The Joint Airborne IASI Validation Experiment (JAIVEx) and select contributions from NAST-I

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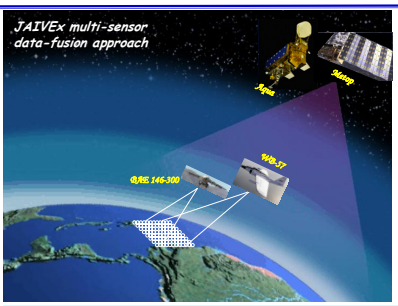
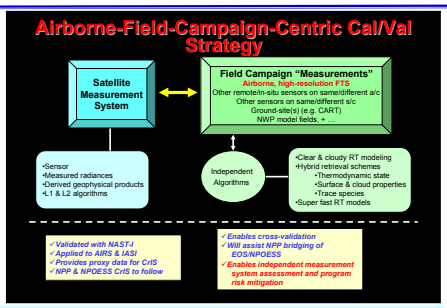
LaRC SD





Calibration validation approach *

- **Spatial**
  - **Landmark navigation**
    - compare observations to databases for known, time invariant distinct features (e.g., coastlines)
  - **Comparison with coincident observations**
    - spatial feature variability (coastlines, thermal gradients, clouds, hot lava, fires, etc.)
- **Spectral**
  - **Comparison with simulations**
    - obs vs LBL RTA calculations; vary simulated instrument spectral response to minimize residuals (e.g., effective metrology laser wavenumber for FTS or channel SRFs for grating)
  - **Comparison with coincident observations**
    - compare obs to same-scene view high-spectral resolution measurements (i.e., a/c- or s/c-based FTS)
- **Radiometric**
  - **Comparison with other coincident observations and simulations**
    - compare varying scene temp, uniform scenes with other (a/c & s/c) observations/calculations
      - High-spectral resolution & broadband measurements
      - RTA calculations (using, e.g., lidar, radiosondes, dropsondes, a/c in-situ, NWP)

* *Applied to each detector, i.e. FTS band, grating channel, etc.*

Joint Airborne IASI Validation Experiment (JAIVEx)

US-European collaboration focusing on validation of radiance and geophysical products from MetOp (IASI/AMSU) and Aqua (AIRS/AMSU) to provide data and experience for NPP & NPOESS (CrIS/ATMS) Cal/Val and program risk mitigation

Location/dates
–**Ellington Field (EFD), Houston, TX, 14 Apr – 4 May, 2007**

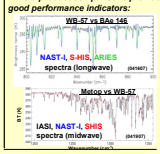
Aircraft
–**NASA WB-57 (NAST-I, NAST-M, S-HIS)**
–**UK FAAM BAe146-301 (ARIES, MARSS, SWS; dropsondes; in-situ cloud phys. & trace species)**

Satellites
–**Metop (IASI, AMSU, MHS, AVHRR, HIRS, ASCAT)**
–**A-train (Aqua AIRS, AMSU, HSB, MODIS; Aura TES; CloudSat; and Calipso)**

Ground-sites
–**DOE ARM CART site (RAOBS, Raman Lidar, AERI, etc.) & GOM (scene uniformity—radiometric, spatial, & spectral)**

Participants
–**LaRC, UKMO, UW, MIT, MIT-LL, NASA, IPO, EUMETSAT, ECMWF, + …**

In-field product comparisons provide good performance indicators:

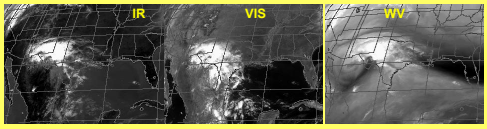


Abstract: The Joint Airborne IASI Validation Experiment (JAIVEx), a US-European collaboration focusing on validation of radiance and geophysical products from MetOp-A (IASI/AMSU) and Aqua (AIRS/AMSU), supports NPP & NPOESS (CrIS/ATMS) Cal/Val and program risk mitigation. IASI, launched 19 October, 2006 on MetOp-A, is the first operational advanced ultra-spectral resolution temperature, humidity, and trace gas sounding instrument to be flown on the Joint Polar System (JPS) of NPOESS and MetOp operational satellites for the purpose of improved weather, climate, and air quality observation and forecasting. This presentation details the extensive and unprecedented dataset resulting from JAIVEx, as well as illustrates the unique benefits achieved from implementing airborne assets, such as the NPOESS Airborne Sounding Testbed-Interferometer (NAST-I), within such cal/val campaigns.

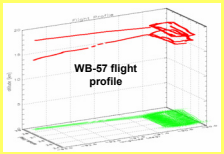
Case Study: 29 April 2007—JAIVEx

- **Flight mission objective**
  - Coordinated WB-57 and BAe-146 aircraft under-flight of Metop (1550 GMT) and Aqua (1919 GMT) satellites over northern Gulf of Mexico

GOES images of extended scene (1602 GMT)



- **Aircraft flight profiles**
  - WB-57 flew north-south-oriented oval racetrack pattern (@ ~ 17 km) in between satellite overpass events; BAe-146 characterized atmosphere and surface, from a range of altitudes below the WB-57

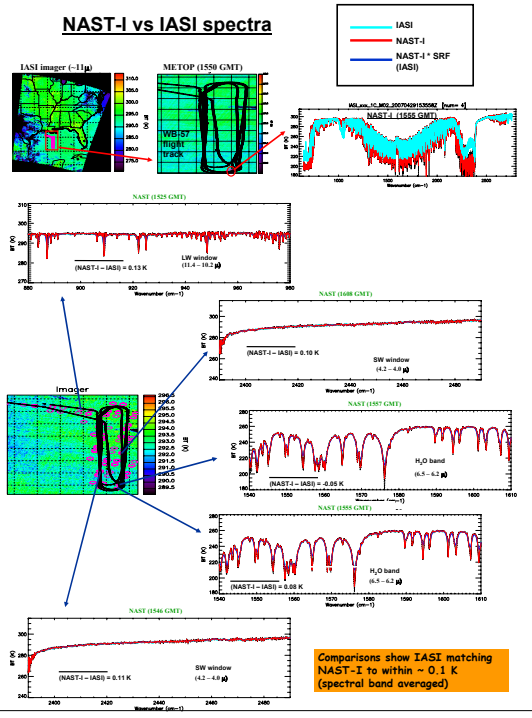


  - WB-57 arrived on-station 20 min prior to Metop, and remained until 10 seconds after Aqua (for a 3 hr & 50 min on-station duration). Conditions ranged from very clear on northern part of race track, to low, puffy cumulus sparsely populating southern extent of flight profile

Select preliminary results (29 April 2007): *Infrared Spectral Radiance* & *Geophysical Retrievals*

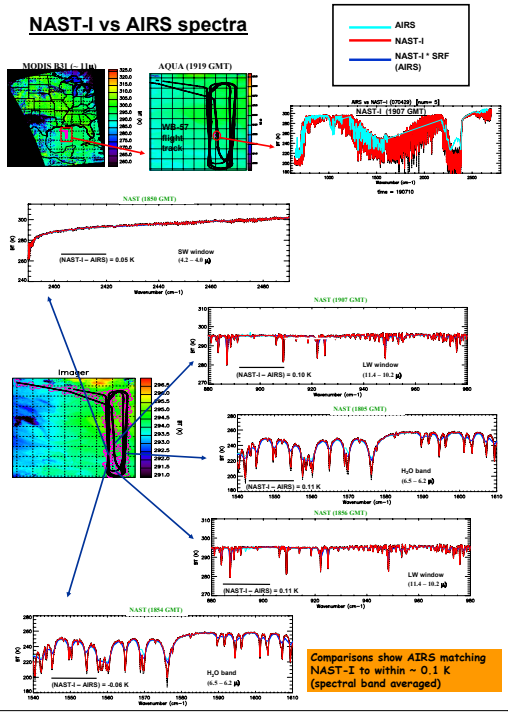
JAIVEx aircraft underfly both Metop (1550 GMT) & Aqua (1919 GMT) within single flight mission (042907) enabling a/c sensors to obtain space/time coincident observations with both satellites

NAST-I vs IASI spectra



Comparisons show IASI matching NAST-I to within ~ 0.1 K (spectral band averaged)

NAST-I vs AIRS spectra

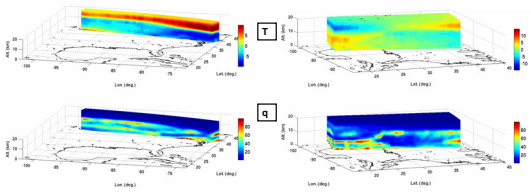


Comparisons show AIRS matching NAST-I to within ~ 0.1 K (spectral band averaged)

IASI temperature & water vapor retrieval cross-sections (Metop 1550 GMT overpass)

Cross-track x-section

Along-track x-section



Demonstrates high vertical resolution retrieval capability from IASI data

Summary and Conclusions

- Post-launch validation activities, including airborne field campaigns, are critical to verify quality of satellite measurement system (i.e., sensor, algorithms, and data products)
- High-altitude, airborne FTS systems enable NIST-traceable high-spectral-resolution comparisons with space/time coincident spaceborne measurements
- The need for exact spatial/temporal coincidence increases with the degree of scene non-uniformity
- **JAIVEx was a great success!**
  - –10 coordinated flight missions implemented under MetOp and Aqua overpasses
  - –Campaign data are proving to be very useful for IASI and AIRS product validation, and are serving to further refine methodologies for future advanced sounder validation activities (e.g., NPP & NPOESS CrIS)

Future National Operational Environmental Satellite Systems – Research to Operations, American Meteorological Society Annual Meeting, New Orleans, Louisiana, 22 January 2008.