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Assessing the Characteristics of the Regional Climate that are essential for studies of hydrological changes over Pakistan

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The warming observed due to green house gases over the past several decades is consistently associated with changes in the hydrological cycle such as: increasing atmosphere water vapor; changing precipitation patterns, intensity and extremes; widespread melting of snow and ice; and changes in soil moisture and runoff. Pakistan, which lies between 24°-38°N and 61°-78°E, gets most of its fresh water supply from snow and ice melt in the mountainous region. These snow and ice reserves may be affected by the changes in climate in many ways. Thus the economy of the country, which is dependent heavily on agriculture, which in turn depends upon water, is heavily vulnerable to such changes.

The Indus River and five of its major tributaries dominate the surface water hydrology of Pakistan and all of them are originated outside of Pakistan. This work focuses on the application of the Max Planks Institute for Meteorology (MPI-M) regional climate model REMO (Regional Model) over the whole South Asia Region including Pakistan. The REMO model splits the water from each grid box into surface runoff and drainage component. HD (Hydrological Discharge) Model, which simulates the lateral freshwater fluxes at the land surface, is coupled offline with the REMO model, to assess the inflow of water into the major reservoirs of the country.

The initial results of the model simulations, executed at 0.5 degree resolution suggest that the model is too wet in the winter season which causes the snowfall to occur in the northern areas of the country. This resulted in the overestimated snowmelt in the winter. However, timing of the flow matches very well with the observation. It

is expected that increasing the resolution of the Model to $1/6^{th}$ degree along with the implementation of dynamical glacial scheme might improve the results in a more realistic manner.