Comparison of IASI radiances with NWP models from four operational centres

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Bias and noise in IASI spectra may be identified by comparing the data with radiances calculated from forecasts and analyses from Numerical Weather Prediction (NWP) models. The bias and standard deviation of fit against model fields are compared for four operational centres: the Met Office, ECMWF, EUMETSAT and Meteo-France/CMS. Good agreement is found between IASI and the NWP fields from all centres, showing that IASI is performing within its specification. Investigation of where the comparisons differ or agree can be used to infer whether errors arise from the NWP model, the spectroscopy or the instrument.

1. The case study for intercomparison

The data used for the intercomparison consist of 24 hours of IASI observations from 00:00 on 8th June to 00:00 on 9th June 2007. 314 Channels are shown[1]

Each centre processed the data with their operational system (see Section 2 for details), and selected only night-time observations over the sea which passed cloud detection tests.

The data are compared with NWP forecasts or analyses by the use of a fast radiative transfer model. Differences between IASI and NWP model are shown as brightness temperatures.

Because of differences in processing, the number of observations used by each centre are not the same:

	Met Office	ECMWF	EUMETSAT	Météo-France
Number of Obs	12757	81620*	564	38800

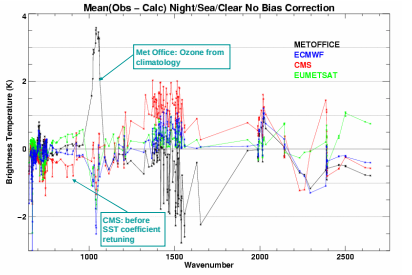
*clear channels only – around 6800 obs for surface-viewing channels

2. Data Processing at the Four Centres

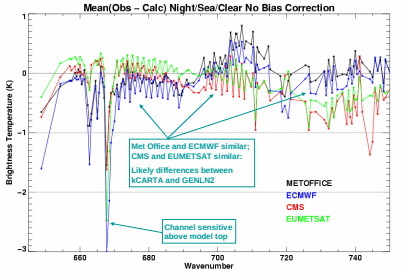
	Met Office	ECMWF	EUMETSAT	Météo-France
NWP Data	Met Office Forecast valid at observation time	ECMWF Forecast valid at observation time	ECMWF 6-hour Forecast; SST from AVHRR L1b	ECMWF Analysis; SST from AVHRR L1b
Fast Model	RTTOV 7	RTTOV 8	RTIASI	RTTOV 8 (with RTTOV7 predictors)
LBL model	kCARTA	kCARTA	GENLN2	GENLN2
Spectroscopy	kCARTA v24	kCARTA v24	HITRAN2000	HITRAN1996
Cloud Detection	Threshold on cloud cost taking into account model profile[2];Test of SD of 4 IASI pixels[3]; IASI-AMSU comparison[3]	Clear channel detection: rank channels according to cloud sensitivity[4]	Check on L1c-IASI AVHRR clusters within IASI FOV – 99% must be in 1 cluster	MAIA[5] on L1c-IASI AVHRR clusters; window channel Obs-Calc <2.5K

3. Intercomparison of Biases

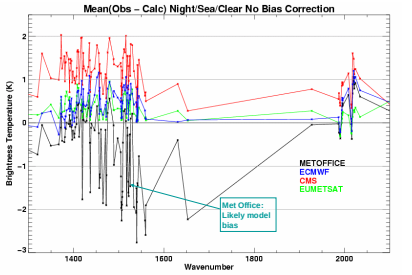
Full Spectral Range



15μm CO_2 band

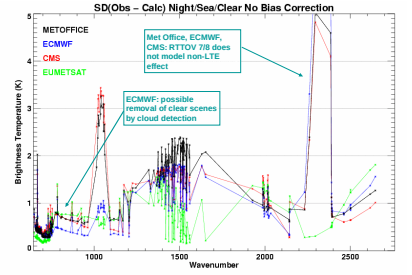


H_2O band

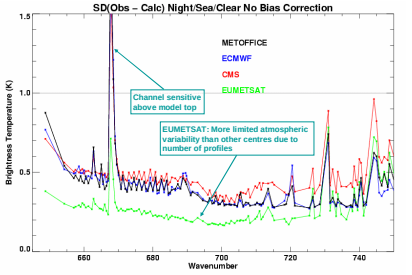


4. Intercomparison of Standard Deviation

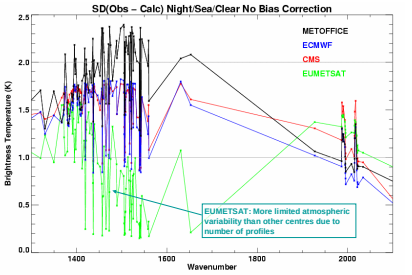
Full Spectral Range



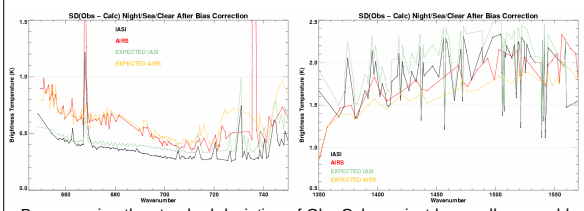
15μm CO_2 band



H_2O band



5 Met Office IASI fit compared to pre-launch expectation



By comparing the standard deviation of Obs-Calc against how well we would expect to fit IASI taking into account NWP errors, instrument noise and forward model error it is shown that the fit of NWP model to IASI is as good as we would expect.

A comparison of IASI against AIRS (processed in a very similar way) shows that, as expected from the instrument noise profile, the IASI fit is better in the 15μm CO_2 band and very similar in the H_2O band (it is not possible to compare the same wavelengths and especially for the H_2O band, differences in fit may result from the differing sensitivities of the exact channel selection)

6. Conclusions

IASI fit to operational NWP models are consistent between centres and differences can be explained by variations in data selection techniques, cloud detection methodology and radiative transfer models.

The intercomparison experiment can highlight opportunities for improving data processing

The fit of IASI is as good as expected prior to launch taking into account pre-launch estimates of noise, model errors and radiative transfer errors.

IASI compares favourably to AIRS, showing lower SD(Obs-Calc) in the 15μm CO_2 band

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