The need for faster delivery of satellite data to NWP centres

Roger Saunders, Met Office

The Met Office assimilates satellite data in global, regional and mesoscale models using a 3D variational analysis. In recent years the requirement for the timeliness of these data has changed because of the increasing demands on the Met Office to deliver its forecasts to the customer as quickly as possible. Before December 2002 a 3 hr data cut-off (from analysis time) was used but since then this has been reduced to a 1hr 50 min cut-off resulting in a significant fraction of the satellite data received not arriving in time to be assimilated in the main model run which provides the analysis for the forecasts. An update model run with a data cut-off of 7hrs does include nearly all the data which provides the first guess for the next assimilation cycle so at least the 'late' observations can influence the next analysis through the background.

The data with the most impact on the forecasts are ATOVS radiances, which are received from NOAA/NESDIS via a dedicated link. An analysis of data delay times for NOAA-15/16/17 data shows that at some times of the day the delay can be as much as 6 hrs due primarily to the 'blind' orbits where the data has to be downloaded from the satellite via the on board tape recorder. These delays are experienced by all NWP centres. In order to obtain more timely ATOVS data the Met Office is now receiving data from the EUMETSAT ATOVS Retransmission Service (EARS), which provides data within 30 mins of observation time using a network of HRPT receiving stations. The global data from NESDIS and EARS ATOVS data are routinely compared as a check on the geolocation and calibration of the two data sources. One issue is that the HIRS calibration is not as accurate for the EARS data because of the lack of past data around the orbit and so the Met Office only plans to assimilate AMSU data from EARS in the first instance. Figure 1 shows the benefit of including EARS data over the N. Atlantic as far more data (75% for EARS vs 25% for global) get into the main model run. It is planned to assimilate EARS data in both the global and EUROLAM models at the Met Office. Other satellite datasets are less affected regarding the choice of data cut-off time although the atmospheric motion wind vectors (AMW) from the Japanese GMS-5 satellite were not always received for the 1:50 cut-off. This has recently improved with the GOES-9 satellite, which replaced GMS-5. MODIS polar AMWs arrive very late (5-6 hrs) and so they can only influence the update runs. Even conventional data volumes (i.e. radiosondes and AMDARs) were reduced by 10-20% by reducing the cut-off from 3:00hrs to 1:50hrs.

To demonstrate the impact of the ATOVS data delay an experiment was run where the 'late' ATOVS data (up to 50% more data) was included in the main model analysis run to influence the forecasts. The experiment was run for over 3 weeks from 12 May to 4 June 2003 with data from NOAA-15/16/17 all included. For the update run the same data was used in both runs. The forecast impacts are shown in Figure 2, which demonstrates that apart from the Tropics the addition of the 'late' data is beneficial to the forecasts at least in the short to medium ranges in both hemispheres. In addition time series of the forecast 500hPa geopotential height showed some evidence of the additional ATOVS data reducing bad forecasts in the N. Hemisphere. For the S. Hemisphere the improvement in forecast skill was more consistent on all days. This underlines the importance of improving the timeliness of satellite data for NWP centres.

In the short term European Met Services will benefit from the use of EARS data, for ATOVS, but longer-term satellite agencies need to be aware of the new requirement of NWP centres to make their data available within 30 minutes of measurement time and plan accordingly. The same is also true for the conventional in-situ observations.

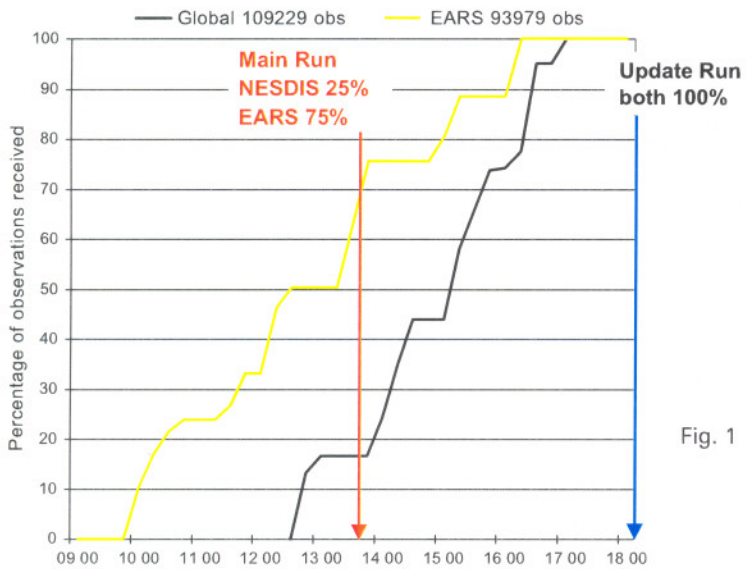

Fig. 1 Arrival times of ATOVS data at the Met Office for the N. Atlantic region in a 6-hour assimilation window. NESDIS data (black line) refers to the global dataset from Washington and EARS (yellow line) refers to the data provided by the EUMETSAT EARS service.

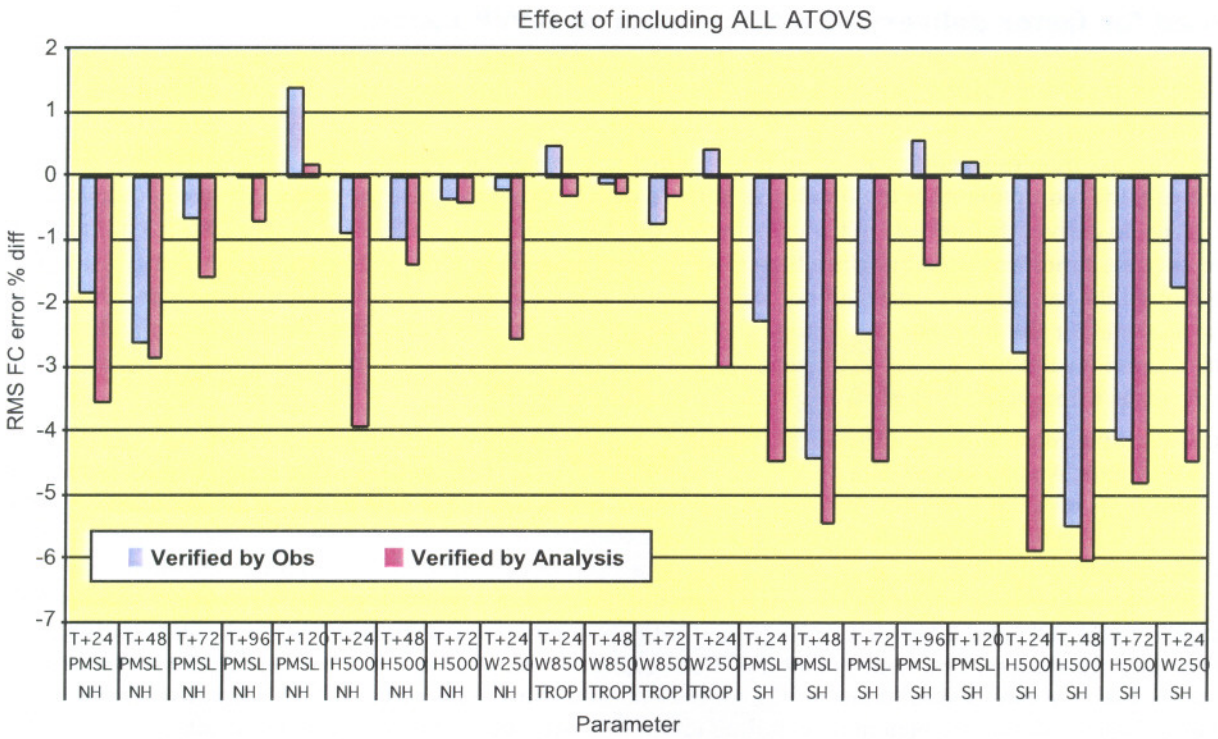

Fig. 2 Forecast impacts of including 'late' ATOVS data in main-model run for period 12/5/03 to 4/6/03. Values below the zero line show forecast improvements.