Recent advances in the use of satellite data in the French NWP models

Météo-France/CNRM-GAME/GMAP

Summary: The use of satellite data in the French NWP models at global (ARPEGE) and regional (ALADIN) scales is described. In the last year, a lot of effort had been dedicated to the assimilation of data from the MetOp satellite (ATOVIS, ASCAT and IASI). The operational assimilation of ATOVIS and ASCAT has been performed. IASI channels are taken into account in the current E-suite. Another major milestone has been the operational use of GPS radio-occultation data from the COSMIC, CHAMP and GRACE satellites mid-2007. METEOSAT CSR data are also being introduced in the global model (in the regional model ALADIN, a fine resolution radiance product provided by the CMS in Lannion is used instead). In terms of algorithmic development, an improved parameterisation of microwave emissivity allows a better use of these data over land, as investigated in particular over Africa during the ANIMA field experiment period. Another major development was the introduction of a variational bias correction algorithm for radiances based on the one developed at ECMWF.

GPS-RO, ATOVIS on MetOp (AMSU-A, MHS, ERS)

Variational Bias correction (VarBC)

- VariBC operational in ARPEGE 4DVar since February 2008 for radiances
- ALADIN 3DVar uses the coefficients computed for ARPEGE, except for SEVIRI radiances at high resolution for which specific computations have been performed

VarBC main principles:
- Satellite radiance data have systematic biases that have to be removed before the assimilation
- These biases can depend on the scan angle and on the flow
- They can be explained by predicted values such as pressure of the scanned areas
- These information are transmitted to the assimilation centre
- In the VarBC scheme, coefficients of the regression are dynamically adapted at each analysis step
- They are included in the control variable of the assimilation, and they use the observation-minus-background (or analysis-minus-analysis) as a start value (see Dez 2005, Audigane et al. 2007)

Impact on forecasts:

In the last year, a lot of effort had been dedicated to the assimilation of data from the MetOp satellite (ATOVIS, ASCAT and IASI). The operational assimilation of ATOVIS and ASCAT has been good enough to meet the NWP requirements

GPS-Ro assimilation:
- Assimilation of bending angles from COSMIC/CHAMP/GRACE between 1 and 18 km
- Ad hoc quality control to discard data reporting abnormal propagation conditions (e.g. super-refraction) (Paul et al. 2008)
- Observation operator from ECMWF

Innovation RMS error are reduced for channel #219 (699.50 cm

Meteosat-8 & SEVIR Clear Sky Radiances:

- Hourly 16x16 pixels super observation that includes a percentage of cloud
- Assimilation in ARPEGE 4DVar of 2 W channels with a thinning of 250 km
- Only data that are cloud free over 70% are considered

Positive impact on precipitation forecast, mainly over Africa

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Emissivity parameterization over land

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