Monitoring and Assimilation of IASI Radiances at ECMWF

Andrew Collard and Tony McNally

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....
Correlations from forecast model
Covariance of first-guess departures
1st 200 channels

Nearly diagonal instrument noise
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 CO₂ Band

Calculated Std. Dev. ➤ Observed Std. Dev.
Jacobians of 15μm CO$_2$ Band
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 \( \text{O}_3, \text{CH}_4, \text{NO}_2, \text{CO} \) 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

MetOp HIRS-12 Tropics
Choosing 10 IASI Water Vapour Channels

Grey channels are the 120 H$_2$O channels distributed via the GTS
Fit to other observations:
10 IASI Water Channels

Best value at ~1.5K

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

1st-23rd August 2007

N.Hemis.

S.Hemis.

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

N.Hemis.

S.Hemis.
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