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Future of Himalayan glaciers: Projections from CMIP5 and CORDEX climate models and their uncertainties

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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 34 GCMs of the CMIP5, 5 RCMs of the East-Asia CORDEX, as well as 3 RCMs of the South-Asia CORDEX for 3 different representative concentration pathways. The models' ability to correctly reproduce local weather patterns is accounted for via temporal and spatial correlations to observed tas and pr over the southern ridge of the Himalaya. APHRODITE is used as observational data. The reanalyses ERA-Interim, NCEP/NCAR and JRA-55 are used to further account for observational uncertainty. tas and pr of all climate simulations have been bias corrected (quantile mapping) in order to obtain snow accumulation and positive degree days. Finally, the uncertainty of the projected trends of the climate model ensemble has been quantified.

First results indicate a uniform rise of positive degree days over all scenarios leading to a higher melting rate. However, this uniform behavior is in contrast to changes in snow accumulation, for which some models project an increase and others a decrease until the end of the century.