Comparison of IASI radiances with NWP models from seven operational centres

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Bias and noise in IASI spectra may be identified by comparing the data with radiances calculated from Numerical Weather Prediction (NWP) model data. The bias and standard deviation of fit against model fields are compared for seven operational centres: the Met Office, ECMWF, EUMETSAT, Météo-France/CMS (Lannion), Météo-France/CNRM-CNRS/GAME (Toulouse), Environment Canada and NRL.

Each centre processed the IASI observations with their operational system (see below for details), and selected only night-time observations over the sea which passed cloud detection tests. The IASI data are compared with NWP forecasts or analyses at each centre by the use of a fast radiative transfer model. Owing to differences in processing, the number of observations passing quality control is different for each centre.

The data used for the intercomparison consist of 24 hours of observations from 00:00 to 23.59 on 1 April 2008. 314 channels are shown in the plots[1].

1. Data processing at the seven centres

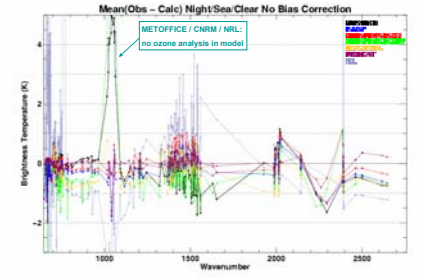
	Met Office	ECMWF	EUMETSAT	Météo-France/CMS	Météo-France/CNRM	Environment Canada	NRL
NWP Data	Global Unified Model forecast valid at observation time	ECMWF forecast valid at observation time	ECMWF 6-hour forecast; SST from AVHRR L1b	ECMWF Analysis; SST from AVHRR L1b	ARPEGE forecast valid at observation time	GEM parallel forecast (+AIRS) valid at observation time	NOGAPS forecast valid at observation time
Num Levs (model top)	50 (63km)	91 (80km)	91 (80km)	91 (80km)	60 (0.1hPa)	58 (10hPa)	30 (4hPa)
Horiz. Res at Eq	~60km	~25km	55km	111km	~30km Atlantic, 70km Pacific	~33km	55km
Is IASI Assimilated?	Yes	Yes	Yes	Yes	No	No	No
Fast Model (num levs)	RTTOV 7 (43)	RTTOV 8 (43)	RTIASI 4 (90)	RTTOV 8 (43)	RTTOV 8 (43)	RTTOV 8 (43)	pCRTM
LBL model	kCARTA	kCARTA	GENLN2	kCARTA	GENLN2	kCARTA	LBLRTM v9.4
Spectroscopy	kCARTA v24	kCARTA v24	HITRAN2000	kCARTA v24	HITRAN1996	kCARTA v24	HITRAN2000 + AER Updates
Emissivity	0.98	RTTOV (ISEM-6)	RTIASI	RTTOV (ISEM-6)	RTTOV (ISEM-6)	Masuda 1998	CRTM (IRSSE)
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]	All AVHRR pixels within FOV must be clear and 99% must be in one L1c-IASI AVHRR cluster	MAIA[5] on L1c-IASI AVHRR clusters; window channel Obs-Calc <2.5K	Clear channel detection: rank channels according to cloud sensitivity[4]	[6]. Complex comparison between window channel and model T_{surf}[7];Comparison of IASI-derived T_{skin} with model T_{surf}	O-B check on channel 1194 (943.25cm^{-1})

Good agreement is found between IASI and the NWP fields from almost all centres. The differences in IASI fit can be explained by variations in model resolution, data selection, cloud detection methodology and radiative transfer models. The NRL model shows greater deviation from IASI than the others: this is attributable to a low model top and the fact that IASI processing at NRL is not as far advanced as at the other centres so for this study only crude quality control and cloud detection have been applied.

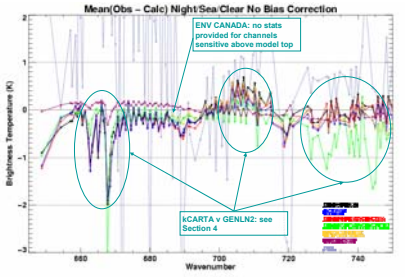
This type of intercomparison is a useful tool for operational centres to find problems with their data processing and to compare the performance of radiative transfer models. It can also help to diagnose model biases.

2. Intercomparison of bias

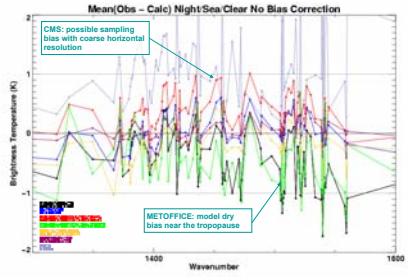
Full Spectral Range



15μm CO_2 band

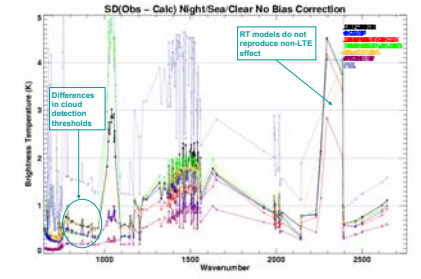


H_2O band

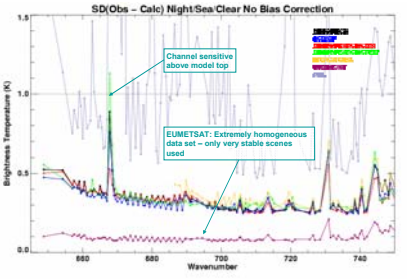


3. Intercomparison of standard deviation

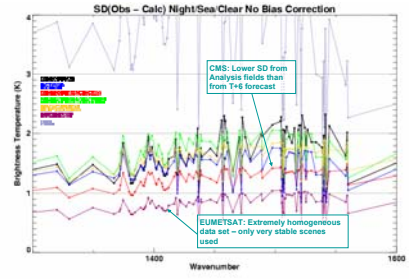
Full Spectral Range



15μm CO_2 band

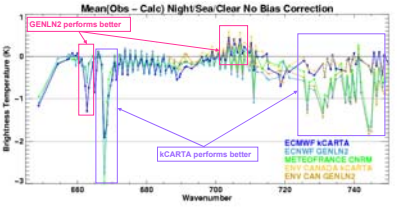


H_2O band



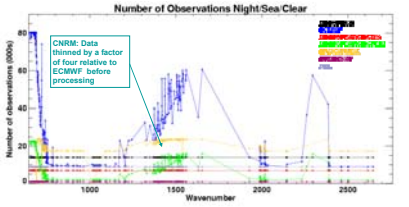
4. kCARTA v GENLN2

15μm CO_2 band



5. Observation counts

H_2O band



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