EUMETSAT AND AFRICA

EUROPEAN METEOROLOGICAL SATELLITES AT THE SERVICE OF AFRICA





EUROPEAN METEOROLOGICAL SATELLITES FOR AFRICA

Climate change is a major threat to sustainable growth and development in Africa.

FIG.1

Accumulated rainfall over Africa for June 2012 derived from Meteosat data (Source: TAMSAT, University of Reading, UK) Changing rainfall patterns are predicted to have a negative impact on agriculture and food and water security, while extreme weather events, such as severe storms, droughts and floods, are expected to increase in frequency and intensity. In addition, sea level rise combined with storm surge and breaking waves is predicted to threaten coastal areas, potentially causing major population shifts. To help Africans cope with the impacts of a changing climate, accurate weather forecasts and severe weather warnings are essential and this is one area where weather satellites have a key role to play.



The very short range weather forecast required to ensure safety in severe weather situations requires fast, high quality data as delivered by Europe's Meteosat satellites, 36,000 km above the Equator in geostationary orbit. The Meteosat operational system, which comprises satellites over continental Africa and over the Indian Ocean, ensures a regular flow of full earth disc data every 15 minutes.

Over 70 per cent of the land surface in the Meteosat satellites' field of view is in Africa, so the data and imagery the satellites provide is crucial to enhance weather forecasting capabilities across the African continent and support climate and environmental monitoring applications. The additional information on weather, atmosphere and oceans is provided by the polar-orbiting Metop and Jason ocean altimetry satellites to feed numerical weather and seasonal prediction models, the output of which are also vital to Africa.

The European nations that have joined forces in EUMETSAT have made the support of Africa a strategic objective and, in doing so, combine their efforts with the European Union, the African Union and the World Meteorological Organization. A number of projects and initiatives have already taken place to help the African meteorological community meet their national and regional requirements in terms of severe weather warnings, water and agriculture management, and mitigation of the effects of natural hazards and climate change.

"Africa is one of the most vulnerable continents to climate change and climate variability"

(IPCC 4th Assessment Report: Climate Change 2007)





AFRICA: AN INTEGRAL PART OF EUMETSAT'S STRATEGY

EUMETSAT cooperation with Africa is part of the EUMETSAT strategic objective to "extend the user base for EUMETSAT data, products and services in EUMETSAT Member and Cooperating States and in WMO Members". This overall objective is expressed in the wider framework of the Joint EU-Africa Strategy and the World Meteorological Organization's Strategic Plan.



Ambassador Gary Quince EU Special Representative for the African Union and Head of the EU

"EUMETSAT activities contribute to progress within the Joint Africa-EU Strategy. Through our involvement with PUMA, AMESD and MESA over the past 10 years, we have witnessed the increasing African ownership of Earth observation services for environmental and climate policies. This is an excellent basis for developing a space dialogue that supports sustainable development."

CONTRIBUTING TO THE JOINT EU-AFRICA STRATEGY (JAES)

During the 2nd EU Africa Summit organised in Lisbon in December 2007, the European Union and the African States adopted the Joint Africa-EU Strategy (JAES) with related action plans. The JAES strategy outlines a long-term shared vision of the future of Africa-EU relations and defines eight "Partnerships".

EUMETSAT is contributing, in particular, to:

- Partnership 6, dedicated to Climate and Environment. This encompasses the AMESD and follow-on MESA projects and the ClimDev-Africa initiative.
- Partnership 8, dedicated to Science, Information Society and Space. The dialogue between the EU and the AUC on space in general, including on Earth Observation (i.e. GMES and Africa), is taking place under this partnership.

Involvement in these areas is specifically addressed in the recently published EUMETSAT strategy: "In Regional Association I (Africa), EUMETSAT shall work with the EC to secure a continuation of their excellent cooperation on projects in Africa initiated through the Preparation for the Use of Meteosat in Africa (PUMA) and the African Monitoring of Environment for Sustainable Development (AMESD) projects, and continued through the Monitoring of Environment and Security in Africa (MESA) project."

FIG. 2

Meteosat RGB composite image showing large smoke plumes over the Mozambique Channel, which were visible at low sun angles due to strong forward scattering, 1 September 2008



CONTRIBUTING TO THE WMO STRATEGIC PLAN

The WMO Strategic Plan 2012-2015 was approved at the Sixteenth World Meteorological Congress (Geneva, 2011) and one of its expected results is: *Enhancing capabilities of National Meteorological and Hydrological Services, in particular in developing and least developed countries, to fulfil their mandates.*

EUMETSAT activities fully contribute to WMO objectives in Africa and are specifically highlighted in the EUMETSAT strategy: "The objective shall be to help the meteorological communities in Africa get easier access to EUMETSAT data, products and services and to make best use of available and planned satellite services in order to help individual countries and regions to meet their respective needs."

FROM STRATEGY TO ACTION

During the last 20 years, a number of activities have been established to support EUMETSAT's strategic objectives towards Africa, and these are continuing to make a key contribution within the framework of the WMO and Joint EU-Africa strategies.

These activities are implemented by EUMETSAT directly or through various projects and initiatives and include:

- 1. Satellite data coverage of Africa ensured with an appropriate data policy.
- 2. Real-time data access to African users via EUMETCast/GEONETCast.
- 3. Strengthening capacities to exploit satellite data by training.



- 4. Ensuring close links with African users (Biennial User Forum in Africa, EUMETSAT Help Desk).
- 5. Advancing the use of EUMETSAT data and infrastructure (Research).
- 6. Supporting projects and initiatives in Africa (PUMA, AMESD, MESA, ClimDev Africa, GMES and Africa).

FIG. 3

Meteosat dust RGB image showing a large dust squall (magenta) over Niger, Mali and southern Algeria, 10 June 2010



SUPPORT TO JOINT EU-AFRICA INITIATIVES

To maximise the benefits of its involvement in Africa, EUMETSAT is linking its activities to existing initiatives related to weather, climate and environmental monitoring. In the framework of the Joint EU-Africa Strategy, EUMETSAT is involved in two major initiatives: "GMES and Africa", which aims to strengthen cooperation on Earth observation between Europe and Africa, and "ClimDev-Africa" which focuses on improving African access to climate data and helping to make it available for decision-makers to use.



Signature of the Maputo Declaration, in October 2006, on the eve of the 7th EUMETSAT User Forum in Africa which initiated "GMES and Africa"

THE GMES AND AFRICA INITIA-TIVE: COOPERATION ON EARTH OBSERVATION BETWEEN EUROPE AND AFRICA

The Global Monitoring for Environment and Security in Africa (GMES and Africa) initiative is the flagship of the EU-Africa dialogue on Space, and was launched by the Maputo Declaration, signed on 15 October 2006.

The aim of this initiative is to strengthen and further develop infrastructure for a more coherent exploitation of Earth observation data (space and in-situ), technologies and services in support of the environmental policies for sustainable development in Africa and ACP (African, Caribbean and Pacific) countries.

GMES and Africa's objectives are to:

- develop the necessary capacity (institutional, human and technical) in Africa to adapt and exploit, on an operational basis, the technology, data, products and services developed in the framework of GMES Europe and, which are relevant to African needs;
- 2. develop techniques, products and services to better serve African interests and requirements in terms of environmental monitoring, by adapting them, when necessary, to the institutional African context.

BACKGROUND

The GMES and Africa initiative started with the Maputo Declaration signed by the representatives of the African Union Commission, the African Regional Economic Communities (RECs), the Secretary General of the ACP Secretariat and the Minister of Transport of the Republic of Mozambique, on 15 October 2006 on the eve of the 7th EUMETSAT User Forum in Africa.

In December 2007, during the EU-Africa Lisbon Summit, "The Lisbon Process on "GMES and Africa"" was approved. It foresees the drafting of an "Action Plan on GMES and Africa". The GMES and Africa initiative was then integrated into the partnership #8 of the JAES first and second Action Plan.

EUMETSAT'S CONTRIBUTION

EUMETSAT satellite data and infrastructure can contribute significantly to the implementation of the Action Plan on GMES and Africa. It is expected that this initiative will provide continuity and build on the efforts deployed over the past 10 years through the PUMA, AMESD and now MESA project.



THE CLIMDEV-AFRICA INITIATIVE: STRUCTURING AFRICA'S RESPONSE TO CLIMATE CHANGE

ClimDev-Africa is an initiative that aims to address the need for greatly-improved climate information for Africa, and strengthen the use of such information for decision-making, for instance by improving analytical capacity, knowledge management and dissemination activities. It is a joint initiative of the African Union Commission (AUC), the United Nations Economic Commission for Africa (UNECA) and the African Development Bank.

The importance of satellite-based information for monitoring climate change and variability has been recognised and structured within the Global Climate Observing System (GCOS).

EUMETSAT'S CONTRIBUTION

EUMETSAT is contributing not only its data and products but also training and dissemination of climate-relevant information. The organisation also works closely with its African and international partners to structure a coordinated contribution that can respond to some of the needs of African policy makers in terms of climate information, and thus facilitate the introduction of climate services in Africa.

FIG. 4

Normalised Differenced Vegetation Index (NDVI) image of the African continent, which is used to monitor changes in, for example, vegetation cover, droughts and desertification (Source: VGT-VITO)



THE ACHIEVEMENTS AND PROSPECTS OF EARTH OBSERVATION IN AFRICA

As a result of close cooperation between the European Commission, the African Regional Economic Communities, the ACP Secretariat, the African Union Commission and EUMETSAT, a succession of projects have been organised to help African countries get better access to Earth observation data. The focus for the initial PUMA project was to provide access to satellite data for weather forecasting. The objective of the subsequent AMESD and MESA projects has addressed the provision of data for climate and environmental monitoring.



Dr. Mamadou Lamine Bah President of WMO Regional Association I (Africa)

"Thanks to the PUMA stations, the African NMHS can access EUMETSAT data and key meteorological information, such as forecast model outputs. This allows the production of improved weather forecasts for our population. The permanent dialogue with EUMETSAT is also instrumental to successfully implementing the Global Framework of Climate Services in our region."

PUMA: PAVING THE WAY (2001-2006)

PUMA (Preparation for the Use of MSG in Africa), was the first pan-African technology project focusing on Earth observation funded by the European Union and has vastly enhanced weather forecasting capabilities across the African continent. A total of 53 EUMETCast stations were deployed in all African National Meteorological Services and regional centres to ensure operational and real time access to relevant data and products. Access to this data has enabled African national meteorological and hydrological services to provide more accurate weather forecasts, monitor extreme weather events, improve disaster management, and forestall drought and starvation. Six PUMA pilot projects enhanced the use of Earth observation data beyond meteorological applications, i.e. for marine resources, agriculture, river and environmental management.

The PUMA project was funded through the 8th European Development Fund of the European Union and implemented by the Kenyan Meteorological Department, acting on behalf of and under the steering of the Regional African Economic Communities.



AMESD: SUPPORTING SUSTAIN-ABLE DEVELOPMENT (2006-2013)

The African Monitoring of Environment for Sustainable Development (AMESD) project is taking PUMA a stage further by significantly extending the use of remote sensing data for environmental and climate monitoring applications. On a practical level it also involves installing 111 new EUMETCast stations (one per sub-Saharan African country) and upgrading the EUMETCast stations already provided in the framework of the previous PUMA project.

By extending the operational use of Earth observation technologies and data from meteorological to environment and climate monitoring applications, AMESD enables all African national and regional institutions, as well as the continent's National Meteorological and Hydrological Services, to provide decision-makers with the information needed to manage their environment more effectively and ensure long-term sustainable development in the region.

Most importantly, AMESD aims to improve the lives and prospects of the 350 million disadvantaged people in Africa who currently endure poverty and hardship, whose livelihoods depend heavily on their environment.



BACKGROUND

AMESD is financed by the 9th European Development Fund of the European Union, contributes directly to the Africa-EU partnership #6 and paves the way for the GMES and Africa initiative.

The African Union is responsible for its implementation, in close cooperation with the five participating African Regional Economic Communities and the ACP Secretariat. The AMESD regional thematic applications are managed by the five Regional Implementation Centres: the Commission Internationale du Bassin Congo-Oubangui-Sangha (CICOS) for the CEMAC region; AGRHYMET for the ECOWAS region; ICPAC for the IGAD region; the Botswana Department of Meteorological Services for the SADC region; and the Mauritius Oceanographic Institute for the IOC region.

More information is provided on the AMESD Technical Assistance website: www.amesd.org

FIG. 5

Meteosat RGB composite image showing the extent of the 2007 floods of Africa, reported by the UN as being one of the worst floodings in recorded history. Areas covered by vegetation are shown in green colour and water surfaces in black. One can also see enlarged rivers like the Niger river in Mali and Nigeria or the Volta river in Ghana, 17 September 2007



THE ACHIEVEMENTS AND PROSPECTS OF EARTH OBSERVATION IN AFRICA

CONTINUED



H.E. Rhoda Peace Tumusiime Commissioner for Rural Economy and Agriculture, African Union

"Through AMESD and MESA, our Member States obtain critical information from EUMETSAT. The addedvalue services developed in Africa allow policy makers to improve the performance of climate and weather sensitive sectors such as agriculture, environment, fisheries and transportation. We are grateful to the EU and EUMETSAT for the fruitful and long term partnership."

MESA: MONITORING ENVIRON-MENT IN AFRICA (2012-2018)

The "Monitoring of Environment and Security in Africa" programme (MESA) builds on the results obtained in PUMA and AMESD and will be a first contribution to the GMES and Africa and CLIMDEV-Africa initiatives of the EU-Africa Joint Strategy. MESA will consolidate and widen the operational environmental services developed in AMESD, and propose new services, such as African climate services.

The purpose of the MESA project is: "to increase the information management, decision-making and planning capacity of African continental, regional and national institutions mandated for environment, climate, food security and related responsibilities by enhancing access to and exploitation of relevant Earth Observation applications in Africa."

The project's focus is to strengthen the capacity to use of Earth observation data in Africa, with emphasis on climate and environment applications.

Among other activities, MESA plans securing the maintenance and upgrading the EUMETCast reception stations deployed through AMESD and support the development of operational services based on Earth observation data.

MESA is also introducing a continentalwide and thematic transversal theme "Support to Climate Services (climate change monitoring)". This theme has been proposed by the African Regional Economic Communities and the African Union Commission with the aim of receiving pertinent information for developing, implementing and monitoring their climate policies at regional and continental level.

This MESA theme is closely linked with the Global Framework for Climate Services (GFCS) and the ClimDev-Africa initiative. It will support the African meteorological community in the development or strengthening of their capacity to deliver appropriate climate information to decision makers in their countries and regions.



Meteosat data are made available to users, together with other information, through hundreds of EUMETCast user stations deployed across the African continent in the framework of projects (PUMA, AMESD, and now MESA) established in cooperation between the African Union Commission and the European Development Fund



THEMES

The programme will be implemented by the African Union Commission and seven Regional Implementation Centres (RICs), which will operate services in the following themes:

Region	RIC	Theme
CEMAC	CICOS	Water Monitoring for fluvial transportation and environmental assessment
IGAD	ICPAC	Land Degradation assessment, Natural Habitat Conservation, Forest management and change monitoring
IOC	MOI	Costal and Marine Resources management
ECOWAS	AGRHYMET	Water monitoring for Cropland and Rangeland management
SADC	BDMS	Agricultural and Environmental Resources Management
ECOWAS	TBD	Costal and Marine Resources management
All Africa	ACMAD	Support to Climate Services (Climate Change Monitoring)

The MESA project was proposed through the Ouagadougou Declaration signed in September 2010 by the African Union Commission, the ACP Secretariat and the African Regional Economic Communities. It is funded by the 10th EDF of the European Union.

OVERVIEW - EUMETSAT'S ROLE IN SUPPORTING PUMA, AMESD AND MESA

EUMETSAT's contribution will be as fundamental to the success of the MESA project as it has been to the PUMA and AMESD projects. It encompasses the following:

- the continuous supply of its satellite data and products via the EUMETCast dissemination service;
- the dissemination via EUMETCast of additional meteorological and environmental information;
- support in the maintenance and upgrade of receiving stations and equipment; coordination with its training programmes for African National Meteorological and Hydrological Services personnel;

- provision of managerial support to the committee in charge of supervising the project; and
- an opportunity, through its biennial African User Forum and other workshops, for the African user community to meet, discuss and exchange information about the activities of the project.



EUMETSAT'S OWN ACTIVITIES IN AFRICA

EUMETSAT's activities in Africa focus on providing real time satellite data and other meteorological and environmental information via EUMETCast, providing training on how to get the most out of the data, and working closely with users through the EUMETSAT Help Desk and biennial user forums. These activities benefit from information produced across the European Meteorological infrastructure and by other operators in Europe and Africa.

ENSURING CLOSE LINKS WITH AFRICAN USERS: USER FORUM AND HELP DESK

Maintaining close links with users all over the world is a high priority for EUMETSAT. In the case of Africa this means not only the day-to-day support through the EUMETSAT Help Desk, but also the organisation of a biennial User Forum in Africa. Typically, about 150 participants, from each African country and Europe, attend this forum.

THE IMPACT OF GEONETCAST

EUMETSAT's data dissemination system, EUMETCast, delivers data and products to users through inexpensive reception stations. It is the organisations contribution to GEONETCast, a global network of satellite-based data dissemination systems, and also to the Integrated Global Data Dissemination Service (IGDDS) a component of the World Meteorological Organization's information service (WIS). Through EUMETCast-Africa, the African component of GEONETCast, all African users have real-time access to a wide variety of satellite data, including World Meteorological Organization (WMO) basic data, forecast data from the European Centre for Medium-Range Weather Forecasts (ECMWF) and the National Meteorological Services of EUMETSAT Member States, environmental data relevant to various Societal Benefits areas of the Group for Earth Observation, distributed by various data providers such as VITO, South Africa, etc.

One of the strengths of the EUMETCast system is its simple user infrastructure and the resulting low cost of obtaining high-quality data. All this is possible with a single receiving station using off-theshelf components. Currently, about 400 EUMETCast stations are in operation throughout Africa.





Example of an ECMWF model output disseminated through EUMETCast (5-days temperature forecast)

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STRENGTHENING USERS' CAPACITIES

Regular training in satellite meteorology is provided through cooperation with four training centres in Niger, Morocco, Kenya and South Africa, which are all recognised as Centres of Excellence by WMO. Hundreds of African meteorologists and environment scientists are trained each year in these centres, on the use of Earth observation data for meteorological and climate applications.

EUMETSAT also contributes to training organised by other institutions, or through projects such as AMESD, by providing training materials, trainers, data and knowledge for the African user community.



FIG. 7

Meteosat-9 Brightness temperature difference (BTR) image, used to depicts a dryline with dryer air to the west and more moist areas east. 2 October 2011



ADVANCING THE APPLICATION OF SATELLITE PRODUCTS, THROUGH RESEARCH

Various research and development projects aiming to explore the potential use of Earth observation data in Africa and facilitating the access to some data and products for scientist and researchers are also planned. These projects, funded by the European Commission Framework Programme for Research and Technical Demonstration (FP7), provide a platform for technical exchange between EUMETSAT and its potential and enlarged user community in Africa. Training session at the South African Weather Service, Pretoria, South Africa



EUMETSAT'S COOPERATION WITH AFRICAN INSTITUTIONS

The African National Meteorological and Hydrological Services (NMHS) are the direct beneficiaries of EUMETSAT activities in Africa. To inform and assist them, EUMETSAT maintains frequent contact with this community, either directly or through WMO. The African NMHS are also involved in a number of specific activities such as training, the biennial user forum and the Expert Group for EUMETCast Data Dissemination.



MESA preparation workshop, 9 -12 May 2011, EUMETSAT headquarters, Darmstadt

COOPERATION WITH REGIONAL TECHNICAL CENTRES (ACMAD, AGRHYMET, ICPAC AND SADC-CSC)

EUMETSAT has established close cooperation with African regional technical centres which have the mandate to undertake weather, climate and environmental monitoring, in support of various socio-economic policies in Africa (agriculture, desertification, food security, water management, etc).:

- The African Centre for Meteorological Applications for Development (ACMAD) aims to contribute to the sustainable development of African socio-economic sectors through the use of information related to weather, climate and environment as resources for development.
- The Centre Regional de Formation et d'Application en Agrométéorologie et Hydrologie Opérationelle (AGRHYMET) a specialised institution of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) with the mission of promoting information and training related to food security, desertification control and the management of natural and water resources.
- The Intergovernmental Authority on Development (IGAD) Climate Prediction and Applications Centre (ICPAC) and the Southern African Development Community Climate Service Centre (SADC-CSC). These two institutions are mandated to provide climate and seasonal forecasting services in their respective regions.



COOPERATION FOR TRAINING ACTIVITIES

EUMETSAT cooperates with four African WMO Centres of Excellence on training in satellite meteorology:

- the Direction de la Météorologie Nationale (DMN, Maroc Meteo), in Casablanca, Morocco.
- the Ecole Africaine de la Météorologie et de l'Aviation Civile (EAMAC) of the Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA), located in Niamey, Niger.
- the Institute for Meteorological Training and Research (IMTR) in Nairobi, Kenya.
- the South African Weather Service (SAWS) training centre in Pretoria, South Africa.

COOPERATION WITH POLICY INSTITUTIONS

EUMETSAT is in contact with several African policy institutions that provide the necessary input to the various projects and initiatives, and ensures that they are properly aligned with national, regional and continental policies:

- The African Union Commission (AUC), which is the executive and administrative branch of the African Union.
- The African Regional Economic Communities (IGAD, ECOWAS, IOC, CEMAC, SADC) and the Secretariat of the African, Caribbean and Pacific Group of States (ACP Secretariat).
- The African Climate Policy Centre (ACPC), hosted by the UN-ECA, who is contributing significantly to the advent of the ClimDev Africa initiative.

The four African WMO Centres of Excellence on training





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EUMETSAT also has established cooperation agreements with organisations involved in meteorological satellite activities, including the National Meteorological Services of Canada, China, India, Japan, Korea, Russia and USA.

