Submitted Abstract

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Abstract

Mountain regions are naturally characterized by steep climatic gradients and a high variability of meteorological conditions over short distances and periods of time. At present, many open-source models are applied by the hydrological community (e.g., the hydrologically enhanced version of the Weather Research and Forecasting Modeling System (WRF-Hydro, Gochis et al., 2016) or the Community Water Model (CWatM, Burek et al. 2020)) to simulate hydrological processes at different temporal and spatial scales, often driven by comparatively coarsely resolved climate data, e.g. from reanalysis initiatives like ERA5 provided by the European Centre for Medium-Range Weather Forecasts (ECMWF). These data sets provide valuable climatic information, particularly in regions with scarcely available station recordings as well as for model application at larger (e.g., continental) scales. However, when hydrological simulations at higher spatial resolution or in mountainous terrain are envisaged, topographic effects (e.g., on shortwave radiation fluxes) are not sufficiently resolved when simply interpolating from the coarser grid of the meteorological input (typically 1-10 km resolution) to the finer grid applied by the hydrological model (typically 100-1000 m resolution), inducing systematic biases in the subsequent hydrological simulations.

The here presented R-package CliMapR includes different approaches for a quasi-physically based remapping of various meteorological variables as required as input for most hydrological models (e.g., temperature, precipitation, air humdity, solar and longwave radiation as well as wind speed). The remapping software combines algorithms available from previous studies (e.g., Corripio 2003, Liston and Elder 2006, Marke 2008, Marke et al. 2013) in combination with ordinary direct interpolation techniques to topographically adjust coarsely resolved meteorlogical input from gridded data sets as well as from point-scale station observations. The present version of CliMapR includes interfaces to many common data products (e.g., ERA5/ERA5Land data) as well as data formats (e.g., ASCII or netCDF format) and is easily extendable to deal with different data sources and formats in the future. As plots for the whole model domain and selected output locations are exported by default, the remapping tool is particulary suited to be applied in a teaching context. This poster presentation provides an overview of the software's functionality as well as an exemplary application in a hydrological context by using meteorlogical input remapped using CliMapR for the simulation of water fluxes in selected mountain catchments in Tyrol (Austria).