



# Twenty-first century-end climate scenario of Jammu and Kashmir Himalaya, India, using ensemble climate models

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## Abstract

The study investigates the future climate change in the Jammu and Kashmir (J&K) Himalaya, India, by the end of the twenty-first century under 3 emission scenarios and highlights the changes in the distribution of the prevalent climate zones in the region. The multi-model climate high-resolution projections for the baseline period (1961–1990) are validated against the observed climate variables from 8 meteorological stations in the region. The temperature projections from the GFDL CM2.1 model are found in good agreement with the observations; however, no single model investigated in the present study reasonably simulates precipitation and therefore multi-model ensemble is used for precipitation projections. The average annual temperature is projected to increase by 4.5 °C, 3.98 °C, and 6.93 °C by the end of the twenty-first century under A1B, RCP4.5, and RCP8.5 scenarios, respectively. In contrast, an insignificant variation in precipitation projection is observed under all the 3 scenarios. The analysis indicates that, unlike the 13 climate zones under the updated Köppen-Geiger climate classification scheme, the J&K Himalaya broadly falls into 10 main climate zones only namely, “3 subtropical (~ 11%), 4 temperate (~ 19%), and 3 cold desert (~ 70%) zones”. The projected climate change under the 3 emission scenarios indicates significant changes in the distribution of prevalent climate zones. The cold desert climate zone in the Ladakh region would shrink by ~ 22% and correspondingly the subtropical and temperate zones would expand due to the projected climate change. This information is vital for framing robust policies for adaptation and mitigation of the climate change impacts on various socio-economic and ecological sectors in the region.

**Keywords** Climate change · Climate classification · Downscaled climate projections · Kashmir Himalaya

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