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Water availability and contribution of runoff components in the past and the future periods in the upper Chu River Basin, Kyrgyzstan

Olga Kalashnikova (1), Zhihua He (2), Abror Gafurov (2), Katy Unger-Shayesteh (2), and Sergiy Vorogushyn (2)

(1) CAIAG Central Asian Institute of Applied Geosciences, Department Climate, Water and Natural Resources, Bishkek, Kyrgyzstan, (2) GFZ German Research Centre for Geosciences, Potsdam, Hydrology, Potsdam, Germany

The River Chu is a transboundary River crossing borders of Kytgyzstan and Kazakhstan, Central Asia. Water resources of the Chu River is mainly used for irrigation (58% of the intake occurs in Kyrgyzstan and about 42% in Kazakhstan). Water availability in future is an important factor for planning of agricultural production and livestock sectors for both countries.

We have analyzed water availability of the upper Chu River Basin, up to the gauge Kochkor. Water formed in this basin supplies the inflow into the Orto-Tokoy reservoir which is important for water distribution among different stakeholders. We used a semi-distributed glacio-hydrological model WASA and calibrated it using multiple datasets. Afterwards, we have quantified the runoff components over the past decades since 1960s. Moreover, past changes in runoff components have been analyzed. Finally, we assessed potential future changes in annual and seasonal runoff in this basin, including tributaries, as well as changes in their runoff components based on the IPCC CMIP5 climate scenarios.

Our results show the contribution of groundwater to be 18-46%, runoff from liquid precipitation - 13-26%, runoff from seasonal snow melting - 30-53% and runoff from glacier component – 0,01-1,3%, depending on the tributary/subcatchment. The results in changes in the runoff components demonstrated that the role of liquid precipitation will decrease, while the role of snow melt will increase in the future. In the interim of 2050-2100, liquid precipitation will amount to about 70-80% of the period 1960-1985. The contribution of seasonal snow melting will be 130-160% for the corresponding periods. A rise in air temperature will lead to an earlier melting of the snow cover correspondingly, and flood peaks will not take place in the summer months (July-August), but rather in the spring (May-June). In addition, the groundwater runoff will increase and will make up to 140-180% for the period 2050-2100 comparing to 1960-1985.

In order to further use water resources in the future for irrigation purposes in a dry summer period, certain measures are required, such as building reservoirs. This will also protect the population in the middle and lower reaches of the river from spring floods.