying to show areas with maximum rainfall, and are related to zones whose seasonal forecasts are either above, normal or below. On the other hand when there is a persistent high-pressure cell over the southwest part of the sub-continent (southern Africa), these systems are normally pushed towards the extreme north of the country and is usually during an El-Nino season. The images are used as observed data to verify the occurrence of rainfall or storms particularly to places where the actual amounts are not reported. In addition, during the presence of a tropical cyclone in the Indian Ocean depending on its location, the low pressure belt such us the ITCZ is forced to pass through it, thus maintaining a lot of rainfall over Zambia. This is because the ITCZ will be forced to remain stationary or oscillate about and this occurs normally during the mid-season of January, February and March.

Empirical models for seasonal forecasts also make use of predictors such as sea surface temperatures and reasently introduced General Circulation Models (GCM) using the Model Output Statistics (MOS) climate predictability tool (CPT). The GCMs makes use of historical data such as precipitation, 850 and 700 hpa. Details and demonstrations explaining how this method is used will be presented with the text.

THE IMPACT OF THE TARGET BOX SIZE ON THE WIND SPEED BIASES IN THE SATELLITE-DERIVED ATMOSPHERIC MOTION VECTORS

Hee-Je Cho, Eun-Ha Sohn, Mi-Lim Ou

METRI/KMA

ABSTRACT

This study investigates the error sources in atmospheric motion vectors (AMVs) derived from the geostationary satellite images. There essentially exist errors in calculation of AMVs in themselves because only single vector is produced for each satellite observation target. Also there could be involved subjective decisions with determination of target box size which affects the scale of atmospheric motion and statistical distribution property of satellite-observed radiation field that AMV catches.

The operational AMV determination at Korea Meteorological Administration (KMA) uses cross-correlation method with target box size of 32x32 pixels (larger than 128x128 km^2) which can include broad cloud with multi-layer atmospheric motion system. In this research, various sizes of target box are examined. Summer (August 2007) and winter (December 2007) wind vectors derived from images of MTSAT-1R 11μm channel with 30-minutes-inverval are collocated with wind profiles of rawinsonde observations.

With 32x32 target box size, AMVs with lower speed have been produced than observation especially at upper troposphere and winter hemisphere (about -2.9m/s, AMV quality>70%). The wind speed biases of AMVs are reduced with smaller box size (16x16 pixels) to -0.8 m/s. Comparing the characteristics of AMV with different box sizes, small boxes seem to effectively reduce the possibility of containing multi-type cloud features within a box so that it can be possible to assign the height of vectors more effectively. It appears that it keeps slow satellite-derived winds from being assigned to higher level than expected.

The result includes typical cases of high level westerly wind vectors of winter hemisphere and convective winds accompanied with tropical multi-type cloud cells to understand the relation in detail between the target box size and wind speed bias.

IMPROVED DIAGNOSIS OF LOW-LEVEL CLOUD FROM SEVIRI DATA FOR ASSIMILATION INTO MET OFFICE LIMITED-AREA MODELS

Peter Francis

Met Office

ABSTRACT

Correct diagnosis of the initialised low-level cloud field is crucial to the performance of limited-area Numerical Weather Prediction (NWP) models. Errors in the determination of low-cloud coverage, or of its height, can lead to significant deficiencies in the analysed structure of the model boundary layer (BL), resulting in too much or too little BL cloud in the initial state, or errors in the time-evolution of this cloud through the forecast period. These in turn can cause serious inaccuracies in important forecast quantities such as near-surface temperature or visibility.

The Met Office limited-area models (i.e. the North Atlantic European and UK models) currently make use of MSG-derived cloud-cover and cloud-top height (CTH) fields as part of their cloud analysis, using algorithms developed at the Met Office. Obviously, these measurements lack any vertical information below the cloud top, but the fact that they have excellent spatial and temporal coverage when compared with, say, radiosondes makes them an invaluable source of cloud data. For low-level cloud in particular, the model background (i.e. the forecast from 6 hours previously) is a very important constraint in determining the cloud-top height, due to the infrared channels' reduced sensitivity to these types of cloud. However, problems can arise when the model background profile is poor - for example, when the BL-capping temperature inversion is not captured accurately by the model. In these cases, it is very easy for automated CTH schemes to place the cloud-top at the wrong level - e.g. in the dry layer above the inversion - which can lead to serious shortcomings in the subsequent model evolution.

This presentation will focus on some recent changes which have been made to the Met Office CTH derivation. The first of these changes involves updating the fast radiative transfer model, with RTTOV version 9 replacing the RTTOV version 7 currently being used by the scheme. The advantage of this is that, whereas RTTOV-7 uses a fixed vertical grid of 43 levels, RTTOV-9 allows us to perform the radiative transfer calculations on a user-defined vertical grid. This removes the need to carry out vertical interpolations between different vertical grids, and results in a significantly improved CTH product. The second change involves updating the so-called "stable layers" scheme, which is used to determine the CTH for most low-level cloud cases, and which helps to avoid the cloud-top being placed at the base of unstable layers (as determined from the background profile). In the existing scheme, only the background temperature information is utilised, but the updated scheme makes additional use of the background humidity information to improve the CTH determination.

GLOBAL ATMOSPHERIC MOTION VECTOR INTER-COMPARISON STUDY

Iliana Genkova[1], Regis Borde[2], Johannes Schmetz[2], Kenneth Holmlund[2], Daniels Jaime[3], Chris Velden[1]

(1) UW/CIMSS, (2) EUMETSAT, (3) NOAA

ABSTRACT

Atmospheric Motion Vectors (AMVs) are amongst the data assimilated routinely by the weather prediction centers. The raw AMV data sets undergo various thinning, quality indicator (QI) and/or recursive filter function (RFF) threshold-based AMV pre-selection or a similar quality control routine. Until now all AMV producers disseminate their data without an in depth understanding of how consistent all the data sets are, how algorithm tuning impact the results, are the quality indicator routines implemented in a consistent fashion etc. These issues will be addressed in our study.

Five AMV producers retrieved AMVs from a MSG-SEVIRI image triplet applying their own retrieval algorithm and the same first guess forecast model. Winds from VIS, IR and WV channels are compared with regard to spatial coherence, agreement in height assignment, quality indicator agreement. With this study we hope to assess how the various AMV producers data inter-compare, recognize the strengths and weaknesses of each retrieval algorithm, and suggest how to better interpret the winds sets prior and during their assimilation into NWP models.

GRAS SAF PROJECT: RADIO OCCULTATION DATA FROM METOP

Kent Lauritsen[1], Hans Gleisner[2], Frans Rubek[2], Stig Syndergaard[2], Martin Sørensen[2]

(1) Danish Meteorological Institute, (2) DMI

ABSTRACT

The GRAS SAF is part of EUMETSAT's network of Satellite Application Facilities (SAFs) under the EUMETSAT Polar System (EPS). The objective of the GRAS SAF is to deliver operational radio occultation products from the GRAS occultation instruments (Global Navigation Satellite System Receiver for Atmospheric Sounding) onboard the three MetOp satellites. The Leading Entity is the Danish Meteorological Institute (DMI) and this is also the physical location of the operational GRAS SAF processing and archiving center. The other project partners are ECMWF (European Center for Medium-range Weather Forecasts), IEEC (Institute d'Estudis Espacials de Catalunya, Barcelona, Spain), and Met Office (Exeter, UK).

The basic principle of the radio occultation (RO) method is that a receiver onboard a low-orbiting satellite tracks GPS signals as the transmitting satellite sets or rises behind the Earth. Due to refraction in the ionosphere and the neutral atmosphere the signal is delayed and its path bent, enabling calculation of the index of refraction (or refractivity) and subsequently temperature and humidity as a function of height. The operational GRAS SAF Processing and Archiving Center will receive raw and preprocessed GPS radio occultation data from the GRAS instrument, process these into vertical height profiles of refractivity, temperature, pressure, and humidity, and distribute these products continuously in NRT (near real time, within 3 hours from sensing) to numerical weather prediction users.

Raw GPS radio occultation data are calibration free and the assumptions are known. Thus, RO data is also well suited for climate investigations and monitoring and the GRAS SAF will provide improved offline products (within 30 days from sensing) and climate data to the research user community. We are investigating how to best exploit the GRAS data, both for construction of an accurate single-source climate data base with known error characteristics of the data and for provision of global climate monitoring.

Another objective of the GRAS SAF is to supply the software package ROPP (radio occultation processing package) containing tools for 3D/4D-VAR-assimilation of radio occultation data into numerical weather prediction (NWP) models. The results of several NWP assimilation impact trials using RO data show a clear positive impact on NWP forecasts in the upper troposphere and lower stratosphere.

We present the status of the GRAS SAF project with emphasis on the analyses and validation of GRAS data from MetOp. We also discuss the latest results related to scientific investigations of offline processing and global climate data based on radio occultation data.

EXTREMELY RAINY PERIOD IN LITHUANIA ON 5-8 JULY 2007

Izolda Marcinoniene

Lithuanian Hydrometeorological Service

ABSTRACT

This rainy episode (locally up to 85-86 mm/12 h of precipitation, while monthly rate in Lithuania is 79 mm) between 5 and 8 July 2007 is a good example of the rapid cyclogenesis to analyze.

The evolution from an emerging cloudhead, as the main feature in the initial stage, towards the V - pattern of the dry tongue, in the advanced stage and, eventually, the spiral in the mature stage could be found in d ifferent MSG images. RGB Airmass, Microphysics, HRI, WV, IR images together with analysis of physical parameters helped to, firstly, predict and explain the processes behind this unusual event in Lithuania (such a heavy prolonged rainy period in summer was for the second time over the last 50 years).

An upper low with sharp trough approaching from Southern Europe triggered-off the deepening of a lower tropospheric cyclone within unstable warm and wet airmass boundaries over the Ukraine. Especially intense cyclone development and powerful release of the energy of instability occurred in a zone of occluded front movingslowly from Belarus to South-Eastern Lithuania (on 6th of July) and towards the North approaching Latvia andmoulding into expressive occlusion spiral(on 7-8th day). The centre of cyclone in the upper level coincided with the centre of a low-level cyclone – this determined the prolonged nature of the process. Confluence at the surface in combination with upward vertical motion in upper-surface layer provided heat and moisture for powerful Cb clouds and heavy rains forming over Lithuania and neighbouring countries.

Vertical cross sections of main NWP parameters show the conditions suitable for convection within the airmass boundaries: high equivalent potential temperature, wind shear in the lower troposphere, and a potentially unstable stratification of the air in a rather deep layer. Potential vorticity shows an anomaly protruding deep into the atmosphere to the rear in the region of the highest gradient of the isentropes of the front. These conditions were favourable for the rapid cyclogenesis to occur. Obviously, the most intensive convection appeared over the Eastern and Western Lithuania at the point of coincidence of the wet bulb maximum potential temperature and the strongest convergence near the surface.

ECMWF, MetOffice and DWD numerical models as well as HIRLAM provided very good guidance on the cyclogenesis 2-3 days in advance of the event. It allowed forecasters to predict extremely dangerous rainy episode quite well and issue their warnings in time.

During this extreme meteorological phenomenon, a significant damage had been done – mainly by river floods. Moreover, it spoiled the Lithuanian open-air festival of folk songs and dances, which is organized every four years only.

A GRAPHICAL USER INTERFACE FOR RTTOV

Philippe Marguinaud

Météo-France

ABSTRACT

RTTOV is the radiative transfer model developped by the NWP SAF.

The project team has decided to create a graphical user interface to run the RTTOV model. We have chosen to develop an interface based on the Linux Desktop (Gnome/KDE). This interface will allow users to edit RTTOV initial conditions (atmospheric profiles, ground parameters, etc...) run the RTTOV model efficiently (keeping coefficients in memory, possibly using multithreading) and view the results (radiances, transmittances).

Our poster will present the principles of this interface, and we intend to have a laptop running a demo as well.

COMPARISON OF AMV CLOUD TOP PRESSURE DERIVED FROM MSG WITH SPACE BASED LIDAR OBSERVATIONS.

Genevieve Seze[1], **Stephane Marchand**[1], **Jacques Pelon**[2], **Redis Borde**[3]

(1) Laboratoire de Météorolgie Dynamique/IPSL, (2) Service d'Aeronomie/IPSL, (3) EUMETSAT

ABSTRACT

The atmospheric motion vectors (AMV) derived from geostationnarysatellite data is one of the most important products that are assimilated in global Numerical Wheather prediction models. The new generation of METEOSAT with its high repeat cycle and 12 channels facilitate the derivation of the AMV field. However, the altitude allocation still remains the most challenging task in the AMV extraction scheme. In spite of the multi-channel capability of SEVIRI radiometer, an exact estimation of AMV cloud top pressure still suffers from inherent problems of passive measurements from radiometric sensors. New observations from active sounders may be then very helpful to compare and validate the AMV heights.

The CALIOP lidar embarked on the CALIPSO platform flying in the A-train, continuously delivers observations of the atmosphere on the vertical since mid-June 2006. Comparison of the AMV cloud top heights (CTHs) against collocated CALIOP cloud tops have been performed for a 21 day period in spring 2007, using METEOSAT-8 AMV intermediate product and intermediate Cloud Analysis (CLA) product.
An overall good agreement has been found between all CTHs from MSG (CLA box and AMV) and CALIOP. However, the AMV pressure allocation is systematically higher than CALIOP retrieval for semi-transparent clouds. The correction of temperature inversion for dense low level clouds was identified to have a good impact on AMV pressure. Detailed comparisons for various cloud types and several geographical areas will be presented and discussed.

MONITORING OF THE USE OF IASI DATA IN A LIMITED AREA DATA ASSIMILATION SYSTEM

Roger Randriamampianina, Andrea Storto

Norwegian Meteorological Institute

ABSTRACT

The assimilation of IASI data in the ALADIN/Norway data assimilation system at the Norwegian meteorological Institute is being carried out in the frame of the THORPEX-IPY Norway project. This project aims to improve the accuracy of high-impact weather forecasts in the Arctic region.

The use of limited number of channels is being tested at the first stage using all the available IASI field of view. To the conference we would like to report some monitoring results of the assimilation of IASI data on a limited area model.

ASSIMILATION OF REMOTE-SENSED CLOUDINESS OBSERVATIONS

Andrea Storto, Frank T Tveter

met.no

ABSTRACT

Cloudy radiances are usually not assimilated in numerical weather prediction systems since the forward model for these observations is highly non-linear, and it makes their optimal use difficult in variational data assimilation methods.

However, these observations have high density, and contain information about the distribution of clouds, which is an advantageous information for the forecast model. A new approach to the assimilation of cloudiness observations is being developed at the Norwegian Meteorological Institute.

A model for the probability density function (PDF) is introduced to calculate the probability of having a "cloud" given the true state of the atmosphere. This model is based on a simplified physics package for computing the cloud fraction from the model state variables.

However, it is not straight forward to implement this method in 3DVAR assimilation systems, since the assumption about Normal PDF of observations errors, usually adopted by variational theory, fails for binary observations. Nevertheless, the observation operator for cloud fraction has non-continuous derivative: a feature that, again, doesn't satisfy the requirements for implementation in 3DVAR.

As solution, classical Bayesian decision theory is applied to obtain super-observations of humidity by combining the a priori knowledge of the state variables from a previous forecast or 3DVAR analysis and the cloud cover observations. Thus, the moisture analysis is optimal with respect to Mean Squared Error verification methods, and the behavior of Bayes risk functions is used to show the benefits of new analysis. Humidity super-observations can be directly used in variational assimilation system, after proper evaluation of super-observations errors.

This theory is applied to cloud fraction observations derived from the Cloud Profiling Radar (CPR) onboard CloudSat, that provides reflectivities at very high resolution both on the vertical and along the satellite track. However, the CPR is a nadir-pointing instrument whose data density is poor for a limited area 3DVAR system and the impact of these observations is often not appreciable.

The same theory is being used for cloud products from nowcasting applications, where informations about cloud cover are usually well-distributed. On the other hand the assimilation of such observations requires assumptions for the vertical distributions of clouds and for the spatial correlations of observations errors.

GRAS SAF VALIDATION OF METOP RADIO OCCULTATION DATA

Stig Syndergaard, Frans Rubek, Hans Gleisner, Michael Gorbunov, Kent Lauritsen, Martin Sørensen

Danish Meteorological Institute

ABSTRACT

The GRAS SAF - short for Global Navigation Satellite System (GNSS) Receiver for Atmospheric Sounding (GRAS) meteorology Satellite Application Facility (SAF) - is part of EUMETSATs SAF network. The aim of the project is to deliver operational radio occultation (RO) products from the GRAS receiver onboard the EPS/MetOp satellites. The Leading Entity is the Danish Meteorological Institute (DMI) and this is also the physical location of the operational GRAS SAF facility. The three other project partners are the IEEC (Spain), the Met Office (UK), and the European Center for Medium-range Weather Forecasts (ECMWF).

The GRAS receiver provides about 650 atmospheric RO soundings per day. These soundings contain information about atmospheric temperature, pressure, and tropospheric humidity from near-surface altitudes to the upper stratosphere. The operational GRAS SAF Processing and Archiving Center (GPAC) receives the raw and preprocessed RO data from EPS, processes these into vertical profiles of refractivity, and - via 1D variational retrieval - further into temperature, pressure, and humidity profiles. These products are continuously disseminated in near-real time (NRT, within 3 hours from sensing) to numerical weather prediction (NWP) users. In addition, offline products (improved products, within 30 days from sensing) are produced for climate monitoring users. The offline products take advantage of data not available within the NRT timeliness constraints, like e.g. more precise satellite orbits and NWP reanalysis. Dedicated RO climate products are also produced in the form of monthly mean zonal grids of the meteorological quantities. A fourth objective of the GRAS SAF is to supply the software package ROPP (Radio Occultation Processing Package) to support assimilation of RO data into NWP models.

During the operational phase the GRAS data quality, accuracy, and latency is monitored continuously by the GRAS SAF. We present an overview of the processing of GRAS data at GPAC, as well as the status of the ongoing validation activities at DMI. The validation results include statistics based on comparisons between the retrieved refractivity profiles and the corresponding profiles from the ECMWF forecast fields. We also show validation results for temperature and humidity as derived by the 1D variational approach.