



The CMIP5 picture of current and future precipitation in the Karakoram-Himalaya

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Extended and orographically complex areas, such as the Hindu-Kush Karakoram Himalaya (HKKH) region, can pose a serious challenge for climate models in their ability to reproduce historical precipitation and in projecting its future change, particularly for global climate models (GCM), still characterized by a quite coarse resolution.

This study analyses and compares the skill of a set of thirty-two state-of-the-art GCMs participating in the Coupled Model Intercomparison Project Phase 5 (CMIP5) in simulating precipitation in the HKKH. In particular we consider the ability of the models in reproducing the annual cycle and historical long-term trends of precipitation and we analyse precipitation changes in future scenarios with respect to historical conditions. We consider separately the HKK (Hindu-Kush Karakoram) in the west and the Himalaya region in the east, which are characterized by different precipitation climatologies, known to depend on different circulation patterns. Future precipitation is analysed for the two Representative Concentration Pathways (RCP) scenarios RCP 4.5 and RCP 8.5. Historical model simulations are compared with Climate Research Unit (CRU) and Global Precipitation Climatology Centre (GPCC) precipitation data in the period 1901-2005.

We find that the multi-model ensemble mean and most models exhibit a wet bias with respect to CRU and GPCC observations in both regions and in all seasons. The models differ greatly in the seasonal climatology of precipitation which they reproduce in the HKK. The CMIP5 models simulate wetter future conditions in the Himalaya in summer, with a gradual precipitation increase throughout the twenty-first century. Wetter summer future conditions are also predicted by most models in the RCP 8.5 scenario for the HKK, while no significant change can be detected in winter for both regions on average, with the models showing a large spread in their behaviour.