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Impact of advanced infrared sounder radiancesin the french global numerical weather prediction ARPEGE model.

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The Atmospheric Infrared Sounder (AIRS) onboard Aqua and the Infrared Atmospheric Sounding Interferometer (IASI) onboard METOP belong to a new generation of advanced satellite sounding instruments. They provide information with spectral resolution far exceeding that of previous sounders (HIRS). The aim of this presentation is to describe the developments performed at Meteo-France to assimilate the IASI and AIRS radiances for clear and cloudy observation conditions, over sea and over land.

Currently, 54 AIRS channels and 64 IASI channels are assimilated in operations, both in the global model ARPEGE 4D-Var and in the limited-area model ALADIN 3D-Var. They both provide information on temperature mainly from 50 hPa down to 650 hPa. Clouds are detected using the McNally and Watts (2003) method, which enables to have a cloud flag for each channel in a profile. Data are bias corrected with an adaptative variational method (namely VarBC), using geometric and flow-dependent predictors. In addition, 270 AIRS channels and 250 IASI channels are monitored. IASI data are assimilated both over sea and over land and sea-ice (specific subsets of channels are discarded over sea ice or over land), whereas AIRS data are only assimilated over open sea.

Indeed, cloud affected radiances used to be rejected from the ARPEGE model (90% of total observations). The under-exploitation of these sounding instruments and the fact that sensitive regions (where forecast error can rapidly grow) are often cloudy, motivated our research efforts to assimilate AIRS and IASI cloudy radiances. The assimilation of AIRS radiances affected by low clouds inside the 4D-Var assimilation scheme has been implemented in the operational configuration. The approach is based on the use of cloud parameters, the cloud-top pressure and the net emissivity calculated offline by the cloud-characterization algorithm CO2-Slicing. These cloud parameters are then provided to the radiative transfer model RTTOV to simulate cloudy radiances from the background into the observation operator. Experiments assimilating AIRS cloud-affected radiances showed a significant positive impact on the forecast especially for long-term forecasts. The positive impact of the AIRS cloudy radiance assimilation had also been studied on a September 2006 meso-scale mediterranean cyclogenesis.

In research mode, a great part of our work deals with the improvement of the data assimilation of IASI, especially for cloudy systems. The CO2-slicing approach used to assimilate AIRS cloudy radiances is currently extended and adapted to IASI data. The impact of the additional cloudy IASI radiances will be studied with global forecast scores and through impact studies on Atlantic storms of January 2009. The assimilation of IASI radiances is also extended to some water vapour channel and is currently evaluated. First results showed a positive impact on the forecasts.