Added values with the regional atmospheric reanalyses

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Abstract

Recent years have seen increasingly many regional high resolution atmospheric reanalyses being conducted at meteorological institutes. This follows the major success with the global reanalysese such as the ECMWF ERA climate dataset, offering the global climate community with a high quality, gridded, gap free and temporarily consistent climate record for the past decades. After 4 years of joint efforts by the nordic national weather services, a 30-year climate reanalysis dataset for the European arctic regions have been produced within the framework of the EU-funded Copernicus Climate Change Service. The Copernicus Arctic Regional Reanalysis (CARRA) is a climate dataset with an unprecedented quality and details for this region. A continuation to the CARRA climate time series is currently being organised for near real time delivery. In the coming years, the CARRA reanalysis is to be extended with full coverage to the entire Pan-arctic area. Using similar approaches and reanalysis system, multi-decades, high resolution climate dataset are currently also being produced in Europe, among others, for Denmark, Iceland, Ireland, Spain as well as for European continents. These high resolution, national to continental scale climate reanalsyes provide to the national and global climate community with a much enhanced tool for assessment about the recent and current climate states and trends, contributing to the worldwide efforts on climate adaptation and green transition.

Regional reanalysis utilises data assimilation and forecast infrastructure with a state of art regional numerical weather prediction (NWP) system, which is Harmonie-arome for the nordic countries. In the reanalsyis context, advantages with such system generally come from a much higer spatial resolution, thereby a better representation of the underlying surface conditions, and a better potential to resolve local climatology with some of the scales of extremes (such as convection, gust conditions etc.) closely associated with local conditions. Availability of large amount of local, especially surface in-situ observation data , which normally are out of reach for real time use at weather services outside of national territory, adds critical details for reproduction of smaller scale weather features. This in particular is of vital importance for the data sparse Arctic region, especially for the Greenland Icesheet, for which the data from the climate monitoring network GCnet and PROMICE fill in a huge gap over the vast geographic region with no regular meteoroloigcal observation. As a reanalsyis is about past weather. It is found that, in comparison to routine weather forecast with similar model system, due to the use of global reanalysis as lateral boundary, representation of large scale atmospheric parameters in a regional model, such as surface pressure and upper air parameter in wind, temperature and geopotential, is much improved and often more superior to the counterparts with the hosting model, which is seldom the case due to a use of time lagged boundary data in routine forecast. Hence, the relative advanateg of the higher resolution regional model on large scale parameters are exposed through the special setup with a regional reanalysis.

In this review talk, we examine performnace of reanalysese data in representation of general climatolgy and weather features with the CARRA reanalysis dataset and for Denmark. We also report the recent experimentation about impact of model resolution, significance with nonhydrostatic effects with the present Harmonie-arome forecast ssytem with 2.5 km grid, and the major challenge with the data assimilation system in the event of fast developing weather system in which correct observation risks to be rejected due to significant departure from the model first guess.

Acknowledgement: CARRA (Copernicus Regional Reanalsyis) project team and DANRA (Danish atmospheric Reanalysis) project team.