

Towards a Longer Assimilation Window in the IFS 4D-Var

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Several studies in recent years have shown that there are theoretical benefits to the use of a weak-constraint formulation and a long assimilation window in 4D-Var. We will focus in this presentation on the strategy to increase the length of the assimilation window in ECMWF's operational forecasting system, the IFS. We will present the challenges in implementing long window weak-constraint 4D-Var, both technical and scientific.

Most operational 4D-Var implementations assume that the model being used is accurate enough that model error can be neglected over the length of the assimilation window. This assumption is one of the factors that limits the length of the assimilation window in practice, it is removed in weak-constraint 4D-Var. The full implementation of weak-constraint 4D-Var implies a four dimensional control variable and requires significant technical changes in the system. This will be achieved in a new framework: the Object-Oriented Prediction System (OOPS).

Some aspects of long-window weak constraint 4D-Var, such as convergence issues, preconditioning and nonlinearity are already being studied in the context of OOPS (see talk by M. Fisher).

At the same time, other aspects are addressed in the current system. A simpler implementation of weak-constraint 4D-Var, aimed at estimating the systematic component of model error has been implemented in operations in 2009. From this initial implementation, experience has been gained in estimating the model error covariance matrix and in increasing progressively the assimilation window length. A 24-hour assimilation window is already being used in the context of the 20th century reanalysis and is planned for operational implementation at ECMWF by the end of 2013. Pre-operational testing results will be shown with the full observing system and at full resolution.