



Islamic Republic of Afghanistan

National Environmental Protection Agency

AFGHANISTAN: CLIMATE CHANGE SCIENCE PERSPECTIVES





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First published in December 2016 by the National Environmental Protection Agency (NEPA)
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This report was developed jointly by the National Environmental Protection Agency (NEPA) of the Islamic Republic of Afghanistan together with UN Environment, with funding from the Global Environment Facility's Least Developed Countries Fund (GEF LDCF), UKaid, Estonian Development Cooperation, and the European Union.

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Suggested citation: NEPA & UN Environment. (2016). *Afghanistan: Climate Change Science Perspectives*. Kabul: National Environmental Protection Agency & UN Environment.

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Acknowledgements: Many thanks to the Indian Institute of Tropical Meteorology for providing the CORDEX data.



CONTENT

EXECUTIVE SUMMARY	3
[1] INTRODUCTION	4-5
[2] OBSERVED CHANGES IN AFGHANISTAN'S CLIMATE	6-15
2.1. TEMPERATURE	8
2.2. PRECIPITATION	10
[3] CLIMATE PROJECTIONS FOR AFGHANISTAN	16-25
3.1. TEMPERATURE	17
3.2. PRECIPITATION	20
3.2.1. ANNUAL PRECIPITATION	20
3.2.2. SPRING PRECIPITATION	21
3.2.3. WINTER PRECIPITATION	23
3.2.4. HEAVY PRECIPITATION	24
[4] VALIDATION	26-31
4.1. REANALYSIS DATA	28
4.2. CLIMATE MODEL PROJECTIONS	30
[5] STATISTICAL METHODS	32-33
LITERATURE AND REFERENCES	34

EXECUTIVE SUMMARY

Global climate change will likely have severe impacts in Afghanistan. Even an “optimistic” scenario with limited Green House Gas (GHG) emissions (RCP 4.5) is projected to lead, with high certainty, to strong warming. Climate change projections for Afghanistan also show a temperature increase of around 1.4°C until 2050 and stabilization at the end of the century at around 2.6°C. Under a “pessimistic,” business-as-usual scenario with unchecked emissions, temperature rise is projected to become extreme with a mean increase of 2°C until 2050 and reaching more than 6°C by the end of the 21st century. The temperature increase shows regional differences with the strongest increases in the Central Highlands and the Hindukush regions. These findings are in line with historical temperature trends of over 1.8°C since the middle of the 20th century, though in the past the country’s South experienced the strongest warming.

Precipitation projections are more uncertain and the differences between scenarios is less distinct, with no clear trend for annual precipitation for the past and the future. However, most models predict a distinct decrease in precipitation during the spring season, which are the most important months for rain-fed agriculture. For the relevant regions in the East, North and Central Highlands, these precipitation decreases are estimated at around -30% to nearly -40 % for the past. Future projections show decreases in these relevant regions of around -20% until 2100. The trends for winter precipitation are also significant, but not systematic. Heavy precipitation (95th percentile) shows no statistically significant trend for the past and the future.

In sum, the climate signals for Afghanistan are alarming, particularly with regard to temperature increase. Even with limited GHG emissions, Afghanistan’s ecosystems, agriculture, economy, biodiversity, health, and food security will face big challenges. The changes caused by unchecked GHG emissions will be considerably more extreme and lead to unpredictable changes in the aforementioned systems and sectors in Afghanistan. In the face of an already existing adaptation deficit in the country, Afghanistan urgently needs enhancement of adaptation measures and strategies in all sectors, and a strong global effort to limit GHG emissions.

1

INTRODUCTION

1. INTRODUCTION

Afghanistan has a unique geography, ranging from the glaciated peaks of the Hindukush to the arid deserts of the South, covering altitudes from over 7,000 m.a.sl. down to under 250 m.a.sl. It is a landlocked country, located between 29-37° north, and its main geographical features are the very pronounced topography which are part of the Hindukush. These geographic features result in a generally dry and very characteristic continental climate. It is only influenced partly by the Indian sub-continent monsoon from the southeast, bringing moist maritime air in the summer. The majority of the country generally experiences cold winters and hot summers. Temperature ranges vary with elevation. This variation holds not only for the annual cycle but also within one day; temperatures often vary considerably from very cold nights to very hot days. Precipitation is mainly limited to the months between October and May, whereas the arid deserts receive less than 100 mm and in the mountains, mean annual precipitation is considerable above 1000 m.a.sl. In the mountains, most precipitation falls as snow during winter.

Afghanistan's variety of different climates has a large natural variability; however, over recent decades people are beginning to perceive climatological changes. There are very few scientific studies on climate change in Afghanistan. Analysis of past climate and future climate projections for Afghanistan only exist from a study of the Tyndall Center for UNDP and DFID country profiles^{1,2} of which results are also published in a study of the Stockholm Environmental Institute (SEI)³ on the socio-economic impacts on climate change from 2009. The analysis of the past is based on observations of station data which have large gaps, especially after 1970. The projections are based on the third generation of Global Climate Models (GCM) generated within the Coupled-Model Intercomparison Project (CMIP).⁴ They have a grid size of 2.5°, which means that Afghanistan is covered by a total of 19 cells. Regional climate models (RCM) or statistically downscaled GCMs have not been evaluated for Afghanistan comprehensively. In regard of its distinguished topography, a finer grid might bring new insights on climate trends for the future.

This report intends to update the former findings and evaluate the consistency with a new generation of climate models. Due to the large gaps in the observation data, reanalysis data has been analyzed for different regions in Afghanistan (Figure 1) from 1950 to 2010. For future climate trends, seven different RCM GCM combinations generated from the CORDEX⁵ project have been evaluated. Their grid size is 0.5° and Afghanistan is covered by over 300 cells in total, which permits a spatially detailed analysis.

OBSERVED CHANGES IN AFGHANISTAN'S CLIMATE

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