EGU24-12144, updated on 11 Aug 2024
https://doi.org/10.5194/egusphere-egu24-12144
EGU General Assembly 2024

Reconstruction of the atmosphere over the European Alps from 1850 to present using dynamical downscaling

Madlene Pfeiffer[1], Ben Marzeion[1,2], and Inga Labuhn[1]
[1]Institute of Geography, University of Bremen, Bremen, Germany
[2]MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany

The Alps are very sensitive to climate change and have experienced a strong increase in temperatures since the end of the Little Ice Age (1850 AD). This in turn influences the alpine glaciers, which are experiencing strong melting, further impacting geomorphological and hydrological processes in the high Alpine catchments. The combined change in climate and in prevalence of ice then has further impacts on erosional processes, biosphere, including local flora, and societies (e.g. by changes in the seasonal cycle of river runoff). In order to better understand small-scale processes, which are not well represented in climate observations and reanalysis products, as well as feedbacks and system interactions within the high Alpine Earth system, we have reconstructed atmospheric conditions over the European Alps from 1850 to present by dynamically downscaling global reanalysis data with the advanced research version of the Weather Research and Forecasting model (WRF-ARW) in a nested grid configuration with domains of 18-, 6-, and 2-km spatial resolution, respectively. To account for uncertainty introduced by the reanalysis, we have forced WRF with an ensemble of global reanalysis products. To quantify the errors, we compare our datasets to in-situ observations. In comparison to the reanalysis products that act as a forcing, we find an improvement in spatial correlation between the simulated and observed temperatures, as well as a better representation of precipitation patterns and amounts in the high-resolution domain. We present the first dynamically downscaled dataset over Europe (18 km), the entire Alps (6 km), and parts of central Alps (2 km), at high temporal resolution (3, 1, and 1 hour, respectively) that spans the entire period from 1850 to present.