GC31B-1178: Contemporary changes of water resources, water and land use in Central Asia based on observations and modeling

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Water is a key agent in Central Asia ultimately determining human well-being, food security, and economic development. There are complex interplays among the natural and anthropogenic drivers effecting the regional hydrological processes and water availability. Analysis of the data combined from regional censuses and remote sensing shows a decline in areas of arable and irrigated lands and a significant decrease in availability of arable and irrigated lands per capita across all Central Asian countries since the middle of 1990thas the result of post-Soviet transformation processes. This change could lead to considerable deterioration in food security and human system sustainability. The change of political situation in the region has also resulted in the escalated problems of water demand between countries in international river basins.

We applied the University of New Hampshire - Water Balance Model - Transport from Anthropogenic and Natural Systems (WBM-TrANS) to understand the consequences of changes in climate, water and land use on regional hydrological processes and water availability. The model accounts for sub-pixel land cover types, glacier and snow-pack accumulation/melt across sub-pixel elevation bands, anthropogenic water use (e.g. domestic and industrial consumption, and irrigation for most of existing crop types), hydro-infrastructure for inter-basin water transfer and reservoir/dam regulations. A suite of historical climate re-analysis and temporal extrapolation of MIRCA-2000 crop structure datasets has been used in WBM-TrANS for this project. A preliminary analysis of the model simulations over the last 30 years has shown significant spatial and temporal changes in hydrology and water availability for crops and human across the region due to climatic and anthropogenic causes. We found that regional water availability is mostly impacted by changes in extents and efficiency of crop filed irrigation, especially in highly arid areas of Central Asia, changes in winter snow storage, and shifts in seasonality and intensity of glacier melt waters driven by climatic changes.