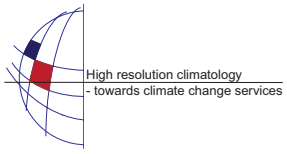
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-653, 2010
10th EMS / 8th ECAC



Reconstruction of highly resolved atmospheric forcing fields of Northern Europe for 1850-2009

F. Schenk and E. Zorita

GKSS Research Center, Insitute for Coastal Research, Geesthacht, Germany (frederik.schenk@gkss.de, (0) 4152 / 87 - 1888)

For the detection and attribution of changes in the ocean-climate of Northern Europe and for a better estimation of model uncertainties, long simulations are needed. These however, require spatial forcing fields of atmospheric variables at high temporal and spatial resolution. Therefore we reconstruct a long homogeneous and spatio-temporal highly resolved data set of atmospheric forcing fields for Northern Europe (70.5° N – 48° N and 5° W – 36.75° E) since 1850 AD. The reconstructed daily atmospheric fields comprise the variables SLP, zonal (U) and meridional (V) wind, T2m, rel. humidity, tot. cloud cover and precipitation with a horizontal resolution of 0.25° x 0.25°.

In order to reconstruct atmospheric fields from long historical daily station data (SLP, T2m), we use the analog-method as a simple time invariant non-linear upscaling method. For each day in the past, the day in a recent period with the most similar atmospheric fields (analogs) are found by searching the smallest Euclidian distance between the past and recent station data. The complete high resolution fields from the analog day are taken as the reconstructed fields for the target day in the past. The analogs for the large-scale atmospheric circulation fields (predictand) are taken from a pool of atmospheric fields from the Swedish Rossby Centre Regional Climate Atmosphere Ocean model (RCAO). The method is crosswise calibrated and validated for the periods 1958-1982 and 1983-2007 and applied for the period 1850-2009.

The general advantage of the analog-method is a realistic reconstruction of the variability, leading to similar amplitudes and magnitudes of extremes in the reconstructed fields. This can be clearly seen comparing the variance of the reconstruction with the reference data resulting in ratio of variance close to one. However, for events far in the past or future, the analogs are limited to already observed events making the method “blind” for events exceeding our already experienced limits. Having daily analogs of 50 years (N=18 231), this should be hardly the case for the period since 1850.

The reconstruction skills are strongly dependent on the variable and also partly on the season. Due to their low spatial degrees of freedom for our limited domain, large-scale features like SLP und wind are almost perfectly reconstructed for the period 1958-2007 by SLP station data. Precipitation generally yields good results for winter and lower skills for summer. Although the other variables suffer from their weak physical link to SLP as predictor, their skills are significantly better than their mostly used climatological means. A particular problem arises for the reconstruction of daily temperature, as at long-time scales, SLP is not the only factor affecting the long-term temperature trends. For temperature fields, a hybrid reconstruction scheme is adopted: the long-term variations are reconstructed based on monthly station temperature observations, to which the daily variability derived from the SLP station data is superimposed. From our results it can be concluded that the analog-reconstruction is a very useful upscaling method for spatio-temporal highly resolved atmospheric fields.