# Development and Operational Implementation of Flow-dependent Wavelet-based Correlations using the Ensemble 4D-Var at Météo-France

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A variational ensemble data assimilation system is being run at Météo-France since 2008 ([1]), in order to estimate and provide flow-dependent error variances to the deterministic 4D-Var system. It is also used in order to initialize the global ensemble prediction system. This ensemble data assimilation system has been designed to simulate the error evolution of the deterministic 4D-Var system, and it now also includes a model error estimation and representation ([2]), which relies on the comparison of ensemble- and innovation-based estimates of error variances.

With respect to background error correlations, a flow-dependent wavelet approach has been developed and experimented ([3], [4]), based on sliding 4-day averages, and this is planned to become operational at Météo-France in July 2013. Wavelets are functions which vary in terms of location and scale, which means that e.g. wavelet error variances contain information on geographical variations of error correlations.

A static version of wavelet-based correlations can be estimated in order to capture "climatological" heterogeneities, but this does not allow weather regime dependencies to be represented. A flow-dependent version has therefore been experimented at Météo-France. It is based on the use of sliding 4-day averages, in order to estimate associated time variations in a robust way.

Such a flow-dependent wavelet approach is also a way to filter sampling noise through the use of implicit local spatial averages of ensemble correlation estimates. The foundations and results of this wavelet filtering will be shown using examples from the Météo-France ensemble data assimilation. The connection and distinction with other filtering approaches (such as the Schur filter in gridpoint space) will also be discussed.

## References

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[3] Varella, H., Berre, L., and Desroziers, G., 2011 : Diagnostic and impact studies of a wavelet formulation of background error correlations in a global model. Quarterly Journal of the Royal Meteorological Society, Volume : 137, Issue : 658, Pages : 1369-1379.

[4] Berre, L., Varella, H., and Desroziers, G., 2013 : Modelling of flow-dependent ensemble-based background error correlations using a wavelet formulation, in preparation.