Highlights from the Session of RT and Clouds and Precipitation

Session Highlights

- ***Community Radiative Transfer Model (CRTM)***
  - CRTM status and development – P. Delst, EMC and Y. Han, STAR
  - Microwave emissivity model update – B. Yan et al., STAR
  - Optical properties of cloud particles and dust aerosols and the truncation of scattering phase function – P. Yang, Texas A&M
  - CRTM including aerosols and historical sensors – M. Liu et al., STAR
- ***New Radiative Transfer Schemes & Spectroscopy***
  - Assimilation of clouds & precipitation – R. Bennartz et al., U. Wisc.
  - Improved Spectroscopy for Microwave and Infrared Satellite Data Assimilation - Vivienne Payne, AER Inc.
- ***CRTM validation and error characterization***
  - Validation of CRTM by using CloudSat data – Y. Chan et al.,, STAR
  - Improved Clouds and Precipitation Products for NWP – N. Wang, CICS/UMD
- ***CRTM Impacts and Cloudy radiances in NWP***
  - CRTM Implementation in Navy Assimilation Systems – N. Baker et al, NRL
  - Radiance Data Assimilation for WRF model: overview and results – Z. Liu et al., NCAR/AFWA
  - The inclusion of cloudy radiances in the NCEP GSI analysis system – M. Kim, STAR

CRTM Status and Development-pual/yong

- CRTM-v11 released (2/08)
- Gas absorption: water vapor continuum
- Exra layering, overcome large jacobian. CRTM with climatology profile, improve the performance, 10K difference. Temperatue jacobians more realistic.
- Clouds – six cloud types, spherical particles
- Aerosols – 8 types, spherical
- Infrared emissiity- no update
- Microwave, MHS-snow/ice model, FASTEM-1 is used
- Radiative transfer scheme: ADA-sensor zenith angle for additional stream
- SSU – SRF needs to be parameterized as cell pressure.
- Zeeman splitting for AMSU ch 14 produce difference about 0.5K, polarized radiative transfer in terms of absorption coeff.
- Earth rotation doppler shift – RCP reference issue (feed vs. reflector)
- Transmittance, compact-optran, smooth profile but bad performance in some channels
- Trace gas
- MW training using MonRTM
- LBLRT
- MW emissivity
- Ocean emissivity – Masahiro Kazumori's low frequency
- ADA, 2-4 streams for fast computation
- SOI – layer temperature.. Conversion
- Interpolation for optical LUT
- Visible channels – souce function analytic

Microwave Emissivity Model Update (Yan, Weng and Derber)

- Empirical emissivity vs. physical model – 183+-1 GHz, 40-60% of SSMIS channel 1,2…water vapor..
- Two layer model: better handle for stratification, melting and ice covered…
- Multilayer soil/vegetation..prepare for L-band such as SMOS and SMAP mission

Improved Spectroscopy- Viviian et al

- Microwave – MonoRTM-v3.3 work for 0-1648 GHz
  - Difference between MonoRTM and Rosennkranz model
    - Width of the 22 GHz water vapor line
    - Temperature dependence of widths
    - Self and foreign broadening
  - TB 22 GHz is very sensitive to line width and biases.. How do you know it is not related to calibration
  - DTB is related to PWV
- LBLRTM: HITRAN 2000/2004+updateds fpr H2O, CO2, O3
- LBLRTM 11.3 vs SARTA for AIRS comparison
- Some significant difference between LBLRTM vs SARTA
- LBLRTM vs, IASI ,,, residual large due mainly to the high resolution ..

Cloud Optical LUT (Zhibo Zhang, Ping Yang et al)

- Aerosols:spheriodal
- Ice/water Clouds:
- Nonspherical dust aerosols. Difference..
- Tmatrix: small particles
- Phase function Truncation: finite terms with adjustment to single scattering and optical depth.
- Ice LUT: 6 shapes for
- 8 terms for Legendre polynomial is good enough.

RT ModeRalf Bennartz

- Sigmoid snow/rain optical properties parameterization (snow and rain)
- Single scattering albedo/asymmetry intercomparison
- Error and error covariances: current plan parallel approach vs slant path-SOI,
- Error correlation introduced by RT model at AMSU/MHS low and high frequencies
- Petty rain model (10 parameters for Min-Jeong)

Radiance Assimilation (Zhiquan Liu)

- WRF-VAR – CRTM/RTTOV: Consisionstency in clear sky performance
- Modify CRTM –one call for getting the information for cloudy radiance
- In Katrina case, GFS has already assimilated all conventional..
- WRF VAR has no liquid/rain. Use Total water vapor for partition ?

CRTM in NRL (Craig Bishop)

- NAVDAS (3dvar), NAVDAS-AR (4dvar)
- CRTM_rev1876
- North Pole, CRTM makes big difference in 500 mb ac
- NRL LBL include earth rotationa doppler shift

Cloudy radiance (Naiyu Wang)

- Cold season land emissivity from CNRM, angle < 40 degree
- Simulation data sets: C3VP, emissivity, distrometer data in raining conditions, compared with clear atmosphere
- Lake effect snow depress little on TB91 and 150

CRTM Validation (Yong Chen)

- Cloudsat data sets are matched with ECMWF and NCEP surface analysis, NOAA-18 for validation
- Cloud inhomongeneity effect…
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The inclusion of cloudy radiance in the NCEP GSI analysis system (Min-Jeong Kim)

- Current GSI passed some cloudy radiance into system although GSI has no cloud minimization
- Current MW radiance assimilation .. (Outerloop and inner loop)
- F = (0 – T)/20.0, ice cloud fraction, MW significant

CRTM Including aerosol and historical sensors (Liu)

- Correlated K-distribution/QSS – longer time
- Source function is analysis for solar/UV
- Speed (?)
- Assimilation of radiances for aerosol sensitive channels for better vertical structure. AOD has no vertical information
- GOCART (5 types) and CMAQ (8 types)
- SSU/MSU…for renalysis