Plans and Progress on AIRS assimilation at DAO

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Progress Report since last meeting

- Web-based monitoring of radiance/retrieval biases, quality control decisions, and coverage
- Implemented OPTRAN
  - Tested with TOVS
  - Began testing with simulated AIRS data
- Software completed to read and archive level 1b test data sets from NESDIS and compute observed minus forecast radiances
- Received level2 test data sets from NESDIS, software nearly complete for assimilation
- Began modifications to DAOTOVS software to incorporate AIRS
  - Testing with internally-synthesized radiances
Features in NESDIS 1b data sets

- Some strange radiance values (noisy) are seen over e.g. Greenland
- Emissivities significantly different from Masuda ocean model or CERES land emissivity data set?
  - Radiances in clear scenes fail cloud-detection checks, especially over ocean
  - Most retrievals fail radiance residual checks
OPTRAN significantly reduces ATOVS radiance biases: note: a) scale b) large reduction in channel 1 and 12 biases
Scan-angle-dependent biases (red: before tuning, green: after)

OPTRAN

GLATOVS

November, 2001

AIRS meeting, Joanna Joiner
Radiances (O-F) 649.6 cm$^{-1}$ (note: noisy values over Greenland, middle right shows where passed cloud-detection checks, less strict over land)
Left: Obs 801 cm\(^{-1}\) (window),
Right: O-F 1571.9 cm\(^{-1}\) (H\(_2\)O)
DAOTOVS 1DVAR system

- Uses raw (level 1b) data
- Variational cloud-clearing (Joiner and Rokke, 2000; http://dao.gsfc.nasa.gov/pages/jjoiner.html); eigenvector FOV determination (AIRS ATBD)
- Physically-based systematic error correction (tuning)
- Forward models: OPTRAN, as well as GLATOVVS, HFFP, and MIT microwave code (e.g. use HFFP/MIT for OSSE simulations, OPTRAN for retrievals)
- Runs in operational GEOS-DAS and next-generation Finite-volume DAS (FVDAS), currently running in parallel system
DAOTOVS and treatment of retrievals at DAO: What makes it different?

- Uses cloud- and land-affected data (using CERES land-emissivity data set based on satellite/laboratory measurements). Positive impact shown at last meeting.
- Variational cloud-clearing (clearing done simultaneously with retrieval); allows for internal quality control, consistency, simplicity; examples shown at last meeting.
- Tuning using collocated radiosondes (not background). Updated daily.
- Data are thinned on an equal-area grid; best retrieval selected (e.g. clear over cloudy); sounding data marked as passive near sondes so as not to underweight sonde
- Errors in assimilation system include separate components with and without vertical/horizontal correlations
Cloud detection

- Background window channel check (Derber and Wu) $|O-F(HIRS8)|<1K$ sea, $<3K$ land
- Albedo check from VIS channel and frozen sea test (McMillin and Dean) – any way to put visible channel info into l1b data sets?
- Long-wave/short-wave consistency checks (Eyre, McMillin and Dean, others internally developed)
- FOV homogeneity check (if passes, average all FOVs), otherwise take 1 FOV as clear if passes all tests
- Implemented for AIRS using representative long-wave short-wave window channels
- Working on microwave/IR consistency check for AIRS/AMSU
- Less that 10% found clear, less than half of those clear in all 3 FOVs
Summary and Future Work

• OPTRAN implemented with good results. Used to compute O-F radiances using NESDIS data sets
• DAOTOVS 1DVAR is in process of being adapted for AIRS; simplified system working with internally-simulated data
• DAO has developed a variety of web-based validation tools (O-F radiance-retrieval, QC monitoring, forecast-synoptic evaluation, etc.); will be used to evaluate AIRS team retrievals and level 1b radiances (will be available to AIRS team members)
• Working on upgrades for AIRS (dynamic channel selection using cloud-height determination)
• Designing experimental setups (different channel subsets)