SATELLITE APPLICATION FACILITY ON OZONE AND ATMOSPHERIC CHEMISTRY MONITORING

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Background

EUMETSAT´s Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M SAF) is part of the EUMETSAT´s Polar System (EPS) Ground Segment. The O3M SAF will produce a set of near real-time and offline products based on Metop data. The O3M SAF operational system and the status of the ozone and UV products are described here. The O3M SAF project is now near the end of its development phase and will enter the next five year phase, the Continuous Development and Operations Phase (CDOP), in March 2007. After the launch of the first Metop satellite in July 2006, the products will become available in 2007.

Operational System and Product delivery

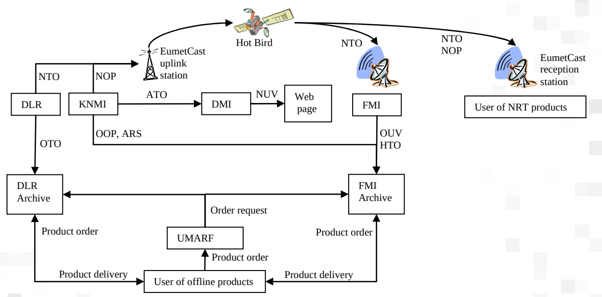


Fig 1. An overview of the O3M SAF distributed processing and archiving system. The NRT products include total ozone (NTO), ozone profile (NOP) and UV clear-sky fields (NUV). The NTO and NOP products are delivered via EumetCast. The NUV product is based on assimilated total ozone (ATO) and is available at the DMI web site. The offline products include total ozone and trace gases (OTO), ozone profile (OOP), HIRS total ozone (HTO), aerosol product (ARS) and offline UV fields (OUV). The archived offline products are available to the users from the FMI and DLR archives. The products can be ordered directly from the archives or through the EUMETSAT's Unified Meteorological Archive and Retrieval Facility (UMARF).

Total Ozone and Trace Gases (DLR)

- ozone total columns in near-real-time
- total columns of O3, NO2 and BrO in offline
- experimental total columns of SO2, HCHO and OClO in offline

The current accuracy of the operational GOME/ERS-2 ozone total column products using GDP 4.0 is in the “percentage level”. The GDP 4.0 algorithm was validated and the complete GOME/ERS-2 data set covering over 10 years measurements was reprocessed by end of 2004.

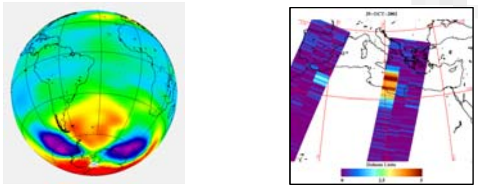
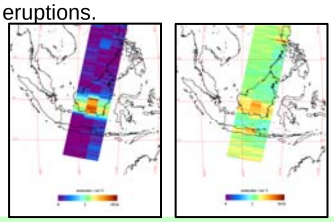


Fig. 2. (left) Break down of the Antarctic ozone hole measured by GOME/ERS-2 on 25 September 2002. (right) Total sulphur dioxide content derived from GOME/ERS-2 on 29 October 2002 during Mt. Etna (Sicily) eruptions.

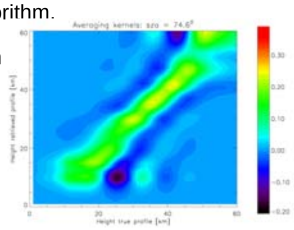
Fig 3. Vertical columns of formaldehyde (left) and nitrogen dioxide (right) derived from GOME/ERS-2 during the biomass burning event in September 1997 in Asia



Ozone Profile (KNMI)

The ozone algorithm solves the inverse problem using optimal estimation. This involves the use of an a-priori ozone profile and error covariance to fill-in the missing profile information from the measurement. The balance between the two sources of information is described by the averaging kernel (fig. 4) The algorithm has been tested on the GOME instrument on ESA ERS-2 satellite. As an example, fig. 5 shows differences between GOME and sonde ozone profiles. It is clear that the GOME profiles compare better than the a-priori. Furthermore, if the averaging kernel is taken into account a very good agreement is found, indicating a good quality of the Level 1 data and the forward model in the retrieval algorithm.

Fig. 4. Averaging kernel for a high value of the solar zenith angle (sza), showing that the main profile information lies between 25 and 40 kilometers where the kernel is highest. The kernel is scaled with the a-priori profile.



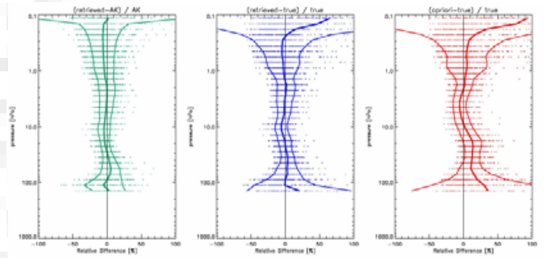


Fig. 5. Differences between GOME ozone profiles and collocated microwave profiles (Bern 1997, 140 collocations). The thick line denotes the bias, the thin lines the standard deviation of the difference; individual differences are denoted by dots. Right: Differences between microwave and a-priori, Middle: Differences between microwave and GOME, Left: differences between GOME profiles and microwave profiles on which the GOME averaging kernel has been applied.

UV fields (FMI)

The off-line UV product (fig. 6.) will be derived from GOME-2 total column ozone product and AVHRR cloud data, therefore combining data from two instruments onboard the Metop satellites.

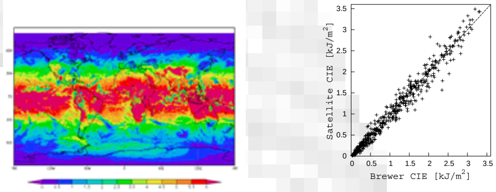


Fig. 6. Left: An example of the O3M SAF Off-line UV product derived from OMI data. A global map of erythemal daily UV dose [kJ/m2] for 7 October 2005, showing enhanced levels of UV radiation at the tip of South America due to the ozone hole. Right: A prototype product derived from EP TOMS total ozone and NOAA AVHRR data against ground-based Brewer spectrophotometer measurements in Sodankylä, Finland, from 23 February 2001 to 1 September 2003.

http://o3saf.fmi.fi