

## **UPDATED INFORMATION ON EUMETSAT SATELLITE APPLICATIONS FACILITIES**

Following the introduction of the Satellite Applications Facilities (SAFs) as distributed elements of the future EUMETSAT Ground Systems, four SAFs have started their development activities in 1998/1999. This paper provides the current status of the on-going activities.

## **UPDATED INFORMATION ON EUMETSAT SATELLITE APPLICATIONS FACILITIES**

### **1 INTRODUCTION**

Since CGMS-XXVI, SAF activities have further evolved. The purpose of this paper is to report on the status of the SAFs and presents a full list of the SAF products.

### **2 CURRENT STATUS**

The SAF on support to Nowcasting and VSRF, the SAF on Ocean & Sea Ice and the SAF on Ozone Monitoring have successfully passed their first milestone (requirement analysis and architectural design review). These SAFs are currently working on the tuning of the retrieval algorithms and the detailed design of the software/facilities. Prototype products for most of the products are already available. Fully validated products will only become available in the pre-operational phase of the SAFs (nominally the last 6 months of the 5-years SAF development).

Two further SAFs, the Climate Monitoring SAF and the NWP SAF, have been approved by EUMETSAT Council in November 1998 and activities have started early this year. The development approach of the Climate Monitoring SAF follows the EUMETSAT standard approach for SAFs with the following main phases:

- Requirement definition/analysis and preliminary design (12 months)
- Detailed design & prototyping (18-24 months)
- Implementation/integration & testing (12-18 months)
- Facility verification & validation (12 months)

The development approach for the NWP SAF is based on yearly workplans and deliverables. This approach is consistent with tried and tested methods used at NWP Centres. After the first year, i.e. in February 2000, the following software will become available from the NWP SAF:

- Updated RTTOV
- Updated version of AAPP
- Fast RTM for IASI and associated observation operators
- Basic pre-processing, retrieval, quality control and observation operator for SeaWinds
- Validated version of RTTOV for SSM/I
- 1DVAR retrieval scheme for SSM/I(S)

Finally, two more SAFs have been approved by EUMETSAT Council in April and June 1999, namely:

- SAF on GRAS Meteorology
- SAF on Land Surface Analysis

A full list of EUMETSAT SAFs is given in the following table:

SAF on	Date of kick-off	Hosting Institute	Consortium members
<b>Support to Nowcasting &amp; VSRF</b>	Feb. 1997	INM (Spain)	NMSs of France, Austria and Sweden;
<b>Ocean &amp; Sea Ice</b>	April 1997	Météo France (France)	NMSs of The Netherlands, Denmark, Norway and Sweden; Institut Français de Recherche pour l'Exploitation de la Mer (France);
<b>Ozone Monitoring</b>	October 1997	FMI (Finland)	NMSs of The Netherlands, Belgium, Denmark, Greece, Germany and France; Deutsches Zentrum für Luft- und Raumfahrt (Germany), University of Thessaloniki (Greece);
<b>Climate Monitoring</b>	Dec. 1998	DWD (Germany)	NMSs of The Netherlands, Belgium, Finland and Sweden; Bundesamt für Seeschifffahrt und Hydrographie (Germany)
<b>Numerical Weather Prediction</b>	Feb. 1999	UKMO (UK)	NMSs of The Netherlands and France; ECMWF;
<b>GRAS Meteorology</b>	April 1999	DMI (Denmark)	NMS of United Kingdom; Institut d'Estudis Espacials de Catalunya (Spain);
<b>Land Surface Analysis</b>	Sep. 1999	IM (Portugal)	NMSs of Belgium, France and Sweden; Inst. Of Meteorology & Climate Research (Germany), University of Bonn (Germany), Federal Inst. Of Hydrology (Germany), University of the Aegean (Greece), Inst. of Agrometeorology & Environmental Analysis Applied in Agriculture (Italy), Applied Meteorology Foundation (Italy), Inst. For Applied Science & Technology (Portugal), University of Evora (Portugal), University of Valencia (Spain)

### 3 UPDATED LIST OF PRODUCTS

There are four major types of SAF products/services:

1. Software packages for users
  - Application SW (SAF on Nowcasting, SAF on NWP)
  - Data Processing SW : for level 1 products (AAPP)
2. Software development support for central processing
3. Real time product services
  - Programme-specific (MSG, EPS) & multi-mission
4. Off line product services
  - Programme-specific (MSG, EPS) & multi-mission

The following lists indicate the products and software packages to be delivered by the seven SAFs:

### 3.1 Application Software Packages for Users

#### 3.1.1 SEVIRI (Nowcasting SAF)

- Cloud Mask and Cloud Amount
- Cloud Type (including Fog)
- Cloud Top Temperature/Height
- Precipitating Clouds
- Convective Rainfall Rate
- Total Precipitable Water
- Layer Precipitable Water
- Stability Analysis Imagery
- High Resolution Wind Vectors from HRVIS
- Automatic Satellite Image Interpretation
- Rapid Developing Thunderstorms
- Air Mass Analysis

#### 3.1.2 SEVIRI (NWP SAF)

- New/improved Observation Operators (for AMVs)
- Geostationary Radiance Assimilation

#### 3.1.3 AVHRR/AMSU (Nowcasting SAF)

- Cloud Mask and Cloud Amount
- Cloud Type (including Fog)
- Cloud Top Temperature/Height
- Precipitating Clouds

#### 3.1.4 ATOVS (NWP SAF)

- Improved & Extended RTMs (updated RTTOV etc.)

#### 3.1.5 IASI (NWP SAF)

- Fast RTM & Associated Observation Operators

#### 3.1.6 GOME (NWP SAF)

- Observation Operators

#### 3.1.7 ASCAT/SeaWinds (NWP SAF)

- Improved Observation Operators

#### 3.1.8 SSM/I (NWP SAF)

- 1DVar Retrieval System (for wind speed, cloud water etc.)
- Fast RTM

#### 3.1.9 SSMIS (NWP SAF)

- 1DVar Retrieval System (for wind speed, cloud water etc.)
- Fast RTM

#### 3.1.10 AIRS (NWP SAF)

- 1DVAR Retrieval System

### **3.2 Data Processing Software (NWP SAF)**

- Improved and extended versions of AAPP for annual distribution (e.g. updated ingest function, updated cloud detection, added ICI retrieval module etc.)
- Extension of AAPP to process IASI+AMSU+AVHRR

### **3.3 Software Development Support for Central Processing**

- Support Global Instability Index (GII) Development (Nowcasting SAF)
- Support Total Ozone from SEVIRI Development (Ozone SAF)
- Other relevant activities in NWP SAF

### **3.4 Real Time Products**

#### 3.4.1 Real Time Products from MSG

- Surface Albedo (Land Surface Analysis SAF)
- Aerosol (Land Surface Analysis SAF)
- Scattered Radiance Field (Land Surface Analysis SAF)
- Surface Short-wave Fluxes (Land Surface Analysis SAF)
- Land Surface Temperature (Land Surface Analysis SAF)
- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)
- Soil Moisture (Land Surface Analysis SAF)
- Evapotranspiration Rate (Land Surface Analysis SAF)

#### 3.4.2 Real Time Products from EPS

- Near Surface Wind Vector (Ocean & Sea Ice SAF)
- Atlantic High Latitude SST (Ocean & Sea Ice SAF)

- Atlantic High Latitude Radiative Fluxes (Ocean & Sea Ice SAF)
- Regional SST (Ocean & Sea Ice SAF)
- Sea Surface Thermal Fronts (Ocean & Sea Ice SAF)
- Total Ozone from GOME (Ozone Monitoring SAF)
- Total Ozone from HIRS (Ozone Monitoring SAF)
- Ozone Profiles (Ozone Monitoring SAF)
- Aerosol Index (Ozone Monitoring SAF)
- Surface Albedo (Land Surface Analysis SAF)
- Aerosol (Land Surface Analysis SAF)
- Scattered Radiance Field (Land Surface Analysis SAF)
- Surface Short-wave Fluxes (Land Surface Analysis SAF)
- Land Surface Temperature (Land Surface Analysis SAF)
- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)
- Evapotranspiration Rate (Land Surface Analysis SAF)
- N. Europe Snow Cover (Land Surface Analysis SAF)
- Refractivity Profiles (GRAS Meteorology SAF)
- Temperature, Humidity and Pressure Profiles (GRAS Meteorology SAF)
- Integrated Water Vapour (GRAS Meteorology SAF)

#### 3.4.3 Multi-Mission Real Time Products

- Atlantic Low & Mid Latitude SST (Ocean & Sea Ice SAF)
- Merged Atlantic SST (Ocean & Sea Ice SAF)
- Atlantic Low & Mid Latitude Radiative Fluxes (Ocean & Sea Ice SAF)
- Merged Atlantic Radiative Fluxes (Ocean & Sea Ice SAF)
- Atlantic Sea Ice Edge (Ocean & Sea Ice SAF)
- Atlantic Sea Ice Cover (Ocean & Sea Ice SAF)
- Atlantic Sea Ice Type (Ocean & Sea Ice SAF)
- Clear-Sky UV Fields (Ozone Monitoring SAF)
- Land Surface Temperature (Land Surface Analysis SAF)
- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)
- S. & Central Europe Snow Cover (Land Surface Analysis SAF)

### 3.5 **Off-Line Products**

#### 3.5.1 Off-Line Products from MSG

- Surface Albedo (Land Surface Analysis SAF)
- Aerosol (Land Surface Analysis SAF)
- Scattered Radiance Field (Land Surface Analysis SAF)
- Surface Short-wave Fluxes (Land Surface Analysis SAF)
- Land Surface Temperature (Land Surface Analysis SAF)

- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)

### 3.5.2 Off-Line Products from EPS

- Total Ozone from GOME (Ozone Monitoring SAF)
- Trace Gases (Ozone Monitoring SAF)
- Ozone Profiles (Ozone Monitoring SAF)
- UV Fields with Clouds & Albedo (Ozone Monitoring SAF)
- Surface Albedo (Land Surface Analysis SAF)
- Aerosol (Land Surface Analysis SAF)
- Scattered Radiance Field (Land Surface Analysis SAF)
- Surface Short-wave Fluxes (Land Surface Analysis SAF)
- Land Surface Temperature (Land Surface Analysis SAF)
- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)
- Refractivity Profiles (GRAS Meteorology SAF)
- Temperature, Humidity and Pressure Profiles (GRAS Meteorology SAF)
- Integrated Water Vapour (GRAS Meteorology SAF)

### 3.5.3 Multi-Mission Off Line Products

- Land Surface Temperature (Land Surface Analysis SAF)
- Surface Emissivity (Land Surface Analysis SAF)
- Surface Long-wave Fluxes (Land Surface Analysis SAF)
- Normalised Differential Vegetation Index (Land Surface Analysis SAF)
- Fraction of Green Vegetation (Land Surface Analysis SAF)
- Fraction of Photosynthetic Active Radiation (Land Surface Analysis SAF)
- Leaf Area Index (Land Surface Analysis SAF)
- Fractional Cloud Cover (Climate Monitoring SAF)
- Cloud Classification (Climate Monitoring SAF)
- Cloud Top Temp. & Height (Climate Monitoring SAF)
- Cloud Optical Thickness (Climate Monitoring SAF)
- Cloud Phase (Climate Monitoring SAF)
- Cloud Water Path (Climate Monitoring SAF)
- Components of the Surface Radiation Budget (Climate Monitoring SAF)
- Surface Albedo (Climate Monitoring SAF)
- Components of the Radiation Budget at the top of the atmosphere (Climate Monitoring SAF)
- Sea Surface Temperature (Climate Monitoring SAF)
- Sea Ice Cover (Climate Monitoring SAF)

## 4 CONCLUSION

In accordance with a planned SAF development cycle over five years, the first three facilities of the SAF Network, dedicated to "Support to Nowcasting and Very Short Range Forecasting", "Ocean & Sea Ice" and "Ozone Monitoring" will be completed in 2002. The development of the four other SAFs on Climate Monitoring, Numerical Weather Prediction, GRAS Meteorology and Land Surface Analysis, which have started in 1999, are planned to be completed by 2004.