# KNOWLEDGE BRIEF
# TEMPERATURE TRENDS IN BANGLADESH

## Overview

The climate of Bangladesh is very likely to be influenced by global climate change. Bangladesh has a subtropical monsoon climate characterized by wide seasonal variations in rainfall, moderately warm temperatures, and high humidity (1). Although Bangladesh is said to have six seasons according to the Bengali calendar year, marked by distinct weather features, these distinctions are getting blurred. Summers are becoming hotter and longer, now spanning from February to October, while the monsoon is also spread over a longer period between February and October with the peak monsoon experiencing less rainfall. Winters are becoming warmer. In essence, Bangladesh appears to be losing its seasonality. Bangladesh's historical climate has experienced average temperatures around 26$^0$C, but range between 15$^0$C and 34$^0$C throughout the year (2).

In Bangladesh, the monthly average temperature ranges from 5.8°C (January) and 35.7°C (August); the coldest month is January and the hottest months in Bangladesh between April and October (3). Winter (December to February), summer/pre-monsoon (March to May), monsoon (June to September), and post-monsoon (October to November) are the four predominant seasons of the country (1, 3).

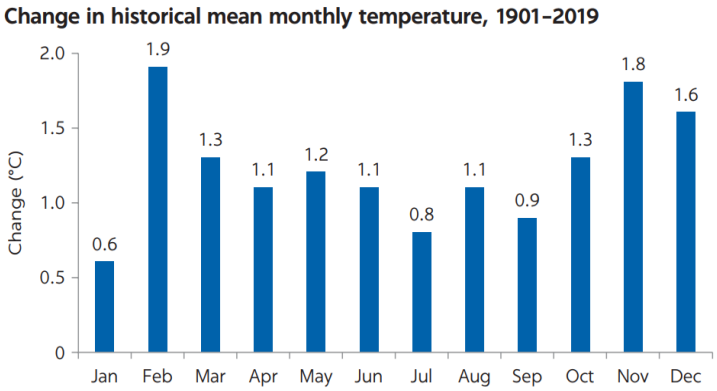


Figure 1: Change in historical mean monthly temperature, 1901–2019 (2).

Figure 1 shows the change in mean monthly temperature between 1901 and 2019 using averages for two 30-year periods, 1901–30 and 1991–2019. Overall, annual mean temperatures have increased. Summers are hotter and longer— temperatures for March to October rising by 1.1°C to 1.3°C except for July and September, when it increased by 0.8°C. Winters are also becoming warmer, with average annual temperature rising by 1.6°C to 1.8°C in November and December; in January it increased by 0.6°C. The maximum change in annual temperature is seen in February, when it increased by almost 1.9°C (2).

## Bangladesh Temperature Projections to 2099

According to an assessment conducted by the Intergovernmental Panel on Climate Change (IPCC), continued emissions of greenhouse gases will cause further warming in Bangladesh. Mean temperatures across Bangladesh are projected to increase by 1.4°C and 2.4°C by 2050 and 2100, respectively. This warming is expected to be more pronounced in the winter

months from December to February. Observed data indicate that the temperature is generally increasing in the monsoon season of June to August. Average monsoon season maximum and minimum temperatures show an increasing trend annually at the rate of 0.05°C and 0.03°C, respectively (2).

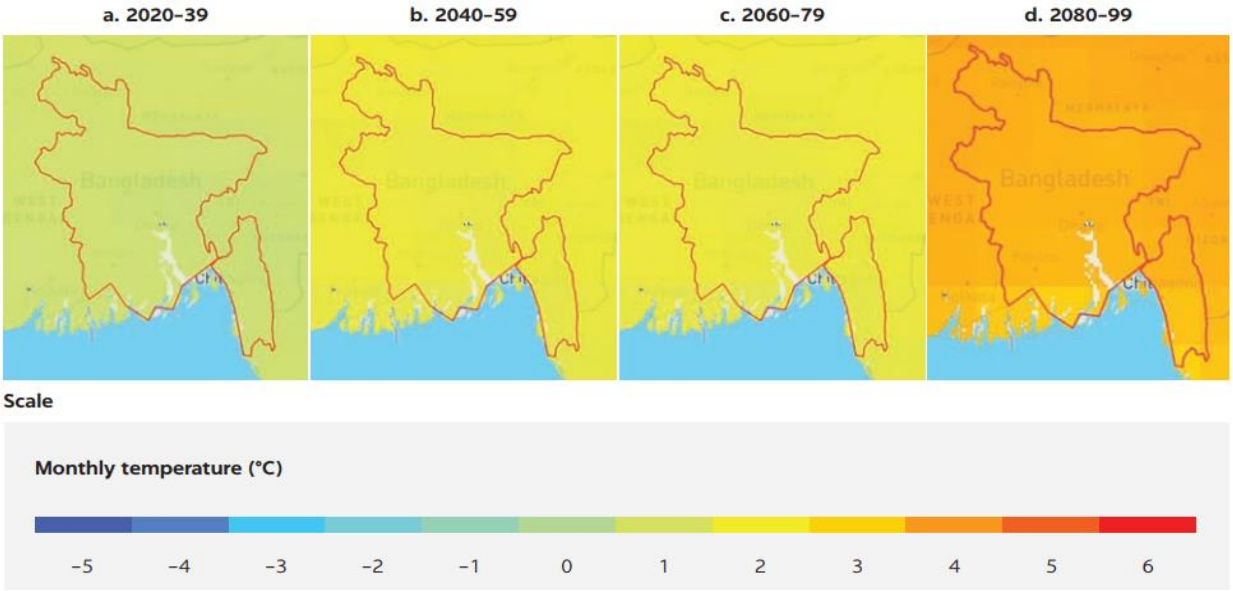


Figure 2: Projected change in monthly temperature (2).

In Bangladesh, models show a trend of consistent warming that varies by emissions scenario. Table 1 below provide information on temperature projections and anomalies for the four Representative Concentration Pathways (RCPs) i.e. RCP2.6, RCP4.5, RCP6.0, and RCP8.5 over two distinct time horizons; presented against the reference period of 1986–2005. RCP2.6 represents a very strong mitigation scenario, whereas RCP8.5 assumes a high-emissions scenario (4).

**Table 1:** Projected Anomaly (Changes °C) for Maximum, Minimum, and Average Daily Temperatures in Bangladesh for 2040–2059 and 2080–2099.

| | Average Daily Maximum Temperature | | Average Daily Temperature | | Average Daily Minimum Temperature | |
|---|---|---|---|---|---|---|
| Scenario | 2040–2059 | 2080–2099 | 2040–2059 | 2080–2099 | 2040–2059 | 2080–2099 |
| RCP2.6 | 1.1 (–1.3, 3.7) | 1.2 (–1.3, 3.8) | 1.2 (–0.8, 2.9) | 1.3 (–0.8, 3.0) | 1.1 (–0.5, 2.7) | 1.2 (–0.5, 2.8) |
| RCP4.5 | 1.5 (–0.9, 3.9) | 2.2 (–0.3, 4.9) | 1.6 (–0.5, 3.2) | 2.1 (0.1, 4.1) | 1.4 (–0.2, 3.2) | 2.1 (0.3, 4.0) |
| RCP6.0 | 1.2 (–1.6, 3.7) | 2.6 (–0.1, 5.6) | 1.2 (–0.9, 3.1) | 2.5 (0.4, 4.6) | 1.2 (–0.3, 2.9) | 2.6 (0.7, 4.4) |
| RCP8.5 | 1.9 (–0.5, 4.4) | 3.9 (1.4, 6.7) | 1.9 (0.0, 3.8) | 3.9 (2.0, 6.2) | 2.0 (0.4, 3.8) | 4.2 (2.3, 6.3) |

Average temperature increases in Bangladesh are broadly in line with the IPCC's global projections. When factoring in warming prior to the baseline period of 1986–2005 (i.e. when

calculating temperatures against pre-industrial levels) the warming experienced in Bangladesh will breach the 2°C threshold by the end of the century under all RCPs except RCP2.6. This highlights the importance of achieving lower global emissions pathways (4).

## Analyzing Temperature Trend in Bangladesh

Bangladesh has experienced considerable rise in temperature. While there is debate about the magnitude of future increase, projections show that temperature will rise in all regions in Bangladesh in future similar to the global trend (5). Analyses of climate data obtained from the 35 weather stations of Bangladesh Meteorological Department (BMD) show that, over the years the maximum, minimum and average temperature have shown increasing trend in Bangladesh.

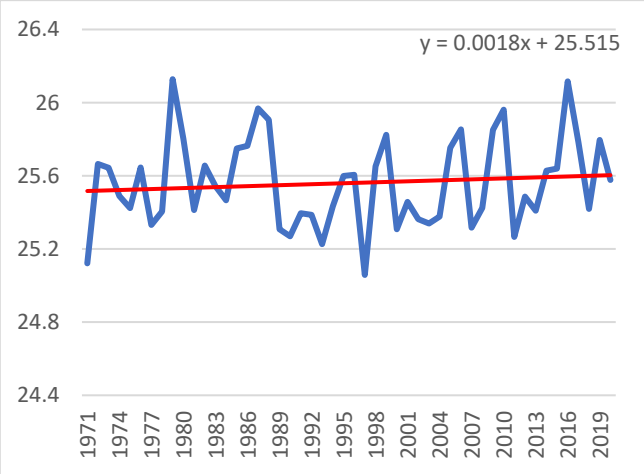


Figure 3: shows the increasing trend in yearly average temperature in Bangladesh from 1971 to 2020

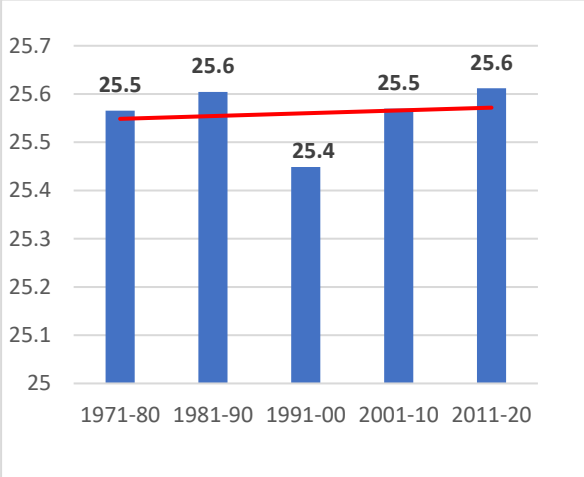


Figure 4: shows the upward trend of decadal average temperature in Bangladesh

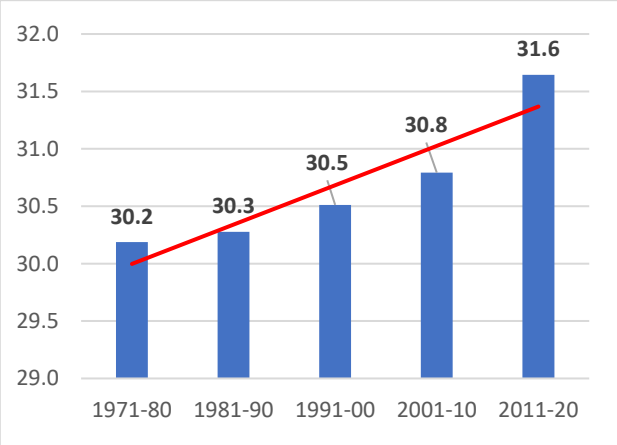


Figure 5: shows the decadal trend of average maximum temperature and it is apparent that in the last decade (2011-2020), average maximum temperature has increased 1.4°C compared to the base decade of 1971-1980.

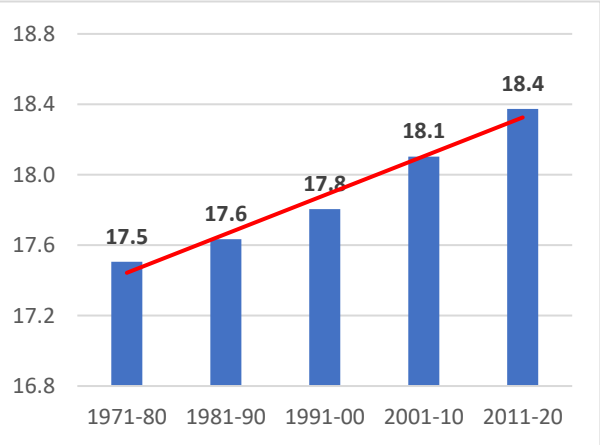


Figure 6: shows the decadal trend of average minimum temperature and it is clear that in the last decade (2011-2020), average minimum temperature has increased 0.9°C compared to the base decade of 1971-1980.

So, it is evident that over the decades, the average, maximum and minimum temperature has increased in Bangladesh and the last decade (2011-2020) was the warmest decade in the history of Bangladesh.

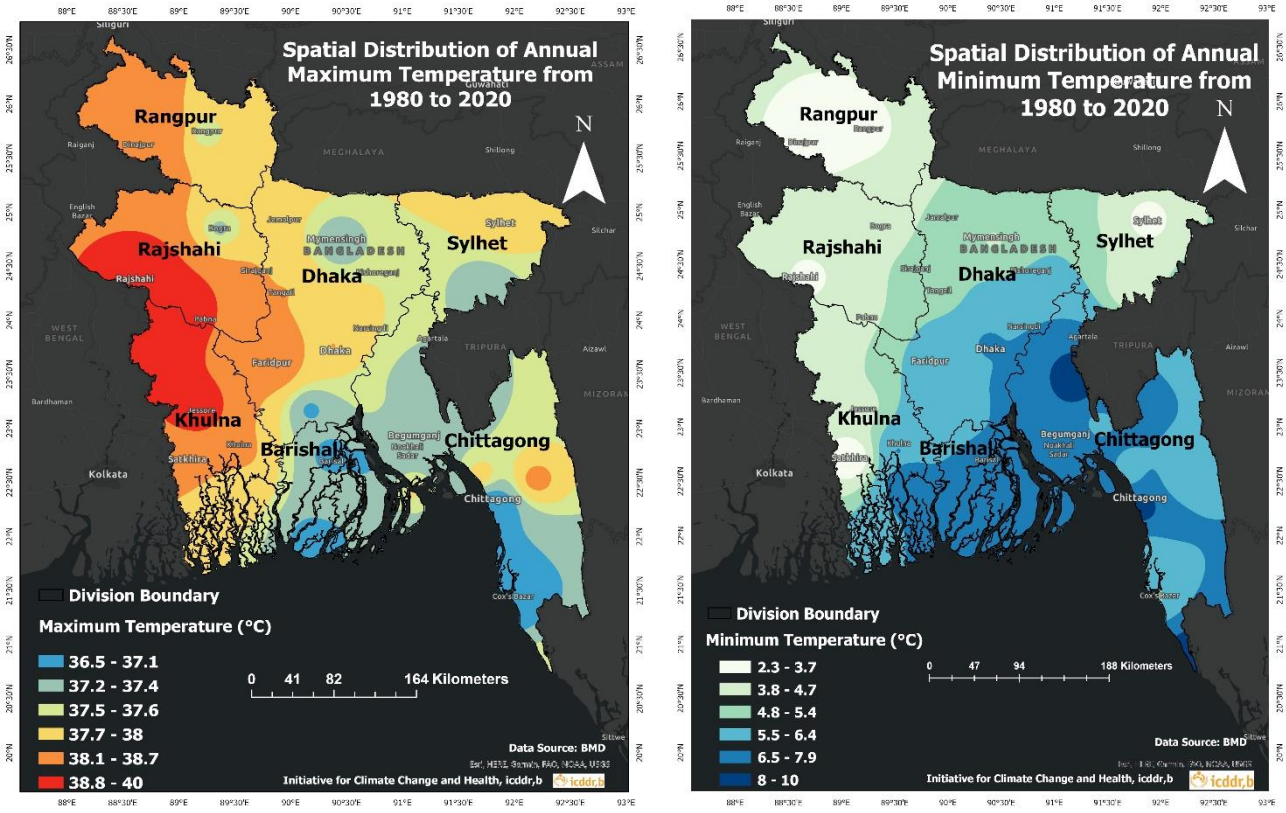


Figure 7: Spatial distribution of annual maximum and minimum temperature in Bangladesh.

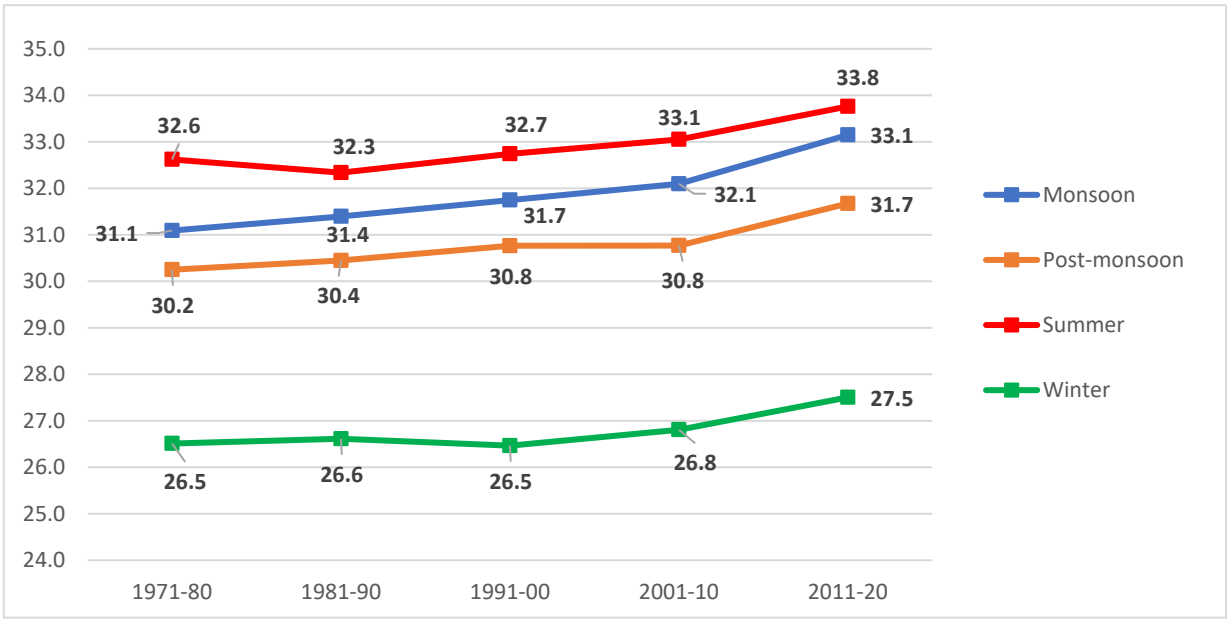


Figure 8: shows the seasonal change in average maximum temperature in Bangladesh by decades.

For each season, maximum temperature is showing an increasing trend over the decades; summer is the hottest season and getting hotter over the decades. in the last decade of

2011-2020, maximum temperature has increased 1.2°C in summer, 2°C in Monsoon, 1.5 °C in Post-monsoon and 1°C in winter compared to the base decade of 1971-1980. It is also notable that winter season is getting hotter by the decades indicating the impact of climate change in Bangladesh.

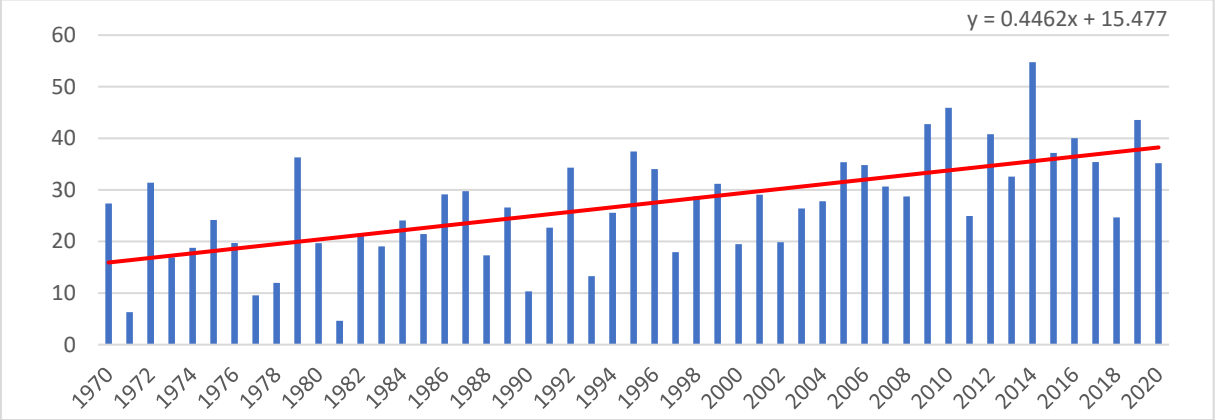


Figure 9: shows the increasing trend of total hot days (>35 °C) in Bangladesh.

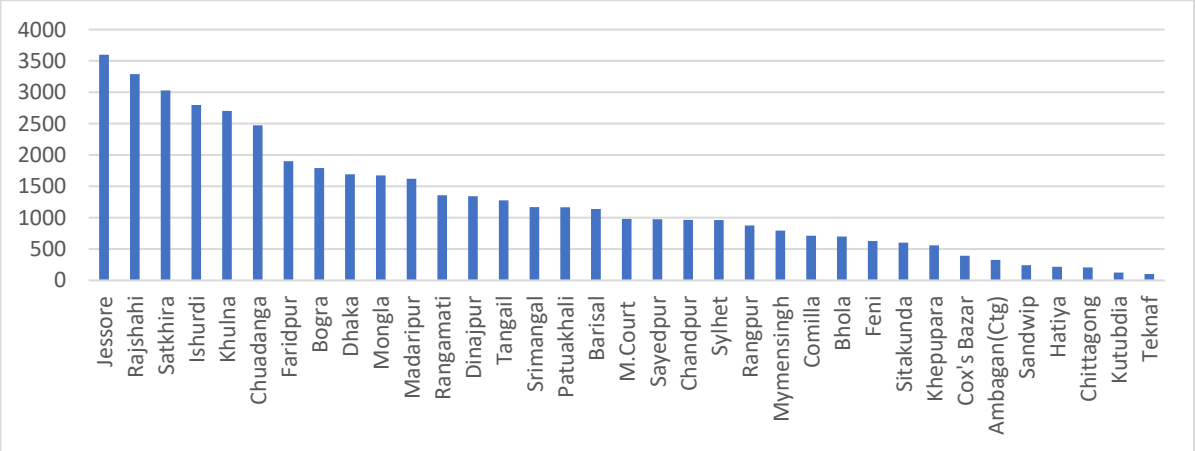


Figure 10: shows the district wise distribution of total hot days calculated based on the BMD weather stations.

From figure 10 and 11, it is evident that the South-West and North-West districts (e.g. Jessore, Rajshahi, Satkhira) are more hotter in terms of total hot days.

Studies also revealed the monthly, seasonal and annual increasing trends of temperature in Bangladesh except a very few places, having the highest increasing trends over southwestern and northwestern part of the country. The highest increasing trends over southwestern and northwestern part may be due to the advection and penetration of higher TMax (maximum temperature) due to northwesterly winds and less rainfall over the area (6-8).

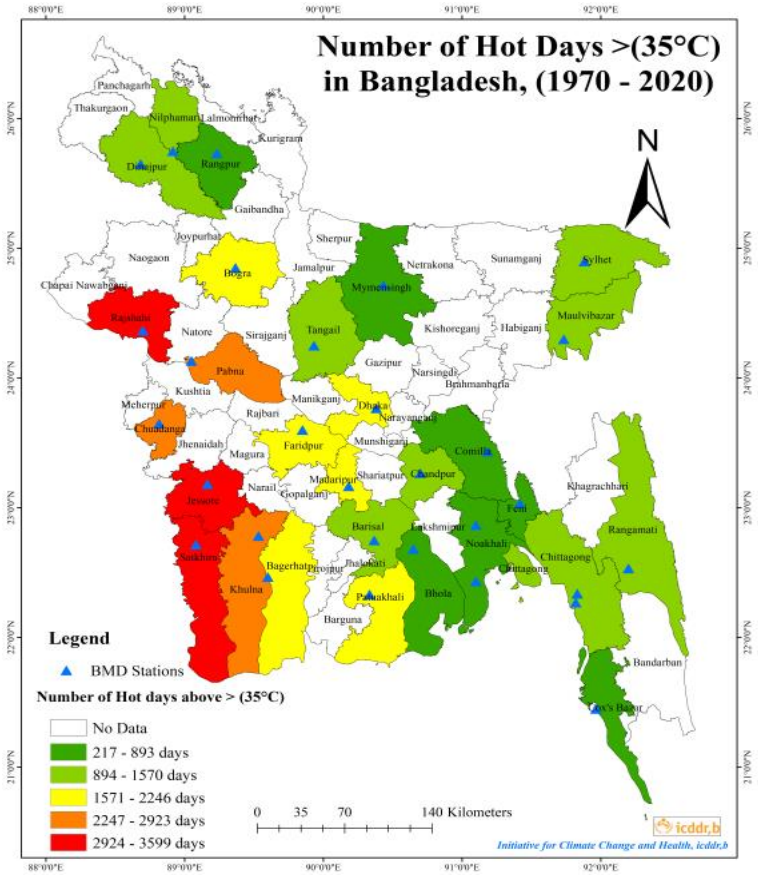


Figure 11: Spatial distribution of total hot days in Bangladesh

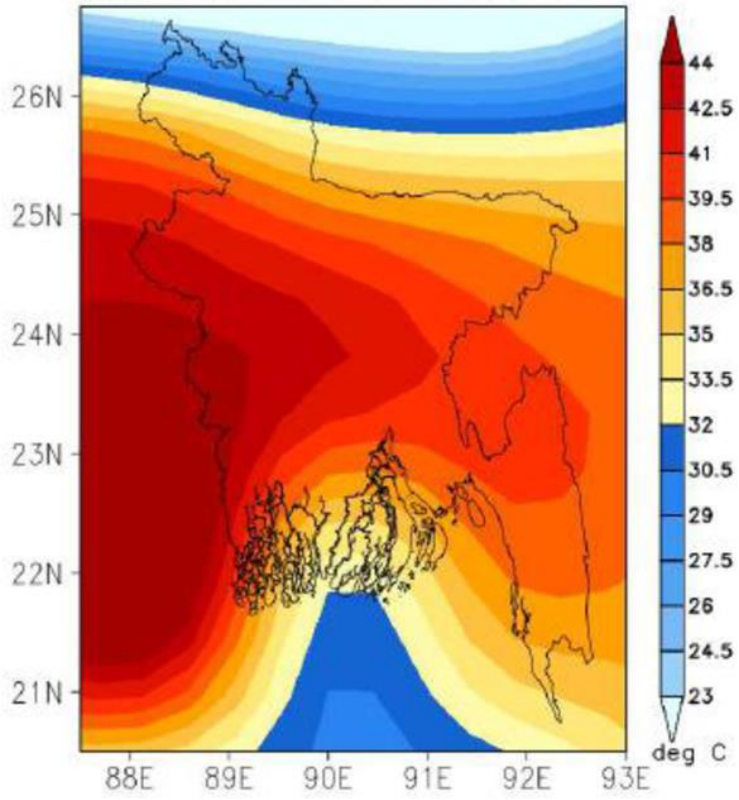


Figure 12: Southwestern and northwestern part of the country is the hottest region due westerly/northwesterly wind from India and less rainfall (8)

The large-scale synoptic conditions show that heat waves are found to enter Bangladesh from the west/northwest due to the advection of higher TMax from the west. It has been found that the heat waves are generated over India, especially in the central India and is advected into Bangladesh raising the maximum temperature due to the westerly/northwesterly wind. The primary centre of maximum temperature surrounding the country lies over India extended to West Bengal and adjoining Bangladesh (Figure 12) (6-8).

## References

1) Bangladesh Meteorological Department (2016). Report on Climate of Bangladesh. URL: http://live4.bmd.gov.bd/file/2016/08/17/pdf/21827.pdf
2) Mahmud, Iffat; Raza, Wameq A.; Hossain, Md Rafi. 2021. Climate Afflictions. International Development in Focus;. Washington, DC: World Bank. URL: https://openknowledge.worldbank.org/handle/10986/36333
3) Mallick, J., Islam, A.R.M.T., Ghose, B. *et al* (2022). Spatiotemporal trends of temperature extremes in Bangladesh under changing climate using multi-statistical techniques. *Theor Appl Climatol* 147, 307–324 (2022). https://doi.org/10.1007/s00704-021-03828-1
4) The World Bank Group, 2021. Climate Risk Country Profile: Bangladesh. URL: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15502-WB_Bangladesh%20Country%20Profile-WEB.pdf
5) General Economics Division (2018). Bangladesh Delta Plan-2100. General Economics Division, Bangladesh Planning Commission, Government of the People's Republic of Bangladesh. URL: https://oldweb.lged.gov.bd/UploadedDocument/UnitPublication/1/756/BDP%202100%20Abridged%20Version%20English.pdf
6) Rahman, M.B., Salam, R., Islam, A.R.M.T. *et al* (2021). Appraising the historical and projected spatiotemporal changes in the heat index in Bangladesh. *Theor Appl Climatol* 146, 125–138 (2021). https://doi.org/10.1007/s00704-021-03705-x
7) Rakib Z (2018) Characterization of climate change in southwestern Bangladesh: trend analyses of temperature, humidity, heat index, and rainfall. Clim Res 76:241-252. https://doi.org/10.3354/cr01535
8) Karmakar, S., & Das, M. K. (2020). On the heat waves in Bangladesh, their trends and associated large scale tropospheric conditions. *Journal of Engineering Science*, *11*(1), 19–36. https://doi.org/10.3329/jes.v11i1.49544

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**Available at: https://cch.icddrb.org/knowledge-briefs**

## About the https://cch.icddrb.org website

Monitoring the growing impacts of climate change (CC) on health in Bangladesh requires various data on climate change, health, and population outcome. To bring together relevant data sources and essential links, to provide a more up-to-date climate change and health scenario in the Global and Bangladesh context in a single web-based platform, a resource website "https://cch.icddrb.org" has been developed under the USAID's Research for Decision Makers (RDM) Activity. The website provides essential resources and relevant data sources for health professionals to enhance their understanding of climate change and utilize the knowledge in health research and intervention design, which may minimize the negative impacts of climate change.

The website shows real-time data and interactive graphs on climatic parameters such as hourly, daily, and monthly temperature, humidity, and air pollution (Air Quality Index, PM2.5) through an integrated iQAir device. The website also generates dynamic graphs on the meteorological parameters collected from Bangladesh Meteorological Department (BMD). The website showcases icddr,b works on climate change and health. We believe the resources website should enable researchers, program managers, and policymakers with essential data and discussion to measure and monitor climate change's impact on health and design interventions that may minimize such negative impacts.

SCAN ME

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