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Spatial and temporal variability of precipitation in rainfall runoff models

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Representation of the spatial and temporal variability in precipitation is a key for successful rainfall runoff calculations. While the relationship between spatial and temporal scales in hydrological applications is widely recognized, the scientific literature still lacks practical guidelines for the choice of optimal spatial and temporal resolution. River networks add additional constraint in terms of representing the length distribution of all possible flow pathways from headwater to river mouth. Gridded river networks - that are commonly used in hydrological simulations - poorly maintain key geomorphological properties such mainstem length basin area ratio and the width function when the number of grid cells within the basin is less the $\sim$200. As a consequence, the resolution at which the input forcing are required to be accurate can be coarser than the resolution at which the model calculations are performed.

The availability of HydroSHEDS a high resolution gridded network at $\sim$500 m resolution derived from the Shuttle Radar Topography Mission (SRTM) combined with network regriding algorithm opens new opportunities to identify the optimal temporal and special resolutions of the input forcing and the underlying river network for various applications. In our presentation, we apply high spatial and temporal resolution precipitation data products from TRMM, GPCP and PERSIANN in gridded networks at different resolutions. We demonstrate the impact of network resolution on the simulated hydrograph by carrying out discharge model calculations using different resolution gridded networks. We also evaluate discharge simulations with spatially and temporally degraded the precipitation inputs and compare them to the results from fully resolved precipitation input. We will summarize our findings as a series of simple sets of rules to guide hydrologist in choosing the necessary spatial and temporal

resolutions for discharge simulations at different scales.