Abstract

Since 1997, the Satellite Application Facility on support to Nowcasting and Very Short-Range Forecasting (NWC SAF) has been committed to providing services to the International Meteorological Community.

NWC SAF belongs to the SAF Network developed under the overall co-ordination of EUMETSAT and is part of the EUMETSAT Ground Segment. Under the leadership of the Spanish Meteorological Agency (AEMET), the NWC SAF is being developed by a Project Team involving the French Meteorological Service (Météo-France), the Swedish Meteorological and Hydrological Institute (SMHI) and the Austrian Institute for Meteorology and Geodynamics (ZAMG).

The general objective of the NWC SAF is to provide operational services to ensure optimum use of meteorological satellite data in Nowcasting and Very Short Range Forecasting by the Meteorological Community. This applies to the MSG and the PPS satellite systems, with 13 SEVIRI derived products and four AVHRR/AMSU/MHS derived products. To achieve this goal, the NWC SAF is responsible for the development and maintenance of appropriate SW Packages, as well as user support and related tasks.

Following the Development Phase (1997-2002), EUMETSAT SAF Strategy established the Initial Operations Phase (2002-2007) as a transition period from the developmental to the fully operational phase. From this point onwards, the Continuous Development & Operations Phase (CDOP: 2007-2012) has been in place and the next stage, CDOP-2 (2012-2017), is now being prepared.

This presentation attempts to describe the goals attained in the current phase as well as to envisage the prospects of the project for CDOP-2.
Desk. The number of users at the time being is 82 belonging to Meteorological Services, Universities and other organisations distributed along Europe, Africa, America an Asia.

The phases of the NWC SAF are as follows:

**1997-2020:** Development and Operations Phase (DOP), in which product prototypes and SW were developed

**2002-2007:** Initial Operations Phase (IOP) for tuning and validation with MSG and EPS. First SW packages were distributed and a Help Desk tool for user support was created

**2007-2012:** Continuous Development and Operations Phase (CDOP): at the current phase products have been improved according to the users’ requirements, SW has been updated in a yearly basis with the corresponding improvements in science and engineering and users have been supported efficiently through the Help Desk


**SERVICES**

The services we provide through the Help Desk are: the software distribution and reports, the support to the users on their questions or problems both in engineering and science aspects through the Mail Box and the distribution of the corresponding science and engineering documentation. Training, product applicability request and user requirements collection are also relevant supporting activities.

The WEB based Help Desk (www.nwcsaf.org) has two main areas, an Open area and a User Support area. At the Open area anonymous user can access general information, scientific documentation, visiting scientist activities and SW delivery conditions. News, Topical Images Gallery, and access in NRT to all the products and product description are also available.

After licensing process ends, users are provided with credentials in order to access software packages for downloading, Mail Box for questions and problems which solutions are quickly provided, Software Problems Report page containing the full record of the software scientific and engineering improvements and project documentation including science and engineering. Other facilities for Consortium internal management are also available.

**PRODUCTS**

Concerning the products, we have developed Clouds, Precipitation, Clear Air, Wind and Conceptual Models products for the MSG and PPS SW packages as shown in Figure 1.

![Figure 1: SAF/NWC/MSG and PPS products classification](image-url)
The product development and maintenance is distributed among the Consortium Members as follows: AEMET is responsible of the Clear Air stability products, the Convective Precipitation and the Wind, all applying to MSG. Météo-France takes care of the Clouds and Thunderstorm MSG products. The Full PPS package is responsibility of SMHI as well as the MSG precipitation likelihood and finally, ZAMG is in charge of the Air Mass Analysis and the Conceptual model MSG products.

Let’s have a more detailed view of the products:

**Cloud products**

These products are all based on MSG and NOAA/METOP.

- The Cloud Mask (CMa) delineates with high confidence the clear air areas also providing snow, desert dust and volcanic ash. The Iceland volcanic event on May 2010 was monitored in near real time by using the Cloud Mask Ash flag.
- The Cloud Type (CT) provides information about the major cloud classes.
- The Cloud Top Temperature and Height (CTTH) contain top pressure, height and temperature data. An example is shown in Figure 2.

*Figure 2: Cloud Top Pressure Example (24th August 2010).*

**Precipitation and Convection products**

- The Precipitating Clouds (PC) product gives precipitation in terms of likelihood and applies to both SW packages.
- The Convection Rainfall Rate (CRR) is the precipitation rate associated to convective clouds with two outputs, instantaneous rate and hourly accumulations.
- The Rapid Development Thunderstorms (RDT) provides identification, monitoring and tracking of intense convective systems, and detection of rapidly developing convective cells.

One of the main uses of these products is to monitor heavy precipitation when radar data is not available. The CRR product has been applied to a train of convective systems over the Portuguese Madeira Island causing heavy flash floods with great damages. In the example below (Figure 3), we can see that the evolution in time of the hourly accumulation CRR and the precipitation data provided by the Portuguese met institute agrees pretty well.
Figure 3: Convective system over the Portuguese island of Madeira on 20th February 2010.

Clear Air products

- The first set of Clear Air products are based on a Physical Retrieval (SPhR) approach with the following outputs: Total Precipitable Water, Layer Precipitable Water in three levels (Boundary Layer, Medium Layer and High Layer), Lifted Index, K-Index and Showalter Index. The main application is the precocity of convection diagnosis. A Precipitable Water Boundary Layer example can be seen in Figure 4.

Figure 4: Layer Precipitable Water Boundary Layer example (24th August 2010).

- The Air Mass Analysis provides a classification of air masses in clear air, as well as potential equivalent temperature features and WV imagery black stripes.

Wind product

- The High Resolution Wind (HRW) retrieves detailed automatic motion winds including pressure level and quality flags. Initially winds were only obtained from the HRV channel. The IR channel winds recently added allows continuity at night and a higher number of winds as shown in the figure below (Figure 5).
Figure 5: High Resolution Winds comparison: in upper image only VIS data used. In lower image Winds are derived from both VIS and IR imagery.

**Conceptual Model product**
- The Automatic Satellite Image Interpretation (ASII) delineates atmospheric features like fronts, wave structures, areas of intensification of fronts by jet streak crossing, position of the jet axis, comma clouds, enhanced convection areas, etc.

**CDOP-2 PREPARATIONS**

The NWC SAF Project Team is now preparing the Next phase CDOP-2: Our vision is to become a Reference and Excellence centre for Nowcasting not only within EUMETSAT but also worldwide. To this end we will continue distributing Software (extending its operability to other satellites) for the generation in NRT of a set of meteorological products as well as supporting services to users.

The User Requirements Collection was made through surveys, users’ workshops, listening to them. One of the main requests has been the extension of the SW applicability to other geostationary satellites, with the advantage of allowing a smooth transition to MTG. At the time being, some users as the Korean Meteorological Administration are making the big effort by adapting some of the SAFNWC/MSG products to MTSAT. The example below (Figure 6) shows the adaptation made by Météo-France of the Cloud Type products to GOES and MTSAT satellites.
Concerning the products, users stressed the need of developing microphysics cloud parameters also useful to improve the precipitation products. On the other hand, one of the problems detected was the inaccurate behaviour of the cloud top features near tropopause in convective situations. To analyse and improve this is one of our goals. An earlier detection of convective clouds is going to be developed in terms of convection initiation and convective warnings.

Concerning the MTG and post-EPS preparations, apart to the added value of spectral, spatial and temporal MTG resolution, other advantages as the use of the MTG-LI for convective precipitation has been proved, as this CRR example including ground lightning information shows (Figure 7).

Figure 7: Convective Rainfall Rate example: Upper images, radar and ground lightning data, lower images CRR without and with lightning assimilation
The MTG multispectral sounder is expected to be very useful for the retrieval of 3D wind as well as for instability indexes retrieval

Some engineering improvements have also been requested as new formats, common libraries and geo-referencing information. We will also intend to continue the Cooperation inside EUMETSAT and between SAF in terms of common library functions for MTG-FCI, common visualization tool, common validation database, tools and tasks and new federated activities

CONCLUSIONS

At the current phase we are offering stable well validated SW packages with variety of operational well validated products. We also provide very good user service via Help Desk WEB.

For the next phase we intend to extend the packages operability to other satellites, to improve the current products and to develop new ones, to prepare for MTG and Post-EPS, to improve the engineering and to continue cooperating inside EUMETSAT and between SAF.

REFERENCES

http://www.nwcsaf.org