EMS Annual Meeting Abstracts
Vol. 12, EMS2015-206, 2015
15th EMS / 12th ECAM

Uncertainties in the surface variables from an ensemble of reanalyses under UERRA project

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The Uncertainties in Ensembles of Regional ReAnalyses (UERRA) is a 4-year project financed by the European Union under its 7th Framework Programme SPACE. One of its main objectives is to provide a 50-year reanalysis dataset of surface essential climate variables at 5.5km grid at European scale, together with, as much as possible, uncertainty estimates. Additional information about the UERRA project can be found at http://www.uerra.eu.

The main purpose of this work is to investigate the uncertainties in the surface variables from an ensemble of high-resolution reanalyses at the European scale, on a chosen trial period. The reanalyses are produced with the MESCAN optimum interpolation system. The observations for 24-h accumulated precipitation (RR24) are taken from the ECA&D database, whereas the 2-m temperature (T2m) are from the Global Telecommunication System.

This study focuses on the ensemble of reanalyses of RR24, although the T2m reanalyses are also assessed. The ensemble of backgrounds is generated on a large domain encompassing Europe and Mediterranean basin through a multi-model approach by using two numerical models, namely ALADIN and ALARO. The two models have different physical parametrization and can be run, in turn, with two surface schemes, ISBA and SURFEX. In forecast mode, the models are coupled with the analyses created by the ALADIN 3D-Var system. Hence, a four-member ensemble can be produced. Furthermore, the background used for the precipitation analysis is taken as the difference between the accumulated fields at lead time t2 and t1 (t2>t1) from the same run started at 00UTC and must fit the daily climatological rain-gauge measurement (0600 UTC yesterday – 06UTC today). To enlarge the ensemble of backgrounds for precipitation analysis, differences of forecast ranges +54-30 h and +30-06 h respectively, spanning the same 24-h period are considered. Therefore, an eight-member background ensemble can be created. Among these members, some of them may be too close one another that they may lead to similar solutions in the subsequent reanalyses. These members are identified and removed from the ensemble. In order to determine the reliability of the ensemble of backgrounds and reanalyses, rank histograms are used. The distribution for each ensemble member will also be shown and discussed. In order to increase the sampling error of the ensemble of reanalyses, perturbed observations are used. The perturbation are generated from a normal observation error distribution with zero mean and an estimated error standard deviation. Thus, the reanalyses can be created by using the same set of perturbed observations or different sets.

The research leading to these results has received funding from the European Union, Seventh Framework Programme (FP7-SPACE-2013-1) under grant agreement no 607193.