EMS Annual Meeting Abstracts
Vol. 7, EMS2010-290, 2010
10th EMS / 8th ECAC

High resolution climatology
- towards climate change services

A simple stochastic model for testing ensemble data assimilation methods at the convective scale

M. Würsch (1) and G.C. Craig (2)

(1) Meteorologisches Institut der Universität München, Theresienstr. 37, 80333 München, wuersch@meteo.physik.uni-muenchen.de, (2) Meteorologisches Institut der Universität München, Theresienstr. 37, 80333 München, george.craig@lmu.de

The new generation of high resolution numerical weather prediction models establishes new chal-lenges for data assimilation. They are able to (at least partially) resolve the dynamics of cumulus convection and may potentially benefit from the assimilation of high-resolution data sources like radar. Conventional data assimilation methods are likely to have difficulties in this context because of:
a) The nonlinearity that is associated with the rapid evolution of convective clouds, and b) The non-Gaussianity of error statistics in a highly intermittent cloud field.
Most simplified models that are currently used to develop data assimilation methods, including the Lorenz-96 or quasi-geostrophic models like AMIC (Ehrendorfer, 2008) were not conceived with the convective scale in mind, and therefore do not encounter these problems. Here we propose a simple stochastic model that is suitable for the convective scale. The model is based on a simple stochastic treatment of convective clouds that are defined by a half-life and an average density. These two parameters define the evolution of the cloud number at a gridpoint and the statistical properties because they are related to the birth and death probabilities per timestep. During every timestep there is a certain probability for each cloud to be dissolved and a new one to emerge.
With this very simple model we test different assimilation schemes, in particular, the ETKF (En-semble Transform Kalman Filter), SIR (Sequential Importance Resampling) and their local formu-lations. To magnifiy the impact of these methods the model is assumed to be perfect and the obser-vations have no error.
With this simple model we are able to:
i) Determine how the different assimilation schemes behave and under what conditions they con-verge to the real solution.
ii) Examine the effects of varying parameters like the number of grid points, the number of observa-tions used, the number of ensemble members or the cloud half-life.
iii) Find out how these parameters relate to each other and affect the ensemble root mean square error and spread.
iv) Investigate the frequency of observations required to allow the assimilation scheme to mirror the observations.
v) Compare the effectiveness of localisation and observation averaging in reducing the requried en-semble size.