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Climate Change in the Himalaya: Providing state of the art climate information

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Glaciers are of key importance to the freshwater supply in the Himalayan region. Their growth or melting is influenced by an interaction of temperature near the surface (TAS) and precipitation rate (PR). In a changing climate characterized by rising temperatures mountain glaciers are ought to decline. However, recent observations indicate a glacier growth over the Karakoram (western Himalaya) due to a rise in snow accumulation while positive degree days show no change.

To further investigate this behavior and to clarify whether this glacier growth is intermediate we use a model ensemble encompassing 36 global climate models (GCMs) of the CMIP5, 5 regional climate models (RCMs) of the East-Asia CORDEX, as well as 8 RCMs of the South-Asia CORDEX for two different representative concentration pathways. First, we downsized the ensemble in respect to the models' ability to correctly reproduce local weather patterns and their skill in reproducing elevation dependent trend signals in winter. Within this evaluation, a newly produced dataset for the Indus, Ganges and Brahmaputra Catchments (IGB) is used as observational data. The reanalyses WFDEI, ERA-Interim, NCEP/NCAR and JRA-55 are used to further account for observational uncertainty. In a next step, we applied a new bias correction method (scale distribution mapping, SDM) to TAS and PR of the remaining models. In comparison to quantile mapping, SDM does not distort climate change warming signals important to phenomena as elevation dependent warming. Finally, the uncertainty of the projected trends of the climate model ensemble have been quantified.

Until the end of the century, first results indicate a rise of positive degree days (TAS > 0°C) over all scenarios, especially pronounced in summer affecting all altitudes. Clearly also TAS is rising with the highest increase projected for higher altitudes and a stronger warming occurring between December and April (DJFMA). Between June and September (JJAS) solid precipitation is robustly projected to decline over the whole ridge of the Himalaya, while a robust increase is visible for some parts within the northern Indus catchment for DJFMA. PR is projected to significantly increase during the monsoon season (JJAS) especially in the eastern Himalaya.