2. WORKING GROUP REPORTS

2.1 RADIATIVE TRANSFER AND SURFACE PROPERTY MODELLING

Web site: https://groups.ssec.wisc.edu/groups/itwg/rtsp

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2.1.1 Fast RT model coefficient generation

The RTSP-WG seeks to improve the availability and quality of spectral response functions needed to generate accurate coefficients required by fast RT models.

Recommendation RTSP-1 to fast model developers

Fast non-LTE models should include a representation of ozone variability in the mesosphere in support of shortwave radiance simulations.

Recommendation RTSP-2 to CGMS

To encourage sensor manufacturers and instrument engineering and science teams to provide SRFs with higher quality, consistent format, and with rapid availability. Commercial providers need to provide SRFs, APCs, and calibration information in support of RT.

Recommendation RTSP-3 to GSICS and CGMS/WMO/SATURN

Maintain and update Spectral Response Function databases for all available sensors, focusing on operational sensors. Recommend calibration information from sensor to be applied to RTM / SRF.

Action RTSP-1 on Benjamin Johnson

Create Community SRF repository and coordinate inputs from RTWG and other contributors. Continue to support previous recommendations of creating a spectral response function (SRF) repository, to be shared publicly with the RT community.

2.1.2 Line-By-Line models

RTSP-WG seeks to improve the quality of LBL models, and support diversity and continued development and funding for LBL modelling efforts.

Recommendation RTSP-4 to the RT and LBL community

The RTSP-WG strongly supports continuous line-by-line model development as a fundamental basis for accurate radiative transfer calculations in fast RT models. The RT community also encourages and supports the development of competing line-by-line codes (encourage innovation and diversity).

Recommendation RTSP-5 to LBL developers

Encourage line-by-line model developers to include a better formulation of the Voigt line shape (e.g., include velocity dependence).

Action RTSP-2 on Raymond Armante

To communicate results obtained using a speed dependent formulation of the Voigt line shape providing an assessment of the impact in the infrared region of the spectrum, especially in the long-wave.

Recommendation RTSP-6 to Fast RT and LBL community

Look at the current continuum absorption models at higher MW frequencies (< 1000 GHz) and investigate the use of the MTK_CKD model in line-by-line microwave codes. Including Far-IR in support of new missions.

Recommendation RTSP-7 to LBL developers

Characterization of LBL model biases and uncertainties, especially focusing on warm and moist air masses. Attempt to map uncertainties in spectroscopy into radiance uncertainties, starting from major lines of a given region.

Action RTSP-3 on Marco Matricardi

To communicate to the working group on the CO2 perturbation impact on LBL radiances, and to provide a report on the perturbation of the line mixing model.

2.1.3 Spectroscopic parameters

Similar to our support for line-by-line modeling improvements, we also seek to encourage the development and the improvement of spectroscopic databases, particularly with respect to those databases that support LBL models. We address a specific need for extending research into higher microwave frequencies that will be used on future sensors.

Recommendation RTSP-8 to spectroscopic model developers

A strong emphasis should be put on the continuous support of theoretical and laboratory spectroscopic studies. Continuous efforts should be maintained in the generation and improvement of basic line parameters.

Recommendation RTSP-9 to spectroscopic model developers

The RTSP-WG recommends promoting research into spectroscopy of higher frequency microwave channels up to 1000 GHz.

2.1.4 Surface properties

The following recommendations are aimed at strengthening the research aspects of surface modeling and associated RT simulations, and encourages communication and collaboration between and within the physical modeling and RT modeling communities.

Recommendation RTSP-10 to the physical modeling community, ICWG, ISWG, IPWG, IWWG

To develop accurate physical models to support emissivity modeling requirements in RT models.

Recommendation RTSP-11 to reference-quality model developers

The RTSP-WG strongly recommends support of developing reference-quality ocean-surface emissivity modeling, specifically Infrared, Microwave, for both active and passive simulations. And support the development of a reference surface emissivity model (English, et al.).

Recommendation RTSP-12 to vegetation modeling community

Spectral library developers to include broader and more diverse vegetation sampling (e.g., new types), and include the effects of senescence. Also include the impact of the diurnal cycle.

Action RTSP-4 on ISWG

Identify group that can provide broadened vegetation parameters in support of the spectral databases.

Recommendation RTSP-13 to snow modeling community

Determine the classification methodology for emissivity modeling over snow-free land surfaces, statistical vs. physical or some mixture thereof.

Recommendation RTSP-14 to surface modeling community

Improve the interface between land surface model parameters and RT models, and specifically incorporate angular dependence impact on polarized emissivity and reflectivity over all surface types. Include, specifically, the temperature dependence of the index of refraction of water, land, snow/ice, and vegetated surfaces.

Action RTSP-5 on Nick Nalli, Stu Newman, and Steve English

Identify up-to-date and develop new laboratory measurements across spectral ranges [UV-MW] and resolution of interest for various surface properties (land, water/ocean, snow cover, sea-ice), and anything that's missing, specifically include Far-IR.

2.1.5 Optical and physical properties: Aerosols, clouds, and precipitation

The optical properties of aerosol, clouds, and precipitation particles require continued support to improve physical and radiometric accuracy. The accuracy of scattering computations can be significantly affected by errors and uncertainties of the parameterization of optical properties of the scattering particles.

Recommendation RTSP-15 to aerosol/materials modeling laboratories

The RTSP working group recommends encouraging research into laboratory measurements of aerosol refractive indices, with an initial focus on common dust and sea-salt modes. Characterization of the indices of refraction of hygroscopic aerosols at different moisture levels is also highly encouraged.

Recommendation RTSP-16 to fast RT model developers

Explore the necessity of using non-spherical aerosol particle scattering properties in fast RT models in support of detailed scattering calculations (e.g., LIDAR).

Recommendation RTSP-17 to RT and physical model developers

With regard to the computation of cloud and aerosol optical properties and formation of parametric schemes in fast models: we recommend that there be an intercomparison of the parameterized schemes in order to assess the validity and continuity of the schemes across various size parameter ranges. This should assess against particle physical and optical properties from ultraviolet to microwave.

Action RTSP-6 on Benjamin Johnson

To continue to report on current developments of physical and scattering properties of aerosols, clouds, and precipitation to the RTSP working group. These links will be hosted on the RTSP WG webpage.

Recommendation RTSP-18 to ice/precipitation model developers

For all scattering/absorbing particles, extend the frequency range to cover the ranges of current and upcoming sensors, from visible to microwave (i.e., ICI channels). Extend the range of particulate sizes to be consistent with observed parameters for each particle type.

Recommendation RTSP-19 to laboratory property modelers

Far-IR studies of temperature dependent index of refraction.

2.1.6 Model solvers and approximations

Scattering approximations used in fast RT models are essential for operational use within simulations involving scattering atmospheres. The RT community should compare results from scattering model solvers to both each other, and to external models.

Recommendation RTSP-20 to RT developers

Encourage the comparison / validation of full scattering solvers. This should include the computational efficiency, specifically including the adjoint model.

Recommendation RTSP-21 to RT developers

For aerosol scattering computations, more research is needed to characterize the regimes where fast RT approximations are effective.

Recommendation RTSP-22 to RT developers

To look at the importance of simulating radiances in turbulent layers in coordination with model developers.

2.1.7 Validation of RT Model physical assumptions and RT calculations

In the pursuit of traceability, improved accuracy, knowledge of uncertainties, and in support of development of reference models, careful validation datasets must be made available to the community for use in RT calculation assessments.

Action RTSP-7 on Benjamin Johnson and Marco Matricardi

To maintain and update list of "golden" field experiments (variety of observations, high data quality, good sensor overlap/coverage), need input from instrument scientists and other key users/developers.

Action RTSP-8 on Marco Matricardi

To provide link on MAGIC campaign calibrated datasets.

2.1.8 Fast RT Model Intercomparison

The working group plans to continue CRTM/RTTOV/ARMS model intercomparisons and expand it slightly to cover both clear-sky and cloudy RT comparisons.

Action RTSP-9 James Hocking and Benjamin Johnson

To coordinate the CRTM/RTTOV/ARMS model intercomparison effort. JEDI/UFO is a possible framework. Aim toward developing a standardized intercomparison framework for testing new coefficient files / scattering tables, etc. And to reach out to ARMs developers to include them in the effort.

2.1.9 Coordination of Recommendations

Fostering communication between various working groups is essential to reduce the duplication of effort and to promote collaborative cross-group activities.

Action RTSP-10 to the RTSP-WG Co-Chairs and members

Share RTSP recommendations with other relevant working groups (e.g., ITSC, IPWG, ICWG, IWWG, ISWG, ISDA, and other groups where reference radiative transfer will be of interest). Individuals from RTSP-WG should volunteer to present recommendations at their respective meetings.

Recommendation RTSP-23 to the RT model development community

Promote the extension of RT models to the simulation of active/passive data (e.g., Radar/LIDAR/Scatterometers), and to UV, Visible, and Far-Infrared portions of the spectrum. An accurate treatment of atmospheric and surface polarization (linear and circular) should also be considered in support of these bands.

2.1.10 Future RT Outlook

Fast RT models should be responsive to upcoming requirements arising from NWP or other communities. We specifically identify areas of importance that need to have some early attention and discussion. It is expected that these items will move up into other areas as requirements and research progress.

Recommendation RTSP-24 to the RT modeling community and partners

Support the development of a set of community models for building a reference standard radiative transfer model, but using existing reference models where available (e.g., LBL, Spectroscopic databases).

Action RTSP-11 on the "IRRTM" team

Deliver whitepaper and present on the International Reference Radiative Transfer Model ("IRRTM") status and planning to ITSC, IPWG, ICWG, IWWG, ISWG, ISDA, and other groups where reference radiative transfer will be of interest.