HIMAP

CHAPTER 3 BRIEF

UNRAVELLING CLIMATE CHANGE IN THE HINDU KUSH HIMALAYA

The Hindu Kush Himalaya (HKH) are sensitive to climate change and variability. Adapting to long- and short-term climate-related problems requires a thorough understanding of changes in climate in the past and possible changes in the future. This chapter presents a broad overview of weather and climate elements pertaining to the HKH. It specifically examines the linkages between large-scale drivers and climate variability in the HKH, past and present regional climate variations, and likely future regional climate projections using high-resolution regional climate models suitable for the complex topography of the HKH.

This chapter aims to support HKH countries in building resilience and adaptive capacity in the face of climate-related hazards and in integrating climate change adaptation measures into national policies, strategies, and plans.

KEY FINDINGS

- Even if global warming is limited to 1.5°C, warming will likely be at least 0.3°C higher in the Hindu Kush Himalaya (HKH), and at least 0.7°C higher in the northwest Himalaya and Karakoram.
- There has been a rising trend of extreme warm events in the HKH over the past five to six decades, a falling trend of extreme cold events, and a rising trend in extreme values and frequencies of temperature-based indices (both minimum and maximum).
- The HKH is experiencing increasing variability in western disturbances and a higher probability of snowfall in the Karakoram and western Himalaya, changes that will likely contribute to increases in glacier mass in those areas.
- Consensus among climate models for the HKH region is weak – a result of the region's complex topography and the coarse resolution of global climate models.

POLICY MESSAGES

- Improved long-term hydrometeorological monitoring is necessary for more robust climate change analysis and adaptation planning in the HKH.
- More reliable projections of elevation-dependent warming are crucial for accurate understanding of cryospheric dynamics.
- Policies and planning should focus on improved disaster warning systems and management and mitigation measures to address hydrometeorological extremes.

LINKS TO

SUSTAINABLE DEVELOPMENT GOALS

13 CLIMATE ACTION

OBSERVATIONS AND TRENDS

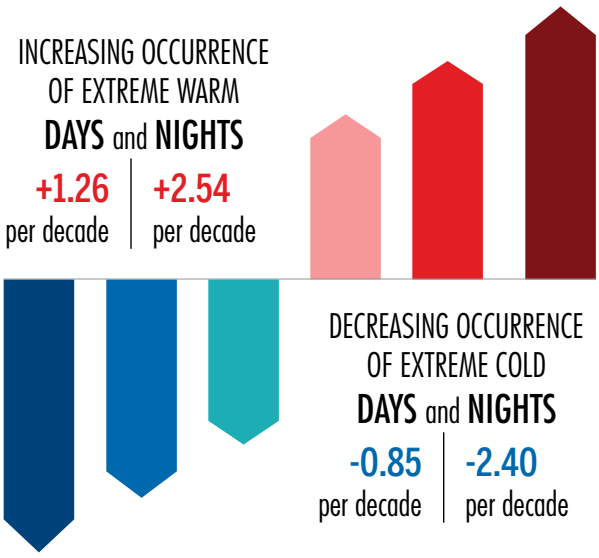
The climate of the HKH has changed significantly and is projected to change more dramatically in the future. Urgent actions are needed to mitigate the effects and consequences of climate change.

HKH CLIMATE PROJECTED TO CHANGE MORE DRAMATICALLY IN THE NEAR FUTURE

The HKH region's weather and climate is influenced by climate drivers of tropical and extra-tropical origin such as the El Niño-Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO), the Indian Ocean Dipole (IOD), the Madden-Julian Oscillation (MJO), and the Arctic Oscillation. The HKH is sensitive to climate change and variability. Much of the warming observed during the last few decades of the 20th century is attributed to the increase in anthropogenic greenhouse gas concentrations and, to some extent, to other regional climate forcing elements like anthropogenic aerosols and land-use changes.

Although the climate of the HKH has changed significantly in the past, it is projected to change more dramatically in the near future. Regional warming continued even during the global warming hiatus – the period between 1998 and 2013 when global warming appeared to have slowed.

DAYS AND NIGHTS ARE GETTING WARMER



EXTREME TEMPERATURE INDICES HAVE CHANGED SIGNIFICANTLY

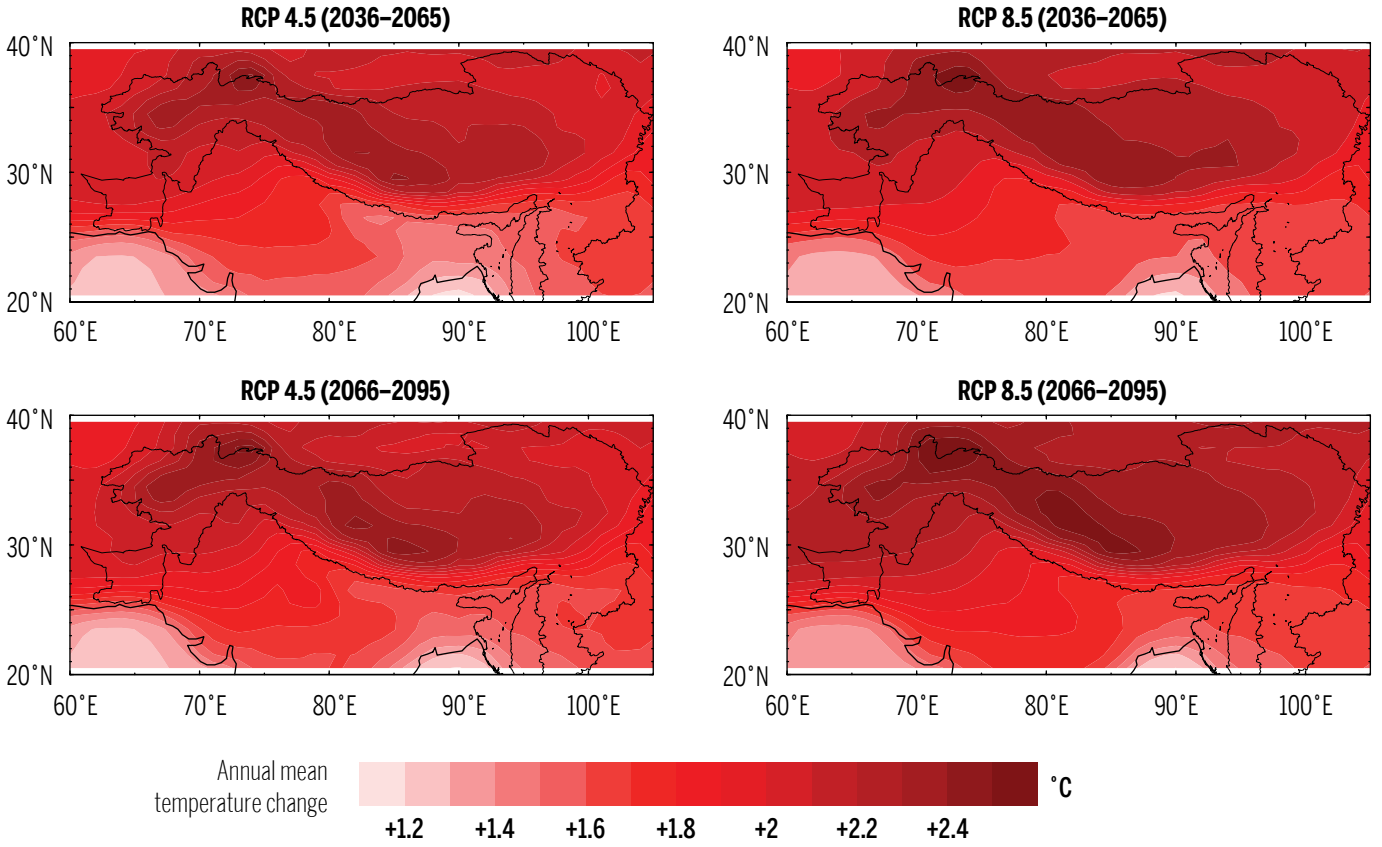
Generally, from the last century through the beginning of the current one, the HKH has experienced warming from 1901 to 1940, cooling from 1940 to 1970, and warming from 1970 to the present. The warming rate over the last 50 years in the HKH has been 0.2°C per decade. Extreme indices in the region have also changed over this period: occurrences of extreme cold days and nights have declined (days by 0.85 days per decade, nights by 2.40 days per decade), while occurrences of extreme warm days and nights have increased (days by 1.26 days per decade, nights by 2.54 days per decade). Warm nights have increased throughout the region, and extreme absolute temperature indices have changed significantly. Frost days show a significant declining trend in most parts of northern India and the Tibetan Plateau. The length of the growing season has increased by 4.25 days per decade – a positive change for agriculture.

EXTREMES IN PRECIPITATION INCREASING

The number of intense precipitation days and intensity of extreme precipitation have increased overall in the last five decades. If these trends persist the frequency and magnitude of water-induced hazards in the region will increase in the future.

TEMPERATURES IN THE HINDU KUSH HIMALAYA WILL WARM MORE THAN THE GLOBAL MEAN AND MORE RAPIDLY AT HIGHER ELEVATIONS

This figure shows projected spatial distribution of annual mean temperature change (°C) over the HKH for two representative concentration pathways (RCP 4.5 and RCP 8.5) over two time periods (2036–2065 and 2066–2096)



Even if global warming is limited to 1.5°C by the end of the century, the Hindu Kush Himalaya will warm by around 1.80°C.

PROGRESSIVELY GREATER WARMING WITH ELEVATION OBSERVED IN THE HKH, PROJECTED TO CONTINUE

There is ample evidence for elevation-dependent warming (EDW) in the HKH, especially in the Tibetan Plateau and its surrounding regions. This calls for further investigation – in part because EDW can illuminate cryosphere dynamics, and in part also because EDW makes current efforts to contain global warming all the more important for the HKH. Signatories to the United Nations Framework Convention on Climate Change (UNFCCC) agreed at the Conference of the Parties (COP21) in Paris in December 2015 to take steps towards limiting the global mean annual surface air temperature increase to well below 2°C above pre-industrial levels, and to pursue efforts towards a target of 1.5°C. By the end of the century, if average global warming is limited to 1.5°C above pre-industrial levels, the HKH will warm by 1.80±0.40°C. It is projected that EDW will continue.

TIBETAN PLATEAU, CENTRAL HIMALAYAN RANGE, AND KARAKORAM WILL WARM MORE THAN THE HKH AVERAGE

The Coordinated Regional Downscaling Experiment (CORDEX) models project significant warming over the HKH region in the future. In the near term (2036–2065), the region is projected to warm by 1.7–2.4°C for representative concentration pathway 4.5 (RCP 4.5) and 2.3–3.2°C for RCP 8.5. In the long term (2066–2095), regional warming is projected to be 2.2–3.3°C for RCP 4.5 and 4.2–6.5°C for RCP 8.5.

Increased warming during the winters is also projected. The Tibetan Plateau, the central Himalayan Range, and the Karakoram will see a rise in temperature higher than the HKH average.

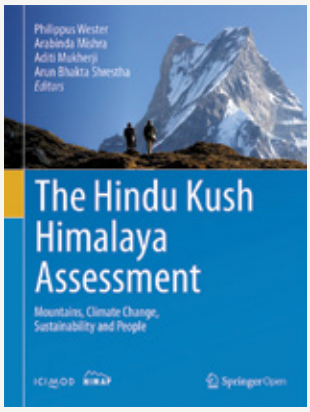
SIGNIFICANT CHANGES IN PRECIPITATION EXTREMES IN PAST DECADES

Significant increase in the number of wet days and extreme rain events recorded over the western Himalaya and the Karakoram region.

In the eastern Himalaya, the total amount of precipitation did not change much and the number of rainy days decreased, which meant a higher amount of rainfall in a shorter period of time.

INCREASING WESTERN DISTURBANCES AND THE KARAKORAM ANOMALY

Winter precipitation in the Himalaya is predominantly from synoptic weather systems known as western disturbances, which propagate eastward from the Mediterranean region. Annual winter snowfall amounts range from a few hundred to several hundred centimetres at different elevations, with the maximum snowfall occurring over the Karakoram. The western disturbances also significantly impact temperature patterns of the Himalaya besides precipitation. The changes in the westerly disturbance are also believed to increase the mass of some glaciers in the Karakoram and western Himalaya, popularly known as the "Karakoram Anomaly".



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