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Comparative analysis of two hydrological models with different glacier parameterisations for climate impact assessment and water resources management in the Syrdarya Basin, Central Asia

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Central Asian river basins in general and zones of run-off formation in particular are currently experiencing the impact of increasing temperatures and changes in precipitation. The headwaters thus exhibit negative glacier mass balances, decreasing glacierisation, changes in snow cover characteristics and changing runoff response. These changes are likely to intensify in future under the changing climate. Both hydropower industry and irrigated agriculture in the downstream areas strongly depend on the water amount, its seasonal and long-term distribution. This fact calls for an effort to reliably assess water availability in the runoff formation zone of Central Asia in order to improve water management policy in the region. One of the approaches to assessment of water resources is the evaluation of climate scenarios with the climate-and-hydrology model chain. Application of several models allows reducing the modeling uncertainty and proceeding with more robust water balance components assessment.
We present the comparison of the two hydrological models AISHF (Automated Information System for Hydrological Forecasting) developed at the Centre for Hydrometeorology of Uzbekistan and WASA run at GFZ Potsdam, implemented for the Naryn and Karadarya basins (Syrdarya). These models use different parameterization and calibration schemes. Whereas in the AISHF model glacier dynamics is considered in scenarios of glacier area loss, the WASA model simulates continuous glacier mass balance, glacier area and volume evolution based on meteorological drivers. Consideration of initial glacier volume and its temporal dynamics can be essential for climate impact assessment in transient model simulations. The impact of climate change scenarios, developed with the regional climate model REMO at the University of Würzburg, are compared with respect to total discharge dynamics and runoff contributions from glacier, snowmelt and rainfall. Implications of water availability assessment using two different approaches for decision making are finally discussed.