

The Met Office (U.K.) status report to 15th N. America-Europe Data Exchange Meeting at Silver Spring, MD, USA 25-27 June 2002

1.0 Introduction

This report describes changes to the use of U.S. satellite and in-situ data in the Met Office NWP models and other forecasting systems since the last US-Europe Data Exchange Meeting in May 2001. Changes to the Met Office NWP models and assimilation systems are now regularly documented in the NWP gazette which is available on line at:

http://www.metoffice.com/research/nwp/publications/nwp_gazette/

A brief status report on the EUMETSAT NWP Satellite Application Facility, co-ordinated by the Met Office which carries out satellite related activities, is also given below.

The relocation of the Met Office headquarters building from Bracknell to Exeter (~200km to the south west) is underway and is planned to be complete by the end of 2003. At that time the links will be established at Exeter rather than Bracknell.

1.1 Model and assimilation changes

A major change in the dynamical formulation of the unified model is about to be introduced together with an update of the model physics. The formulation includes the exact equations of motion in 3D, non-hydrostatic effects, semi-Lagrangian advection and a hybrid-eta co-ordinates in height. It will provide the scientific foundation for very high resolution modelling. More details are given in the June 2002 Gazette (see link above).

There have been no major changes in the data assimilation or data usage other than that described below.

1.2 ATOVS radiances

The brightness temperatures (BTs) in the Level 1B ATOVS datasets (HIRS, AMSU-A and AMSU-B) from NOAA-15 and 16, mapped to the HIRS fovs, are continuously monitored by comparing with calculated BTs from the 6 hour global forecast. The link to the monitoring plots has changed and can now be viewed at:

<http://www.metoffice.com/research/nwp/satellite/radiance/atovs/main.html>. Feedback on these plots is welcomed to atovs.nwpsaf@metoffice.com. Monitoring of the instrument housekeeping parameters also continues for AMSU-A and AMSU-B.

The Met Office generates Level 1C ATOVS datasets (i.e. geolocated brightness temperatures), which are passed to ECMWF and MétéoFrance and are potentially available to other European NWP Centres. The generation of level 1C NOAA-16 AVHRR parameters on the HIRS fields of view is also operational and provided to ECMWF. The ATOVS level 1C data are pre-processed to level 1D (i.e. brightness temperatures of all ATOVS channels mapped on to the HIRS grid) which are then used in the Met Office global NWP models. There are still significant delays in the ATOVS 1B files at some periods of the day due to the 'blind orbit' delays. A plot is given in Figure 1. A significant amount of data is missing the model main forecast run

cut-off and some even misses the update run to provide the first guess for the next assimilation cycle.

A change to the use of ATOVS radiances in the global model was implemented on 17 October 2001 which had two components. The first was to provide an improved sea-ice analysis which allowed the use of more ATOVS radiances over sea-ice. The forecast impacts were neutral in the N.H. but gave slightly better forecasts in the S.H. The second change was to modify the thinning algorithm to favour microwave observations in cloudy areas over clear observations as the model background is poorer in cloudy areas. This gave significantly positive benefits in the short range forecast.

Attempts were made to assimilate ASMU radiances in the mesoscale model, primarily to improve the humidity field but to date the analysis and forecast impacts have been disappointing. This work is being continued. Work also continues on developing a new radiance bias correction, expanding the use of both IR and microwave data over land/ice and the use of the AVHRR data to improve the infrared radiance assimilation.

1.3 Advanced infra-red sounders (IASI, AIRS)

Simulated AIRS data from NESDIS in BUFR are received routinely and being used to test our data pre-processing for AIRS. This is proving an excellent way to prepare our assimilation software to ensure we can make early use of the AIRS data in the 3D-Var assimilation. The day-1 system is to assimilate a limited number (~50 channels) of clear sky AIRS radiances. The Met Office plans to provide monitoring statistics of the AIRS radiances to NOAA and NASA as part of our participation with the AIRS science team once the data become available in near real time later this year. A study on information content of the AIRS channels confirmed the 281 selected by NESDIS do contain most of the information in the AIRS spectra. Liaison has also continued with NOAA on refining the format of the AIRS BUFR message. Work has started on developing cloud detection techniques for AIRS.

1.4 SSM/I & SSMI(S)

Orbit-by-orbit brightness temperatures are received from F-13, F-14 and F-15 in near real-time via the Washington-Bracknell link. These data are passed to ECMWF where they are BUFR-encoded and returned to Bracknell for onward transmission to other European centres.

The brightness temperatures are processed through a 1D-Var analysis which provides retrieved total column water vapour, surface wind speed and cloud liquid water path. Since February 13 2001 surface wind speeds from both F13 and F15 have been assimilated in 3D-Var and since 17 October 2001 the limit in number of observations was increased from 400,000 to 800,000 per 6 hour cycle. The surface windspeed analysis was improved with these extra data when compared with radar altimeter winds (not assimilated). Experiments are continuing with assimilating the total column water vapour. Difficulties have been encountered with how the model's hydrological cycle treats the additional water vapour amounts provided by the SSM/I retrievals.

It is planned to process SSMIS radiances as soon as they become available for comparison with the NWP model and ultimately to assimilate these radiances. The SSMIS and ATOVS 1D-Var pre-processing software are being merged to simplify the

radiance pre-processing once SSMIS replaces SSM/I. The Met Office continues to co-operate with FNMOC on BUFR definitions for SSMIS.

1.5 Scatterometers

Since 2001 Quikscat data have been received on the dedicated Washington-Bracknell link and passed on to ECMWF and KNMI and DNMI. The timeliness of the data has been acceptable for meeting the 3 hour cut-off. Assimilation trials with QuikScat data have been run which show a small positive impact on the forecast in the S.H. for a 4-week period during September and October 2001. It is planned to introduce Quikscat winds into operations in September 2002.

ERS-2 scatterometer data are not yet of a quality to be operationally disseminated, but are being monitored in readiness for an expected improvement with an enhanced ESA processing system planned for late 2002.

1.6 Altimeters and in-situ ocean data

The Met Office receives altimeter data products once a week from the DUACS/SSALTO centre in Toulouse and assimilates them into the FOAM models which are run daily in the operational suite. Discussions have started on access to daily altimeter data products. Significant progress has recently been made towards agreement for operational access to the US Navy's daily altimeter data products produced by Navoceanano.

1.7 SST products

Retrieved AVHRR SSTs obtained from NESDIS in SATOB format continue to be used in the operational global SST analysis. Daily data from NESDIS at 1° resolution and twice weekly data at 0.5° resolution are being delivered to the Met Office.

NOAA-16 SSTs are retrieved from locally-received AVHRR data (covering N. Atlantic) for assimilation in the mesoscale model's SST analysis.

AATSR on ENVISAT was successfully launched on 1 March 2002. The instrument performance is nominal. The AATSR meteo SST product in BUFR format should be available from ESA in July 2002. In addition to the retrieved skin SST it includes the top of atmosphere mean radiances from both nadir and oblique views of the 3 infrared window channels together with an estimate of the number of clear pixels within the 10 arc min cells. Access to this product is via ftp on the internet from ESRIN. Users must first submit a proposal to ESA on-line outlining their use of the data. The Met Office plans to process these data from skin SST to bulk SST for inclusion in a high quality climate model SST analysis. The skin SSTs are accurate to 0.3 K.

1.8 Sea-ice products

The NCEP sea-ice analysis continues to be used operationally in the global NWP systems. More details can be found at:

http://www.metoffice.com/research/nwp/publications/nwp_gazette/mar01/operate.html

The product is transferred over the internet at present as the GTS product cannot be reliably decoded at the Met Office.

1.9 Cloud-tracked winds

GOES IR winds (thinned to one per 2 deg box) continue to be assimilated and monitored. The details of the current use of the winds in the global model are at:

http://www.metoffice.com/research/interproj/nwpsaf/satwind_report/ukmodel.html

The monitoring results are at:

http://www.metoffice.com/research/interproj/nwpsaf/satwind_report/index.html

GOES WV winds are currently being trialed. In the next year, we plan to test the impact of GOES BUFR winds and NESDIS GMS winds. In particular, we will investigate how to use the additional quality indicator information in the BUFR format and hope also to have access to the GOES winds before they have gone through the auto-editor.

1.10 Polar and Geostationary Imagery

We receive NOAA GAC polar composites once or twice a day at Bracknell and these are used by the forecasters. We are currently investigating using images on the NOAA PSB polar WEFAX product internet site.

For geostationary imagery the GMS imagery is received from the Bureau of Meteorology passed through Bracknell and on through Lannion to EUMETSAT.

1.11 Tropical cyclone data

The arrangements with the National Hurricane Center, Miami are running smoothly. We receive their text warnings which are automatically ingested and used for generation of bogus data in our model. They receive the Met Office TC forecast text guidance messages and also access the model fields for use in their forecasting process. We also ftp Met Office TC forecast positions to NHC in 'adeck' format which can be input directly to NHC's ATCF system.

1.12 U.S. profiler data

The profiler data continue to be assimilated in 3D-Var. More data will be used when 4D-Var becomes available in 2003.

1.13 NWP SAF

The Met Office is leading the EUMETSAT Satellite Application Facilities (SAFs) for NWP in partnership with ECMWF, MétéoFrance and KNMI. It is now into its fourth year. More details of the NWP SAF's activities can be found at:

<http://www.metoffice.com/research/interproj/nwpsaf/index.html>

Highlights for the third year of the NWP SAF's activities were:

- AAPP V3 was delivered in February 2002
- SSMIS 1D-Var V1 was made available for Beta testing in Sept 2001 and V2 release is planned for July 2002.
- An updated version of the fast radiative transfer model code (RTTOV-7) was released in Mar 2002. It includes an improved microwave surface emissivity model (FASTEM-2), much improved water vapour channel simulation accuracy,

AIRS, MODIS, GMS and FY-2 have been added to the list of sensors supported and the code has been rewritten in Fortran-90.

- Co-ordination of the monitoring of observations for NWP has been improved:
 - Atmospheric motion winds with both ECMWF and Met Office monitoring plots available http://www.metoffice.com/research/interproj/nwpsaf/satwind_report/index.html
 - ATOVS radiances: <http://www.metoffice.com/research/nwp/satellite/radiance/atovs/main.html> where links to the Met Office, ECMWF, CMS Lannion, NCEP and NESDIS ATOVS monitoring are all listed.
- A 1D-Var retrieval module for ATOVS, AIRS and IASI has been developed and is available as a package to any interested users on request.
- SeaWinds preprocessing software and user manual has been released to HIRLAM.
- A selection of reports available from the website related to use of satellite data in NWP.

Max delay time 1 June 2002

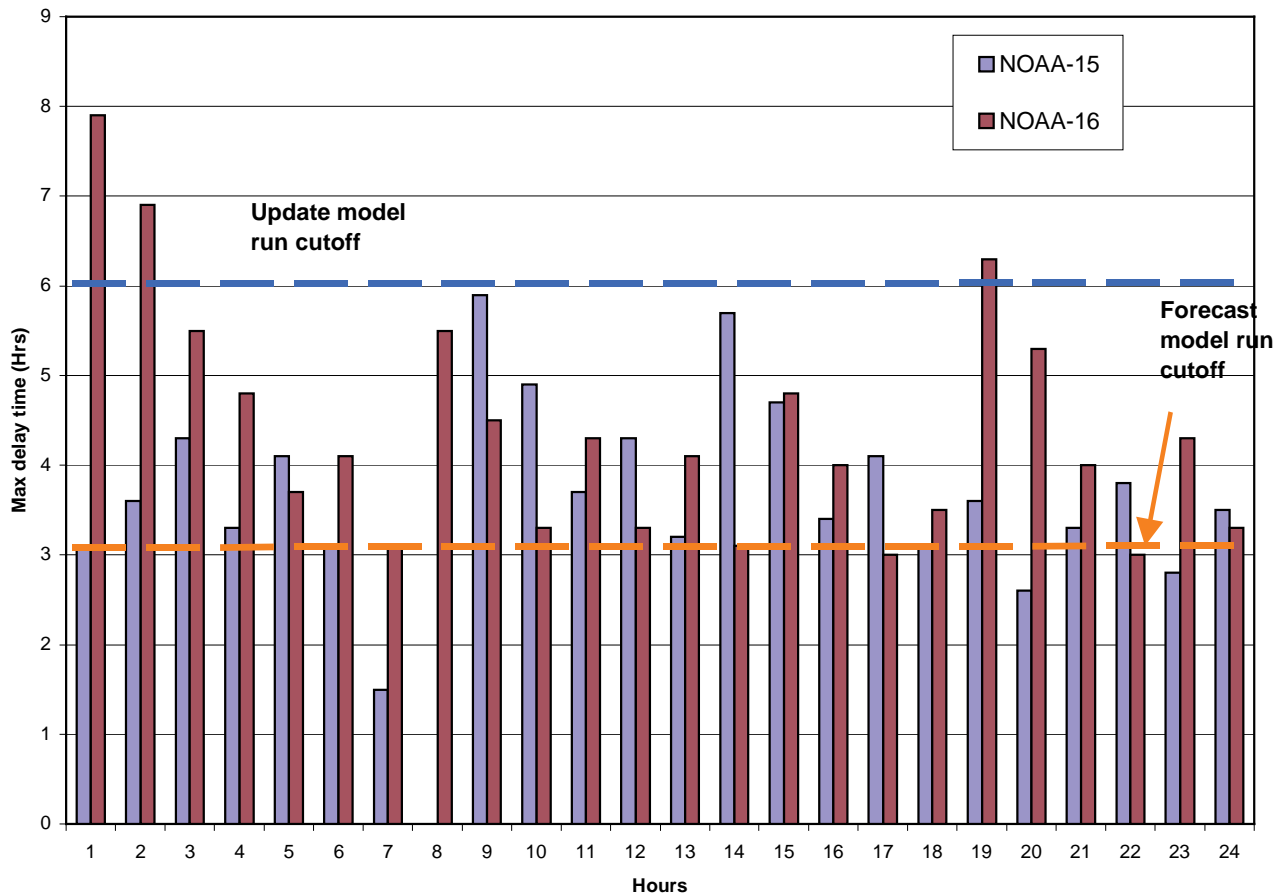


Figure 1 Data delay times for ATOVS 1B files at the Met Office. The delay refers to when all the HIRS, AMSU-A and AMSU-B files have arrived.