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Value of additional discharge information for tuning a global hydrological model

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In hydrological modelling it is general practice to tune model parameters with observed river discharge data. Tuning serves to compensate for uncertainties of model structure, model parameters and input data. Measured discharge can provide models with additional integral information on local hydrological characteristics. Little is known on which density and distribution of observed data is adequate to tune macro-scale hydrological models. This contribution discusses the value of densifying the discharge information for tuning the global water model WaterGAP 2. WaterGAP 2 was developed to assess and predict water availability and water use worldwide. It combines a global hydrological model with several global water use models. WaterGAP computes time series of surface runoff, groundwater recharge and river discharge with a resolution of 0.5° latitude by 0.5° longitude, taking into account industrial and domestic water use as well as water withdrawals for irrigation and livestock. The calculations are based on spatially distributed physiographic characteristics and on time series of climatic data. The last model version - WaterGAP 2.1e - was tuned with time series of annual river discharge at 724 stations around the world by adjusting one model parameter. Meanwhile updates for several input datasets are available and a new sub-version of the model - WaterGAP 2.1f - is introduced. The new version includes extended climate and water use time series reaching from 1901 to 2002, an improved irrigation database and an advanced algorithm for snow accumulation and melt. WaterGAP 2.1f is tuned, in one case using the former discharge dataset (724 stations), and in the other case using a new densified dataset with almost 1250 stations. The output of the two resulting model variants is compared and evaluated with the focus on their ability to simulate the annual and inter-annual variability of discharge as well as the 90% reliable monthly discharge Q90. The benefits of including additional

discharge information for tuning are discussed in detail and conclusions for further improvements of WaterGAP are drawn.