Intensive Course on Data Assimilation
Buenos Aires, Argentina
27 October - 7 November 2008

SPEEDY EXERCISES

1) Using the script run_cycle.sh located (home/user/SPEEDY_DA/model/run) perform a 1 month simulation (with no assimilation) with the SPEEDY model.

2) 3DVAR error statistics.
a) Using the scripts stdev.gs , reg.gs , xcorr.gs and ycorr.gs available in /home/user/SPEEDY_DA/tdvar/dat_stat/ plot the standard deviation of the background errors, the correlation between the geostrophic wind and the wind and the horizontal length scale of the error correlation computed with the NMC method.
b) Compare the horizontal length scale of the different variables.
c) Analyze the horizontal distribution of the error standard deviation.
d) Analyze the distribution of the correlation between the wind and the geostrophic wind.

3) 3DVAR single observation experiments.
Following the instructions of the speedy guide perform the following experiments assimilation only one observation at a time.

a) Assimilate an observation of ps at 3 different locations (near the equator, in mid latitudes and near the pole). Analyze the impact in PS, U, V, T and q. Are these results consistent with the error statistics described before?
b) Obtain the response of the analysis increment to one T observation at model level 4. Repeat the analysis for U and q. Analyze the impact of each observations upon other variables. Which is the impact of a single q observation upon PS, T, U and V?

4) LETKF single observation experiments.
a) Repeat 2) a) but using LETKF. Which are the main differences between both experiments? Explain those differences.
b) Repeat 2) b) using the LETKF scheme. Which is the impact of a single q observation upon PS, T, U and V? Why?
c) Looking at the background spread assimilate an observation at a location of low ensemble spread and at a location of high ensemble spread. Note the differences between both cases and try to explain them.
d) Increase the vertical size of the local patch and repeat one of the experiments performed before. Find the differences between both experiments.
e) Test the sensibility of the scheme to the horizontal size of the local patch and to the observation localization parameter.

5) Multiple observations experiment:
Using the realistic observational network assimilate all the available observations using 3DVAR and LETKF. Compare the impact of the observations in areas of high ensemble spread and low ensemble spread.

6) Analysis cycle simulations.
Given the following experiments consisting of two month of data assimilation with the realistic observation network but different variables being assimilated:

- 3DVAR_FULL (3dvar all variables)
- 3DVAR_NOT (PS, U and V only)
- 3DVAR_NOUV (PS and T only)
- 3DVAR_NOQ (PS, U, V and T only)
- 3DVAR_SUPUPPER (rawindsonde data only at 00 and 12 UTC)
- 3DVAR_NOERRSTAT (use prescribed values for the length scale and assume no intervariable correlation instead of using the error model statistics, only U and V are observed).
- LETKF_FULL (letkf all variables)
- LETKF_NOT (PS, U and V only)
- LETKF_NOUV (PS and T only)
- LETKF_NOQ (PS, U, V and T only)
- LETKF_SKIP (all variables but performing the assimilation every 2 grid points)
- LETKF_SUPUPPER (rawindsonde data only at 00 and 12 UTC.
- LETKF_NOOBSLOC (no observation covariance localization experiment)

Compare the RMSE evolution of these experiments at the Northern Hemisphere mid latitudes, the tropics and the Southern Hemisphere mid latitudes.
¿How long does it take the analysis error to converge?
¿Why the error of the analysis is bigger in the Southern Hemisphere?
¿Why in some regions the analysis error is bigger than the observation error?
¿Why errors are larger in the NOUV experiments than in the NOT experiments?