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Integrated catchment and instream water quality modeling in Baiyangdian Basin, China

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The prediction of river water quality requires accurate quantification of both the overland and the subsequent in-stream processes. Therefore, there is an emerging need for the development of integrated water quality models that effectively couple catchment and instream biogeochemical processes. In this study, we developed an integrated catchment-instream water quality model system called AquaSys. AquaSys couples the spatially distributed hydrological model SPHY (Terink et al., 2015), the non-point source model WEISS, and the instream hydrodynamic and water quality model WASP (Ambrose et al., 1988). The SPHY and WEISS models simulate flow and water quality boundary conditions which are automatically written to a WASP model describing the instream water quality processes. The integrated model system can simulate irrigation and the influence of hydraulic structures, allowing it to be used in catchments largely affected by anthropogenic activities.
In this study the AquaSys model system was applied to the Baiyangdian Basin, North of China. 5-years hydrological and water quality monitoring data in 6 stations, provided by Chinese National Environmental Monitoring Centre were used for model calibration and validation. Results showed that the PBias of water quality state variables, including CODMn and ammonia (NH3-N) at more than 80% of the stations were less than 30%, indicating the good water quality forecast capability and applicability of AquaSys.
The Baiyangdian AquaSys model provides near real-time forecasts of discharge and water quality along the river network of the catchment based on weather predictions. Additionally, the model allows simulating impact scenarios that provide insights for taking environmental management decisions. In the future the model could be improved by taking into account real-time water quantity and quality monitoring information provided by the newly-built national automatic monitoring stations, which would further increase the accuracy of the water quality predictions.

References

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