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Downscaling Precipitation in the upper Danube Catchment for Use in a distributed hydrological Model

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A statistical method is presented to downscale precipitation from a mesoscale atmospheric model simulation for use in a distributed hydrological model in complex terrain. The atmospheric model is assumed to operate on a much coarser grid than the hydrological model. Our downscaling algorithm consists of two steps. First, local subscale variability is estimated based on a high resolution observed climatology. Second, there is a bias correction, which constrains the downscaled model climatology to be equal to the observed climatology on the coarse grid. Combining both steps results in a local scaling factor for each day of the climatological year.

The method is applied to the upper Danube catchment which encompasses part of the European Alps and which is characterized by highly complex orography. The subscale variability generated by the first part of the algorithm strongly reflects the underlying orography, especially the narrow Alpine valleys. The bias correction leads to a redistribution of precipitation on the catchment scale and accounts for the well-known model deficiency producing too much precipitation in the inner Alpine regions and too little at the edges of the Alps. Preliminary analysis indicates significant potential of the method for its intended use.

A similar method is currently being developed for downscaling the simulated air temperature. A first analysis shows that this leads to a significant reduction of the RMS error between the simulated and the measured temperature time series at several locations