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Effects of differently interpolated observational precipitation data on hydrological modeling

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For realistic water balance modeling on a local or regional scale, meteorological forcing of the highest possible spatial resolution is required. In this project, the water balances for medium sized catchments (65 - 362 km^2) in Rhineland-Palatinate (RLP, Germany) are simulated. Two different data sets of precipitation with high spatial and adequate temporal resolution exist for the domain and the period 1993 - 2000. One originates from the German Weather Service (DWD), the second from the state office for environment, water and factory inspectorate Rhineland-Palatinate (LUWG). Both datasets have a spatial resolution of 1km x 1km, the dataset of the DWD a daily and the LUWG dataset an hourly temporal resolution.
A comparison of both datasets regarding precipitation sums on a daily, monthly and yearly temporal scale is done for the area mean of the catchment as well as for single grid cells to specify the differences between both datasets. Furthermore, the spatial patterns of interpolated precipitation are analyzed in both datasets.
The analysis of both datasets shows large differences. These differences are mainly due to different interpolation schemes and a partially different data base. There is a not acceptable deviation in the area mean of the yearly precipitation sum for the catchment of up to 241 mm/year (DWD: 807 mm/year ; LUWG: 566 mm/year); in single grid cells, the differences even reach up to 430 mm/year.
Different precipitation input fields also result in different hydrological outputs. So, in order to precisely assess the effects on water balance modeling, the water budget model LARSIM, which was calibrated using the LUWG dataset, was run with both datasets. The output variables are compared on several temporal scales for subcatchments and the whole domain. For the analysis of runoff variables, signature indices are used. Total runoff as well as e.g. the runoff coefficient is higher for the “wetter” dataset.