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Implementation of spatial correlations in the background error covariance matrix in the BASCOE system.

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As part of the MACC project, the Belgian Assimilation System of Chemical ObsErvation (BASCOE) is producing NRT daily analyses of the EOS-Aura-MLS stratospheric chemical measurements (http://macc.aeronomie.be). The current (4D-Var) system is running at 3.75° longitude by 2.5° latitude by 37 vertical levels from the surface up to 0.1 hPa with a diagonal background error covariance matrix. In order to improve the analyses (and their forecast) and also to allow BASCOE to run at a higher resolution, a formulation of the BECM including spatial correlations is required.

In addition, as part of the Belgian-Canada collaboration BACCHUS, it is planned to develop a strict comparison between ensemble Kalman filter (EnKF) and 4D-Var assimilation using the BASCOE model, using the expertise in error covariance modelling available at the Canadian Meteorological Center.

The new background error covariance matrix (BECM) consists in the product of a variance error matrix defined on the model grid and a correlation matrix defined in the spectral space. In this formulation, several parameters of the assimilation system need to be optimized, i.e. the background and observational error variances as well as the vertical and horizontal background error correlation lengths. The BECM formulation is setup as non-separable, i.e. the horizontal correlation lengths differ from one vertical level to another. This communication will present the new formulation of the BASCOE BECM and an application to EOS-Aura-MLS observations for a selected time period. These analyses will be compared to the NRT analyses (diagonal BECM) as to independent observations. Since our formulation is based on non-separable models, the hypothesis on non-separability will also be examined.