

2. WORKING GROUP REPORTS

2.1 RADIATIVE TRANSFER AND SURFACE PROPERTY MODELLING

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

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The group focused on the issues related to atmospheric radiative transfer (RT) and surface property (SP) models which are relevant for radiance assimilation as well as atmospheric and surface retrievals from infrared and microwave sounder or imager data. At ITSC-XV, the group first reviewed the actions from ITSC-XIV. The main accomplishments related to these actions were:

- a) Completion of the AIRS Radiative Transfer inter-comparison with a journal article to appear in JGR.
- b) A first workshop on surface property modeling was held in Paris, France (June 2006). Presentations are available from a link posted on the ITWG Web site.
- c) A special issue is to appear in the Journal of Atmospheric Science in early 2007 consisting of a series of papers summarizing the progress on the modeling of radiation in cloud/precipitating atmospheres.
- d) A new vertical interpolator with good Jacobian mapping characteristics between NWP and RT vertical coordinates has been developed. Code will be made available to the community.
- e) Steady progress was reported at ITSC-XV on the development of new RT capabilities within the RTTOV and CRTM fast RT models.
- f) A major update of the structure and contents of the RTSP-WG portion of the ITWG Web site. This included detailed information on fast and LBL models, links to surface emissivity databases, spectroscopic databases, instrument characteristics, information on adjoint coding etc.

The new action items listed below are to be completed by April 1, 2007.

2.1.1 Profile datasets

Marco Matricardi reported that a new 91 level dataset, including trace gases, to be used for training RTTOV will be available next year.

Action RTSP-1

Marco Matricardi to announce to the RTSP-WG when the new 91 level dataset is available.

The COSPAR (Committee on Space Research) dataset with upper level profile data is now available.

Action RTSP-2

Paul van Delst to ask Yong Han (STAR/JCSDA) to provide COSPAR profile set information to the RTSP-WG Chairs.

2.1.2 Instrument characteristics

The IASI balloon instrument SRF information was advertised to the group.

Action RTSP-3

Paul van Delst to inquire on the availability of the IASI balloon instrument ISRF data. This information should become available from CNES (T. Phulpin, <http://smc.cnes.fr/IASI>).

The characteristics of the MetOp suite of instruments was discussed. General and specific information is available from:

http://www.eumetsat.int/Home/Main/What_We_Do/Satellites/EUMETSAT_Polar_System/Space_Segments/index.htm?l=en

Action RTSP-4

Tom Kleespies and Paul van Delst will provide most relevant links on RTSP-WG Web page related to MetOp instruments and data as they become available.

The history of the AMSU-B RFI coefficients in the on-line user guide was reviewed.

Action RTSP-5

Tom Kleespies will post the AMSU-B RFI information to the group.

2.1.3 Line by Line (LBL) modeling

There is a need to identify the spectral regions (or channels) where LBL model or spectroscopy differences would be of the greatest concern to fast RT model users.

Action RTSP-6

Marco Matricardi will advertise an ECMWF technical memo on LBL model spectral differences when published.

A unique spectral response function shape for all IASI channels can be used. This function will be made available on the RTSP-WG site. This is part of RTSP-4.

2.1.4 Fast RT modeling

The issue of level or layer input to fast RT models was discussed by the group.

Action RTSP-7

Paul van Delst will gather information on level-to-layer conversion methodologies (including any units conversion) and software and distribute to RTSP-WG members for consideration. TL and AD modules to be included.

Concerning vertical profile interpolator software and its TL and AD, new methodology and software have been developed to solve the “blind level” problem, i.e. using all input levels to generate an output. There was a presentation made at ITSC-XV on this topic. A paper should appear next year in QJRMS.

Action RTSP-8:

Yves Rochon and Louis Garand to provide the code of the proposed new vertical interpolator: forward interpolator and mapping of Jacobians from the fast RT layering to the NWP vertical coordinates (TL/AD/Gradient). A link will be put on the RTSP-WG Web site to the code (pending approval from Canadian authorities).

The issue of the accuracy of cloudy radiance modeling was raised. Future inter-comparisons of RT models should involve cloudy atmospheres. Input data for models is not easily obtainable as there are measurements of radiances, but no associated microphysics, or measurements of microphysics but no radiances. Fiona Hilton will survey the <http://badc.nerc.ac.uk> site to determine what measured cloudy model input data (e.g., particle size, water content) and associated measured radiances are available. Similarly, Ben Ruston will contact the IPWG at NRL to identify the availability of observed cloud microphysical parameters.

Recommendation RTSP-1 to fast RT developers

Perform relative comparison between models for cloudy calculations. Evaluate the accuracy of cloudy radiance models with respect to speed and complexity (e.g., how many streams are needed). Additionally perform an absolute comparison between models and measured radiances.

Regarding the databases of particle shapes used to derive cloudy optical properties, and the associated software they will be very useful for the recommendation RTSP-1.

Action RTSP-9

Paul van Delst will distribute information to RTSP-WG members on the availability of optical property databases. More specifically documentation on the optical property databases used within the CRTM will be provided.

For the new Principal Component RTMs the question of how to fairly compare the adjoint of a PC RTM with “traditional” models was discussed. This issue was raised in the Saunders *et al.* (2006) AIRS RT model inter-comparison paper.

Action RTSP-10

Fuzhong Weng will investigate how to better assess the PC-RTM adjoint performance.

There is now consensus that the Zeeman effect at microwave frequencies for channels which have weighting functions that peak in the upper stratosphere or mesosphere should be accounted for.

Action RTSP-11

Paul van Delst and Fuzhong Weng will investigate making the Zeeman model of Yong Han available to ITSC community.

Recommendation RTSP-2 to fast RT developers

Non-LTE effects should be included/parameterised in fast RT models. Progress on this issue (from the SARTA, RTTOV, CRTM teams) should be reported before the next conference.

Improving the speed of fast RT models is important. How do we make them faster? Options are the model parameterisation, the code structure, parallelisation issues (OpenMP/MPI), hardware issues, or combinations thereof that could be improved.

Recommendation RTSP-3 to NWP centers involved in hyperspectral radiance assimilation

Document the methodologies used to speed up the hyperspectral radiance assimilation. Post that information on their monitoring Web site which is accessible to other centers. Speed estimates for standard radiance volumes should also be provided in future intercomparisons.

It was reported that fast model developers are now considering extending their models to the Visible/Near Infrared part of the spectrum.

Recommendation RTSP-4 to fast RT modelers

Consider upwelling oceanic radiation (water leaving radiance) when designing the next generation of RT models that include the visible part of the spectrum.

2.1.5 Surface property modeling

A discussion on the surface property modeling led to the following actions and recommendations.

Action RTSP-12

Ben Ruston to update information on the archival and documentation of sources of emissivity information in the IR and MW on a centralised site (pending NWP-SAF proposal).

Action RTSP-13

Ben Ruston to investigate the interest for global comparisons of land skin temperature in both the NWP and retrieval communities.

Recommendation RTSP-5 to Co-Chairs of the second meeting on surface property modeling

Plan the Second Workshop on Remote Sensing and Modeling of Surface Properties for the spring of 2008 (avoiding interference with ITSC-XVI). Encourage LSM investigators to attend to discuss requirements for inputs to surface emissivity models. Also encourage experts in radiometric property modeling to attend.

Action RTSP-14

Paul van Delst to investigate the feasibility of incorporating the PROSPECT emissivity model in the CRTM.

Bob Knuteson (SSEC/UW-Madison) and the ARM group have done an intercomparison of global surface emissivity maps retrieved from AIRS and SEVIRI data. They generally agree well but over desert there are disagreements. The RTSP-WG group should have access to these kind of studies.

Action RTSP-15

Lihang Zhou to provide link to AIRS Science Team meeting presentations of interest on the subject of emissivity retrieval methodology and validation.

Information on how NWP centers define surface emissivity for the purpose of radiance assimilation is of interest to this group.

Action RTSP-16

Louis Garand to provide a report on surface emissivity definition for radiance assimilation at NWP centers.

Action RTSP-17

Louis Garand to investigate the availability of the LMD surface emissivity database at 1 x 1 degree resolution providing high spectral resolution spectra suitable for AIRS and IASI applications.

Action RTSP-18

Ben Ruston to provide link to soil type database for emissivity modeling.

Snow emissivity estimates are not yet accurate. Eric Wood (Princeton) is working on the snow emissivity problem through JCSDA (intercomparison of three models with CRTM code).

Action RTSP-19

Banghua Yan to provide information on current JCSDA research and future publications on snow emissivity estimates.

2.1.6 Model intercomparisons

Action RTSP-20

Paul van Delst to provide report on comparison of compact OPTRAN and RTTOV gas absorption model in CRTM.

Fast RT cloudy/scattering model comparisons were discussed. There is an NWP-SAF project to compare RTTOV against a reference. Also, details regarding the model inputs for these comparisons still need to be worked out, e.g., conversion of model inputs dominates the error in the comparisons.

Action RTSP-21

Fiona Hilton to provide link to Una O'Keefe's report on the intercomparison between RTTOV (just cloud absorption) and DOTLRT (Discrete Ordinate Tangent-Linear Radiative Transfer) models.

Action RTSP-22

Stefan Buehler to provide information on datasets for cloudy/scattering RT model input.

Recommendation RTSP-6 to RTTOV and CRTM developers

Compare RTTOV and CRTM cloudy/scattering calculations in both the IR and MW.

2.1.7 Validation datasets

Nicole Jacquinet provided an update on the availability of observational datasets for line-by-line (LBL) model validation. However, there are issues with some of these datasets, e.g.

- Access can be difficult.
- Description of the conditions of observations (e.g., ozone, CO, mixing ratio, clear/cloudy situation) and description of instrumental characteristics (e.g., ISRF, S/N ratio) are sometimes insufficiently documented.
- Atmospheric conditions do not extend to very humid atmospheres to validate the formulation of the continua for example.

More information on upcoming experiments would facilitate communication with campaign PIs to address the above issues where appropriate.

Action RTSP-23

Nicole Jacquinet (with colleague R. Armante) to provide links to validation datasets used at LMD for AIRS and IASI and general information on Thorpex, Eaquate and IASI balloon experiments.

Action RTSP-24

Fiona Hilton to contact Jon Taylor about access to the Eaquate dataset on the <http://badc.nerc.ac.uk> Web site and report back to the RTSP-WG.