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Using hydrological modelling for the evaluation of areal precipitation estimates based on downscaled reanalysis and station data in data sparse mountainous catchments in Central Asia

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In data sparse mountainous regions it is difficult to derive areal precipitation estimates. In addition, assessing different precipitation interpolation techniques by cross validation can be misleading when the stations are not in representative locations in the catchment. Our study therefore has two interconnected objectives. Firstly it tests whether monthly accumulated precipitation fields from downscaled reanalysis data can be used for the interpolation of station data and compares this method to other precipitation interpolation approaches. Secondly, the different precipitation estimates are evaluated by using them as input to a hydrological model, which has the advantage that the precipitation estimates are integrated over the catchment scale. This approach for the evaluation of precipitation estimates is further expanded in order to distinguish between over- or underestimation errors and errors in the temporal dynamics, and by considering different sources of uncertainties. The study is performed for six upstream catchments of the Karadarya basin in Central Asia. Generally the precipitation interpolation approach using precipitation fields from downscaled reanalysis data showed an acceptable performance, comparable to another interpolation method using monthly precipitation fields from multi-linear regression against latitude, longitude and elevation. An exception was one catchment where the method using downscaled reanalysis data overestimated precipitation, which might be caused by a poor representation of the orography in the regional climate model in this catchment. In contrast, the APHRODITE data set and an inverse distance method generally overestimated precipitation. The different precipitation data sets mostly differed in their overall bias, while the performance with respect to the temporal dynamics was similar. We showed that in many cases the differences between the precipitation data sets were larger than uncertainties resulting from the calibration parameters, other model inputs or the calibration period.