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Correction of high elevation precipitation at global scale for hydrological modelling

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Global gridded precipitation datasets generally underestimate precipitation over complex topographic regions. The gauges used to derive/correct/adjust the grid information usually have a gap of information or very short time series over mountainous areas mainly due to the difficulties for maintaining a reliable precipitation monitoring network. Moreover, these gauges are usually not located close to the center of the grid that they represent favoring the misrepresentation of the input water over the cell. Global hydrological models usually use these kinds of datasets as forcing data and therefore, this underestimation in precipitation is directly reflected in a bias on the simulated flow. This study proposes a simple precipitation correction algorithm to adjust precipitation with elevation based on different precipitation lapse rates parameters applying to different spatial resolution scales: a) global, applies over the whole model, b) regional, defined over the different mountainous ranges worldwide and; c) local, according to fix elevation zones. The algorithm is implemented as a first stage in the hydrological model (World-Wide HYPE, Hydrological Prediction model for the Environment setting up at global scale) and calibrated using discharge observation in upstream location over watersheds that cover a huge elevation range. The gridded dataset used is GFD (Global Forcing Data), which combines different data sets in order to produce near real-time updated hydrological forcing data that are compatible with the products covering the climatological period and resembles the already established WFDEI method closely, but uses updated climatological observations, and for the near real-time it uses interim products that apply similar methods. The final corrected precipitation results are validated using different studies that defined local precipitation/elevation rates in the main world mountainous ranges (e.g. Himalayas, Karakorum, Hindu Kush, TianShanm, Andes, Alps and Rocky Mountains). The improvement achieved represents around a 6% of the relative error in flow discharge during the study period.