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A historical database of key hydroclimatic variables in and across 6400 catchments around the world

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Availability of historical hydroclimatic data for different climate regions is necessary for hydrological change modeling and analysis. Nowadays, many global products are available that provide hydrological and meteorological datasets based on direct measurements, remote sensing observations, re-analysis outputs, and model simulations. However, differences in spatial and temporal resolutions, and inconsistencies seen between observed hydrological patterns and different model results and datasets makes it difficult to choose an appropriate combination of data products for hydrological studies. This study provides a new combined historical database of five key hydroclimatic variables at monthly and daily scales, obtained from different observational and re-analysis global datasets, including runoff (R; from GSIM), precipitation (P; from GPCC-V7 and ERA5), evapotranspiration (ET; from GLEAM 3.3 and ERA5), soil moisture (SM; from ESACCI-v04.5, GLEAM 3.3 and ERA5), and temperature (T; GHCN-CAMS, ERA5). The new database combines these variables for each of 6,400 catchments of different scales around the world. In order to select the catchments, the existing nearly 35,000 streamflow time series in the GSIM database was analyzed and 8,400 catchments were selected based on the criterion of having at least 25 years of monthly runoff data available from 1980 to 2010. After further quality controls on the accuracy of catchment polygons, and reported catchment areas and stream flows, and consistency of the range, average values, and variations of variables time series, the 6,400 catchments were selected for the final development of the new catchment-related database in this study. The other hydroclimatic variables, besides runoff, are also spatially aggregated for each individual catchment and corresponding catchment-average time series are produced from 1980 to 2019. The final database thus provides a collection of long-term multi-climate and multi-catchment time series of the five key hydroclimate variables, aggregated over each of the 6,400 hydrological catchments around the world. In choosing the data sources for each variable, first priority was given to direct observational datasets (available for all variables except for the ET), and further to re-analysis outputs that many researchers regard as being close to directly observed data. The database developed in this study can be used for different types of studies on hydrology, water resources, and their changes under shifting climate and land use conditions in different parts of the world. The standardized format of this database ensures easy applicability with possibility of expansion to include more and other types of data, e.g., on land use/cover types and their changes, and on other climatic, geomorphologic, and anthropogenic conditions.

