Forecast sensitivity observation impact diagnostic tool
with an observation-based objective function

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Abstract:

The observations and model performance assessment is of crucial importance to advance in weather forecast. In general, standard verification tools are applied that compare forecasts with verifying analyses. However, verifying against own analysis or against operational analysis can produce rather different results, which can lead to opposite conclusion. Verifying the forecasts against observations would provide a more objective verification field. So far only radiosonde observations have been used for verification purposes, hence, clear cut conclusions cannot be drawn for areas poorly observed by radiosondes (e.g. oceans). A very powerful verification field would be the one constituted by all the available and possibly quality controlled ground and satellite based observations.

In this talk, a forecast sensitivity observation impact observation-based norm (FSOI-J^f_o), which consists of the sum of the 24 hour forecast departures squared and normalized by the observation error variances, is presented. To assess the impact of the assimilated observations on the 24 hour forecast, the forecast departures are computed for all the observations available in the 12 hour window a day later.
The new objective function provides a verification field independent from the model and therefore able to disentangle the degradation due to model bias with respect to the degradation due to the observation quality. Such an objective function better represents the impact of observations that are not directly related to the model parameters as for example atmospheric composition observables. The objective function is normalized by the observations accuracies, which provide different weights distribution throughout the atmosphere with respect to the energy weights used so far. For this reason, FSOI-J^f_o shows a larger observation impact than FSOI-J^f_e (FSOI using the energy norm objective function) in the stratosphere and smaller in the troposphere. FSOI- J^f_o measure correlates better than FSOI-^f_e with the DFS. It is also found that in general a few percentages larger observation number contributes to the decrease of forecast error when the observation based objective function is used in FSOI.