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Managing input data and parameter estimation in a global water-balance model

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A comprehensive assessment of the freshwater resources available at a continent or the globe is essential for finding sustainable solutions for water-related problems concerning quantity, quality as well as variability of the world water resources. In this study the WASMOD-M global water-balance model was constructed on the basis of the well-tested WASMOD catchment water-balance model. WASMOD-M works with time steps varying from weekly to monthly, and has 3 to 6 parameters depending on the availability of input data and climate regions. Input climate data are currently gridded precipitation, temperature and vapour pressure at 0.5 degree resolution. Other input data are land mask, catchment boundaries and flow paths at the same resolution. Model outputs include monthly river flow and water-balance components such as soil-moisture content and evaporation. Monthly runoff values cannot be used for parameter-value estimation and model evaluation since almost all large rivers are regulated. Yearly runoff averages were, thus, used for tuning model parameters. The parameter-value combination giving the best yearly average and physically reasonable state variables, was chosen for each flow station. Different simple regionalisation techniques have been tested for setting parameter values of ungauged areas. Results show that 80% of the flow stations could be modelled with reasonable accuracy (yearly average volume error $<$20%) with the current simple, but repeatable, parameter-value estimation scheme. Data quality was found to be a big problem. Many flow stations have runoff coefficients (runoff/precipitation) above one despite correction of precipitation-gauge errors. Future work will focus on the following issues: (1) improvement of the model by considering sub-grid variations of land-surface information and including a flow-routing scheme, (2) improvement of the model-parameter-estimation procedure with different regionalisation techniques.