RTTOV-8 — the latest update to the RTTOV model

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RTTOV website: http://www.metoffice.gov.uk/research/interproj/nwpsaf/rtm/

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 above and click on 'software requests'.

1. What is RTTOV-8?

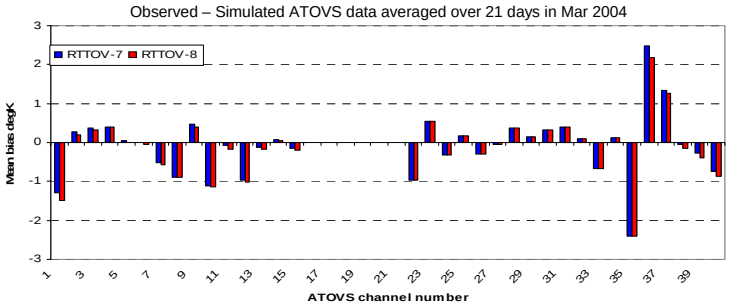
RTTOV is a radiative transfer model for very rapid calculations of top-of-atmosphere radiances for a range of space-borne infrared and microwave radiometers as listed in the Table. The original basis for the RTTOV fast computation of transmittances is described by Eyre and Woolf (1988). This was modified for later versions of RTTOV by Eyre (1991), Rayer (1995), Saunders and Matricardi (1999) and, most recently, Matricardi (2003). Recently, the development of RTTOV (versions 6–8) has been carried out as part of a collaboration between the Met Office (UK), MétéoFrance and ECMWF in the framework of the EUMETSAT-funded NWP Satellite Application Facility. The latest version of RTTOV is RTTOV-8, released in November 2004. All details on the model, documentation and latest updates to the code area are available at the website above. In summary, RTTOV-8 has the following features:

- It comprises a forward, tangent linear, adjoint and K (full Jacobian matrices) versions of the model; the latter three modules for variational assimilation or retrieval applications
- Top-of-atmosphere radiances, brightness temperatures and layer-to-space plus surface-to-space transmittance for each channel are output for a given input atmospheric profile. There are also other layer-to-space and layer-to-surface radiances output for computing cloudy radiances
- It takes about 0.5 *msec* to compute radiances for 20 HIRS channels for one profile on a HP workstation
- The input profile must have temperature and water vapour concentration. Optionally, ozone and carbon dioxide can also be variable gases
- It can compute sea-surface emissivity for each channel internally or use a value provided by the user
- The ISEM-6 model is used for the infrared. The FASTEM model is used for the microwave
- Cloud-top pressure and effective cloud amount can be specified for simple, single-layer cloudy radiance calculations
- A 'wrapper code' allows RTTOV to be used to compute more complicated, multi-layer, cloudy radiances (RTTOV_CLD) with various overlap assumptions
- A new wrapper code allows RTTOV to be used to compute rain-affected microwave radiances (RTTOV_SCATT)
- It can reproduce the results for RTTOV-7 (except for RTTOV_CLD)
- It supports all the sensors given in the Table (right) for all the platforms the sensor has flown on
- It is written in Fortran-90, and run under unix or linux
- It has been tested on a range of platforms including linux PCs

2. RTTOV-8 latest news (see website for more details)

1. Upgrades to the code which have improved the performance on vector machines are now available
2. A new RTTOV-7-like interface for K-code will be available shortly
3. RTTOV_SCATT is being rewritten to be better optimised and work for all microwave sensors. New code will be available at the end of 2005
4. A bug in the new RTTOV-8 predictors has been corrected and an update is available
5. Various bugs in the microwave sea-surface emissivity code have been corrected and updates are available
6. More coefficient files for the RTTOV-8 predictors will be available later this year when tests are completed
7. IASI coefficient file is being prepared

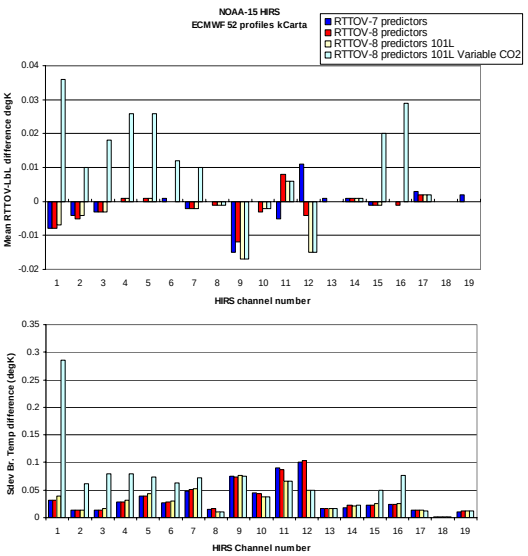
3. Comparisons between RTTOV-7 and RTTOV-8 in the ECMWF model (same predictors)



4. Sensors simulated by RTTOV-7 and 8

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

5. RTTOV-8 validation for different predictors and levels



References

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Saunders R.W., M. Matricardi and P. Brunel 1999b. An Improved Fast Radiative Transfer Model for Assimilation of Satellite Radiance Observations. QJRMS, ***125,*** *1407–1425.*
Matricardi, M. 2003. RTIASI-4, a new version of the ECMWF fast radiative transfer model for the infrared atmospheric sounding interferometer. ECMWF Research Dept. Tech. Memo. ***425****.* http://www.ecmwf.int/publications

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