# RTTOV/CRTM technical sub-group report

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# RTTOV developments

- Updates to MW spectroscopy for MetopSG ICI
- Developments for RTTOV v13:
  - New gas optical depth parameterisation
  - New outputs from RTTOV
  - Updates for VIS/IR scattering
  - Updates for MW scattering
  - Updates to Principal Components-based models
- RTTOV v13 beta testing

# RTTOV developments

- RTTOV Python/C++ wrapper
- NWP SAF Radiance Simulator future plans
- Ground-based RTTOV
- NWP SAF website
- Request for users to contact us with requirements for all NWP SAF products (RTTOV, AAPP, Radiance Simulator, 1DVar, …)

# CRTM developments [1/3]

- CRTM 2.3.0 available
  - Improved cloudy radiance simulations under fractional clouds
  - Improved microwave surface reflectance under cloudy conditions
  - Multiple new coefficients: CrIS-fsrB1/B2/B3_NPP, CrIS*_N20, CrIS-fsr431_npp/n20, AHI_Himawari-9, ABI_G16, VIIRS-JPSS1, ATMS_N20, ATMS_N20-SRF, COWVR, tropics_designed_v1
  - AIRS with NLTE corrections

- CRTM 2.3.1 beta
  - Bugfixes
  - New coefficients: eon_mw.v1,slstr_sentinel3a, seviri_m11, ABI_G17, AVHRR3_Metop-C, IASI(b1,b2,b3)_Metop-C, IASI300_Metop-C, IASI316_Metop-C, IASI616_Metop-C, SMAP and SMOS (V, H, 3rd, 4th Stokes), Tempest_D

# CRTM developments [2/3]

- Parallelisation through OpenMP
- Diverse range of scattering optical properties for clouds/hydrometeors
- Interface with Community Hydrometeor model (CHYM)
- Active sensor capability for radar and lidar sensors (CASM – Community Active Sensor Model)
- New aerosol optical properties for lidar simulations
- Future work: modelling melting layers in clouds which can be radiometrically significant for active and sensors.
- Emphasising value of intercomparisons (e.g. CRTM vs RTTOV) in identifying bugs (e.g. Jacobians of surface ocean emissivity for scattering simulations).

# CRTM-CSEM developments [3/3]

- Interface with Community Surface Emissivity Model (CSEM)
- CSEM Improvement & development in support of NWP data assimilation of surface sensitive MW channels over land & ocean (MW land prognostic model based on deep machine learning (ML) of satellite retrievals and the physical model simulations;  Fast MW ocean emissivity & BRDF model based on ML regression on two-scale physical scattering model and improved foam correction model from L-band to mm bands).
- Implementation of geolocation-based land VIS-IR emissivity/reflectivity models/atlas in CSEM.
- Implementation of the improved IR ocean physical model in CSEM ( accounting for the SST impact on the sea water permittivity).

# Discussion

Spectral consistency in scattering optical properties – we are aiming to improve this in RTTOV.

=> For example, Anthony Baran is working on an update to his ice optical properties to produce a consistent dataset from VIS-MW which will hope to make available in RTTOV and RTTOV-SCATT.

# Discussion

Efficient slant-path calculations *(not to be implemented within fast RT models)*.

Melting layer: sub-grid scales are important. Ben has a good model for this.

Plans for land surface emissivity: JCSDA have a code sprint planned to develop improved model.

Use of machine-learning for coefficient training: size of required dataset? Perhaps the NWP SAF 83 profile set used for RTTOV coefficients is sufficient?