Direct radiance validation of IASI - results from JAIVEx

Stuart Newman, Jonathan Taylor, Fiona Hilton, Andrew Collard, Bill Smith, Allen Larar and many others from the JAIVEx science team

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This presentation covers the following areas

• JAIvEx campaign overview
• IASI direct radiance validation
• Case studies available for research
JAIVEx overview

- The Joint Airborne IASI Validation Experiment (JAIVEx) was based in Houston, Texas in April-May 2007, combining measurements from FAAM BAe 146 and NASA WB-57 (interferometers, profile and surface measurements) in conjunction with MetOp overpasses.

- Campaign aim to collect collocated radiance and profile data for validation of IASI radiances in support of NWP satellite data assimilation and retrieval algorithms.
Collocated set of measurements

- IASI (MetOp)
- NAST-I, S-HIS (WB-57)
- ARIES (FAAM 146)
- Dropsondes $T, q$
- FAAM in situ $T, q$
- FAAM in situ CO, O$_3$
- ARM CART obs
- Surface $T, \varepsilon$
• 8 MetOp cal/val flights
• Sea – Gulf of Mexico
• Land – Oklahoma
• 2 night, 6 day flights
• All MetOp collocated
Gulf of Mexico 30/4/2007

AVHRR channel 1 image from MetOp on 30 April 2007
Radiative transfer simulations

- For case study select dropsondes released closely in time and space with clear-sky interferometer FOVs
- Construct profiles of temperature and humidity etc. for input to line-by-line radiation code; top-up above aircraft profile with NWP model fields
- Output line-by-line infrared simulated spectra for ARIES and IASI
- Compare observed spectra with simulated ones
Window region residual $\approx -0.2$ K
RT code differences

CO$_2$ line mixing?
Night flight on 20 April 2007 – ARM CART site Oklahoma

FAAM 146 and WB-57 flight track
Oklahoma emissivity

Average emissivity spectrum

4222 individual retrievals
Oklahoma emissivity cont.

Retrieved land surface emissivity
Oklahoma night flight 20070420, noise filtered ARIES spectra

Reduced emissivity at higher wavenumbers
Simulation includes retrieved emissivity
Dependence on emissivity

Residuals closer to zero with retrieved emissivity and temperature
JAIVEx case studies

• JAIVEx science team initiative to maximise use of campaign data set

• Case studies have been identified: well-characterised subset of data

• Clear-sky radiance fields of view selected

• Collocated atmospheric profiles provided

• Representative surface parameters included

• Freely available for academic research
JAIVEx case study
Gulf of Mexico 29 April 2007

JAIVEx case study
At comparable spectral resolutions

≈ 0.3 K range

Brightness temperature (K)

Wavenumber (cm⁻¹)
Conclusions

• JAIVEx represents a comprehensive data set for IASI cal/val and testing of retrieval algorithms

• IASI radiometric calibration validated to within 0.2-0.3 K both against other interferometers and best simulations

• ARIES retrieved land surface emissivity and skin temperature shows some skill when included in simulations of spectra from altitude

• JAIVEx case studies are available now to exploit this data set
Questions and answers
Oklahoma, 19 April 2007 (surface retrievals)

ARIES retrieved surface temperature from runs at 3000 feet

Avg. $T = 286.2$ K

Overpass time:
Avg. $T = 284.7$ K

Avg. $T = 283.6$ K