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Using Discharge data and hydrological modelling to evaluate precipitation data

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Historical gridded precipitation data can be derived from rain gauge measurements, satellite, radar, reanalysis using atmospherical models, and combinations of these. Evaluation of these products, however, is generally restricted to how well they reproduce point measurements at rain-gauges, leaving large uncertainties regarding the spatial variation of rainfall regions without observations. Climate models also make simulations of historical gridded precipitation and validation of this precipitation is usually made against one or more of the aforementioned historical gridded precipitation products. Here, it is suggested that long-term averages of measured discharge in river basins ranging in scale from 100 km2 to 100 0000 km2 can be used as a proxy for the long-term precipitation totals across the region. Discharge simulated by a hydrological model that is driven by the precipitation data to be evaluated is then compared with the observed discharge. This method therefore rests upon the assumption that long-term volume errors in modelled discharge are caused by errors in the input precipitation fields upstream of the measuring point. Of course errors in prediction of evapotranspiration, losses to deep groundwater and irrigation also have to be taken into account. In this study, a number of gridded precipitation products, both interpolated and reanalysis data, were used to simulate discharge across Europe using a subbasin resolution of 215 km2. As well as intercomparison of the precipitation products and comparison to more detailed national data sets, the error in simulated discharge could be used to indicate regions where the precipitation products were poor. All of the precipitation products evaluated were poor in at least one region of Europe, usually related to the availability of precipitation gauge data in that region when creating the precipitation product. Hydrological science could better contribute to climate sciences by including these sorts of analyses in atmospherical models both for historical reanalysis and climate prediction.