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Is precipitation variability responsible for hydrological model errors?

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Precipitation is highly variable in space and time. The limited number of observations leads to high uncertainties for the estimation spatial-temporal distribution of precipitation. In this contribution an inverse modelling framework is suggested to find precipitation fields which: (i) are conditioned on observations (reproduce the observed values at the observation locations) (ii) have the same spatial variability as the observations (iii) lead to a better estimation of the discharge.
For this purpose, a stepwise inversion methodology was developed which uses transformed Gaussian fields for simulation. The methodology was applied to two catchments – the Tyne in UK and the Neckar is Germany. 10 years of daily observations were used and about 10 % of the days were altered using the inverse algorithm. As hydrological model an uncalibrated physically based model SHETRAN was used. The procedure reduced the estimation error of discharge by 50 %. A set of different realizations show the high variability of the inverted fields.
Interpolation unfortunately cannot solve this problem. The comparison of three different interpolation methods (i) nearest neighbour (ii) inverse distance and (ii) ordinary Kriging shows that better interpolation does not necessary lead to better discharge estimates. Problems related to extreme areal precipitation are also discussed.