RTTOV user survey

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Scope and background

The NWP SAF is in the process of making plans for RTTOV development over the next 7 years. A user survey was sent out to registered RTTOV v10 and v11 users in November 2014 to understand how RTTOV is currently used and to solicit requests for possible future developments.

The results of this anonymous survey are described below with some comments on the current RTTOV development plans which have taken the survey responses into account.

Survey results

What platform(s) do you run RTTOV on?		
Answer Options	**Response Percent**	**Response Count**
Linux/UNIX	94.9%	150
Mac OS	7.0%	11
Other (please specify)	5.1%	8
answered question		**158**

What compiler(s) do you use to build RTTOV?		
Answer Options	**Response Percent**	**Response Count**
Intel (ifort)	43.0%	68
GNU (gfortran)	67.1%	106
NAG (nagfor)	1.3%	2
Portland (pgf)	12.0%	19
IBM (xlf)	13.3%	21
Other (please specify)	5.1%	8
answered question		**158**

RTTOV will continue to be supported for the platforms and compilers listed above and on Cray.

Several users said they were compiling on Windows: the NWP SAF does not plan to support RTTOV on Windows officially as it is not a very common platform for scientific computing.

Which features/capabilities of RTTOV do you use?		
Answer Options	**Response Percent**	**Response Count**
Visible/near-IR (i.e. solar-affected) clear-sky simulations	32.6%	47
IR clear-sky simulations	67.4%	97
MW clear-sky simulations (optionally including cloud liquid water absorption)	39.6%	57
IR simulations with optional trace gases (any of O3, CO2, CO, N2O, CH4)	38.2%	55
IR aerosol/cloud simulations using scaer*/sccld* files	31.9%	46
Baran ice cloud parameterisation for IR cloud simulations	11.1%	16
IR aerosol/cloud simulations by inputting optical parameters explicitly (cld/aer_opt_param structure)	20.1%	29
MW cloud and/or precip (RTTOV-SCATT)	25.0%	36
Land surface BRDF atlas	15.3%	22
Land surface IR emissivity atlas	31.3%	45
Land surface MW emissivity atlas(es)	21.5%	31
PC-RTTOV	7.6%	11
Zeeman coefficients	6.3%	9
NLTE correction	4.9%	7
RTTOV GUI (graphical user interface)	9.7%	14
answered question		**144**

What application(s) do you use RTTOV for?		
Answer Options	**Response Percent**	**Response Count**
NWP assimilation	36.8%	53
Atmospheric profile and/or surface parameter retrieval	43.8%	63
Simulated satellite imagery	54.2%	78
Reanalysis	12.5%	18
Studies in preparation for future instruments	20.8%	30
Other (please specify)	8.3%	12
answered question		**144**

What features would you be interested in seeing in RTTOV in the future?		
Answer Options	**Response Percent**	**Response Count**
Visible/near-IR scattering (aerosols, clouds)	65.5%	78
Polarisation in VIS/NIR simulations	18.5%	22
Treatment of full Stokes vector	19.3%	23
Simulations at UV wavelengths	21.0%	25
Simulation of unapodised radiances using PC-RTTOV	10.1%	12
Simulation of unapodised radiances using standard RTTOV	11.8%	14
Improved treatment of Zeeman effect	8.4%	10
More optional trace gases (e.g. SO2) (please specify gas(es) below)	18.5%	22
Have the option of downloading RTTOV as RedHat RPM or Debian package	27.7%	33
Other (please specify)	10.9%	13
answered question		**119**

The following list of developments is not exhaustive, but includes activities that are currently planned in the short-, medium- and long-term. Users are encouraged to submit requests, comments and questions about RTTOV either to the NWP SAF helpdesk or to the RTTOV forum:
https://nwpsaf.eu/feedback.html
http://www.nwpsaf.eu/forum/

Current development plans for RTTOV v11.3 (due September 2015) include the following:

- Extend Lambertian option for surface to IR simulations.
- Zenith angle correction in IR emissivity atlas.
- Improved treatment of snow in BRDF atlas.
- Python and C/C++ interfaces to RTTOV: these will initially provide access to the majority of RTTOV functionality through a simplified interface without the need to write any Fortran code.
- Increase the range of example RTTOV Fortran programs to cover more kinds of simulations. These examples all follow a very similar format and have been updated to be as simple as possible to help new users get started. The new interfaces for other languages (Python, C++) should help users who are not familiar with Fortran.
- Added a shell script to the RTTOV v11 coefficients web page which can be used to download coefficient files to their respective directories under rtcoef_rttov11/:
  http://nwpsaf.eu/downloads/rtcoef_rttov11/rttov_coef_download.sh
- Statistics of the differences between RTTOV brightness temperatures and those from the LBL channel-integrated optical depths have been made available here:
  http://nwpsaf.eu/downloads/rtcoef_rttov11/lbl_comp_list.html
  It is planned to add statistics for more sensors over time.
- Simplified instructions for installing the RTTOV GUI have been posted on the webpage:
  http://nwpsaf.eu/deliverables/rtm/rttov_gui_install_instructions.html
  RTTOV v11.3 will also include a shell script which aims to simplify the compilation of RTTOV.

Current plans for RTTOV v12 (due December 2016) include the following:

- Cloud and aerosol multiple scattering for solar-affected channels.
- SO2 as a variable trace gas.
- Simulations of self-apodised radiances using PCs.
- More physically-based sea surface IR emissivity model (intended to replace ISEM, but ISEM will remain as an option).
- Improvements to treatment of Zeeman effect.
- Improvements to RTTOV-SCATT including making it easier for users to run the Mietable generation code using custom functions for the DSDs.
- Address the variability of trace gas concentrations over the satellite era (e.g. CO2).

Other developments under consideration in the medium- to long-term include:

- Making RTTOV available via RedHat and/or Debian package management systems.
- Capability to simulate airborne sensors including upwelling and downwelling radiances at the sensor.
- Work is planned to validate and if necessary update the spectroscopic data in the spectral region above 200GHz for MetOp-SG ICI. Preliminary ICI coefficients are available on request.
- Simulation of UV channels.
- Investigate parameterisation of 3D effects for MW scattering simulations.
- Investigate alternative cloud overlap approach in cloudy IR simulations to reduce computational and memory resource requirements.

There were a number of requests to make the coefficient generation software available to users. The NWP SAF does not plan to do this for several reasons, an important one being that the software is complex to set up and run and it is felt that the significant additional resources that would be required to support users in running it are better spent on developing the RT model itself. The NWP SAF is responsive to requests for new coefficient files: all that is required are the spectral response functions or pass-band information. This also applies to requests for experimental coefficients with different channel configurations that may be required for testing or development of new instruments.