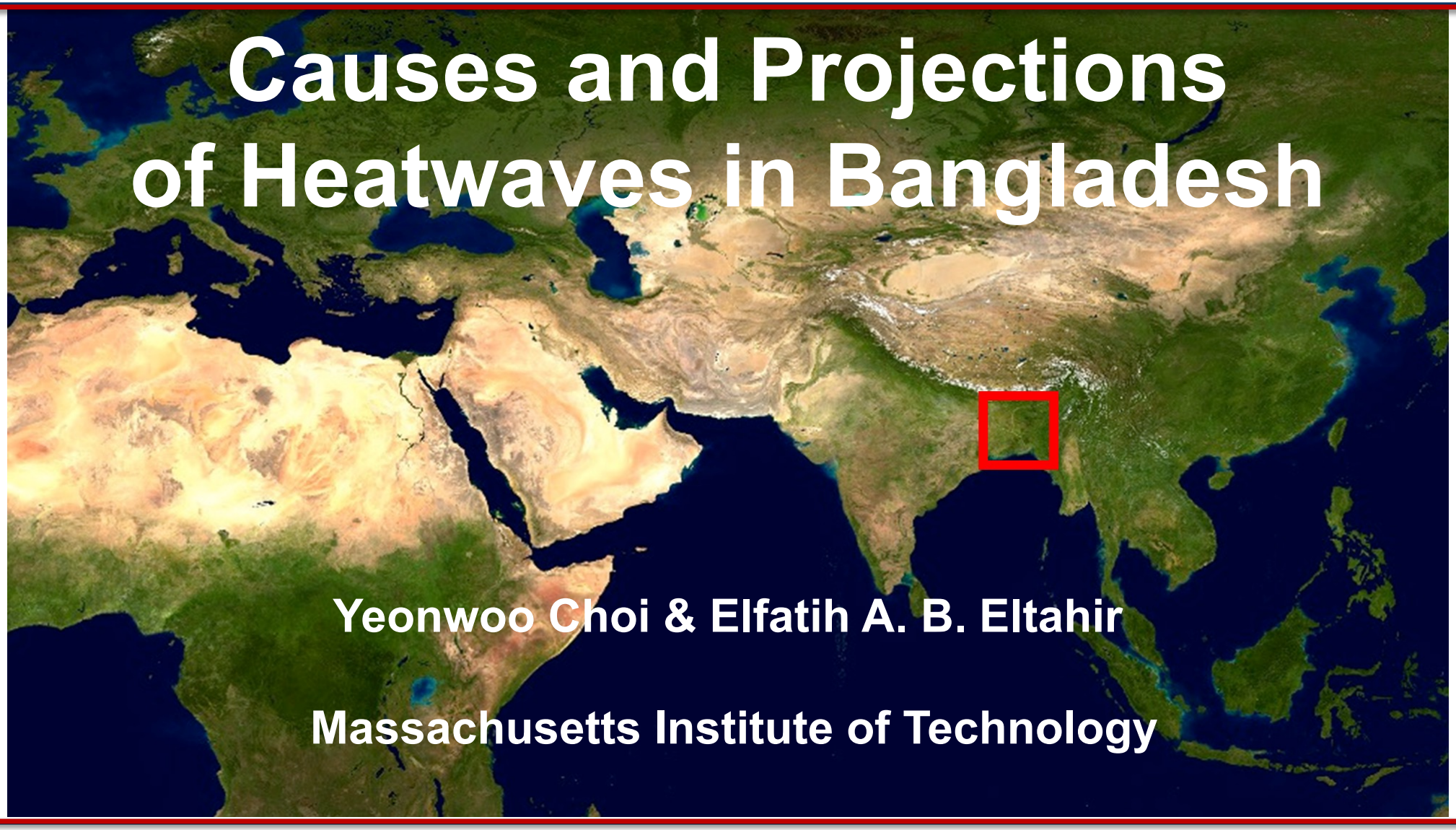
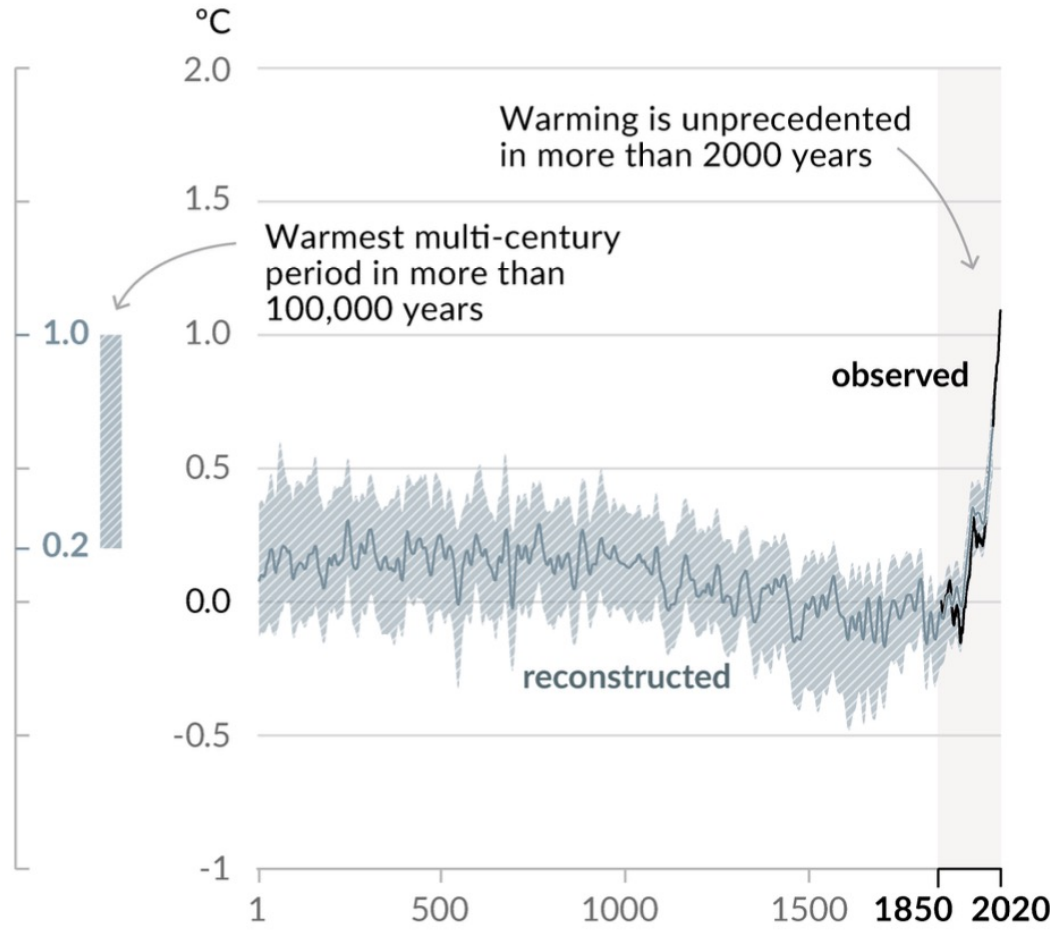
Causes and Projections of Heatwaves in Bangladesh



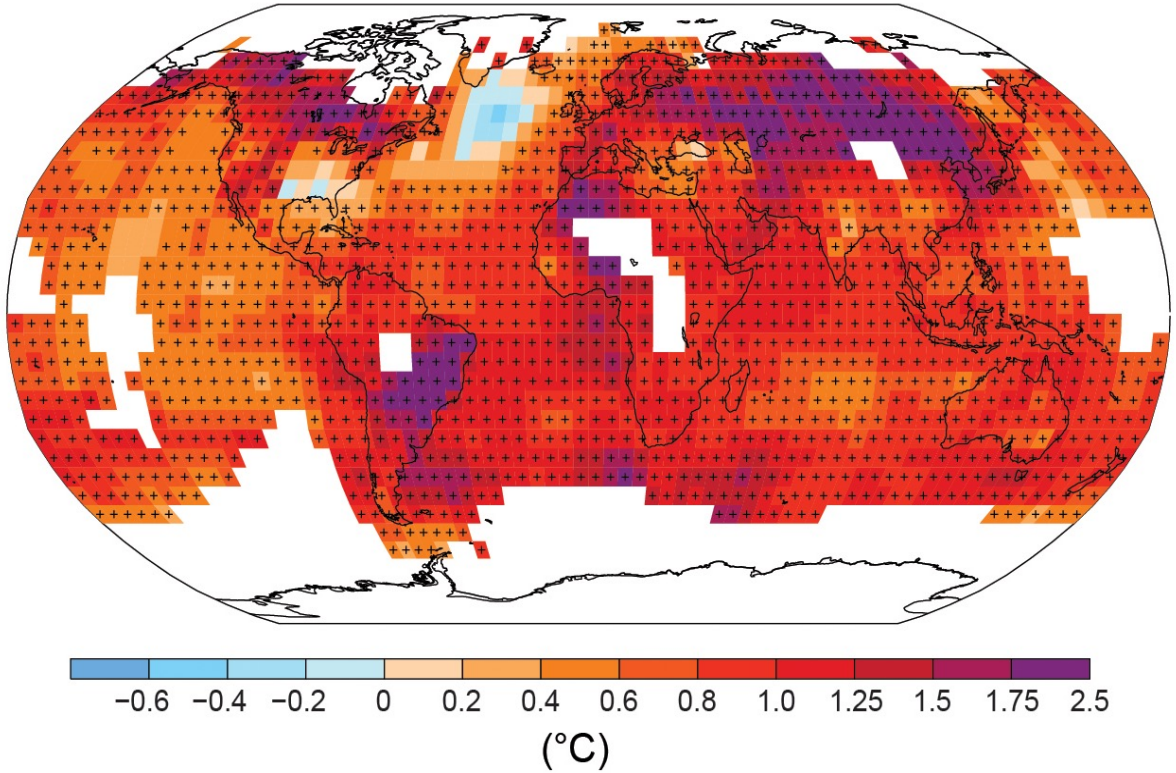
Yeonwoo Choi & Elfatih A. B. Eltahir

Massachusetts Institute of Technology

Observed Global Warming

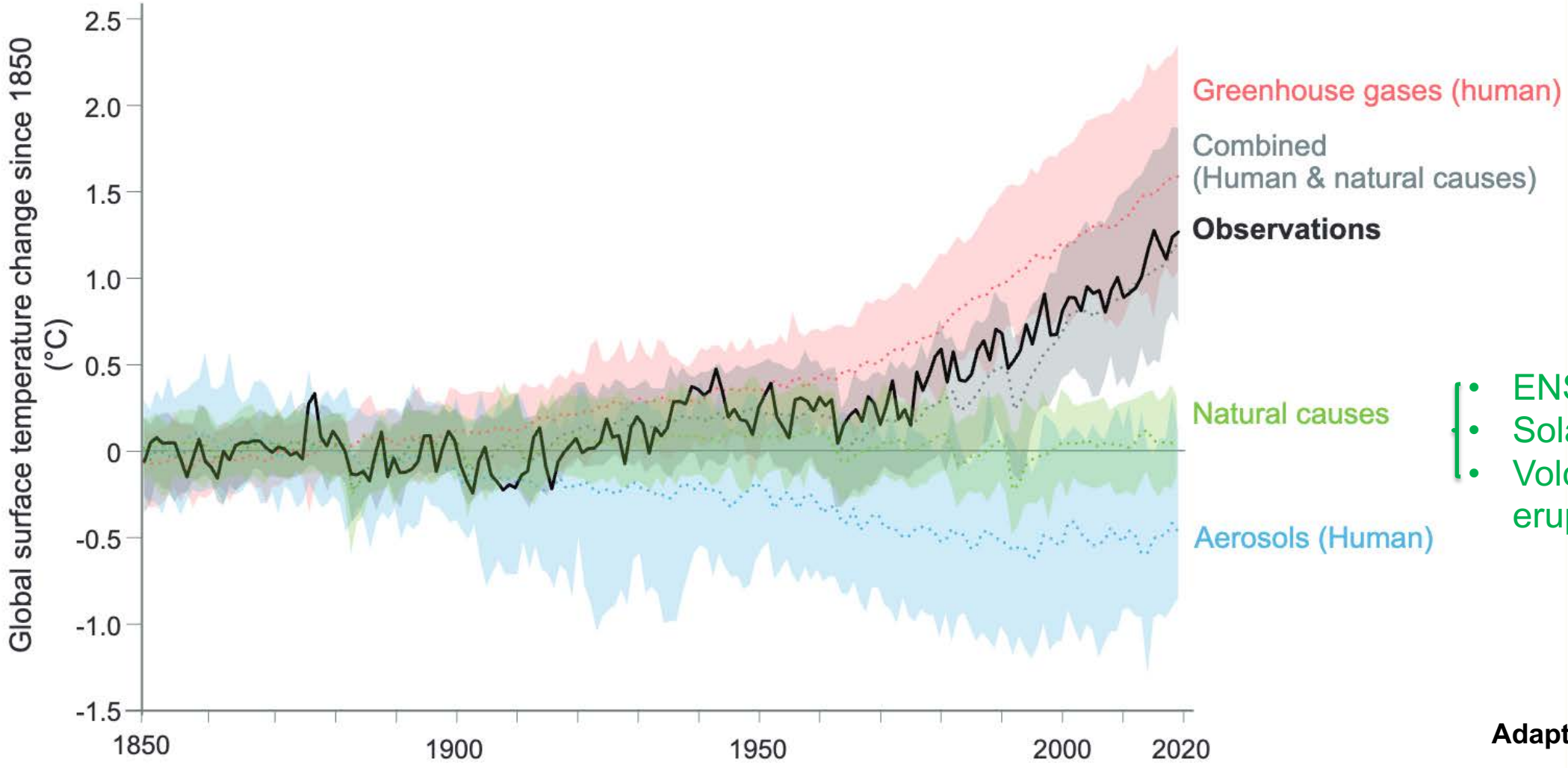


Global surface temperature adapted from IPCC AR6



Adapted from IPCC AR5

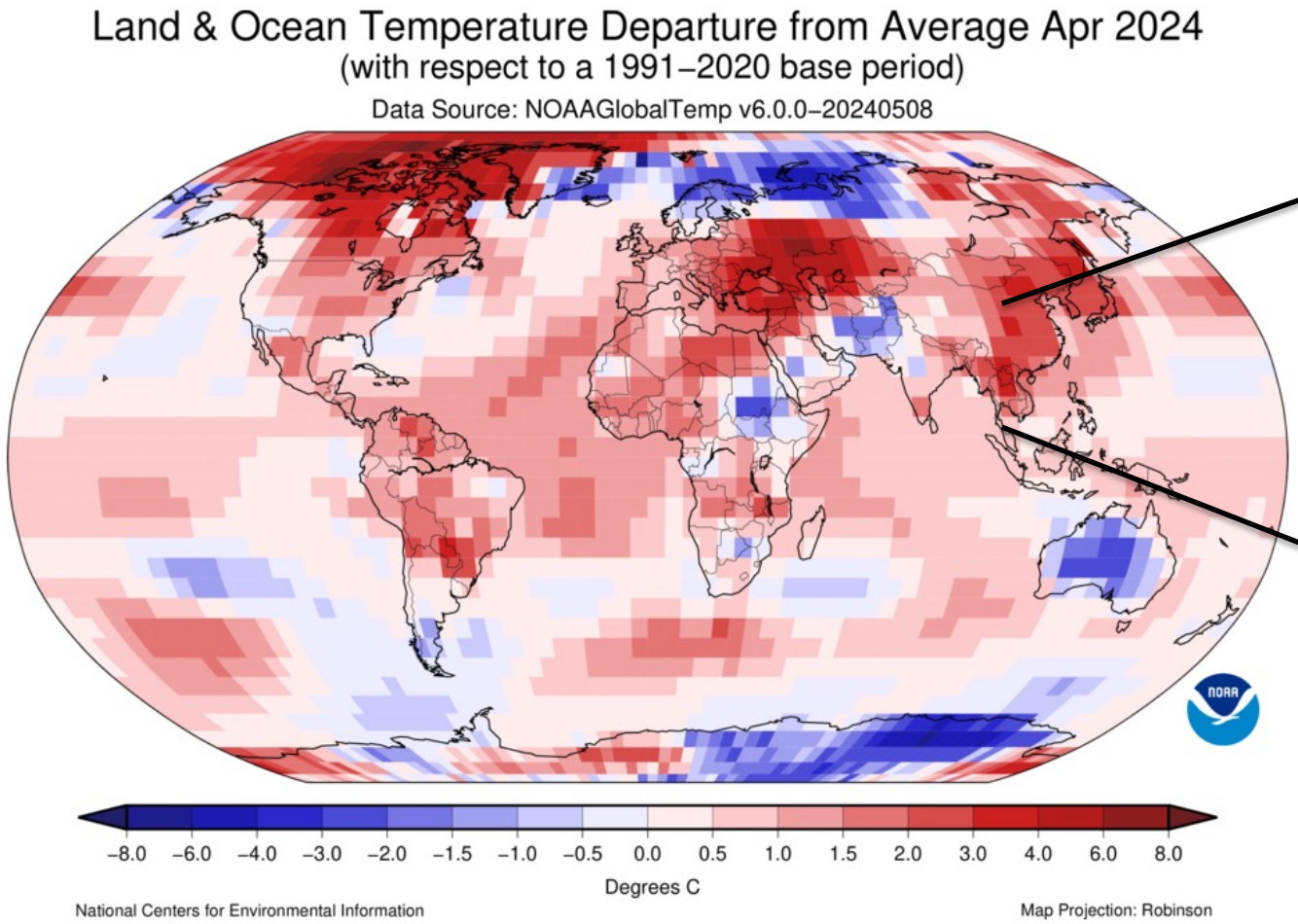
Natural Variability and Human Influence

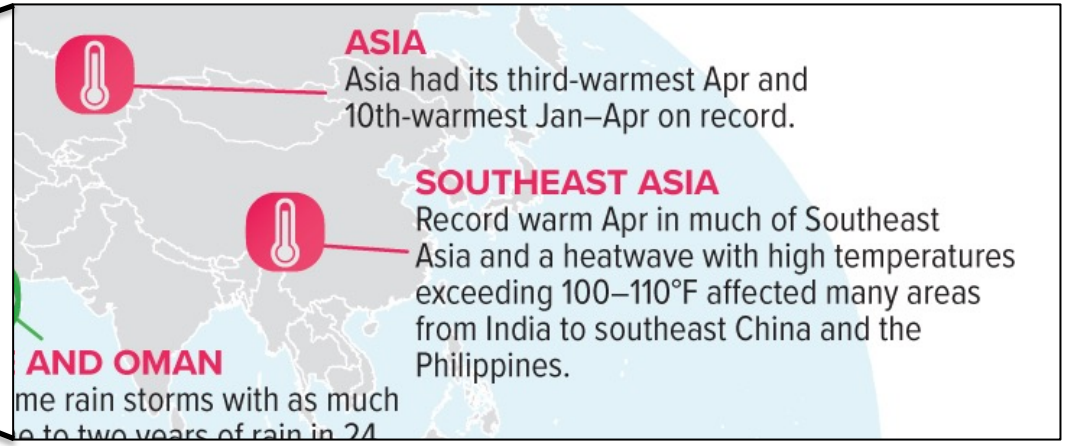


Adapted from IPCC AR6

Bangladesh Heatwave: Characterization

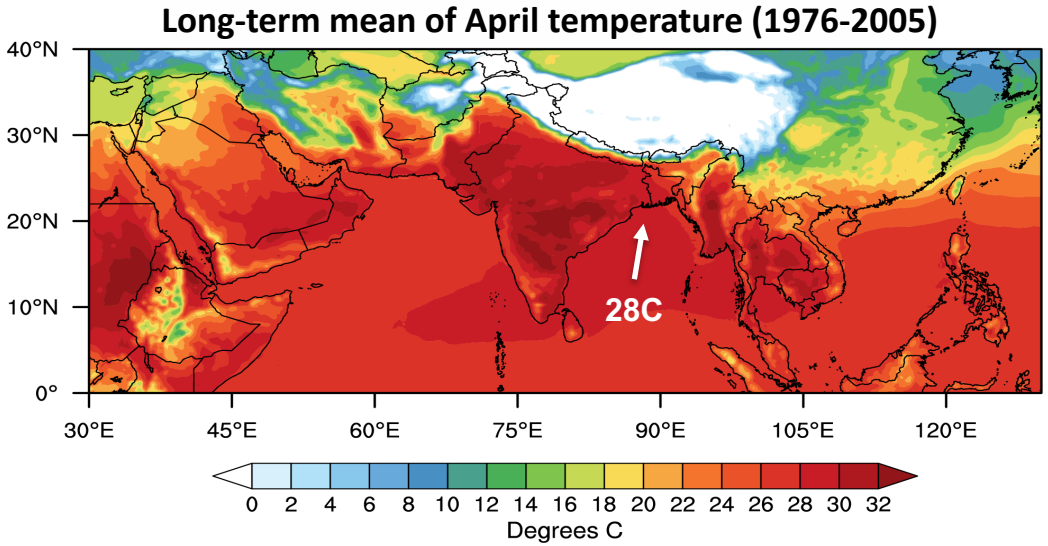
The warmest April on record

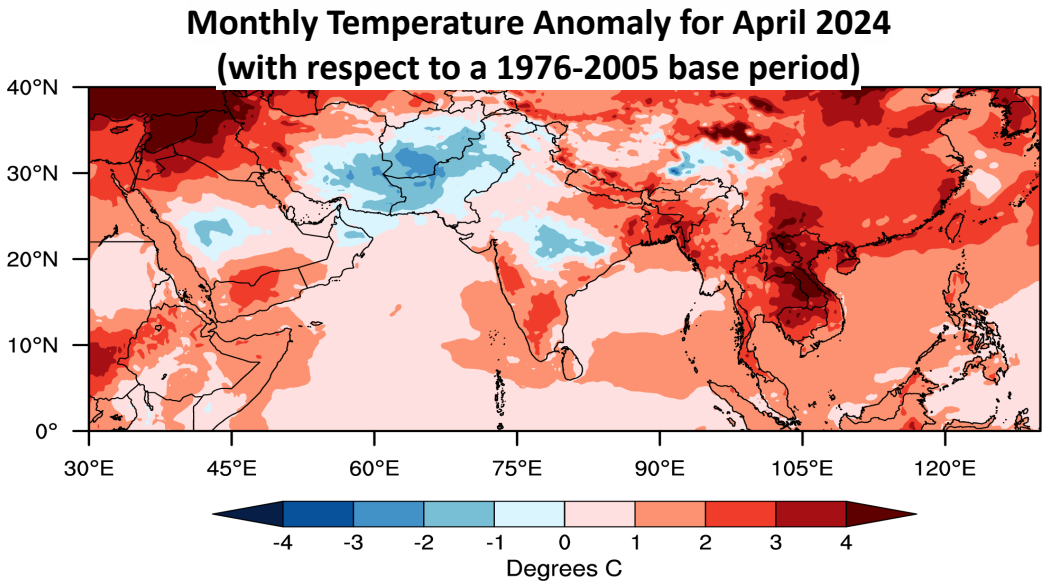


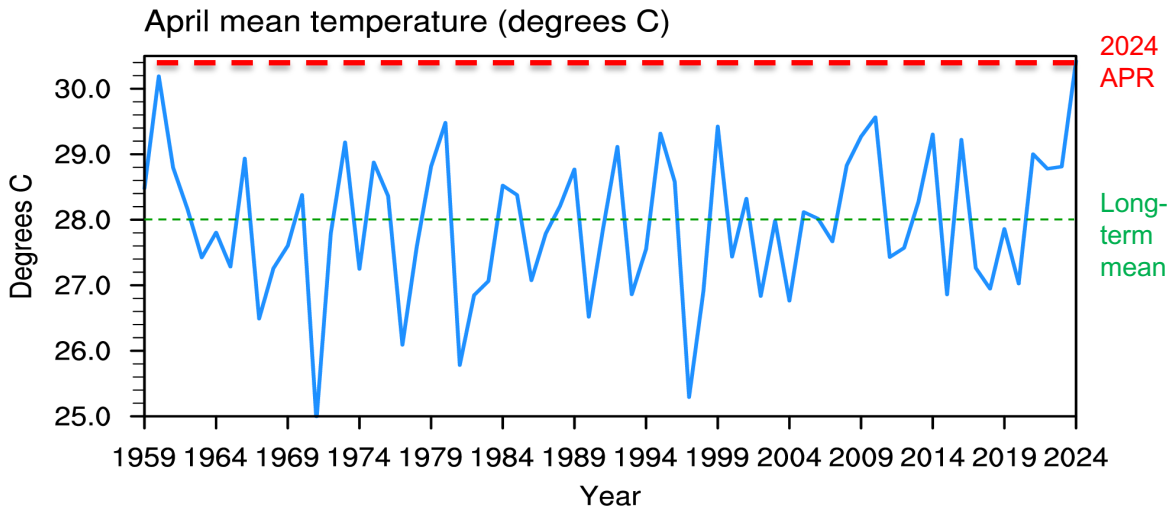


Adapted from NOAA

Extreme heat event in April 2024



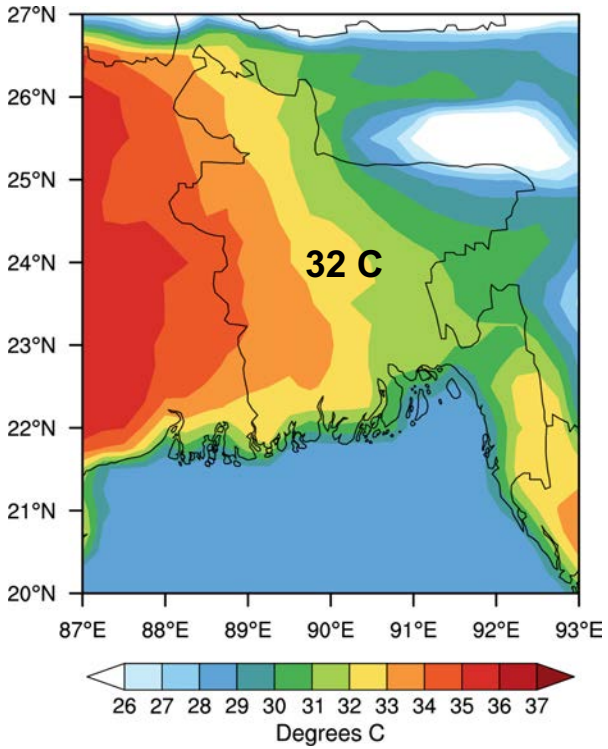




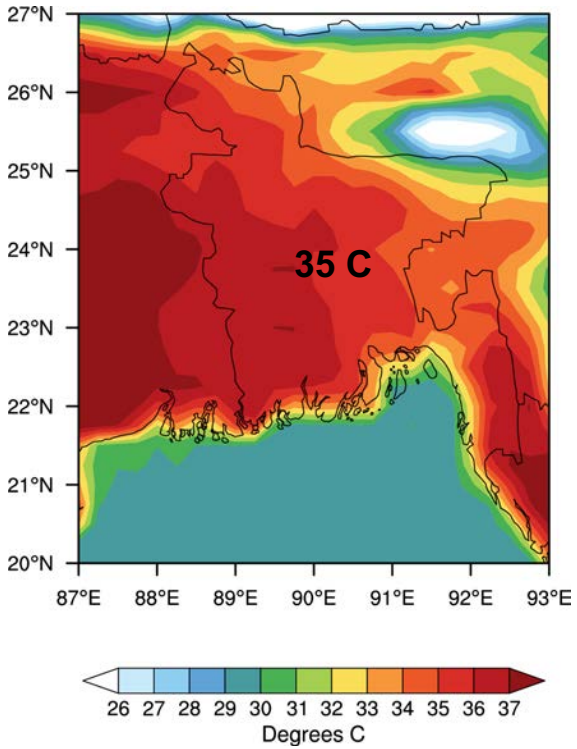
Extreme heat event in April 2024

Monthly mean of daily maximum temperature (degrees C)

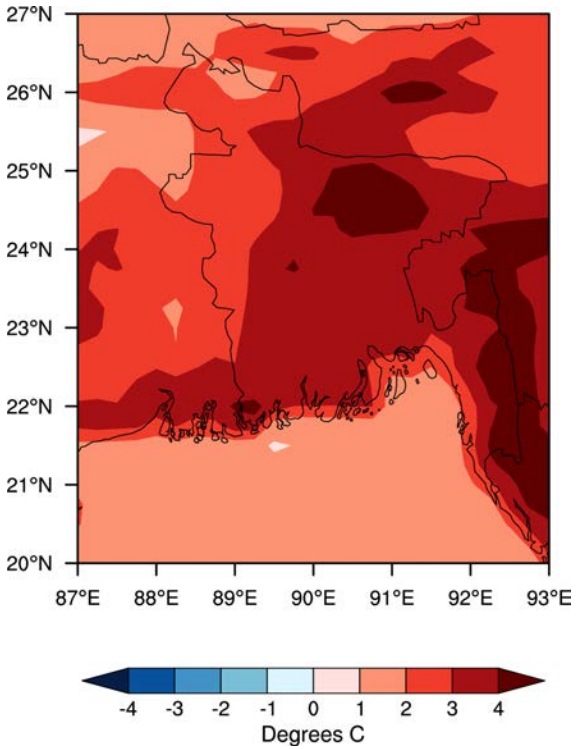
ERA5 (1976-2005)



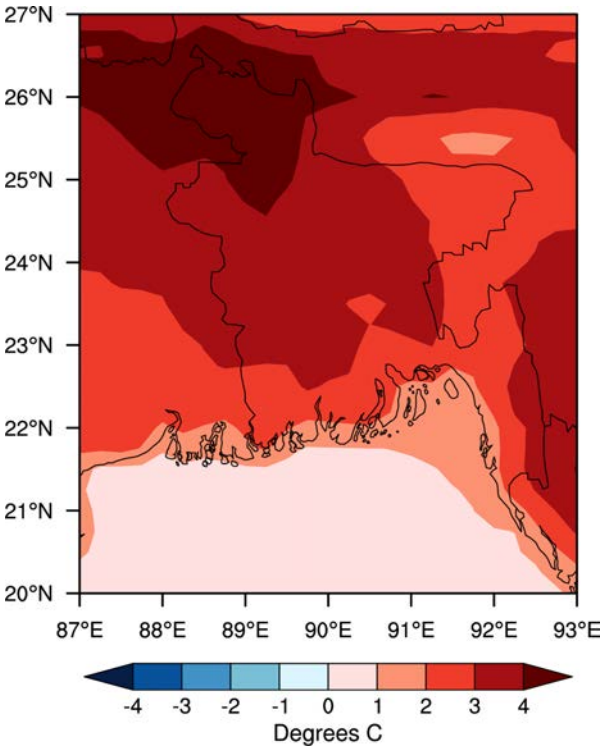
ERA5 (2024)



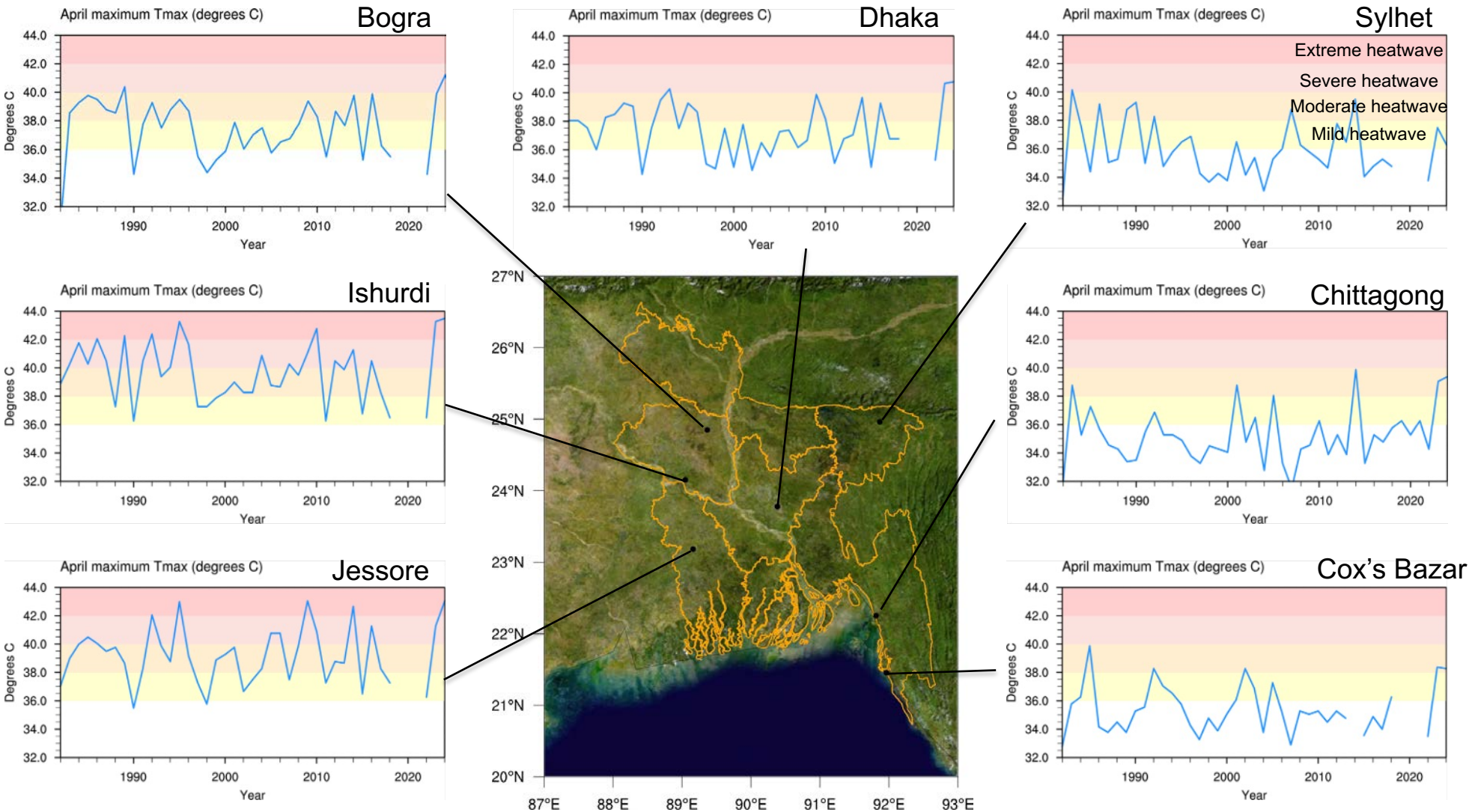
DIFF (2024 - Clim)



ERA5 (2 SD)



Monthly Maximum of Daily Maximum Temperature in April



Station Data

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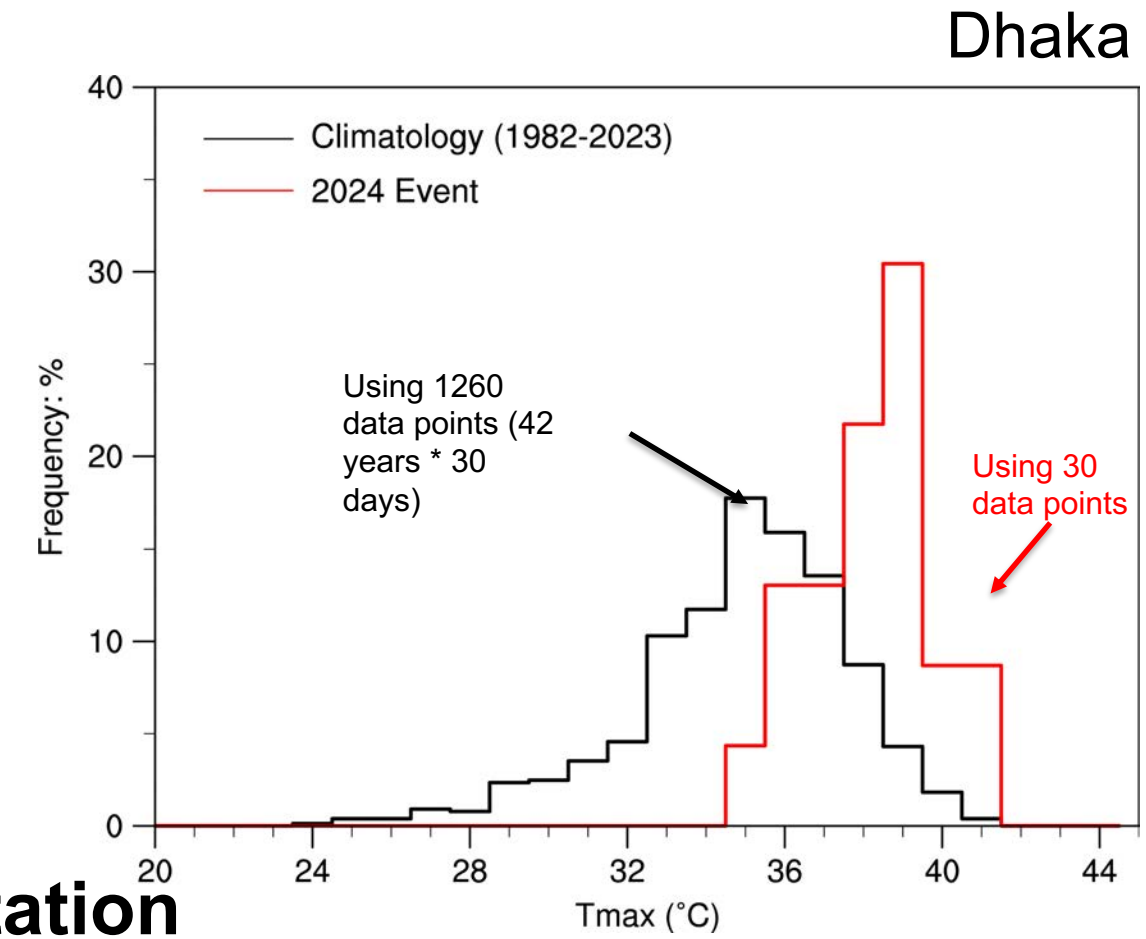
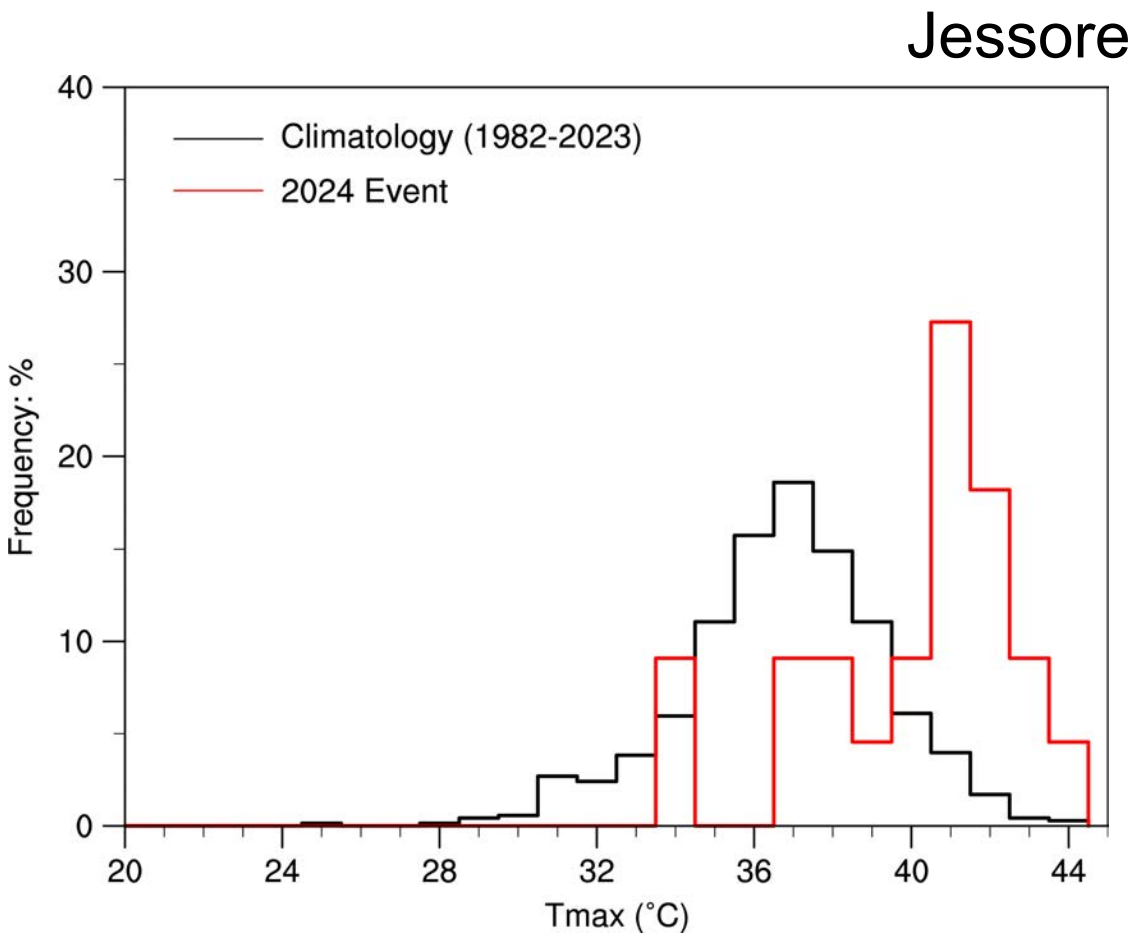
Probability of Observed Daily Maximum Temperature

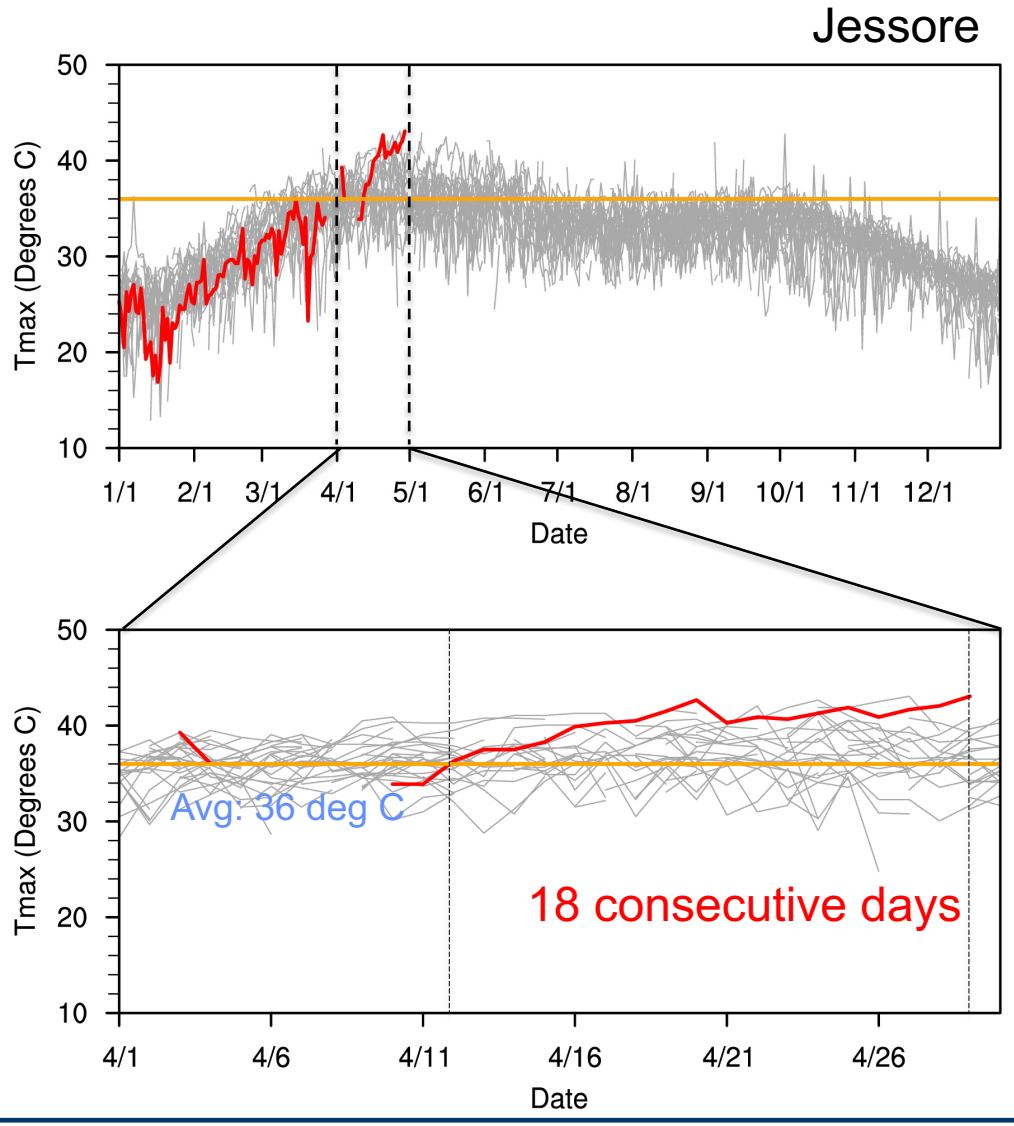




Station Data

Using daily maximum dry-bulb temperature for April during the period 1982-2023.

Consecutive heat-wave days

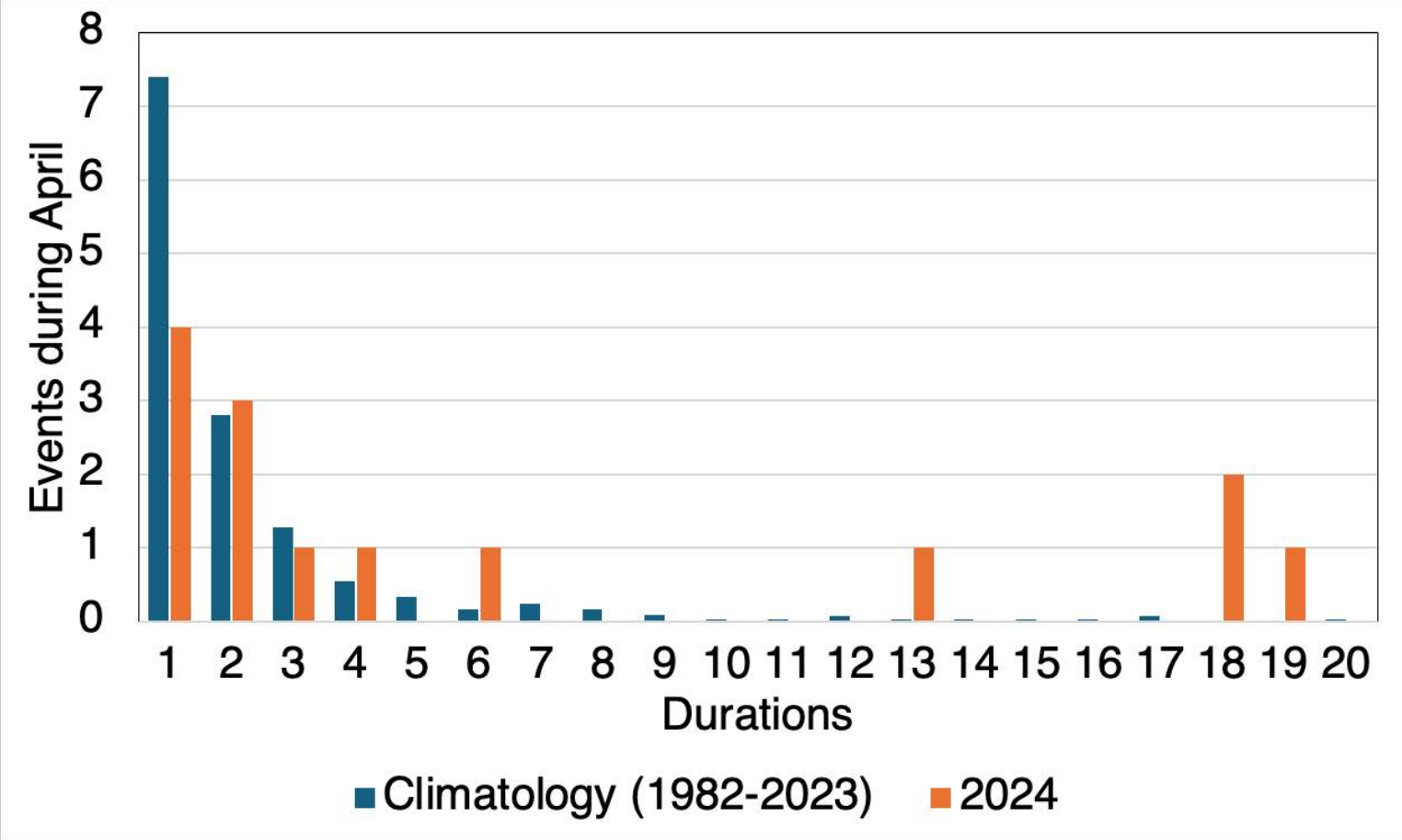


Mild heatwave (36 deg C)

Mild heatwave (36 deg C)

Station Data

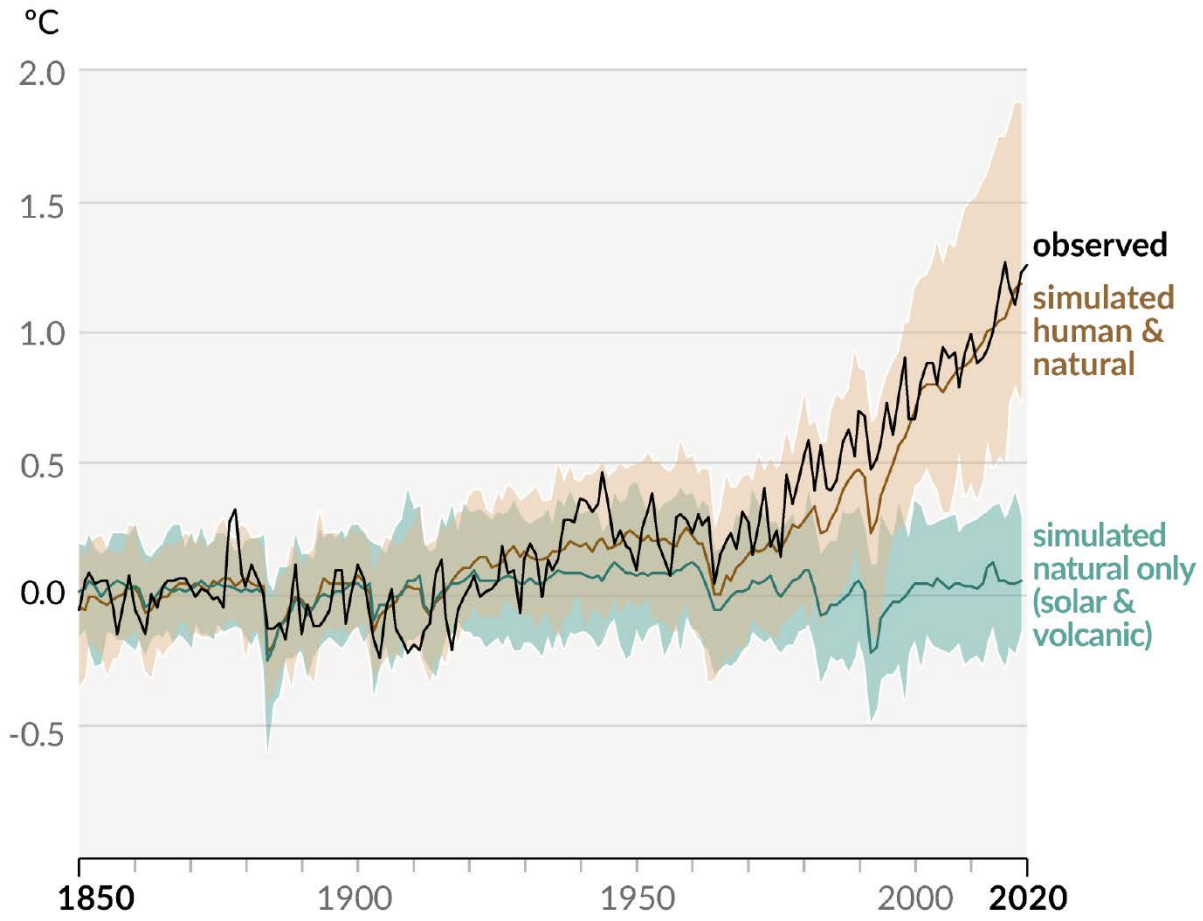
Observed consecutive heat-wave days



Station Data

Bangladesh Heatwave: Causes

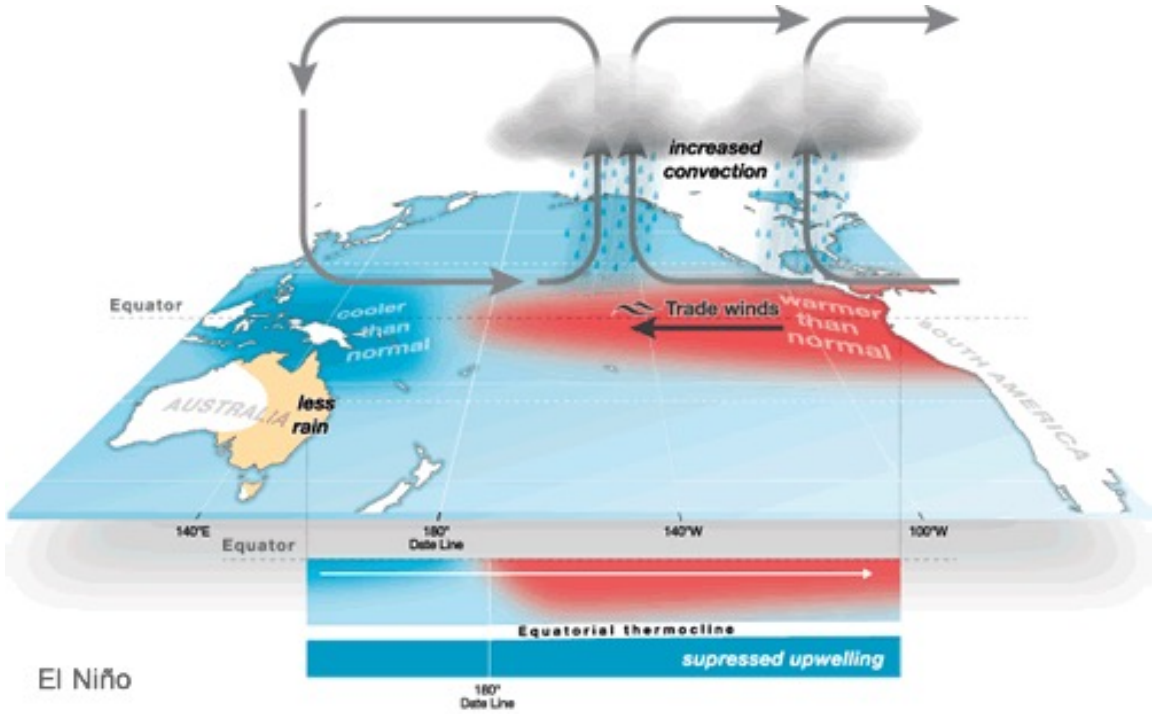
Likely causes: Anthropogenic Climate Change



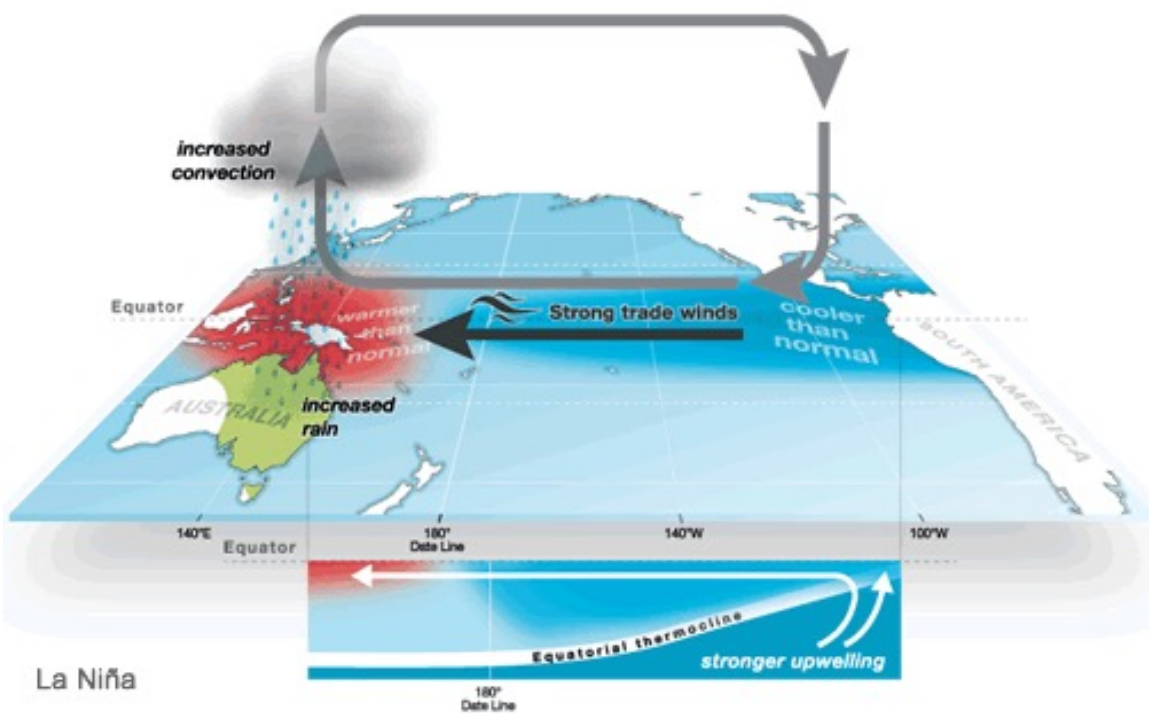
Adapted from IPCC AR6

Climate Variability : El Nino & La Nina

El Nino

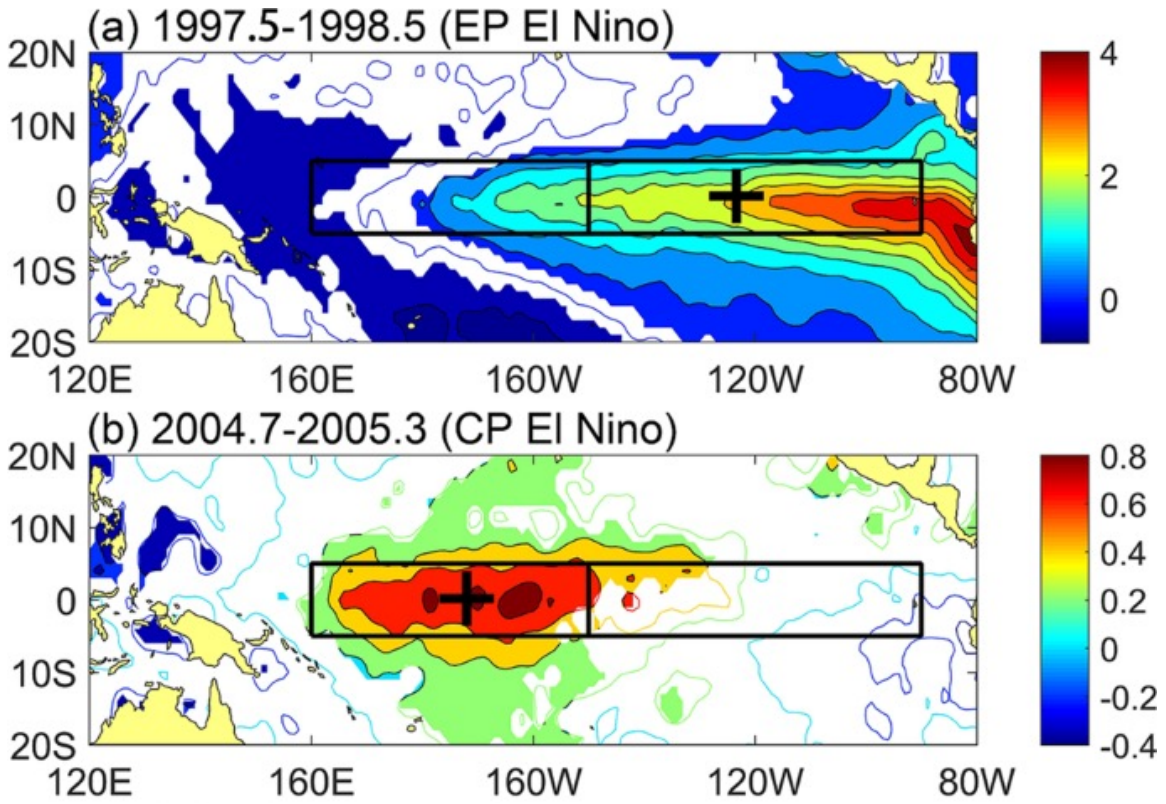


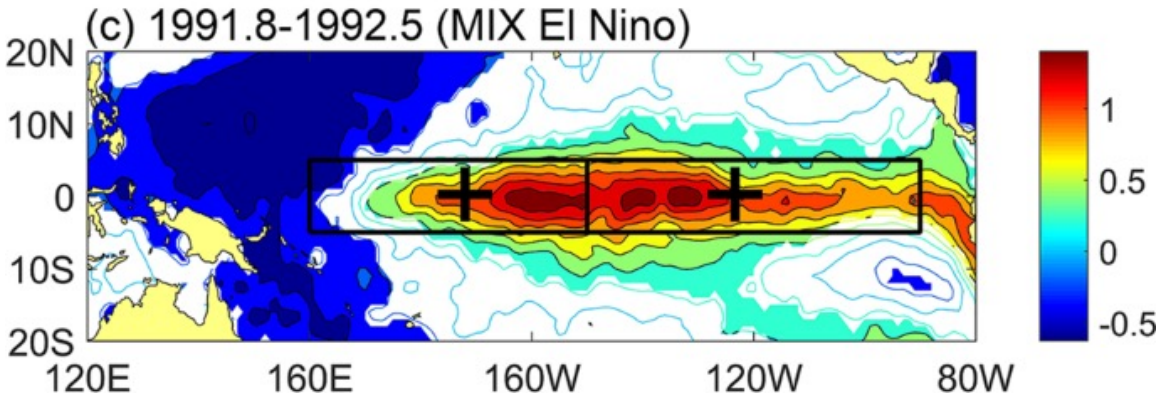
La Nina



Adapted From Web of Australian Bureau of Meteorology

Different Types of El Nino

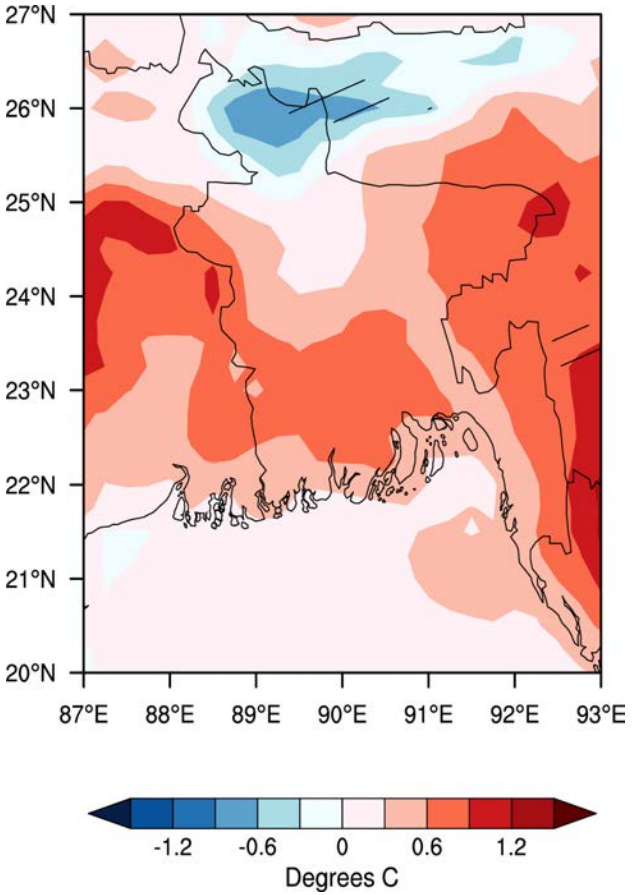




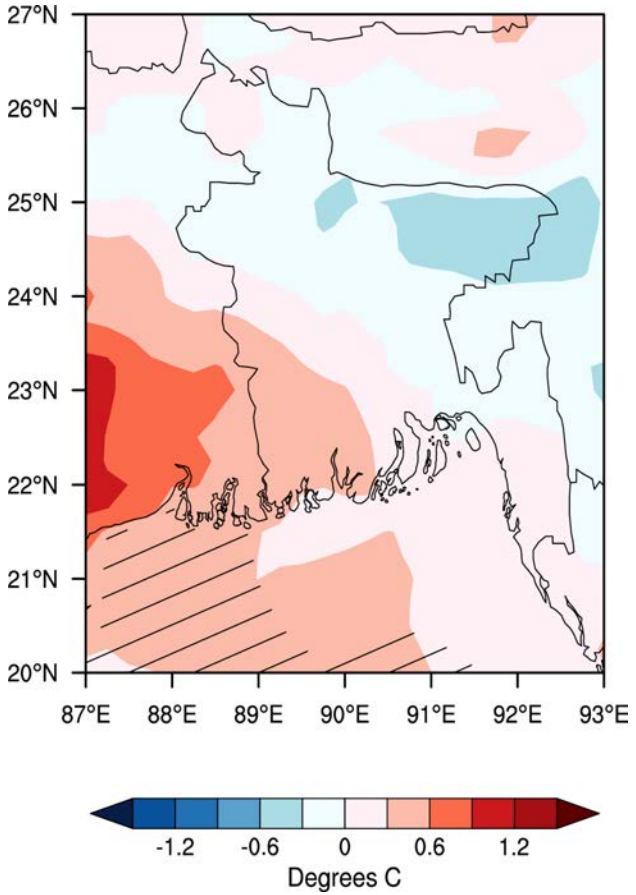
From Zhiyuan Zhang et al 2019

Impact of Different Types of El Nino

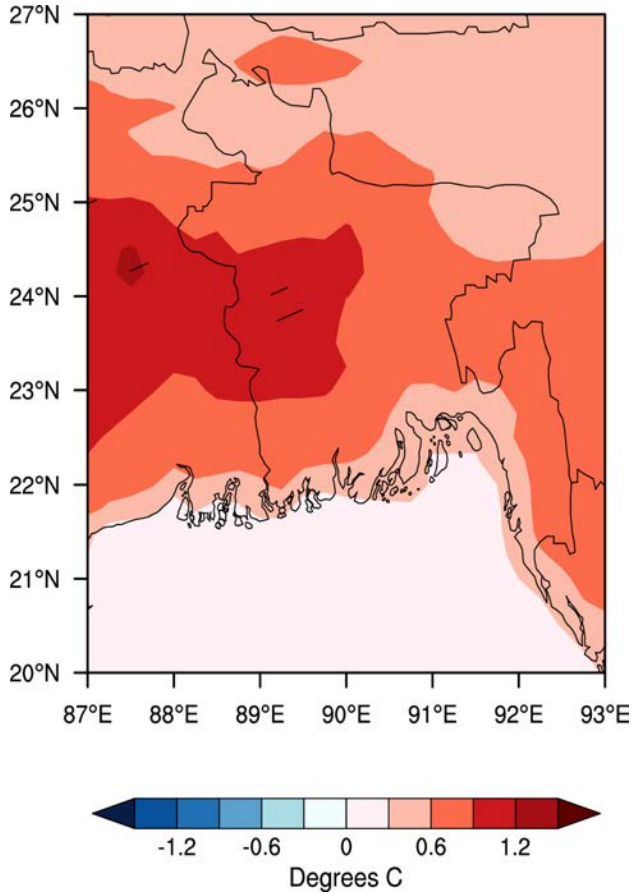
CP El Nino (3 events)



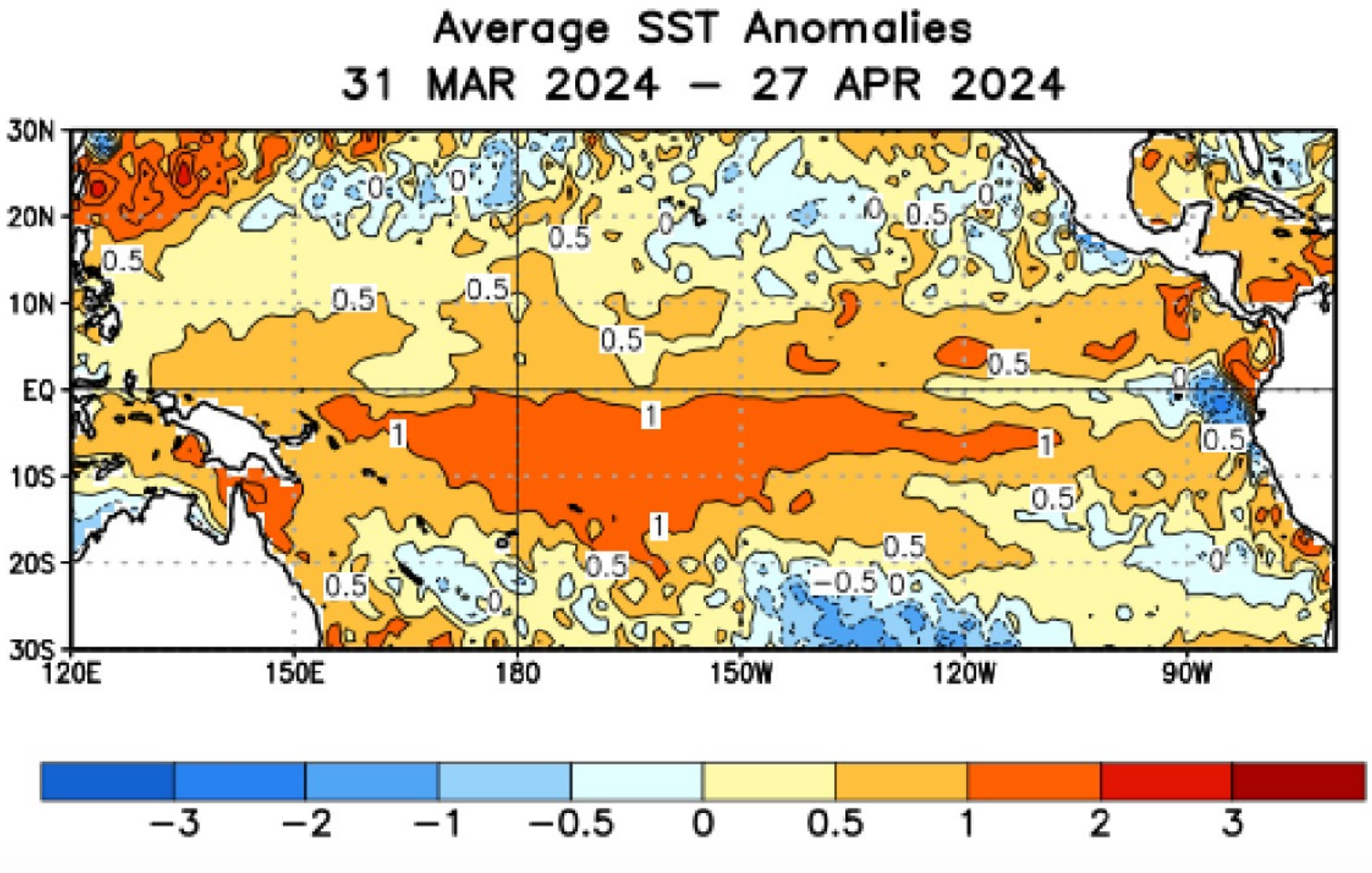
EP El Nino (5 events)



Mix El Nino (CP & EP) (15 events)



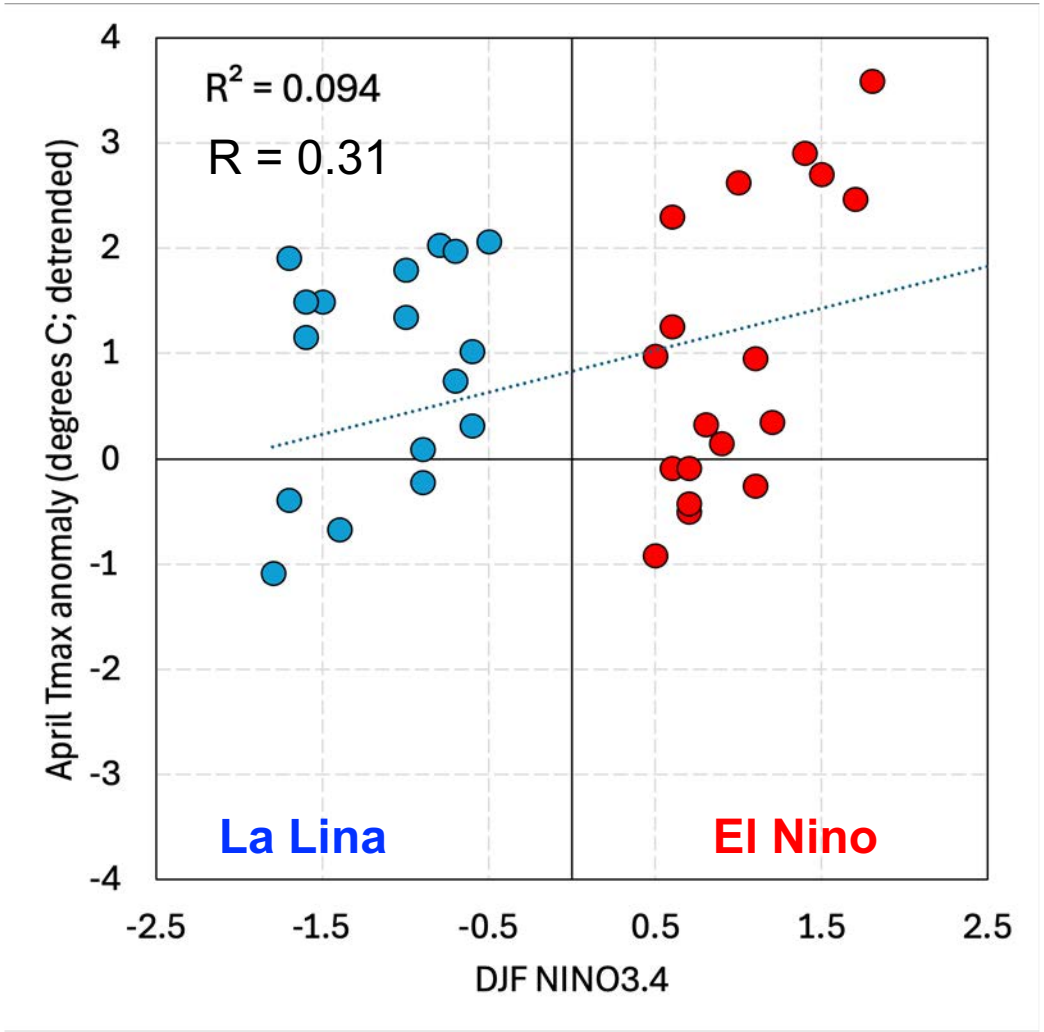
2024: Central Pacific Event



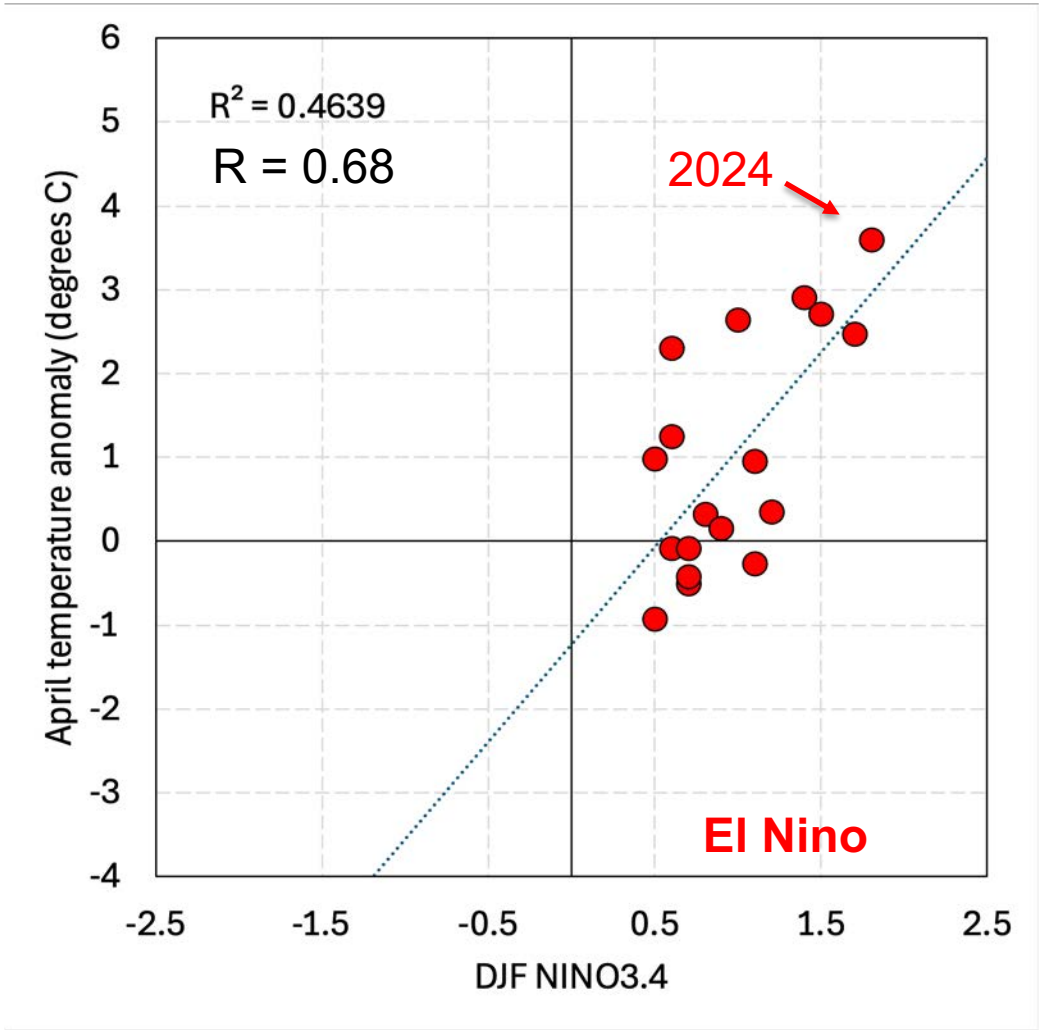
From CPC

Likely causes: ENSO impacts

All CP & Mixed type **ENSO** events (36 events)



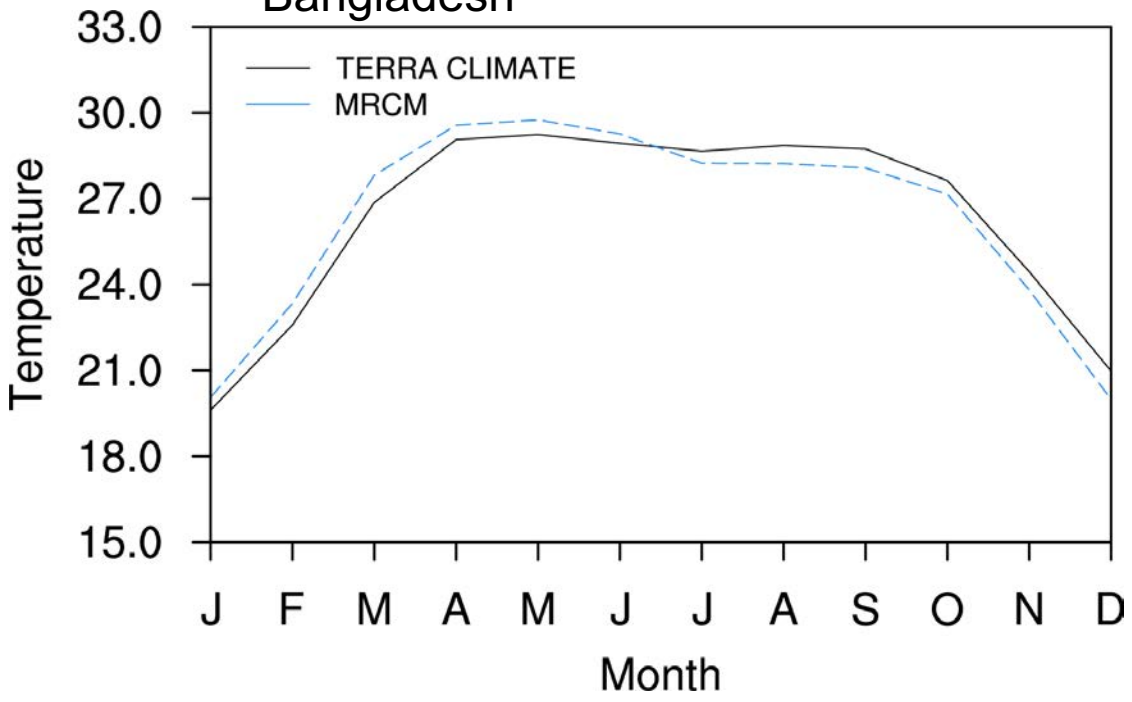
All CP & Mixed type **El-Nino** events (18 events)



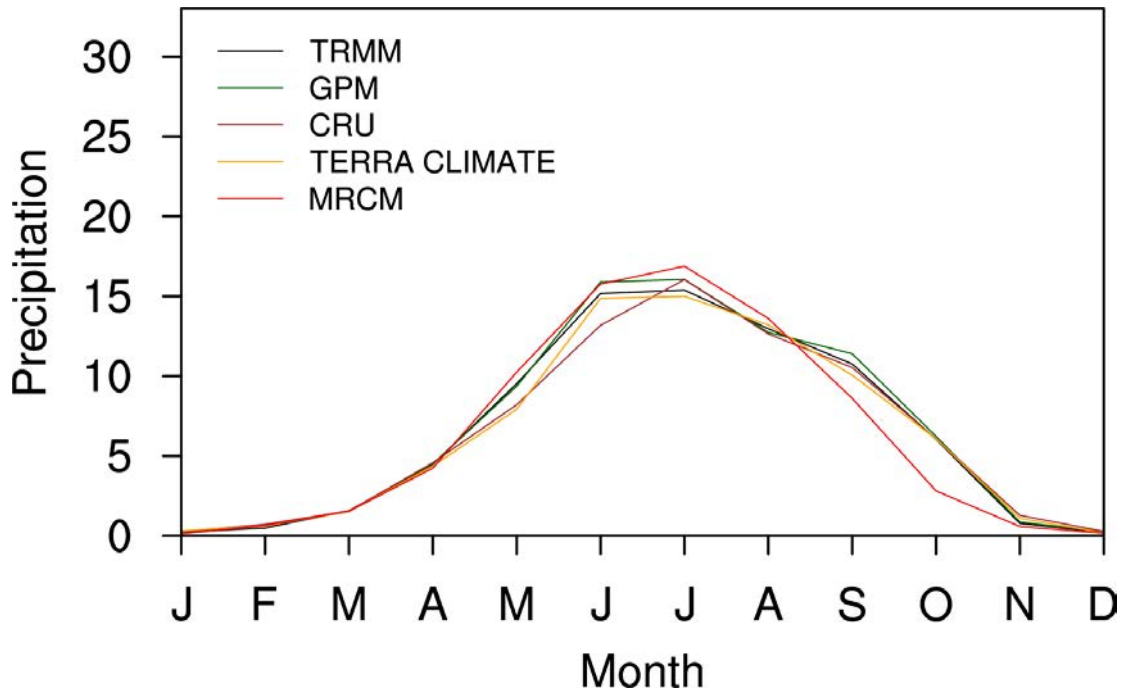
Seasonality of Climate over Bangladesh

- Temperatures peak in April to November.
- Dry conditions persist from November to April.

Temperature (deg C) over Bangladesh



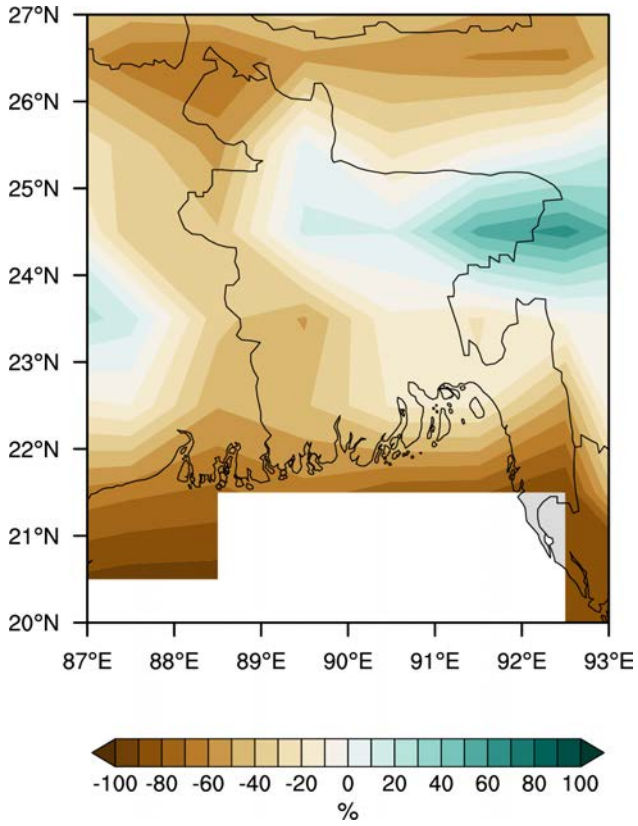
Precipitation (mm/day) over Bangladesh



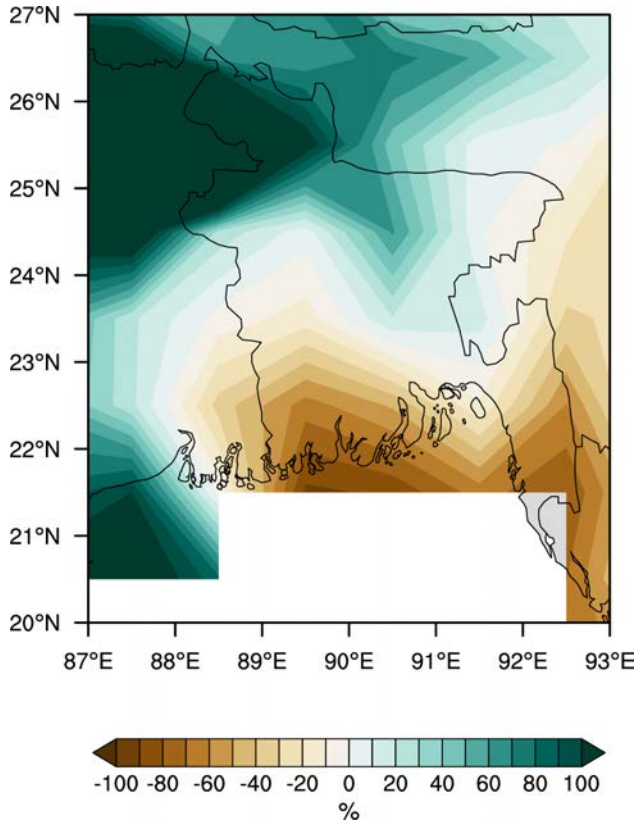
Mechanisms: Prolonged dry condition before events

Less rain contributes to drier conditions, less evaporation, causing land to heat up

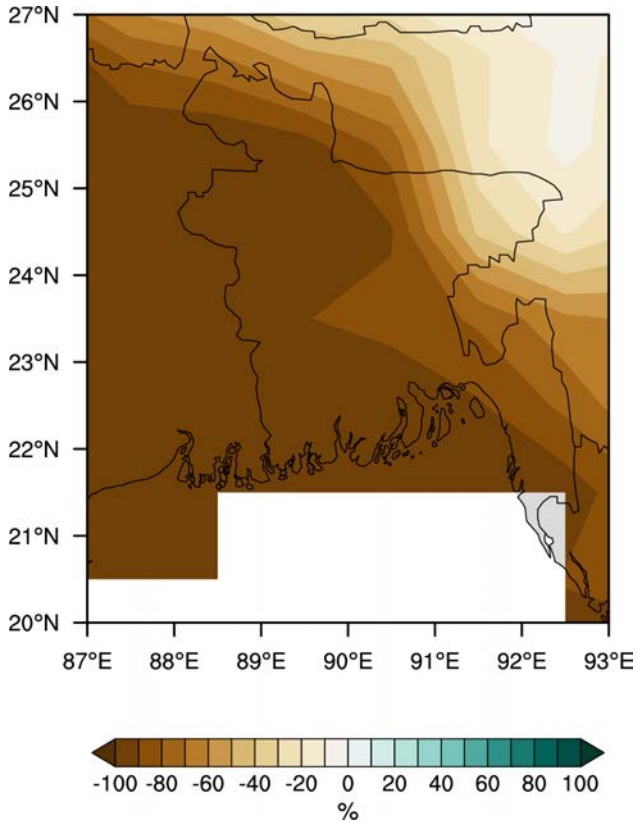
FEBRUARY



MARCH



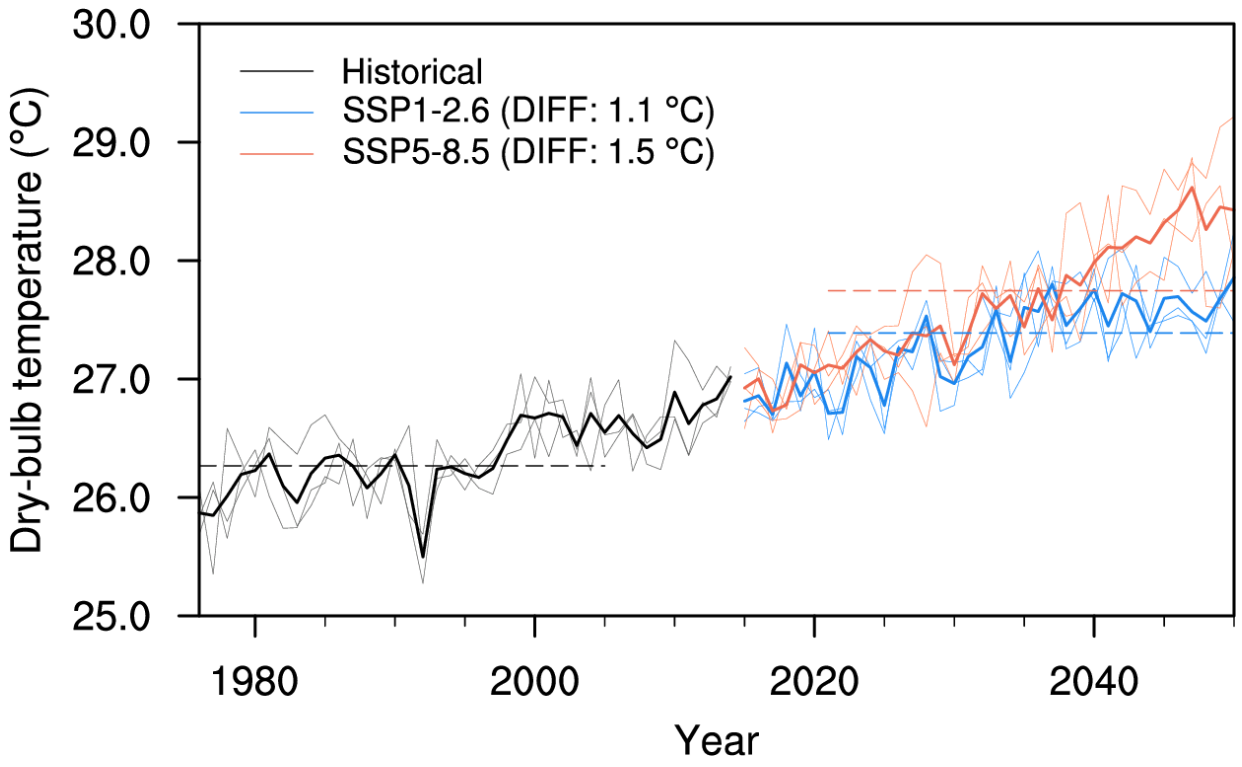
APRIL



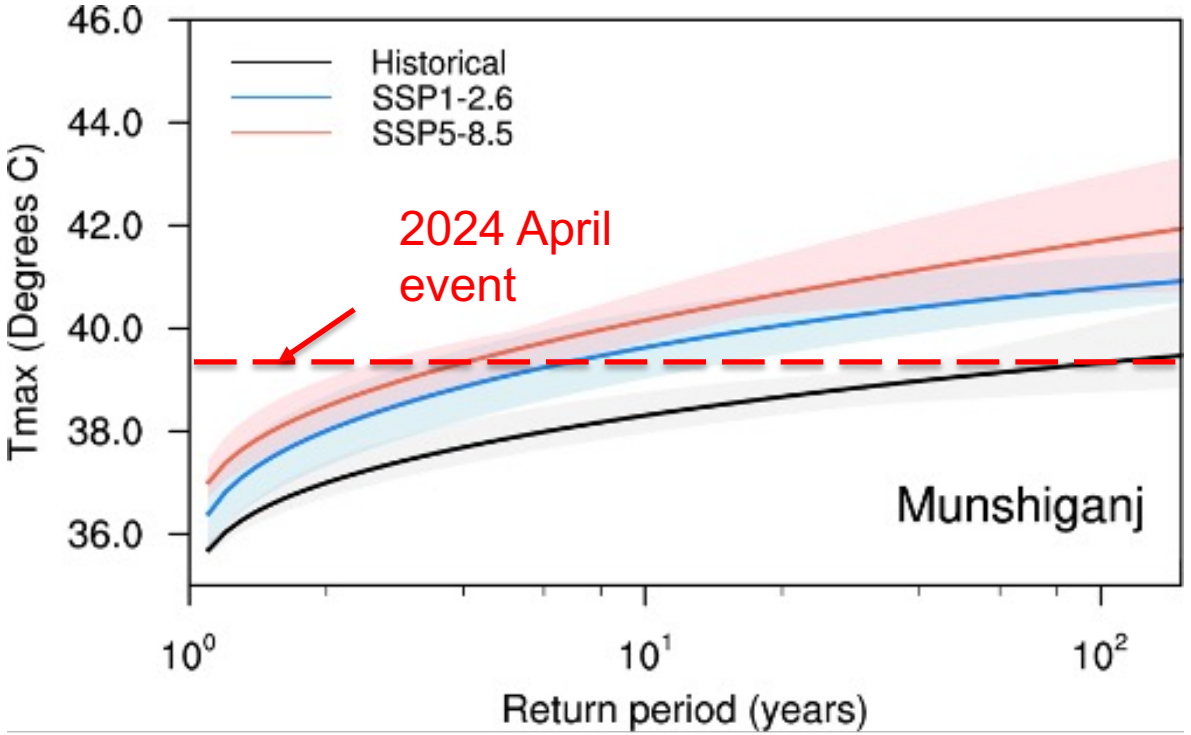
Bangladesh Heatwave: Projections

Near-term climate projection : extreme dry heat

SW Bangladesh



Return period



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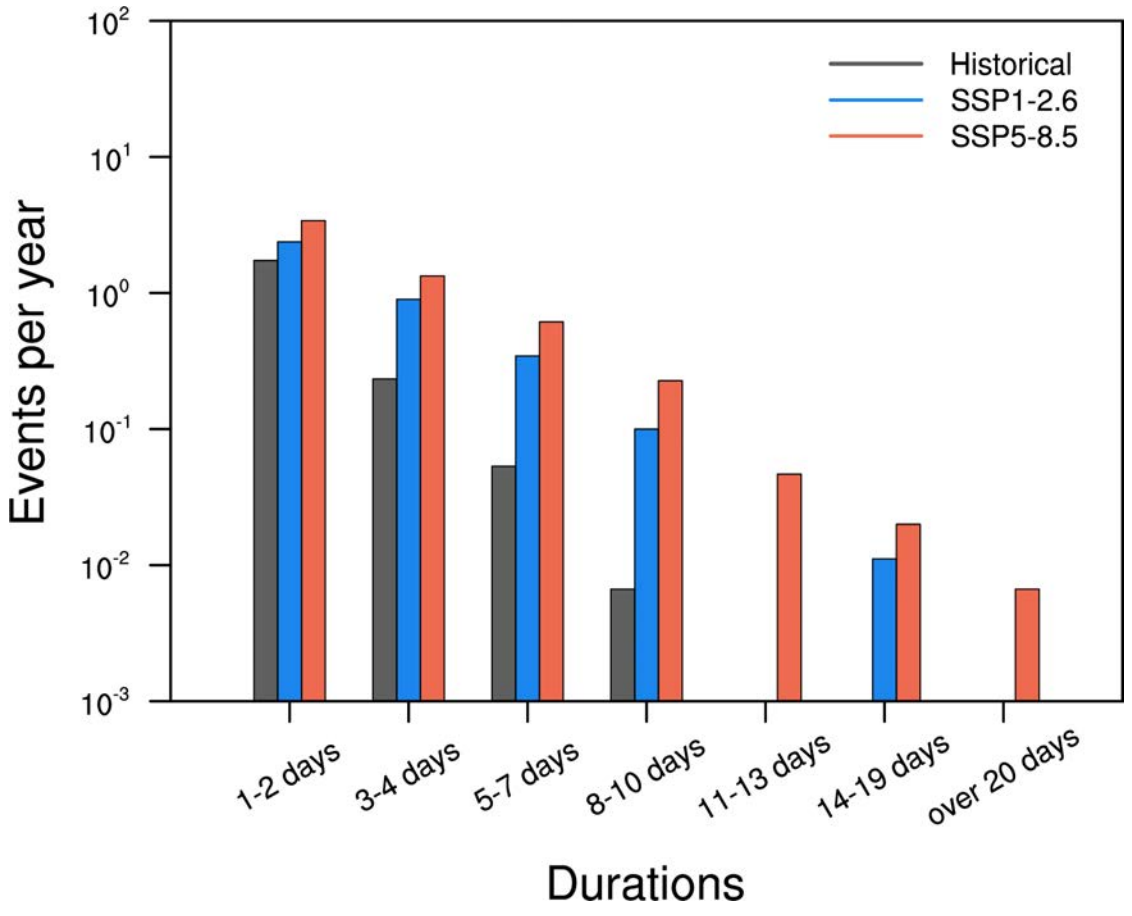
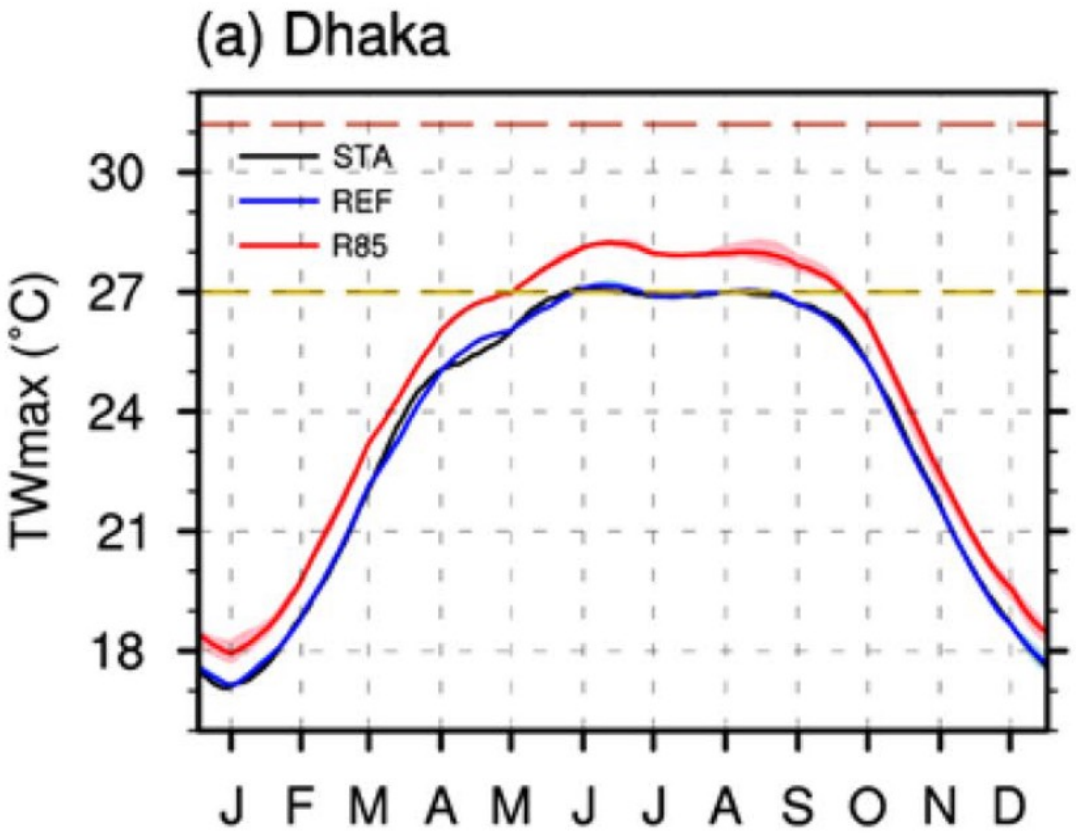
Projected Change in consecutive heat-wave days

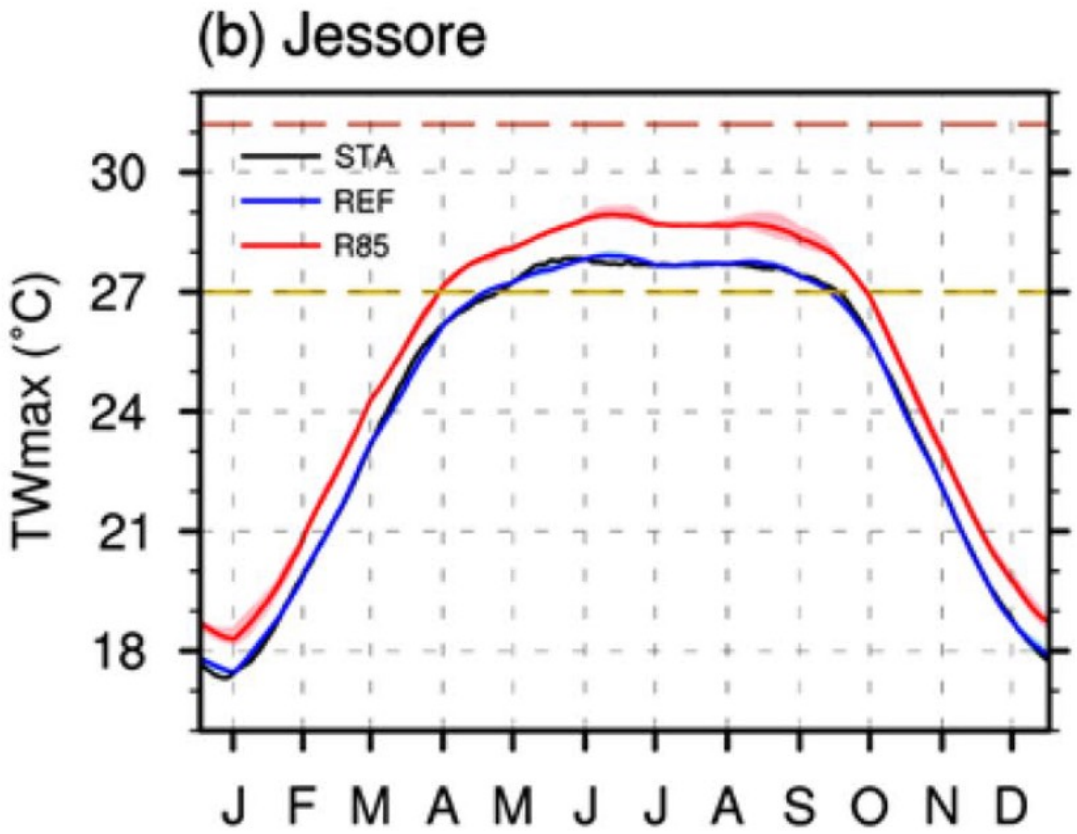


MRCM Projections

Munshiganj

Near-term climate projection : humid heat extremes





What we learned from this extreme event?

- **A glimpse of the future:** helps us better understand nature of likely impacts of climate change. Living laboratory. Ongoing experiment.
- **Seasonality of climate risks** : April-May is a transition season with significant risks, both related to water scarcity and dry heat extremes.
- **Vulnerability of population** : School closure is a good example of vulnerability of populations, particularly children, to climate shocks.
- **Increasing risk of climate change** : This extreme temperature is expected to become the norm in the next 30 years.
- **PROACTIVE adaptation:** underscore the need to develop proactive strategies to guide adaptation to climate change impacts.

Jameel Observatory-CREWSnet

Reinventing Climate Change Adaptation

We are creating proactive, integrated decision-support tools and services that empower frontline vulnerable communities to prepare for climate impacts and minimize losses

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MIT JOINT PROGRAM ON THE SCIENCE AND POLICY of GLOBAL CHANGE

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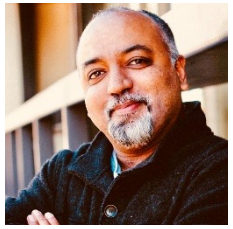
COLUMBIA CLIMATE SCHOOL
LAMONT-DOHERTY EARTH OBSERVATORY

Dr. Sai Ravela

cyclone severity and frequency; coastal inundation and salinity



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MIT JOINT PROGRAM ON THE SCIENCE AND POLICY of GLOBAL CHANGE

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Y-RISE

economics in developing environments


Annajmus Sakib


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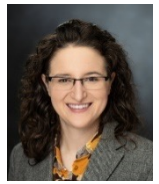
Yeonwoo Choi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Jeff Liu


Xiang Gao


Islamul Haque


Claire Walsh


Austin Chadwick


Ashley Toombs


Shahanoor Kabir


Angelo Gurgel

(Several Principal Investigators and participants maintain multiple affiliations inside MIT, and there are many more participants than our ability to illustrate on one slide!)

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Thank you