Assimilation of IASI All-sky radiances for Numerical Weather Prediction.

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ABSTRACT

Infrared (IR) observations represent a significant proportion (80%) of the observations assimilated for numerical weather prediction (NWP) at Météo-France. These observations are sensitive to various variables, such as non-precipitating hydrometeors in cloud tops.

The IASI instrument accounts for the majority of IR observations assimilated in the ARPEGE model. With its 8461 channels, it measures the radiation emitted by the top of the atmosphere in the thermal infrared (3.6 µm-15.5 µm) and is sensitive to temperature, water vapour and ice cloud.

For the moment, IASI observations are only assimilated in clear sky conditions. Given that 80% of IR measurements are impacted by clouds, the assimilation of cloudy data could provide new observations to be used in NWP models and thus improve forecasts.

At Météo-France, global NWP system is based on the ARPEGE model, which provides forecasts up to 5 days. As IASI infrared data are currently assimilated into ARPEGE under clear sky conditions, the all-sky approach would enable to gain a better knowledge of the initial state of cloud zones. Differents research projects are currently underway on this subject at various meteorological centers.

Kozo Okamoto (2017, 2023) has tested all-sky assimilation for 3 water vapor channels of the AHI instrument in the Japanese regional and global model. At the European Centre for Medium-Range Weather Forecasts (ECMWF), all-sky assimilation has been tested for 7 IASI water vapor channels (Geer, 2019).

The aim of this work is to develop and implement the all-sky assimilation of IASI into the ARPEGE model. However, several key steps are required to achieve this, starting with setting up and evaluating the cloud simulation of IASI observations with the radiative transfer model RTTOV. Another key point for the all sky assimilation is to correctly estimate the observation error matrix with respect to the cloudiness. These errors are larger in cloudy situations than for clear sky and inter-channel correlations are increased for cloudy observations.

This poster will present the results and diagnostics of the IASI cloud simulation implementation. It will also present the first results of the observation error matrix that will be used for all-sky assimilation.