

# ITSC-18

## Radiative Transfer and Surface Property Modeling Working Group

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<https://groups.ssec.wisc.edu/groups/itwg/rtsp>

# TOPICS

- Cloud (and aerosol) datasets
- Fast model new features
- Instruments
- Instrument characterization
- Surface properties
- Spectroscopy and forward models

# Cloud (and aerosol) datasets (1)

- Collect existing profile and observation (in-situ and radiance) datasets for use in comparisons, and in validating the cloudy/scattering RT models.
- Current list:
  - DARDAR (CALIOP, CALYPSO). Only for ice. (Jerome Vidot)
  - C3VP (Paul van Delst)
  - Ongoing work at UKMO for validation (Stuart Newman).
  - Rydberg, Evans. (Gerrit Holl)
  - MACC for aerosols (Marco Matricardi)
- **Action:** on indicated members to provide either the dataset or information about it (URLs, etc).

# Cloud (and aerosol) datasets (2)

- Optical properties datasets (IR/MW/spherical and non).
  - Baran (meas. + calcs) dataset (Jerome Vidot)
  - Gang Hong (MW only calcs, includes polarisation) (Gerrit Hoff)
  - OPAC (meas. + calc) dataset. GADS as well. (Nicole Husson/Virginie Capelle)
  - RTTOV calculated dataset (Marco Matricardi )
  - CRTM calculated dataset (Paul van Delst)
- **Action:** indicated members to provide either the dataset or information about it (URLs, etc).

# Cloud (and aerosol) datasets (3)

- List available models for generating cloud- and/or aerosol-affected radiances for use as a reference.
  - LBLRTM+optical properties+DISORT
  - 4A+DISORT
  - VLIDORT (similar to DISORT but with Jacobians)
- **Action:** Co-Chairs to assemble list of available models and links/access to them on RTSP-WG webpage.
- **Recommendation:** Contemplate the possibility of Garand-type study for cloudy radiance model intercomparison and/or validation.

# Fast model new features (1)

- non-LTE
  - What channels are affected (daytime/nighttime)?
  - Vibration temperature profiles (Manuel Lopez-Puertas IAA?)
  - All isotopologues of affected molecules.
  - Accuracy of fast model parameterisation.
- **Action: Marco to provide line-by-line dataset of LTE vs NLTE computations.**
- **Action: Marco to contact Manuel Lopez-Puertas to investigate the wider distribution of vibrational temperature data.**
- **Recommendation: Introduce NLTE effects in fast models.**

# Fast model new features (2)

- Anticipating future need of unapodized radiances
  - OSS, PCRTM, RTTOV/PC\_RTTOV.
  - Alternative methods (e.g. Deapodisation - they require the availability/simulation of all channels)
  - Baseline for MTG-IRS is for unapodised radiances
- **Action: Jean-Luc Moncet, Xu Liu, James Hocking to provide feedback and current/planned fast model capabilities.**
- **Recommendation: encourage development of unapodised fast radiative transfer models.**

# Instruments

- Spectral response functions: what we want
  - New: Meteor-M, FY3B, MTG-IRS, EPS-SG, IASI-NG, commercial launches e.g. GIFTS/STORM, Iridium
  - Old: VTPR?, SSU, HIRS (NIMBUS-6), PMR?
  - Others?
- **Action: ITSC to contact co-chairs regarding information on available data.**
- **Action: Paul van Delst to create an acronym glossary on RTSP web site.**
- **Recommendation: Pascal Brunel and Paul van Delst to specify a common convention for instrument characteristics data files.**
  - Spectral response function data.
  - Antenna pattern data?
  - FTS instrument line shape.
- **Recommendation: Create a data repository of sensor characteristics for RT modeling community accessible via the RTSP-WP page.**



# Sensor characteristics

- The data typically required are:
  - SRFs
  - polarisations,
  - antenna temperature corrections
  - FTS line shape or analytical model. How to handle band edges. Spectral sampling.
- Recommendation: Sensor vendors supply digitized channels responses for both microwave, infrared, and, visible.
- Delivery of instrument characteristics as early as possible (even if not the final version - or especially so) to allow analysis of data in an RT modeling context.
- Action: ITWG co-chairs to identify members to identify contacts for various programs (MetOp, JPSS, etc.; similar for Chinese, Japanese, Indian, Russian, Korean, programs, etc.) and inform RTSP-WG co-chairs.

# Surface properties (1)

- Action: Ben Ruston to provide report from Surface Properties Technical sub-group. COMPLETED.
- BRDF implementations for fast RT models are required for all land and surface types
  - E.g. Jerome Vitot model is for land. Need similar for snow and ice. Water can use an analytic model.
  - Need for interface for users to input their own models into the RT models?
- Recommendation: develop BRDF models for snow and ice.
- Physical reference models should be identified for use in validating fast RT surface property modelling.
  - The model should be validated.
  - It should include angular dependence.
  - Be valid on micro- and macroscopic scale.
  - Be usable with dedicated surface property missions (e.g. SMOS, SMAP)
    - Candidates are (to be integrated with Ben Ruston's list):
      - MW: CMEM
      - QC/DMRT
      - IR: Snyder's model
- Action: RTSP-WG co-Chairs to list reference model candidates on RTSP-WG website.

# Surface properties (2)

- Emissivity atlases/databases: a file format convention to ease implementation of new ones in RT models should be investigated.
  - What quantities, units, spectral sampling, spectral resolution, spatial resolution, temporal resolution are required?
  - What ancillary information is required. E.G. surface type, quality control, error characteristics ,etc.
  - What naming conventions should be used?
- **Action: Eva Borbas, Catherine Prigent and Felipe Aires to provide information and guidance for determining a file convention.**

# Spectroscopy and forward models

- Water vapour Continuum
  - CAVIAR: MT-CKD-type of format for continuum coefficients are available for use in LBLRTM line-by-line model.
  - These coefficients are not necessarily transferable to other line-by-line models.
  - Action: Stuart Newman to provide IR continuum coefficients and associated documentation.
  - Action: Carmine Serio to provide measured continua coefficients in the far infrared and associated documentation.
- Document the relationship between spectroscopic databases and other quantities such as line coupling coefficients and continua.
  - Action: Nicole Jaquinet Husson to provide documentation on the relationship between spectroscopic databases and quantities such as line mixing and continua.
- There is a constant need for updating the spectroscopy both in the microwave and infrared.
  - Recommendation: fast RT developers update their training coefficients when new spectroscopy becomes available.
- Recommendation: encourage validation and intercomparison of LBL models/spectroscopy to assess the impact of spectroscopic uncertainties and the differences between line-by-lines models. The members of the working group recognize this is a project that will require a large effort.
- Recommendation: support for line-by-line reference model development is of paramount importance and should be continued to ensure that operational centres have access to the latest updates in LBL forward modelling.