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Bangladesh will experience rise of temperature beyond the Paris agreement

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On December 12, 2015, a historic agreement to combat climate change to achieve a low carbon, resilient, and sustainable world was signed by representatives of 195 nations in Paris. The purpose of this historic agreement is to reduce greenhouse emissions to limit increase in global average temperature within 2 degrees Celsius above pre-industrial levels, aspiring even to limit global warming within 1.5C above the pre-industrial level. However, it is important to know how realistic it is to achieve this goal as per IPCC, as global mean temperate has already been raised by 0.78C over the last century, compared to the pre-industrial level.

A mean global rise in temperature by 2C is not guaranteed to be the same for Bangladesh. Recent studies have shown that extreme weather events such as floods, cyclones, severe drought, and sea level the rise are already intensifying in South Asia due to the impact of rise of temperature. The rise of temperature will eventually increase the frequency of cyclones and storm surges, affect crop yields, and increase health hazards and the probability of drought. Thus, for a country like Bangladesh, changes of mean temperature due to climate change will play an adverse role. Quantifying future changes of mean temperature is often found essential to assess these adverse impacts.

Projecting climate variability is essential for a densely populated developing country like Bangladesh. However, projections should be made over a domain large enough to capture the circulation patterns, having a spatial resolution fine enough to provide essential details for the impact models and capturing a wide range of uncertainties of predictions which are often found absent in many of the recent studies.

In this context, a study is conducted with 11 high resolution (~50km) Regional Climate Model (RCM) dynamically downscaled Global Circulation Model (GCM) data over the whole Indian sub-continent known as CORDEX-South Asia domain. Model results are validated using available observed datasets from the Bangladesh Meteorological Department. Changes of temperature are determined for three future time slices, viz short (2020s, ie 2011-2040), medium (2050s, ie 2041-2070), and long (2080s, ie 2071-2100) with respect to the baseline period (1971-2000).

In this context, a four-year long research project called “High End Climate Impact and Extremes (HELIX)” is ongoing at BUET funded by the European Union to carry out this study. An attempt has been made to assess the expected future changes of temperature across Bangladesh under an extreme global warming scenario termed as RCP 8.5. It has been found that high-resolution regional climate models (RCM) perform well in representing the seasonal mean as well as some small-scale features of monsoon temperature patterns over Bangladesh. The average temperature anomaly (difference between observed and model prediction) relative to pre-industrial period for the 11 RCM models exhibits an increasing trend. Towards the end of the 21st century (2071–2100), all RCM models indicate a significant rise in the mean annual temperature ranging between 3.7C and 5.7C over Bangladesh.

On the other hand, considering extreme emission scenarios, Bangladesh will experience a mean rise of 2C by 2040. Based on the median of these 11 regional climate model predictions, Bangladesh will experience a mean rise of temperature by 4C relative to pre-industrial period by the end of 2080.

From these multi-model ensemble results, the highest rise of temperature will be in February during the 2080s ranging between 3.6C and 9.8C. All regional climate models project increase in average temperature over Bangladesh for the three future time slices. During the winter months (January and February) mean monthly temperature will rise to the highest during the 2050s and 2080s, which indicates a warmer winter season for Bangladesh. Though warmer winter will reduce cost of heating, it will adversely affect the production of cold loving crops. On the other hand, both summer and monsoon temperature will have an anomaly ranging between 0.7C and 4C relative to the pre-industrial period.

The scenarios presented in this article are indicative of the expected range of changes in the climate over Bangladesh. The detection of possible changes in extreme temperature, in terms of the seasonal, spatial as well as duration, is of profound importance to the local, regional, and national scales, due to the associated socio-economic consequences. Nonetheless, the majority of models predict that temperatures will rise throughout the century and reach its maximum at the end of the century.

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