Monitoring and Assimilation of IASI Radiances at ECMWF

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ECMWF
Overview

- Operational Assimilation Configuration and Forecast Impacts
- Review of the information in the IASI spectrum
- Water
- Conclusions and Next Steps
First, a quick look at IASI correlated errors....
IASI Spectral Correlation

- Correlations from forecast model
- Covariance of first-guess departures
- Nearly diagonal instrument noise
- 1st 200 channels

16th ITSC, Angra dos Reis, Brazil. 7th May 2008.
IASI Spectral Correlation

Expected correlation structure from apodisation of IASI spectrum
Assimilation Configuration
Current Operational Configuration for IASI

- Operational at ECMWF since 12th June 2007
- 8461 Channels Received in NRT (c.f. AIRS: 324)
- All FOVS received; Only 1-in-4 used (FOV 1) (AIRS: 1-in-9)
- 366 Channels Routinely Monitored (AIRS: 324)
- Up to 168 channels may be assimilated in CO$_2$ band only (AIRS: 155 in CO$_2$ and H$_2$O bands)
- Variational Bias Correction
- Clear Channels Assimilated
Number of Clear Channels

High Peaking Channels

Window Channels
Comparison of Actively Assimilated Channels

\[ \sigma_{\text{obs}} = 1.0 \text{K} \]

\[ \sigma_{\text{obs}} = 0.4 \text{K} \]
First –Guess Departure
Standard Deviations in 15µm CO$_2$ Band

Calculated Std. Dev.

Observed Std. Dev.
Jacobians of 15μm CO$_2$ Band
IASI Forecast Scores: 500hPa Geopot. AC

NH

Forecast Day

IASI Better

SH

Forecast Day

IASI Worse

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168 channels assimilated ... 8293 to go
Using the IASI Spectrum
Longwave CO$_2$ Band

156 of 1st 500 channels are active
Adjacent channels not used because of oversampling
Other channels omitted because of ozone and humidity contamination
Using the IASI Spectrum
Shortwave CO$_2$ Band

Short wave temperature bands: 350 channels
Solar contamination, High Noise, Interfering species
Using the IASI Spectrum
Channels Primarily Sensitive to the Surface

2900 Window Channels
Using the IASI Spectrum
Trace Gases and RT Challenges

700 channels affected by non-LTE during the day

350 channels in the main ozone band

Many other channels (not shown) affected by $O_3$, $CH_4$, $NO_2$, $CO$ etc.
Using the IASI Spectrum
The 6.3μm Water Band

Water band
3800 channels
Water
Choosing 84 IASI H$_2$O Channels

Chosen from the 300 GTS Channels
Black channels have stratospheric contribution
Fit to other observations
84 IASI Water Channels

Best value at ~4K

Normalised to unity here
Choosing 10 IASI Water Vapour Channels

Grey channels are the 120 H₂O channels distributed via the GTS.
Fit to other observations:
10 IASI Water Channels

Best value at ~1.5K

Normalised to unity here
RH500 Forecast Impact
Root Mean Square Error verified vs Operational Analysis

1st-23rd August 2007

Expt Better
Cntrl Better
RH500 Forecast Impact
Root Mean Square Error verified vs Own Analysis

N.Hemis.

S.Hemis.

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Next Steps and Conclusions
Conclusions

- IASI is performing as expected
- The initial ECMWF implementation has focussed on the areas most likely to give positive impact (based on AIRS experience)
- IASI is providing positive impact on forecast scores – even using a system where AIRS is already used
- We aim to be able to use water band soon with appropriate weights (trading off #channels, obs errors and correlations)
Next Steps

- Use the water vapour band operationally
- Use over land
- Cloud affected radiances
- Use of compressed data
Obrigados
Thankyou