EGU24-2267, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-2267
EGU General Assembly 2024
© Author(s) 2024. This work is distributed under
the Creative Commons Attribution 4.0 License.

A grid-based data-driven ensemble probabilistic data fusion: a water balance closure approach applied to the irrigated Hindon River Basin, India

Roya Mourad, Gerrit Schoups, and Wim Bastiaanssen
Delf University of Technology, Delft, Netherlands (r.mourad@tudelft.nl)

Remote sensing observations hold useful prior information about the terrestrial water cycle. However, combining remote sensing products for each hydrological variable does not close the water balance due to the associated uncertainties. Therefore, there is a need to quantify bias and random errors in the data. This study presents an extended version of the data-driven probabilistic data fusion for closing the water balance at a basin scale. In this version, we implement a monthly 250-m grid-based Bayesian hierarchical model leveraging multiple open-source data of precipitation, evaporation, and storage in an ensemble approach that fully exploits and maximizes the prior information content of the data. The model relates each variable in the water balance to its "true" value using bias and random error parameters with physical nonnegativity constraints. The water balance variables and error parameters are treated as unknown random variables with specified prior distributions. Given an independent set of ground-truth data on water imports and river discharge along with all monthly gridded water balance data, the model is solved using a combination of Markov Chain Monte Carlo sampling and iterative smoothing to compute posterior distributions of all unknowns. The approach is applied to the Hindon Basin, a tributary of the Ganges River, that suffers from groundwater overexploitation and depends on surface water imports. Results provide spatially distributed (i) hydrologically consistent water balance estimates and (ii) statistically consistent error estimates of the water balance data.