

Regional European Reanalysis systems and production

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Abstract

Global Reanalyses have been carried out at ECMWF since the end of the 1970's and then at both NCEP and JMA. There have been several generations and periods of these analyses and with ever increasing resolution. In the later decades, from the end of 1990's a number of projects for regional reanalyses were launched to allow much higher horizontal resolution as well as certain additional local observation or particular coupling or downscaling reanalyses. Examples of these will be shown from the EU FP7 EURO4M project where both the Met Office and SMHI built and performed 3-dimensional reanalyses covering the whole Europe (EU-CORDEX) while Météo-France and SMHI built a surface downscaling system with analysis at even higher resolution of near surface observations and precipitation.

In the follow-on EU FP7 project UERRA (2014-2017) more model and data assimilation systems were employed, thereby adding a multi-model dimensionality to cover and gauge the inherent uncertainties. The reanalysis systems also included ensemble assimilation for all or parts of the period. The assimilation systems and the observations used will be described. The Met Office used a 4DEnsVar to estimate both error covariances for the 4D-VAR and uncertainties in the reanalysis. SMHI used the ALADIN 3D-VAR and DWD a nudging ensemble assimilation. The computation efforts were extensive and this could be a problem for state-of-the-art reanalysis systems at

high resolution.

The downscaling reanalysis at Météo-France was used to force a surface model and in turn a hydrological model and this was used to validate run-off and discharge in certain rivers.

There was an extensive evaluation across all the systems (also the DWD reanalysis together with their German COSMO high resolution reanalysis). The resulting reanalyses were in general similar and agreed quite well with special observation sets although wind-sheers, diurnal variations and extreme values were not always accurate. Particularly climate indices were difficult to reproduce. Still the data sets have proven a valuable source for consistent gridded data over many decades. Some problems have been revealed afterwards so it is vital to do an extensive monitoring during the production.

The SMHI ALADIN-HARMONIE reanalysis system with the MF downscaling is now continuing under a Copernicus Climate Change Service (C3S) contract financed by the EC and managed by ECMWF. The new system will be at 5.5 km with 106 levels and 10 ensemble members. More observations are used with many remote sensing data. Emphasis is put on data access and user support for the community at large.

It should also be mentioned that there are other sub-European reanalyses, like the afore mentioned COSMO but also the Irish MÉRA 2.5 km reanalysis.

Rescue of historical observations for climate research and reanalyses was also part of EURO4M and UERRA.

References:

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