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Opportunities of the WegenerNet high-resolution precipitation dataset for hydrological modeling at small catchment scales

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Rainfall is the most important input in hydrological modeling. However, accurate estimation of the spatial rainfall distribution is subject to uncertainties, especially at sub-daily time scales. Some uncertainties are due to insufficient spatial representations of our observations and high variability of rainfall. Such uncertainty in rainfall data can directly affect rainfall-runoff simulations.
The WegenerNet (WEGN) in the southern alpine forelands of Styria, Austria provides the opportunity to investigate the effects of spatial uncertainty of rainfall on simulated runoff. The WEGN is a high-density climate network of 150 stations (about one per 2 km^2, 5 min sampling) in an area of 22 km x 16 km. It has measured precipitation, temperature, humidity, and other variables since the beginning of 2007, and recently completed its 11-year measurement cycle.
With this high-resolution dataset, we investigate the effects of spatial resolution of rainfall data on simulated runoff at the catchment scale (area of about 500 km^2) and in sub-catchments (areas of about 30 to 70 km^2). For this purpose, we use the hydrological model WaSiM (www.wasim.ch) on a 100 m grid with 30 min time resolution. Besides the question how many stations are necessary for reliable hydrological modeling, we test different interpolation methods (e.g., inverse distance interpolation, elevation dependent regression, Thiessen Polygon, arithmetic mean) and combinations.
Our study aims to better understand the role of rainfall as one of the main error sources in hydrological modeling. Moreover, we obtain a better understanding about uncertainties in applications of a rainfall-runoff model arising from the spatial variability of rainfall at the event scale, in particular for convective rainfall events.