High-resolution simulation for the Alpine climate since 1958 – validation on monthly and daily timescales

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Within the EU project ALP-IMP a high-resolution regional simulation for Europe, focussing on the Greater Alpine Region (GAR) with its complex topography has been performed with REMO (REgional MOdel, Jacob and Podzun, 1997) for the period 1958 to 1998.
The dynamical core of REMO is based on the numerical weather prediction model EM (Europa Modell) of the German Weather Service and the parameterizations are taken from the ECHAM4 climate model of the Max-Planck-Institute for Meteorology. The simulation discussed here has a very high horizontal resolution of 1/6 deg on 20 vertical levels in the troposphere and lower stratosphere. It is driven by the 1.12 deg resolution ERA40 reanalysis through prescribing the values at the lateral boundaries and through forcing the large-scale wind field within the model domain by the spectral nudging technique (von Storch et al., 2000).
To validate the REMO simulation on different timescales, first, it is compared to the HISTALP monthly mean temperature station dataset for the GAR consisting of 131 long temperature series with a maximum length of nearly 250 years (Auer et al., 2005). Second, the simulation is compared to a daily mean temperature station dataset for Austria and Switzerland. To analyze whether the high resolution of the simulation leads to an added value in comparison to the ERA40 reanalysis, the reanalysis is also compared to both station datasets.
The comparison is done by calculating correlation, bias and root mean squared error between the stations and the corresponding model grid points. The resulting values are averaged over six subregions defined by Böhm et al. (2001), namely West (Maritime), East (Continental), South (Adriatic), Po Plain, Central Alpine Low Level (CALL) and High Level (>1400 m a.s.l., CAHL). As an indicator of the skill of REMO relative to ERA, the reduction of error has also been calculated. On the monthly timescale the higher resolution of REMO leads to an added value in comparison to ERA in winter and early spring and for the inner Alpine low and high level stations with more complex topography also in early summer. On the daily timescale REMO performs better than ERA during nearly the whole year for the inner Alpine regions and subregion West. The good performance of ERA can be explained by the fact that the observed temperature is an input variable for the reanalysis whereas REMO has to calculate the temperature.

References:

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