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Hydrological response to climate extremes in mesoscale (pre-)Alpine basins at 0.5° and hyperresolution

Joost Buitink, Remko Uijlenhoet, and Ryan Tueling
Wageningen University, Hydrology and Quantitative Water Management, Netherlands (joost.buitink@wur.nl)

Using the distributed hydrological model Spatial Processes in Hydrology (SPHY) we investigated how forcing anomalies translate to hydrological anomalies at two different spatial resolutions in five (pre-)Alpine basins. The model was ran on a resolution matching hyperresolution (500x500m) and a resolution matching the common pixel size of global studies of 0.5x0.5° (40x40km). Four extreme seasons in the period 1993-2014 were selected and the simulated runoff and evaporation were aggregated per season. Due to the different land cover types within each basin, the high resolution model showed large intra-basin variation in hydrological anomalies. This variation can be explained by different runoff generating processes per land cover type. In the low resolution model each basin was represented as a single pixel, and was therefore not able to correctly represent the variation in elevation and land use types. We developed a new metric to quantify the difference between the anomaly from the low resolution model with the range of anomalies from the high resolution model. Since the low resolution model only had one pixel, it was not able to capture the same dynamics as the model on hyperresolution. The high resolution model simulated more extreme anomalies than the low resolution model might show; this has implications for the interpretation of global assessments carried out on coarse resolution.

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