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Shifts in in High-Mountain Asia's mountain-specific climate indicators derived with large ensemble modelling

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Natural disasters in High Mountain Asia (HMA) are largely induced by precipitation and temperatures extremes. Precipitation extremes will change due to global warming, but these low frequency events are often difficult to analyse using (short) observed time series. In this study we analysed large ensembles (2000 year) of present day climate and of a 2 °C and 3 °C warmer world produced with the EC-EARTH model. We performed a regional assessment of climate indicators related to temperature and precipitation (positive degree days, accumulated precipitation, (pre- and post-) monsoon precipitation), their sensitivity to temperature change and the change in return periods of extreme temperature and precipitation in a 2 and 3 °C warmer climate.

In general, the 2°C warmer world shows a rather homogeneous response of changes in climate indicators and return periods, while distinct differences between regions are present in a 3C warmer world and it no longer follows a general trend. This non-linear effect can indicate the presence of a tipping point in the climate system. The most affected regions are located in monsoon-dominated regions, where precipitation amounts, positive degree days, extreme temperature, extreme precipitation and compound events are projected to increase the most. Largest changes in climate indicators are found in the Hindu Kush and Himalaya regions. We also found that precipitation increases in HMA in a 3°C warmer world are substantially larger (13%) compared to the global average (5.9%). Additionally, the increase in weather extremes will exacerbate natural hazards with large possible impacts for the mountain people. The results of this study could provide importance guidance for formulating climate change adaptation strategies in HMA.