

3. TECHNICAL SUB-GROUP REPORTS

3.1 ATOVS AND AVHRR PROCESSING PACKAGE (AAPP)

Since ITSC-XIII (October 2003) AAPP version 4 has been extended to provide support for Linux systems, at the request of users. Version 5, supporting NOAA-N and NOAA-N', is in the final stages of preparation, and work has been started on Version 6, for METOP. There are also plans to support NPP and NPOESS at the pre-processing stage. See presentations 10.2 (N Atkinson) and 10.3 (P Marguinaud) for full details of these developments.

Regarding future support, the sub-group confirmed that there is a strong requirement to support AAPP beyond the end of the Initial Operating Phase of the NWP-SAF in February 2007.

The group recognized that some aspects of AAPP are out of date - for example the FORTRAN77 code and the build scripts. However they work well, are understood by users and are compatible with most Fortran 90 compilers, so the effort that would be required to re-write the code, and the possible risks, are not justified at present.

The group acknowledged the work done by Meteo-France in modifying the IASI-OPS code so that it would be sufficiently portable to be included in AAPP - the effort being more than was originally envisaged. The group recommended that in the case of any future ground segment projects that feed into user software, portability should be specified from the start - saving time and effort later on.

Several users expressed the view that AAPP should have the capability of writing output in standard formats such as HDF5 or NetCDF, which can be read directly by standard display and analysis software. The NWP-SAF does not have the resources to undertake this at the moment but it was agreed to canvass users to find out what conversion software or display software had been written by users. Any relevant links could be added to the AAPP Web pages.

It was confirmed that there are no plans for AAPP to support other direct readout missions, such as FY-3, but obviously any direct readout software supplied by the operating agencies would be of great interest to the AAPP user community.

3.2 INTERNATIONAL ATOVS PROCESSING PACKAGE (IAPP)

The following highlights presented at the conference were discussed in detail in the subgroup:

- As of February 2005, IAPP is Open Source, and can be obtained at no cost by anonymous ftp via the CIMSS Web site <http://cimss.ssec.wisc.edu/opsats/polar/iapp/IAPP.html>
- To provide assistance to users until the IAPP/NWP interface is made more flexible, global ancillary netCDF files, created from selected NCEP GFS datasets, are now available in a 7-day moving archive.
- Global radiosonde data in the format expected by the IAPP SRX-to-netCDF conversion program are also available in a 7-day moving archive.
- IAPP has been ported to Linux (RedHat Enterprise 4.0) using the GNU g95 compiler.

In the course of debugging the port, several serious logic errors were detected and corrected. The revisions have been incorporated into the versions running routinely on IBM (AIX 4.3) and Sun (Solaris 7). While those versions had never crashed, in spite of the logic errors, some users running Solaris 8 had reported problems which in retrospect appear to be attributable to those errors.

NETCDF-3.4, which has been bundled with IAPP, would not compile under Linux 4.0; it will be replaced in the next release with version 3.5 or later.

The METAR (surface data) to netCDF conversion program also benefited from the port, with several logic errors detected and corrected. That program, which historically has run with failure rates on the order of 0.1 % on the IBM and 15-35 % on the Sun, is now failing on the latter system on the order of (at worst) once every two to three weeks.

To complete the Linux support included in the new version, the installation scripts and documentation will be updated. The endian-ness of the radiative-transfer and regression-retrieval coefficient files needs to be handled in a user-friendly fashion. Those files have already been updated for NOAA-18 (launched 20 May). Release of the upgraded package will be deferred until it has been tested on live data from the new spacecraft.

Tentative date for release of IAPP version 2.1 is 1 October 2005.

CIMSS is committed to maintaining and supporting the IAPP through NOAA-N-prime.

3.3 INTERNATIONAL MODIS/AIRS PROCESSING PACKAGE (IMAPP)

The International Moderate Resolution Imaging Spectroradiometer/Atmospheric Infrared Sounder (MODIS/AIRS) Processing Package (IMAPP) provides users with EOS satellite Terra and Aqua direct broadcast systems the capability to calibrate and navigate locally received satellite data and, from these data, to create environmental data products of significant regional interest. This software development effort is funded by NASA and is freely distributed to end users by the Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin-Madison. IMAPP can be downloaded via anonymous ftp at <http://cimss.ssec.wisc.edu/~gumley/IMAPP/>.

The number of products within IMAPP continues to grow and currently includes:

- MODIS calibrated/navigated radiances, cloud mask, cloud top properties and cloud phase, retrievals of atmospheric profiles (temperature and moisture), total precipitable water, sea surface temperature and aerosol optical depth (all updated to collection 5);
- AIRS calibrated/navigated radiances, and single field of view clear retrievals of temperature and moisture (regression algorithm);
- AMSR-E calibrated/navigated antenna temperatures, and rain rate.

Additional products anticipated for release in the near future include updated MODIS Level 1 (collection 5); AIRS standard Level 2 product retrieval (v4.0), and combined MODIS/AIRS cloud-cleared radiance and sounding retrievals.

3.4 FAST RADIATIVE TRANSFER MODEL, RTTOV

The development of the RTTOV fast radiative transfer model - part of the EUMETSAT-sponsored NWP-SAF activities - has continued since the release of RTTOV-7 in March 2002. Over the last two years, more developments have been made, leading to the release of RTTOV-8 to users in Nov 2004. Around 70 users worldwide have already received the new code. For your free copy, visit the URL below and click on 'software requests' in the right panel. A poster on the current status of the fast radiative transfer model, RTTOV, was given during ITSC-XIV and can be viewed from the ITSC-XIV agenda. For full details the RTTOV documentation can be viewed at: <http://www.metoffice.gov.uk/research/interproj/nwpsaf/rtm/>

The main differences for RTTOV-8 are:

- The code is completely rewritten so that passing of variables is now achieved through structures and all the arrays are allocatable to be more efficient in terms of memory usage.
- The required units for water vapour and ozone profile concentrations for input to RTTOV-8 are changed from *kg/kg* to *ppmv*.
- The ozone and cloud liquid water profiles are now optional and are activated with logical flags; optionally a CO₂ profile can now be provided.
- The number of levels for the input profile is now variable and defined by the coefficient file.
- The optical depth prediction can be either as in RTTOV-7 (for backward compatibility) or using new predictors which separates out the water vapour line and continuum absorption.
- The selection of whether the surface emissivity is computed internally or not is now via a logical *calcemiss* and this can be selected for each input channel. If *calcemiss* is *.false.* the value input is used.
- There is an improved version of the microwave sea surface emissivity model FASTEM-3, but FASTEM-2 and FASTEM-1 can still be invoked (the latter is not supported).
- The code now allows simulations of polarimetric radiometers such as WINDSAT.
- There are changes to the infrared cloud optical properties in the RTTOV_CLD programme to improve the cloudy IR simulations and the option of choosing different parameterisations.
- A new wrapper programme RTTOV_SCATT has been developed to allow the simulation of rain affected microwave radiances.

It should be noted that for those RTTOV-7 users who want to use the new RTTOV-8 code but do not want to change their code interfaces to RTTOV some subroutines are provided to allow RTTOV-8 to be called from an 'RTTOV-7 like' interface. However this is only for a limited set of options for the forward model only.

A table of the current list of satellite platforms and sensors that RTTOV-7 and 8 support is given on the next page.

Platforms	Sensor	Channels simulated
TIROS-N NOAA-6-18 NOAA-2-5	HIRS, MSU, SSU, AMSU-A AMSU-B, MHS, AVHRR, VTPR	1-19, 1-4 1-3, 1-15 1-5, 1-5 1-3, 1-8
DMSP F-8-15	SSM/I	1-7
DMSP F-16	SSMI(S)	1-24
Meteosat-2-8	MVIRI SEVIRI	2 4-11
GOES-8-12	Imager Sounder	1-4 1-18
ERS-1/2 ENVISAT	ATSR AATSR	1-3 1-3
GMS-5, MTSAT	Imager	1-3,1-4
Terra Aqua	MODIS,AIRS AMSU-A, HSB, AMSR	1-17, 1-2378 1-15, 1-4, 1-14
TRMM	TMI	1-9
Coriolis	WindSat	1-10
FY-1, FY-2	MVISR, VISSR	1-3, 1-2

Table 3.4-1. Sensors currently simulated by RTTOV-7 and 8.

3.5 FREQUENCY MANAGEMENT

Web site: <http://cimss.ssec.wisc.edu/itwg/groups/frequency/>

This technical sub-group was created at ITSC-XII with Guy Rochard (chair). The group is open to all interested persons.

An update on the actions from ITSC-XII:

- The ITWG hosted the Space Frequency Co-ordination Group meeting (SFCG-25) in Perros-Guirec, France in September 2004 and presented a paper at: <http://guy.rochard.free.fr/meteo/fichiers/SFCGITWG.doc> (1500k) and a talk: http://cimss.ssec.wisc.edu/itwg/groups/frequency/sfcg1/sfcg1_04.htm (2500k). Some pictures from the event are at: <http://guy.rochard.free.fr/meteo/fichiers/SFCGPERROSGUIREC.pdf> (4400k). The SFCG members enjoyed this productive meeting and the ITWG has taken an action (see below) to be reported at SFCG-26 in Beijing in October 2005: http://guy.rochard.free.fr/meteo/fichiers/SFCG-24_Action_3_1.doc (20k)
- The action was to organise a meeting to quantify the scientific justification for using various microwave frequency bands for meteorological applications which was held in Washington DC on 5/6 April 2005. See <http://guy.rochard.free.fr/meteo/fichiers/Washington.doc> (1200k). A reference example of the scientific justification for a passive microwave band is at: <http://guy.rochard.free.fr/meteo/fichiers/SENGLISH24GHz.doc> (167k). The same MUST be done for all the required bands between 1 to 1000 GHz and is URGENT for the bands between 1 to 40 GHz. <http://guy.rochard.free.fr/meteo/fichiers/SPIE50.doc> (1300k).
- The work will not be completed by October 2005 and so it is planned to hold a second meeting by the end of 2005. The aim is to finish the work by spring 2006.
- We URGENTLY need volunteers to help for land surface sensing bands.
- Support from George Ohring and John Bates was provided at ITSC-XIV. A useful document about climate requirements is the report NISTIR 7047 from NIST: "Satellite Instrument Calibration for Measuring Global Climate Change."
- During ITSC-XIV, progress has been made about the future availability of microwave emissivity atlases over the Earth's surface. Such atlases are crucial for monitoring the contamination of the passive microwave spectrum by human activities. See: <http://guy.rochard.free.fr/meteo/fichiers/Protect.ppt> (7500k). Information on the progress concerning these atlases will be made available on the ITWG Web site at: <http://cimss.ssec.wisc.edu/itwg/groups/rtwg/rtwg.html>
- The technical sub-group's Web site: <http://cimss.ssec.wisc.edu/itwg/groups/frequency/> will be updated but also note the information at: <http://guy.rochard.free.fr/meteo/fichiers/>
- The tables of "Delta T" given in the ITU-R REC(s) 1028-2 and 1029-2 at: <http://guy.rochard.free.fr/meteo/fichiers/10282.doc> and <http://guy.rochard.free.fr/meteo/fichiers/10292.doc> should also be used to specify the required agreement between calibrated radiances processed through "global" and "local/direct readout" pre-processing software.

3.6 ACTIVITIES OF THE ATMOSPHERIC RADIATION ANALYSIS GROUP AT LMD

Reanalysis of TOVS Path-B: Longterm atmospheric properties

8 years of TOVS Path-B data (1987 - 1995) are available in HDF format at NASA DAAC. The analysis of this time series of data has led to some minor improvements, essentially in cloud detection due to the effects of Mt Pinatubo aerosols. The recently reanalyzed data set is stored at LMD, and cloud properties of this data set will soon be made available on the Web (<http://www.ara.lmd.polytechnique.fr/>). Mean effective ice crystal sizes and ice water path for cirrus clouds are retrieved for medium thick cirrus clouds ($0.3 < N_{\text{cld}} < 0.85$), taking advantage of the fact that spectral cirrus emissivity differences between 11 and 8 μm depend on this parameter. This method is sensitive to sizes up to 70 μm . So far, NOAA-10 data have been treated as part of the European programme CIRAMOSA (<http://www.lmd.polytechnique.fr/CIRAMOSA/Welcome.html>).

The above data set has been established using bias adjustment constants obtained from collocated radiosonde-TOVS data for clear sky scenes, the DSD5 data set provided by NOAA/NESDIS for this time period. These monthly mean constants were used to remove systematic biases due to the radiative transfer model, instruments and unexpected events (such as the Mt Pinatubo eruption). To extend this data period, the ARA group has created a similar data set for the construction of bias adjustment constants covering the whole period from 1979 up to now. The complete radiosonde collection used for the ERA40 reanalysis has been transferred from ECMWF. A complex quality control procedure followed by a clear sky identification algorithm have been developed, and the channel biases have been determined and evaluated. One remaining problem is the fact that the radiosonde daytime temperatures of the ECMWF collection have not been corrected in the stratosphere.

The new reanalysis will also use improved versions of the 4A and 3R (fast parameterized) models, as well as extended TIGR and GEISA (Gestion et Etude des Informations Spectroscopiques Atmosphériques) databases.

The 4A model is now licensed and available from Noveltis.

The current TIGR database contains 2311 atmospheric profiles. Surface emissivities from FASTEM-2 (S. English) and O3 profiles from the UGAMP climatology have been integrated. Temperature and water vapor are now extrapolated towards the stratosphere in comparison with measurements of the ATMOS mission. The 3I inversion scheme had to be adapted for the use of the new TIGR database, and a new neural network inversion for water vapor profiles and surface temperature has been introduced.