

RTSP Working Group Recap

ITSC-25 Meeting – Summary of
Activities since ITSC-24

Presented on behalf of the RTSP
Working Group

General Overview

- **Intersessional meeting** held in June 2024 (online)
- **Spectroscopy & Radiative Transfer:** Continued engagement with the spectroscopy community, including updates on HITRAN O₂ bands and the 183.31 GHz WV absorption line. The WG discussed uncertainties in continuum absorption modeling (e.g., MT_CKD), and noted that GEISA does not include continuum data, requiring external models for full RT applications.
- **Fast and Line-by-Line Models:** Discussions included updates from CRTM (v3.1.x), RTTOV (v14 beta), ARMS, and efforts around sigma-FORUM and CLBLM. AI-based tools to accelerate RT calculations were a focus area.
- **Clouds and Aerosols:** Notable work on non-spherical particle models, cloud scattering parameterization, and cloud overlap effects. There was also attention to temperature-dependent refractive index effects in the far-IR.
- **Surface Properties:** Integration of CAMELv3.0, new emissivity models for snow and ice (e.g., Nalli), and evaluations of land-surface emissivity models over MW bands.
- **AI & Tools:** Development of neural-network RT surrogates, Jacobian estimation methods, and discussions of adjoint generation using NN-based systems.
- **New Topics:** NLTE effects (Zhenglong Li) and apodization impacts on radiance spectra (David Tobin) were introduced as active areas for future coordination.

Recommendations (1/2)

RTSP-1 (To: Spectroscopy Community): A strong emphasis should be put on the continuous support of theoretical and laboratory spectroscopic studies. It is crucial that a compilation of basic line parameters is maintained.

RTSP-2 (To: LBL Model Developers): Would LBLRTM continue after CLBLM released? Maintain the latest LBLRTM version.

RTSP-3 (To: Aerosol Research Community): Reach out to the aerosol community. What are the physical needs? What is missing?

RTSP-4 (To: RTSP WG): Conduct literature review of new studies and challenges in VIS/near-IR aerosol sensitivities and spectral dependencies.

RTSP-5 (To: RTSP WG): Connect aerosol field campaigns to radiative transfer evaluation.

RTSP-6 (To: Optical Properties Researchers): Continue support for refractive index dependence studies on temperature.

Recommendations (2/2)

RTSP-7 (To: Cloud Microphysics and RT Modelers): Conduct sub-grid variability studies (e.g., NUBF effects, cloud fraction impacts).

RTSP-8 (To: RTTOV/CRTM Developers): Incorporate CAMELv3 snow/land emissivity.

RTSP-9 (To: NWP Community): Identify partners for improved land-surface emissivity modeling.

RTSP-10 (To: AI and Surface Modeling Researchers): Investigate AI approaches for dynamic emissivity over land (e.g., in response to flooding).

RTSP-11 (To: RT Model Developers): Develop improved spectral representation of snow using physically based models (e.g., Nalli's). [NEW]

RTSP-12 (To: Infrared RTM Community): Incorporate NLTE considerations into RT simulations, especially for upper-atmosphere IR radiance modeling. [NEW]

RTSP-13 (To: Instrument Simulation Community): Refine the treatment of apodization and instrument spectral response functions in FTS RT models. [NEW]

Action Items (1/2)

RTSP Action 1 (Assigned: Co-chairs): Update ITSC/RTSP website.
Status: Completed.

RTSP Action 2 (Assigned: Co-chairs): Contact Eli Mlawer (AER) re: MT_CKD and Raymond Armante (LMD) re: GEISA.
Status: Ongoing. Follow-up during intersessional meeting pending.

RTSP Action 3 (Assigned: Emma Turner): Link key NWPSAF spectroscopy reports to community.
Status: Unknown.

RTSP Action 4 (Assigned: Ben Johnson): Contact JPL/B. Drouin re: O3 parameters.
Status: Completed.

RTSP Action 5 (Assigned: Co-chairs): Contact AER regarding CLBLM status.
Status: Ongoing.

Action Items (2/2)

RTSP Action 6 (Assigned: Co-chairs): Contact Sergio de Souza-Machado (UMBC) re: k-Carta updates.

Status: Ongoing.

RTSP Action 7 (Assigned: RTSP WG): Facilitate access to field datasets (e.g., AEROSE, FIRARICAMEL) for RTM validation.

Status: Ongoing.

RTSP Action 8 (Assigned: RTSP WG): Get updates/plans for new refractive index database (e.g., Ping Yang's study).

Status: Ongoing.

RTSP Action 9 (Assigned: Ben Johnson): Bring IPWG cloud property results into WG discussion.

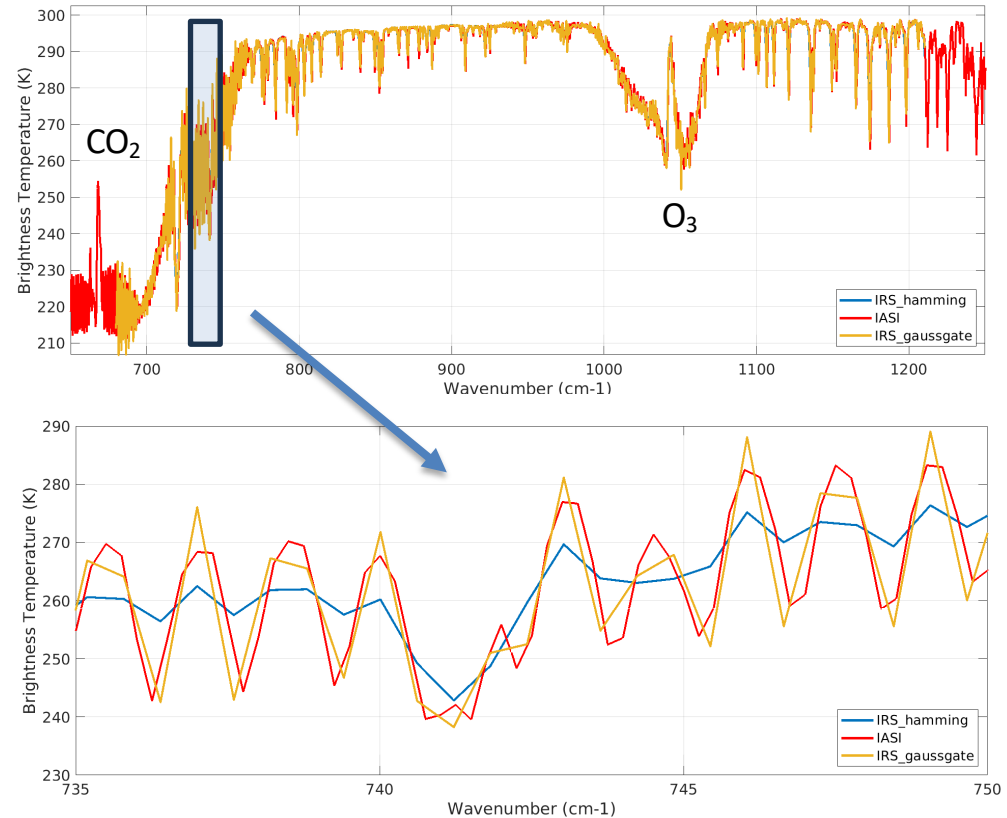
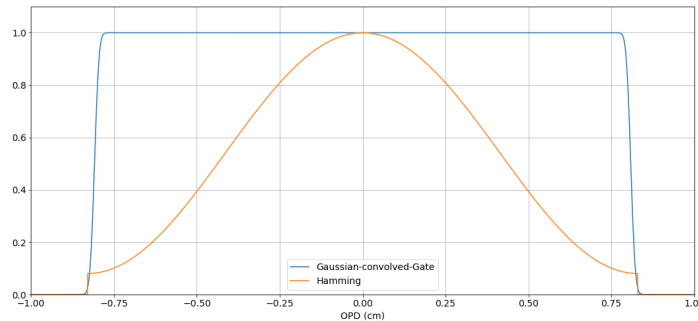
Status: Completed at ITSC-24.

RTSP Action 10 (Assigned: RTSP WG): Share RT-relevant meetings/agenda/notes across WG.

Status: Ongoing.

IRS with different apodization functions – band1

- CRTM coefficients for the IRS_MTG-S1 was created.
- Two apodization functions were tried, Hamming and Gaussian convolved boxcar function.



References

- Nalli, N. et al. (2023). *Physically Based Thermal Infrared Snow/Ice Surface Emissivity for Fast Radiative Transfer Models*. Remote Sensing, 15(23), 5509.
- Li, Z. et al. (2020). *Non-LTE Effects in CrIS Full Spectral Radiances*. JGR Atmospheres, 125(13), e2020JD032710.
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- Turner, E. (2023). *Literature Review on Microwave/Sub-mm Spectroscopy for MetOp-SG*. NWP-SAF.
- Fox, A. et al. (2024). *183.31 GHz Water Vapor Line Under Turbulence*. Atmos. Meas. Tech., 17, 4957–4975.
- Gallucci, F. et al. (2024). *Stratospheric O3 Parametrization and NWP Impact*. ACP, 24, 7283–7302.
- Johnson, Benjamin T., et al. (2023) "The Community Radiative Transfer Model (CRTM): Community-focused collaborative model development accelerating research to operations." *Bulletin of the American Meteorological Society* 104.10: E1817-E1830.