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Does better rainfall interpolation improve hydrological model performance?

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High spatial variability of precipitation is one of the main sources of uncertainty in rainfall/runoff modelling. Spatially distributed models require detailed space time information on precipitation as input. In the past decades a lot of effort was spent on improving precipitation interpolation using point observations. Different geostatistical methods like Ordinary Kriging, External Drift Kriging or Copula based interpolation can be used to find the best estimators for unsampled locations. The purpose of this work is to investigate to what extents more sophisticated precipitation estimation methods can improve model performance. For this purpose the Wye catchment in Wales was selected. The physically-based spatially-distributed hydrological model SHETRAN is used to describe the hydrological processes in the catchment. 31 raingauges with 1 hourly temporal resolution are available for a time period of 6 years. In order to avoid the effect of model uncertainty model parameters were not altered in this study. Instead 100 random subsets consisting of 14 stations each were selected. For each of the configurations precipitation was interpolated for each time step using nearest neighbor (NN), inverse distance (ID) and Ordinary Kriging (OK). The variogram was obtained using the temporal correlation of the time series measured at different locations. The interpolated data were used as input for the spatially distributed model. Performance was evaluated for daily mean discharges using the Nash-Sutcliffe coefficient, temporal correlations, flow volumes and flow duration curves. The results show that the simplest NN and the sophisticated OK performances are practically equally good, while ID performed worse. NN was often better for high flows. The reason for this is that NN does not reduce the variance, while OK and ID yield smooth precipitation fields. The study points out the importance of precipitation variability and suggests the use of conditional spatial simulation as input for modelling.