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Sensitivity to the use of 3DVAR data assimilation in the numerical downscaling of precipitation over the Iberian Peninsula using WRF and WRFDA through the period 1990-1999.

Jon Saenz (1), Gabriel Ibarra-Berastegi (2), Ganix Esnaola (3), Agustín Ezcurra (1), Javier Díaz de Argandoña (4), and Santos J. González-Rojí (1)

(1) University of the Basque Country, Fac. Sciences and Technology, Applied Physics II, Leioa, Spain, (2) University of the Basque Country, School of Engineering, Bilbao, Spain, (3) School of Technical Engineering, University of the Basque Country, Donostia, Spain, (4) School of Technical Engineering, University of the Basque Country, Vitoria-Gasteiz, Spain

A numerical downscaling exercise over the Iberian Peninsula has been run nesting the WRF model inside ERA40. The Iberian Peninsula has been covered by a 15km x 15 km grid with 35 vertical levels. Three model configurations have been tested. The first one (NO_DA) follows the usual strategies used with numerical downscaling, after the model is initialised, the model runs forced by boundary conditions alone. The second experiment (DA12h) is configured the same way as the NO_DA case, but 3DVAR data assimilation is run every 12 hours (00Z and 12Z) using observations used during the preparation of ERA40 and obtained from the analysis feedback files from ERA40. The third experiment (DA06h) is configured the same way as the NO_DA case, but data assimilation of observations is performed every six hours (00Z, 06Z, 12Z and 18Z). Seasonally (monthly) varying background error covariance matrices have been prepared according to the mesoscale model configuration.

Daily precipitation values have been evaluated against daily observations from ENSEMBLES (9.0) and Spain 02 gridded datasets over the Iberian Peninsula.

Results show that, for area averaged precipitation, the results from all the experiments are quite similar and very close to observations. Seasonal precipitation averages show quite a good general agreement with the ones in E-OBS although with a higher spatial variability that is closer to the one in Spain 02 gridded data. It is similar to the topography over the area, and this suggests that the model reproduces spatial variability not present in one of the observational datasets. The seasonal biases of precipitation are lower for both DA runs than for the NO_DA one. Correlation coefficients of daily precipitation anomalies (after removing the seasonal cycle) show that both DA12h and DA06h experiments produce better agreement with observed precipitation. The Root Mean Squared Differences (RMSD) between model runs and observations are of the same order of magnitude than the one between observational datasets. Histograms of model runs and observations show that the model runs underestimate the amount of low precipitation events but produce a similar distribution of high-precipitation events. In terms of added value measured against the original coarse resolution model data (ERA40), the use of a twelve hour assimilation cycle yields better results than the use of a six hourly assimilation cycle.

The use of DA clearly improves the results of simulated precipitation (and also temperature, although not shown in this communication) and it should be seriously considered as an option during the generation of high resolution regional model model hind-casts.