Impacts of Precipitation Interpolation on Hydrologic Modeling in Data Scarce Regions

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Accurate precipitation data are of prime importance as input to hydrologic models. Monsoon regions often exhibit large spatial and temporal variability of precipitation. Also, the available measurements are scarce in these regions, often show data gaps, and require careful analysis of the data quality. Our study aims at analyzing different precipitation interpolation methods and their effect upon runoff model results calculated with the Soil and Water Assessment Tool (SWAT). The study was carried out in the meso-scale catchment of the Mula and the Mutha Rivers (2036 km²) upstream of the city of Pune, India. Measured precipitation data were tested for homogeneity and consistency using double mass curves and were corrected for wind effects. Data gaps were filled. The corrected precipitation was spatially interpolated using three different methods: i. Thiessen polygons, ii. a geostatistical pooled kriging approach, and iii. a combined regression - inverse distance weighting method. The quality of the different interpolation methods was analyzed a) with respect to their capability to reproduce measured data and b) with regards to their effects upon SWAT model results, particularly runoff. We found that the more complex methods (ii, iii) reproduce the measured precipitation data better. Differences in the catchment‘s modeled water balance are small. However, runoff at the sub-catchment level shows more pronounced differences for the different interpolation schemes. Hence, addressing spatial heterogeneities, the chosen interpolation method is very important particularly in data scarce regions to reproduce runoff accurately.

Keywords: SWAT, Precipitation interpolation, Pooled kriging, Data scarce environment, India