STATUS OF THE OSI SAF

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Abstract

The EUMETSAT OSI SAF (**www.osi-saf.org**) was created in 1997 as an answer to requirements from the meteorological and oceanographic communities of EUMETSAT Member States and Co-operating States for a comprehensive information derived from meteorological satellites at the ocean-atmosphere interface.

The two previous phases, the Development phase (1997-2002) and the IOP (initial Operations Phase, 2002-2007) met the main target which was to develop, validate and then produce operationally quality controlled satellite-derived products related to four key parameters (Sea Surface Temperature, Radiative Fluxes, Sea Ice, Wind) over various geographical coverage from regional to global.

These products are currently available in near real time both through EUMETCAST and local FTP servers, and off line from local archive.

The current phase of the OSI SAF, the CDOP (Continuous Development and Operations Phase) takes into account new requirement sources, in particular from GODAE, GHRSST and GCOS at international level, and GMES (through MERSEA and then MyOcean), at European level, with a strong need for increasing the temporal and geographical resolution of the products and for extending the coverage range from coastal to global. Global Sea Ice and wind are already operational, and the global MetOp SST will be in 2008.

The objectives of the OSI SAF Continuous Development and Operations Phase (CDOP) can be summarized as following :

- complete all necessary Verification and Validation activities concerning MetOp-A related products,
- produce, control and distribute in near real-time operational or pre-operational products, which have been successfully validated, with the necessary Users Support activities,
- consolidate validation activities of the operational products,
- conduct necessary R&D activities for the enhancement of current OSI SAF products and for new products, taking into account some new user requirements, including ones from the European operational oceanography centres and the GMES initiative, and satellite possibilities,
- prepare for the next generation of meteorological satellites (NPP/NPOESS, GOES-R and MTG)

In terms of access to the products a new approach has been defined and the products will be accessible both :

- over predefined areas and projections, in particular via EUMETCAST dissemination towards institutional users, as it was for the IOP, and via UMARF,
- via flexible INTERNET access to full resolution and satellite projection fields, based on specific tool allowing geographical extraction, re-projection and re-gridding

The objective of this paper is to offer an overview on the OSI SAF project, its current (pre-) operational production, the way it takes into account new requirements, and its interactions with relevant projects and. The algorithms and validation aspects will not be detailed : they have already been addressed by the OSI SAF project team, or are during this OSI SAF workshop, by Anne Marsouin, Lars-Anders Breivik and Ad Stoffelen, and during the AMS EUMETSAT conference oceanography session by Pierre Le Borgne.

CONSORTIUM ORGANIZATION

The OSI SAF consortium is constituted of Meteo-France (M-F) as leading entity, and Met.no, DMI, SMHI, KNMI and IFREMER as co-operating entities.

The R&D activities are shared among the consortium, with the help of visiting scientists as necessary.

The production is based on 3 sub-systems :

- Sub-system 1 (SS1) under M-F/Centre de Météorologie Spatiale (CMS, Lannion, Brittany, France), with the co-operation of Met.no and DMI for the High Latitude area, processes, archives and distributes the SST and fluxes products. IFREMER is contributing to the products distribution and archiving.
- Sub-system 2 (SS2) under Met.no responsibility, with the co-operation of DMI, processes, archives and distributes the Sea Ice products.
- Sub-system 3 (SS3), under KNMI responsibility, processes, archives and distributes the Wind products.

CURRENT OPERATIONAL PRODUCTION

Currently the OSI SAF is providing operationally in near real-time quality controlled satellite-derived products related to the following parameters :

- Sea Surface Temperature (SST), based on multispectral algorithm,
- Surface Short wave Irradiance (SSI), based on physical parameterization,
- Downward Long wave Irradiance (DLI), based on bulk parameterization,
- Sea Ice probability, concentration and type, based on multisensor analysis,
- Ocean surface wind vector at 10m height, based on sigma0's and swath winds.

Several areas are defined for these products :

- Global oceans (GLB),
- Global oceans for Sea Ice : north of 50N (NH : Northern Hemisphere) and South of 50S (SH : Southern Hemisphere),
- Low and Mid Latitude (LML) Atlantic: Atlantic area from 60N to 60S and from 45 East (to cover the black sea) to 100 West (to cover the Gulf of Mexico),
- High Latitude (HL) Atlantic: Atlantic north of 50N,
- Merged Atlantic Product (MAP): Atlantic ocean from North pole to 60 South and from 45 East to 100 West,
- Northern Atlantic and Regional seas (NAR): seas watering EUMETSAT member states including a large part of northern Atlantic.

The following table gives the characteristics of the current operational and pre-operational products.
*notes : The ASCAT 25km Wind is currently pre-operational, other products are operational.
The SeaWinds 25km Wind is expected to be pre-operational in November 2007.

roduct Name	Characteristics and Methods	Input Satellite data	Dissemination Means	Format	Timeliness	spatial coverage	generation frequency	spatial resolution	target accuracy
* ASCAT 25 km Winds	Sigma0's and swath winds	ASCAT	EUMETCast FTP UMARF	BUFR	2 h 45	Global	Continuous	25 km	Better than 2 m/s in wind component RMS with a bias of less than 0.5 m/s in wind speed
* SeaWinds 100km Wind	Sigma0's and swath winds	SeaWinds	EUMETCast FTP UMARF	BUFR	3 h 30	Global	Continuous	100 km	Better than 2 m/s in wind component RMS with a bias of less than 0.5 m/s in wind speed
NAR NOAA Sea Surface Temperature	multispectral algorithm	NOAA -17 and NOAA-18 (HRPT) AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	4 h	European Seas	6 h	polar stereographic 2 km	monthly bias : 0,5°c, Sdt Deviation : 0,8°c
LML Sea Surface Temperature	multispectral algorithm	GOES-E and MET-09 AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	60°N to 60°S, 45° to 100°W	8 daily	0,1°lat-lon	monthly bias : 0,5°c, Sdt Deviation : 1°c
MAP Sea Surface Temperature	multispectral algorithm	GOES-E , MET-09 and NOAA AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	90°N to 60°S, 45° to 100°W	2 daily	0,1°lat-lon	monthly bias : 0,5°c, Sdt Deviation : 1°c
LML Downward Longwave Irradiance	Bulk parameterization	GOES-E and MET-09 AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	60°N to 60°S, 45° to 100°W	8 daily	0,1°lat-lon	monthly (TBC) relative bias : 5%, monthly relative Std. Deviation :10%
MAP Downward Longwave Irradiance	Bulk parameterization	GOES-E , MET-09 and NOAA AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	90°N to 60°S, 45° to 100°W	daily	0,1°lat-lon	monthly (TBC) relative bias : 5%, monthly relative Std. Deviation :10%
LML Surface Solar Irradiance	physical parameterization	GOES-E and MET-09 AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	60°N to 60°S, 45° to 100°W	7-daily in average	0,1°lat-lon	monthly (TBC) relative bias : 10%, monthly relative Std. Deviation :30%
MAP Surface Solar Irradiance	physical parameterization	GOES-E , MET-09 and NOAA AVHRR	EUMETCast FTP UMARF	GRIB1 on EUMETCAST, UMARFand Météo-France FTP, NetCDF and HDF5 on IFREMER FTP	3 h	90°N to 60°S, 45° to 100°W	daily	0,1°lat-lon	monthly (TBC) relative bias : 10%, monthly relative Std. Deviation :30%
GBL Sea Ice Concentration	Multisensor analysis	SSM/I, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Global	1 day	polar stereographic 10km	10% for NH-product. 15% for SH-product (yearly average)
GBL Sea Ice Edge	Multisensor analysis	SSM/I, ASCAT, AVHRR, VIIRS, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Global	1 day	polar stereographic 10 km	20 km (yearly average)
GBL Sea Ice Type	Multisensor analysis	SSM/I, ASCAT, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Global	1 day	polar stereographic 10 km	TBD
HL Sea Ice Concentration	Multisensor analysis	SSM/I, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Atlantic 50N to North Pole	1 day	polar stereographic 10km	10% for NH-product. 15% for SH-product (yearly average)
HL Sea Ice Edge	Multisensor analysis	SSM/I, ASCAT, AVHRR, VIIRS, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Atlantic 50N to North Pole	1 day	polar stereographic 10 km	20 km (yearly average)
HL Sea Ice Type	Multisensor analysis	SSM/I, ASCAT, AMSR	EUMETCast FTP UMARF	GRIB NetCDF HDF5	5 h	Atlantic 50N to North Pole	1 day	polar stereographic 10 km	TBD

Table 1: **Characteristics of current pre-operational and operational products**

The following pictures show a wide range of the OSI SAF products. The quicklooks are available on www.osi-saf.org

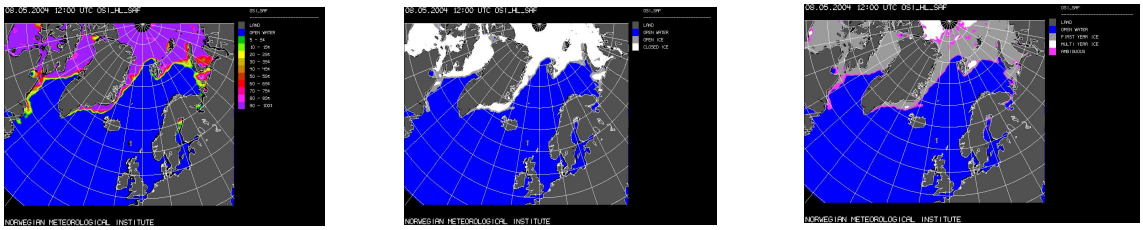

Figure 1 : **from left to right : High Latitude (HL) Sea Ice concentration, Edge and Type (Multi or first year).**

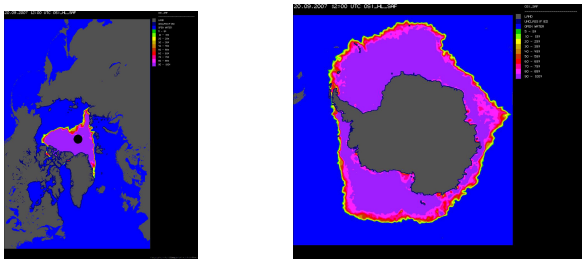

Figure2 : **Global Sea Ice concentration : Northern Hemisphere (NH, left) ; (Southern Hemisphere, right)**

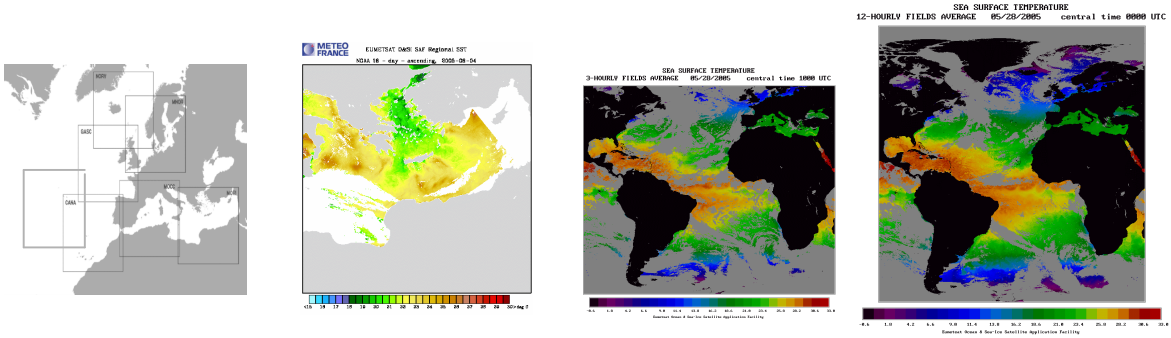

Figure3 : **left to right : NAR SSTcoverage, Quicklooks of NAR SST over Mediterranean Sea, LML SST and MAP SST**

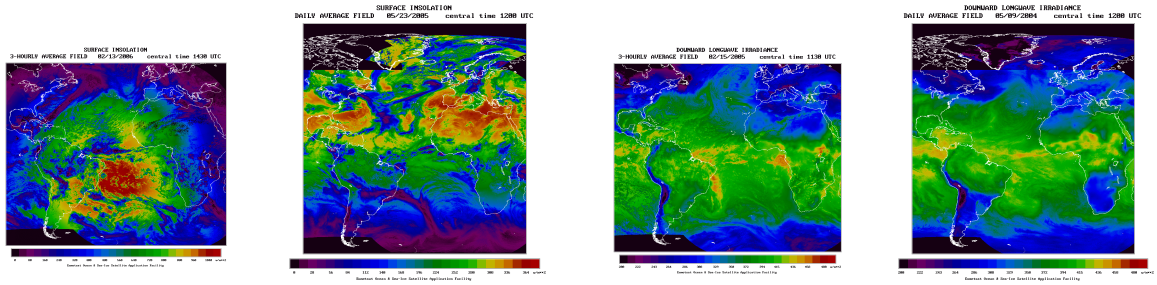

Figure 4 : **LML and MAP Surface Solar Irradiance (SSI, left); LML and MAP Downward Longwave Irradiance (DLI , right).**

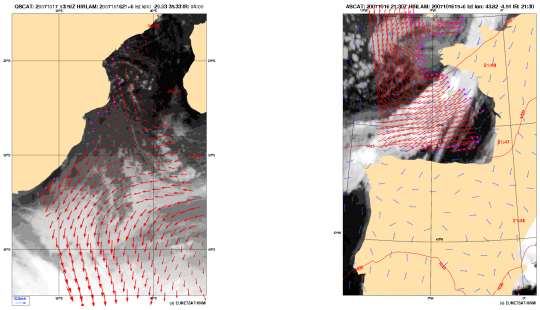

Figure5 : **Quicklooks of SeaWinds 100 km (left), and ASCAT 25 km Winds (right)**

PRODUCT AVAILABILITY

This chapter addresses briefly product delivery statistics (No Product validation statistics are shown in this paper).

Operational OSI SAF products must be available for distribution within the specified time in more than 95% of the cases where input satellite data are available with the nominal level of quality, on monthly basis.

The following figure gives a broad overview on the Products availability compared to the requirement. It shows that 100% are often reached, 98% most of the time, and an anomaly in M-F/CMS production in January 2005 and in April 2005. More details are provided in Quarterly Operations Reports.

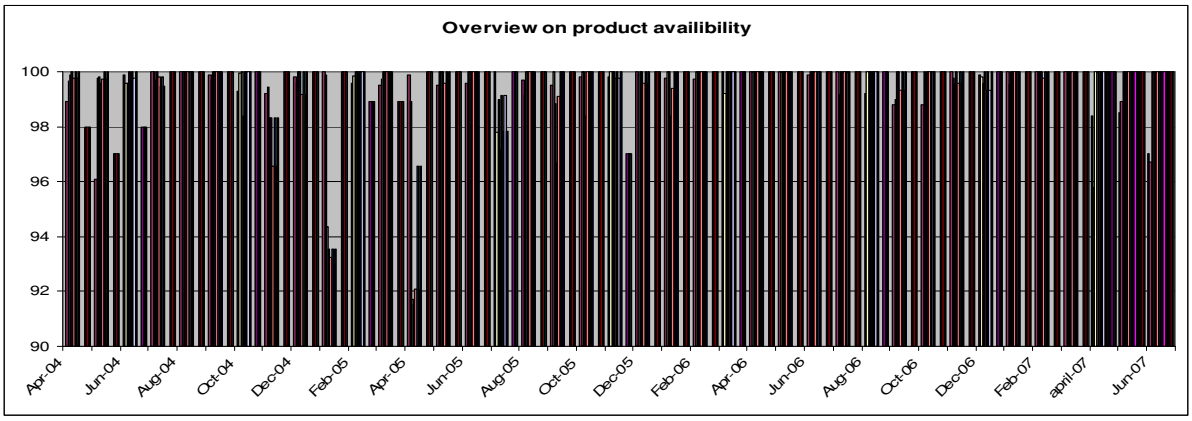

Figure 6 : **Broad overview on product availability.**

NEW REQUIREMENTS

Requirements have been consolidated and new requirements expressed over recent years, in particular in the context of GCOS, GMES, GODAE/GHRSST, and in the OSI SAF workshops, like in Perros-Guirec in March 2005. They can be summarized as following :

- Improved resolution (temporal and geographical)
- Access to full satellite resolution products (SST)
- Specific interfaces allowing flexible access to the products (geographical extraction, remapping …)
- Using of NETCDF, quite a standard format for the Oceanography community.

SATELLITES

The OSI SAF approach is to optimize the use of satellites, in priority the European ones, for continuing to derive the already addressed key-parameters, for improving the products, and perhaps for considering new parameters, such as for example Ocean Colour .

Currently are used MET-09, GOES-12, NOAA-17, NOAA-18, DMSP and Quickscat, and since more recently, MetOp-A. NPP should be used from 2010onwards for replacing NOAA-17 and for preparing the use of future NPOESS. The use of SENTINEL-3, which is scheduled at the very end of the CDOP, is also considered.
The following figure shows the satellites of interest in the CDOP timeframe.

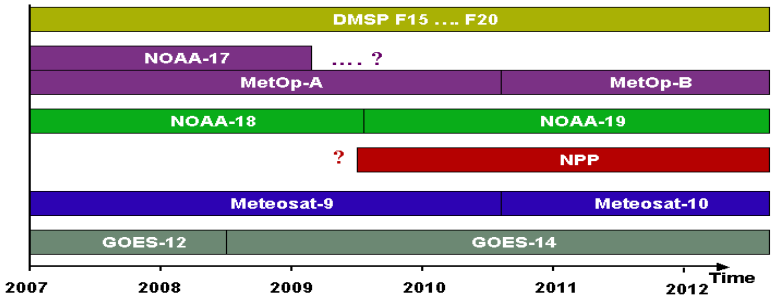

Figure 7 : **Satellites of interest in the OSI SAF CDOP timeframe**

NEW PRODUCTS AND SERVICES

Taking into account the new requirements and the satellites evolution, the OSI SAF proposes new products and services in the framework of the current phase (CDOP) covering till 2012.

MetOp SST

The MetOp SST developed at M-F/CMS is currently being validated, an expected to be operational on 2nd quarter of 2008. The operational chain will produce 3 fields with associated quality indexes :

- The 2-daily Global MetOp SST at 0.05° latitude-longitude resolution, in GRIB 2 and NetCDF L3P,
- The 2-daily NAR MetOp SST, covering the nearest Atlantic and European seas, on polar stereographic projection at 2km resolution, in GRIB 2 and NetCDF L2P,
- The Full resolution MetOp SST, delivered continuously at satellite swath projection and maximum resolution (1km), in NetCDF L3P.

The Gridded products in GRIB 2 (i.e. Global and NAR) will be available via EUMETCAST in near real time and via UMARF archive, while the 3 products will be available in NetCDF on IFREMER FTP server via Internet.

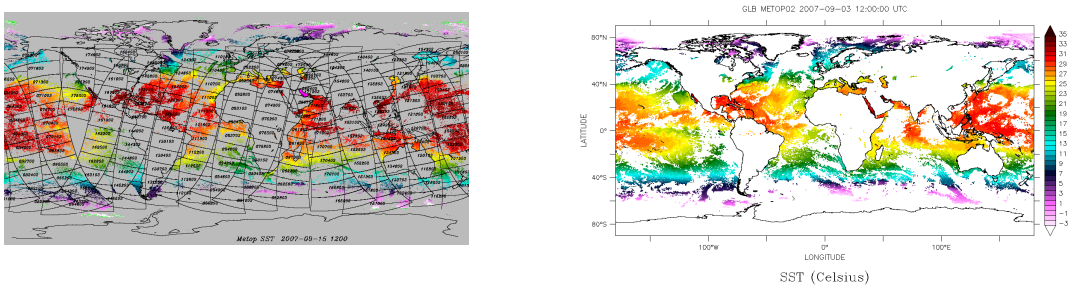

Figure 8 : **Constitution of the 2-daily Global MetOp SST (left) in 3minutes metagranules ; final quicklook (right)**

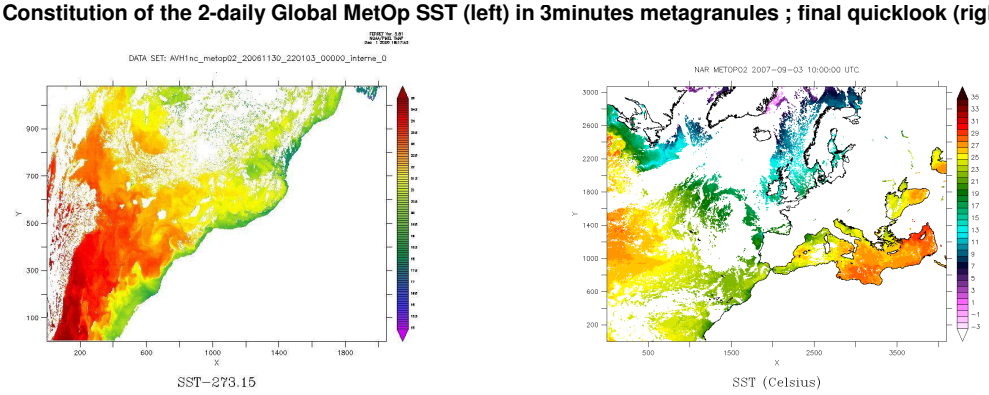

Figure 9 : **Detail of the full Resolution MetOp off Marocco coast (left) ; NAR MetOp SST (right).**

Other SST products

The NAR SST derived from NOAA will be produced in 2008 on an unique area instead of 7 ones, in consistency with NAR MetOp SST. NPP should be used from 2010 onwards.
The 3-hourly (geostationary) LML SST will become hourly in 2009 on 0.05° lat-lon, and in addition the 2-daily MAP SST will be replaced by Atlantic High Latitude SST (AHL SST) on polar stereographic projection at 5km resolution.
A Full resolution NOAA/EARS SST will be produced on High latitudes area in 2009.

Radiative fluxes

The 3-hourly (geostationary) LML Radiative Fluxes (SSI and DLI) will be become hourly in 2009.
The daily integrated MAP SSI and DLI will be split into Atlantic (ATL) with the same resolution on 0.1° lat-lon and derived from GOES-E and MET-09 on the one side, and on the other side Atlantic High Latitude (AHL) on polar stereographic projection at 5km resolution, derived from NOAA and MetOp.

Sea Ice

The Sea Ice drift under development is expected to be operational in 2008.
A Sea Ice emissivity will be developed in view of operational production in 2010.

Wind

The SeaWinds 25km will be pre-operational soon.
An operational ASCAT 12.5km Wind is expected for 2009, and a Coastal ASCAT Wind at 12.5 km for 2011, with as final objective to produce an unique merged Wind.

Flexible access to full resolution products

The distribution of high resolution satellite swath data is an issue for both data providers and users, mostly because of the high volume of data to archive and to transfer to users (who have not the storage capabilities of the data providers). It is thus of high importance to supply users with data sized and suited to their needs, in terms of resolution and coverage. The processing in the OSI SAF was based up to new on a set of fixed product areas.

To take this requirement into account, the OSI SAF (IFREMER) is developing a specific access and distribution tool, based on original products on the native satellite swath grid, and benefiting from the current experience with advanced data servers in the oceanographic community. The new tool, adapted from NAIAD, will allow in particular retrieval and re-mapping of the swath sections matching a geographical area, a time period, and statistical thresholds (such as cloud coverage, rate of valid data,…) as defined by the user.
A similar interface (FEDT) is developed at Met.no for the High Latitude portal.

Formats

GRIB 2 will gradually replace GRIB 1 from 2008 onwards, becoming the standard for the near real time dissemination via EUMETCAST and archiving at UMARF.
All existing SST, DLI, SSI and Sea Ice products are already in NetCDF or will be soon, as all new related products. It has been also decided to produce the Wind in NetCDF.

PRODUCT USAGE AND INTERACTIONS WITH USERS

Main applications for the OSI SAF products

The OSI SAF products are used in various domains. Most of them can be sorted out as following :
Data assimilation in ocean modelling,
Data assimilation in atmospheric modelling,
Data assimilation in se ice modelling,
Climate monitoring
Research in oceanography,
Research in meteorology,
Polar research,
Marne services,
Environment monitoring,
Forecast
Educational

The OSI SAF is involved in the framework of GODAE/GHRSST-PP, and GMES-related projects through MERSEA, MEDSPIRATION, MERCATOR, Polar View, and soon MyOcean.

The OSI SAF Web site and help desk

On its Web site **www.osi-saf.org** the OSI SAF offers general information, quicklooks, statistics, documentation, and a registration function.
Registered users can get access to more documentation, provide feedback on their usage of the products through the permanent user enquiry, and benefit from an automatic and selective service messages sending and from the Help desk mechanism, guaranteeing that any user request will be addressed in time by the relevant team.

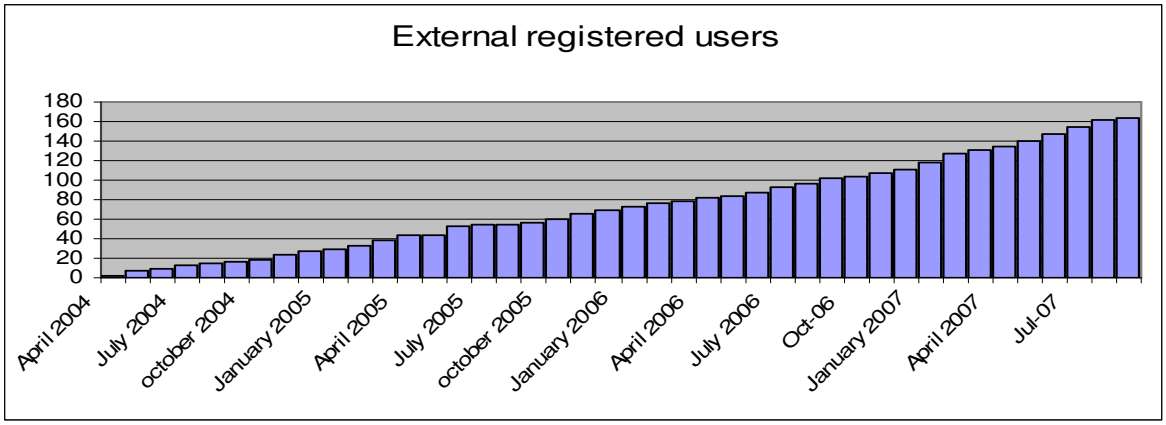

Figure 10 : **number of registered users on the OSI SAF Web site.**