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Water Availability in Indus River at the Upper Indus Basin under Different Climate Change Scenarios

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The last decade of the 20th century and the first decade of the 21st century showed that climate change or global warming is happening and the latter one is considered as the warmest decade over Pakistan ever in history where temperature reached 53 0C on May 26, 2010. The changing climate has impact on various areas including agriculture, water, health, among others. There are two main forces which have central role in changing climate: one is natural variability and the other one is human evoked changes, increasing the density of green house gases. The elements in the bunch of Energy-Food-Water are interlinked with one another and among them water plays a crucial role for the existence of the other two parts. This nexus is the central environmental issue around the globe generally, and is of particular importance in the developing countries.
The study evaluated the importance and the availability of water in Indus River under different emission scenarios. Four emission scenarios are included, that is, the A2, B2, RCP4.5 and RCP8.5. One way coupling of regional climate models (RCMs) and Hydrological model have been implemented in this study. The PRECIS (Providing Regional Climate for Impact Studies) and CCAM (Conformal-Cubic Atmospheric Model) climate models and UBCWM (University of British Columbia Watershed Model) hydrological model are used for this purpose. It is observed that Indus River contributes 80 % of the hydro-power generation and contributes 44 % to available water annually in Pakistan. It is further investigated whether sufficient water will be available in the Indus River under climate change scenarios. Toward this goal, Tarbela Reservoir is used as a measurement tool using the parameters of the reservoir like maximum operating storage, dead level storage, discharge capacity of tunnels and spillways. The results of this study are extremely important for the economy of Pakistan in various key areas like agriculture, energy, industries and ecosystem. The analyses show that there will be much more water available in future under the considered emission scenarios but in some months there will be scarcity of water. However, by proper management and optimum utilization of the available water, the scarcity of water can be minimized considerably. Finally, a meta-analysis has been performed to present a combined picture of all scenarios considered in this study. One way to avoid water scarcity is to upgrade and install new reservoirs and water storage capacities to reserve the extra water during high river flow in Indus River, which will then be utilized during low river flow.

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