

3. TECHNICAL SUB-GROUP REPORTS

3.1 ATOVS AND AVHRR PROCESSING PACKAGE (AAPP)

3.1.1 Background

AAPP was created through the joint development of a number of European institutions, under co-ordination of EUMETSAT, for the pre-processing of HRPT direct readout data from NOAA polar orbiting satellites. AAPP produces, in a suite of processing steps, level 1b, level 1c and level 1d output files. The AAPP level 1d file is the interface to numerous level 2 processing packages, which are available and used world wide.

3.1.2 Status

AAPP has been distributed world wide by EUMETSAT and installed successfully by more than 200 users. The current version is AAPP 4.0 and is being shipped to users at the time of writing this report. This version includes all upgrades up to V3.7 which have been provided via ftp. AAPP V4.0 is compatible with Fortran90. New modules were included and perform the handling of moon contamination of the space views from ASMU-A.

3.1.3 Bugs and problems

No major bugs or problems have been reported.

3.1.4 Information exchange

The current scheme for the exchange of information between involved parties was considered as sufficient.

- New releases (Vn.0) of AAPP are distributed on CD-ROM on an 18 month cycle basis. Temporary updates (Vn.i) are distributed via ftp-server (ftp.eumetsat.de). Users are informed about new releases and updates and any other AAPP related subject via the AAPP internet forum: L-AAPP@eumetsat.de
- The Users can pass requests and information via EUMETSAT's user service (ops@eumetsat.de) or the AAPP helpdesk (aapp.nwpsaf@metoffice.com).
- The AAPP Internet Forum allows users to communicate to each other via e-mail and automatically addresses all forum participants.

NOTE: Beginning with the initial operations phase (IOP) planned for April 2004, the NWP SAF will take over the distribution of AAPP, i.e., from V5.0 AAPP will be delivered by the NWP SAF.

Four links were provided from the AAPP Web page to the NWP SAF home page.

3.1.5 New developments

Three major upgrades are planned for AAPP in the future:

1. Upgrade of AAPP to process the data of NOAA-N and N'. This requires the development of modules for

- The processing of MHS,
- A new level 1b format for MHS (as defined by NESDIS),
- The calibration of HIRS/4 data, and updated level 1b format.

2. Navigation update, including ability to use 2-line element orbital prediction data.

The target date for developments 1 and 2 is summer 2004.

3. Extension of AAPP to process HRPT data from Metop. The level 1 processing of IASI data will be incorporated as a new feature. Development is required for the following modules:

- Software to process IASI level 1 data. It is planned to use the operational IASI Level 1 software, developed by CNES, for this purpose. The software will be made available to Météo-France.
- Additional orbit propagation software. The AHRPT from Metop provides an ADMIN message, which includes the orbit information in the form of TBUS elements and in the form of 13 SPOT orbit parameters.
- The data provided from the spacecraft are instrument source packets (ISP) in the CCSDS (Consultative Committee for Space Data Systems) packetised format. An interface needs to be provided.

The target date for this development is summer 2005.

A Working Group has been set up between the NWP SAF and the EPS Project to co-ordinate the development and to ensure as much as possible the compatibility between the global operational products and the local products. This group has met twice and has triggered a fruitful information exchange. A draft work-plan has been established (it contains essentially the steps listed above).

3.1.6 New platforms

AAPP has been installed successfully on SUN, HP, SGI, DEC and IBM platforms. No new platforms were identified. The Group noted that the Finnish Meteorological Institute (FMI) has established a version of AAPP adapted for Linux, for use with the GNU Fortran Compiler. Some modules needed to be rewritten for this purpose. Note: This version is not part of the official release. After a short discussion whether the development should include Linux with GNU Fortran the group concluded that it was better to use the official release, since GNU Fortran is not further developed via Fortran90.

3.1.7 AAPP License

Users can request a license for AAPP via EUMETSAT's Web page:
<http://www.eumetsat.de/en/area4/aapp/get-aapp/get-aapp.html>

3.1.8 Actions

All actions from the last meeting were closed or overtaken by events.

3.2 INTERNATIONAL ATOVS PROCESSING PACKAGE (IAPP)

Although there was no formal meeting of the IAPP Technical Sub Group, there were useful conversations with several users. They are generally satisfied with the performance of the package, but did raise some issues that, when resolved, will definitely enhance the utility - and appeal - of the IAPP.

One user expressed quite a bit of frustration at the difficulty in adapting the output of his agency's numerical model output to the format of the ancillary files required by the IAPP. This issue has arisen in email and telephone consultations with other users, as well. The procedure that is contained within the IAPP is essentially "hard-wired" to the global files produced by NCEP's Aviation Forecast Model, and how one could go about modifying it to use some other type of gridded data is not at all apparent. Undertaking a major expansion of the relevant documentation will be considered in order to provide more of a "cookbook" that would enable users to make such an adaptation relatively straightforward. This will not be a trivial task, but the issue should be addressed.

Another major concern is the lack, within the IAPP, of any procedures for evaluating the output of the retrieval process - e.g., plotting of data values and construction of contour analyses. In this instance, the inclusion of an interface, in the form of utility software to read the retrieval netCDF output file, that could be used to present data to a FORTRAN or IDL graphics package will be explored.

The lack of an up-to-date radiance bias adjustment procedure is also a concern; users were informed that this issue will be addressed in the near future.

3.3 INTERNATIONAL MODIS/AIRS PROCESSING PACKAGE (IMAPP)

The International MODIS (Moderate Resolution Imaging Spectroradiometer) and AIRS (Atmospheric Infrared Sounder) Processing Package (IMAPP) is a NASA funded, freely distributed software package which allows any ground station capable of receiving direct broadcast from Terra or Aqua to produce calibrated and geo-located radiances, and a variety of environmental products. The versions of the IMAPP software released to date have proven to be highly effective tools for the global EOS direct broadcast community, enabling users to receive and process raw data in real-time (i.e., as observations are acquired) and generate environmental products as needed.

To date, the University of Wisconsin SSEC has released IMAPP software for MODIS Level 1 calibrated and geo-located radiances, and a selection of MODIS Level 2 geophysical products including cloud mask, cloud top properties, cloud phase, atmospheric profiles and total precipitable water vapor. Working in conjunction with the AIRS Team at NASA JPL, SSEC received the first post-launch delivery of the AIRS/AMSU/HSB (AMSU- Advanced Microwave Sounding Unit; HSB - Humidity Sounder Brazil) Level 1 software, and released the first version of the AIRS/AMSU/HSB Level 1 IMAPP software on 5 November 2003. The current IMAPP product algorithms, along with those planned for production during the next three years are listed in Table 3.3-1.

Table 3.3-1. Summary of current and planned IMAPP MODIS and AIRS product algorithms.

	MODIS	AIRS/AMSU/HSB
Current	Geo-location/Navigation Cloud Mask Cloud Phase Cloud Top Property Clear T/Q Sounding Total Precipitable Water	Geo-location/Navigation
Planned	Cloud Particle Size Cloud Optical Thickness Aerosol Optical Thickness Surface Reflectance Sea Surface Temperature Snow Detection Sea Ice Detection Scene Classification (Clouds and Land Surface)	Clear/Cloudy T/Q Sounding Cloud Detection Cloud Clearing Cloud Height/Emissivity Surface Skin Temperature Cloud Liquid Water AMSU Precipitation Estimate
	MODIS/AIRS Collocation	

The IMAPP software is available from <http://cimss.ssec.wisc.edu/~gumley/IMAPP/> and has been ported to and tested on a variety of UNIX and PC platforms (see Web page for more details). The IMAPP MODIS is released to the international EOS direct broadcast community under the GNU General Public License. The software has been well received by a wide variety of users and is currently in use at over 75 ground stations around the world. IMAPP software is supplied as a standard feature by many ground station manufacturers including SeaSpace and Integral Systems of USA, Kongsberg Spacetec of Norway, and Environmental Systems and Services of Australia.

Examples of the IMAPP suite of direct broadcast products produced at CIMSS are shown below (Figure 3.3-1). In the future, IMAPP will evolve to incorporate, adapt, and develop new processing algorithms to meet global users' demands for regional real-time multi-disciplinary applications. IMAPP will also continue to incorporate feedback and suggestions provided by users in order to improve its functionality,

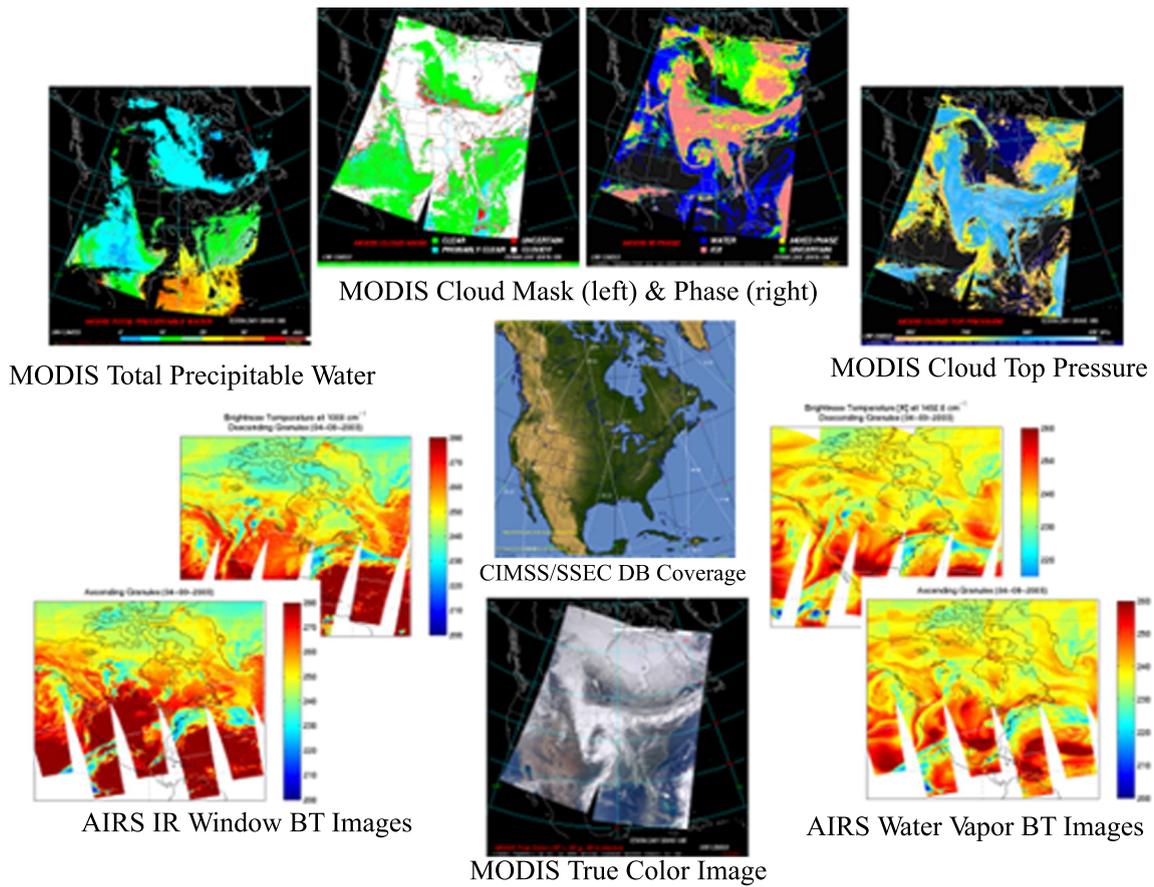


Figure 3.3-1. Examples of real-time IMAPP MODIS and AIRS imagery products generated at CIMSS.

accuracy, efficiency, and standardization. Most of all, with open source architecture and rigorous documentation standards, IMAPP can be easily implemented on almost any computing platform.

3.4 FAST RADIATIVE TRANSFER MODEL, RTTOV

A presentation on the current status of the fast radiative transfer model, RTTOV, was given during ITSC-XIII and a paper summarising the status is available in the proceedings and accessible from the ITWG Web site. The RTTOV-7 software is available to users on request from the NWP SAF (<mailto:rttov.nwpsaf@metoffice.com>). The RTTOV documentation can be viewed on the NWP SAF RTTOV Web site at <http://www.metoffice.com/research/interproj/nwpsaf/rtm/>

3.5 FREQUENCY MANAGEMENT

This technical sub-group was created at ITSC-XII with Guy Rochard (Chair), Narinder Chauhan, Steve English, John Derber, Albin Gasiewski, Roger Saunders, Jean-Noel Thepaut, Tony McNally, and John Bates. The group is open to all interested persons.

The protection of the microwave spectrum to allow scientific use for passive remote sensing of the Earth's surface and atmosphere is an important challenge, due to the huge pressure from commercial, industrial and military applications. Their "man-made" emissions in key portions of the microwave spectrum could render these bands useless for remote sensing applications. Key documents related to this issue are found on the ITWG Web site (<http://cimss.ssec.wisc.edu/itwg/groups/frequency/>); they include "Protection of Radio Frequencies for GEO" and "Comment to GEO Report."

At ITSC-XIII, a short meeting was held. The following summarises the discussions.

- The scientific community, including the ITWG technical sub-group do not have enough contacts and influence in the national radio communications agencies and commercial, industrial or military lobbies (see for example the 23.6-24 GHz problem in the USA and Europe).
- We have scientifically progressed to express the needs for passive microwave applications in NWP, but not in climate. We have not had enough progress for surface (land and ocean), limb sounding (more generally above 275 GHz for passive microwaves on polar or geostationary meteorological satellites) or for active bands (altimeters, scatterometers, rain radars, etc.). ITWG must help make progress on climate needs, particularly in terms of Delta T, by updating or consolidating the tables in the above-mentioned documents. These tables correspond to ITU Records 515, 1028 and 1029 (quoted below) for the passive microwave. We need an extended group to help with several other topics.
- It is critically important to extend our sub-group to other groups affected by the loss of these bands, including universities and manufacturers (e.g., MIT and Northrop Grumman Corporation), and to work together at least by correspondence. To start this expansion it was recommended to have a special session at SPIE in Denver in early August 2004, at IGARSS in Anchorage at the end of September 2004, and at SPIE Asia and Pacific in Honolulu, Hawaii in early November 2004. It is planned to have a common presentation (G. Rochard at Denver, A. Gasiewski at Anchorage and P. Menzel at Honolulu). At the Denver meeting it is planned to invite universities and manufacturers to extend our contacts to improve our presentation.
- As to linking with the ITU Working party 7C and the WMO, we should act more from inside these two organisations. For the time being only the ITU Recs 515, 1028 and 1029 exist but they have to be improved. No progress has been made on the draft WMO table. (See the WMO table either in the ITSC-XII poster of G. Rochard (http://cimss.ssec.wisc.edu/itwg/itsc/itsc12/posters/Rochard_MW_poster.doc) or Table 2 in the SPIE paper Frequency Protection for Passive Remote Sensing of the Earth, located in the Frequency sub-group Web page noted above.)
- Regarding the SFCG (Space Frequency Coordination Group: <http://sfconline.org/>) during the last 3 years ITWG has been a member of SFCG and has been represented at the SFCG 20 meeting in Cairns by John Le Marshall and Guy Rochard in 2000, as well as at the SFCG 21 meeting in Cayenne in 2001. This is also true for SFCG 22 in Italy in September 2002 and at SFCG 23 in September 2003 at San Diego. SFCG 24 will be in Lannion, France in September 2004, hosted by ITWG and held close to the Centre de Météorologie Spatiale of METEO-FRANCE.
- Two specific actions need to occur at SFCG-24 by G. Rochard. The first is to update the WMO/ITU handbook (see <http://www.wmo.ch/web/www/TEM/SG-RFC/Handbook.htm>) and the second is to provide an update of the bands, bandwidths, Delta T and % availability above 275 GHz. This second action refers to the ITU table shown in the ITSC-XII poster of Rochard

or Table 1 of the SPIE paper, Frequency Protection for Passive Remote Sensing of the Earth (both tables are the same). This corresponds to the ITU Recommendations 515, 1028 and 1029. Concerning the WMO/ITU handbook, the issue is to find a way for updating the information in agreement with the ITU and WMO. The Delta T in these tables is also the level of compatibility which must exist between worldwide (global) and direct readout (local) preprocessing to get consistent level 1b or 1c radiances. This applies for all polar orbiting meteorological satellites.

- On our sub-group Web page, three or four new documents will replace the current ones in Spring 2004.
- A report about the expected results of our sub-group and a new meeting will be held at ITSC-XIV.
- Apart from the scientific documents to justify the protection for our needs, the only other approach is for every country to lobby their national radio-communication agencies and convince them that the long term scientific needs are more important than short term economical and/or military interests.