

Climate change: An emerging threat to agriculture and food security in Bangladesh

Harun K.M. Yusuf¹, Subash Dasgupta² and M.A. Halim Khan³

¹Department of Biochemistry and Molecular Biology, University of Dhaka (currently, Nutrition Advisor, FAO-National Food Policy Capacity Strengthening Programme, Bangladesh), ²FAO Representation in Bangladesh, ³Department of Crop Botany, Bangladesh Agricultural University, Mymensingh, Bangladesh

Presented at the International Symposium on Climate Change and Food Security in South Asia, Dhaka, Bangladesh, 25-30 August, 2008.

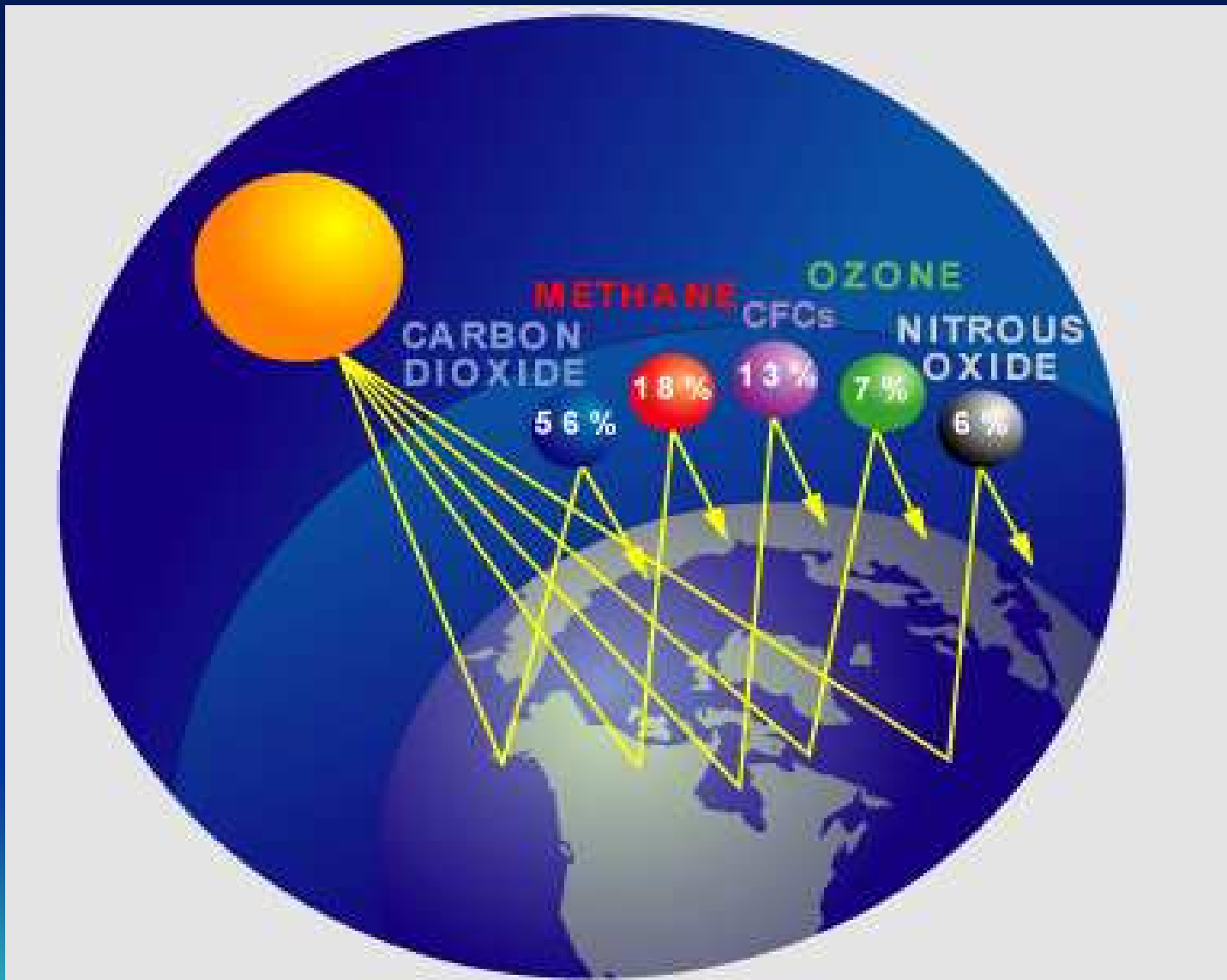
- **Climate change refers to the phenomenon that is causing the earth to become warmer, meaning that our climate and our weather systems are changing towards a warmer state.**
- **Today, the earth is hotter than it has been two thousand years ago.**
- **1990s was the warmest decade**
- **1998 was the warmest year**
- **Snow cover is down 10% in the last 40 years**



- **Most scientists now agree that human activity is largely responsible for climate change.**
 - **industrial output,**
 - **car exhaust, and**
 - **deforestation and other**
- **The choices we make today will decide the future of our climate.**

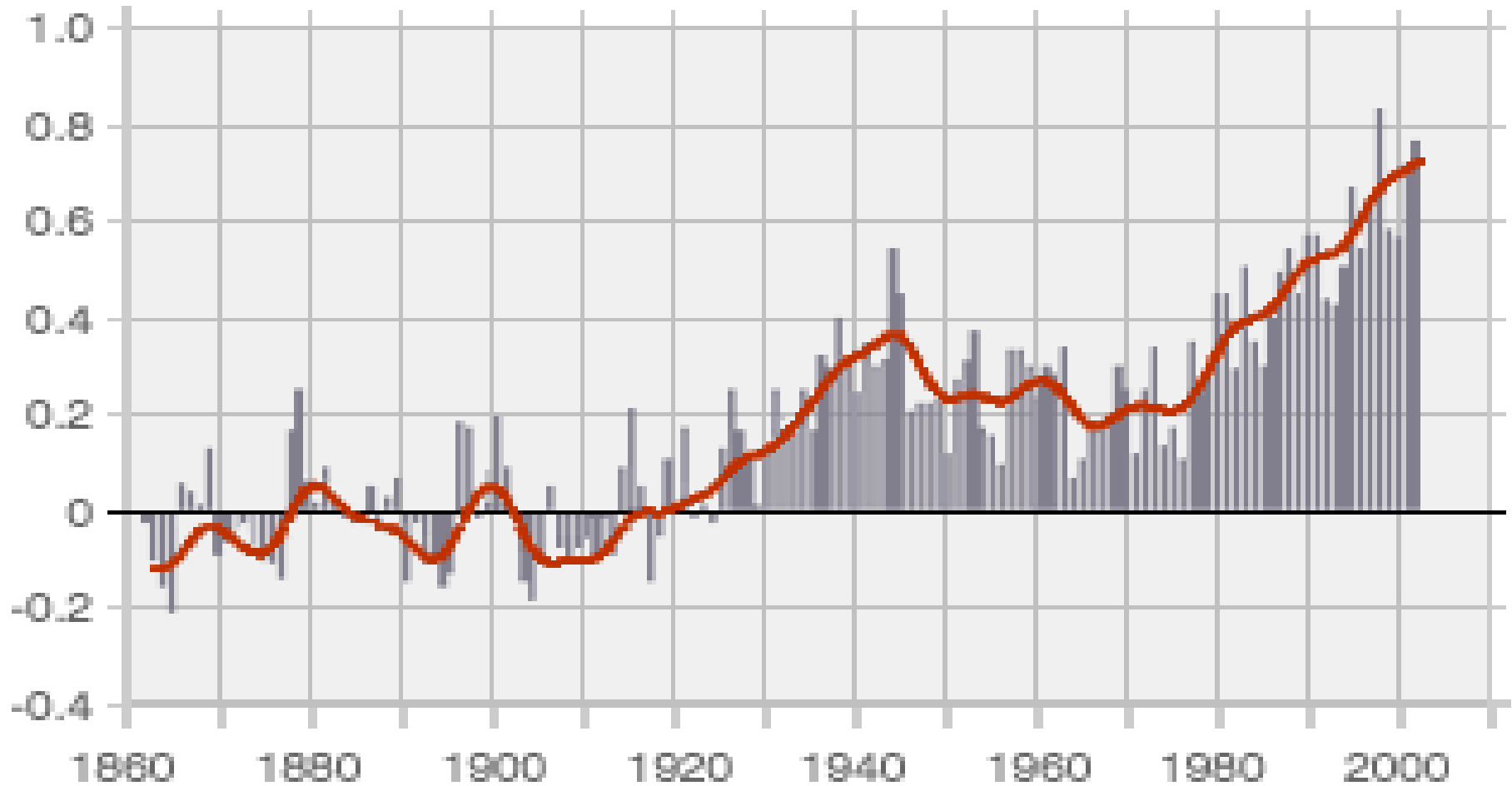


Why global warming?



Variations in global near-surface land temperature

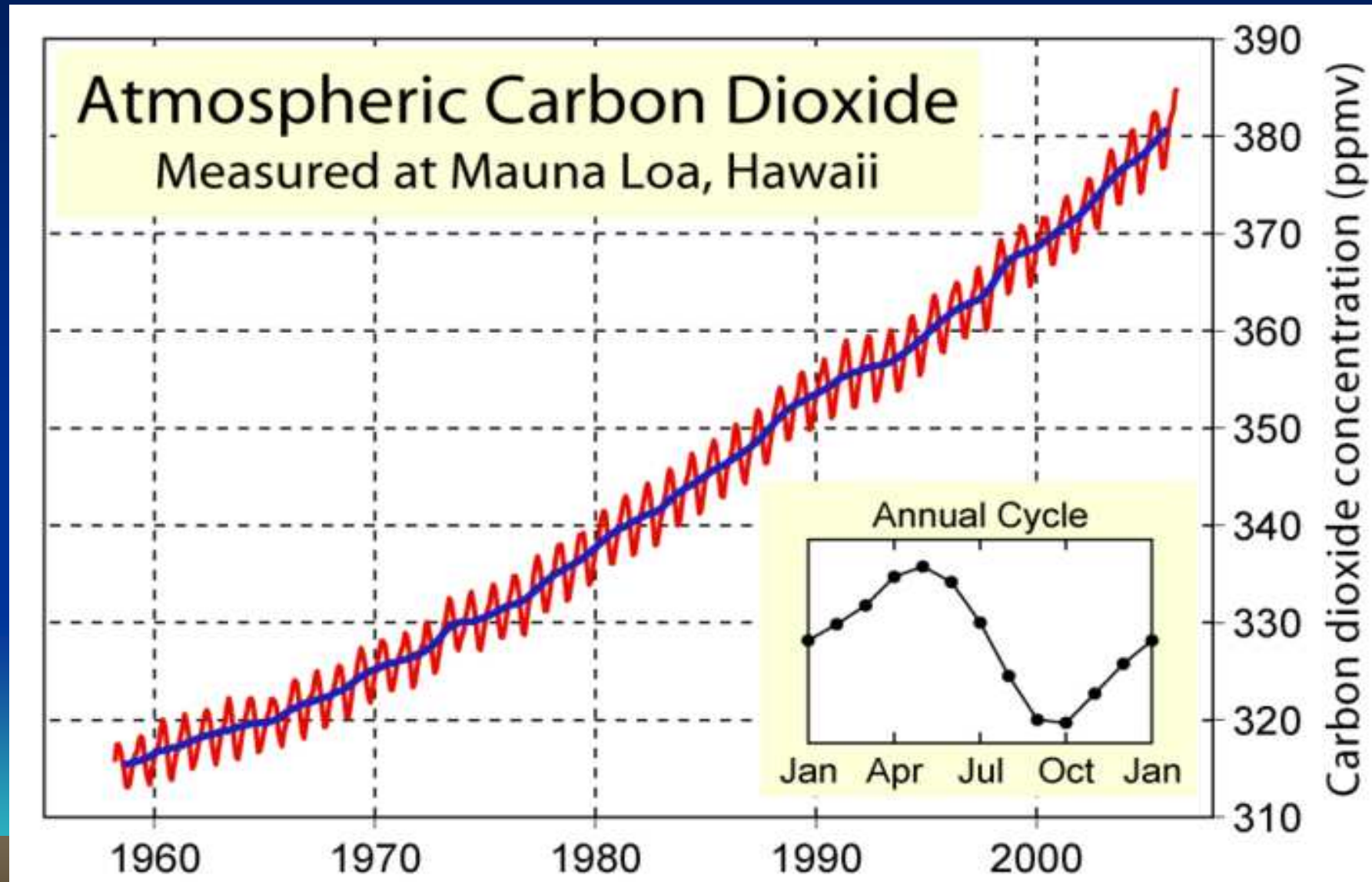
Temperature variation in degrees C



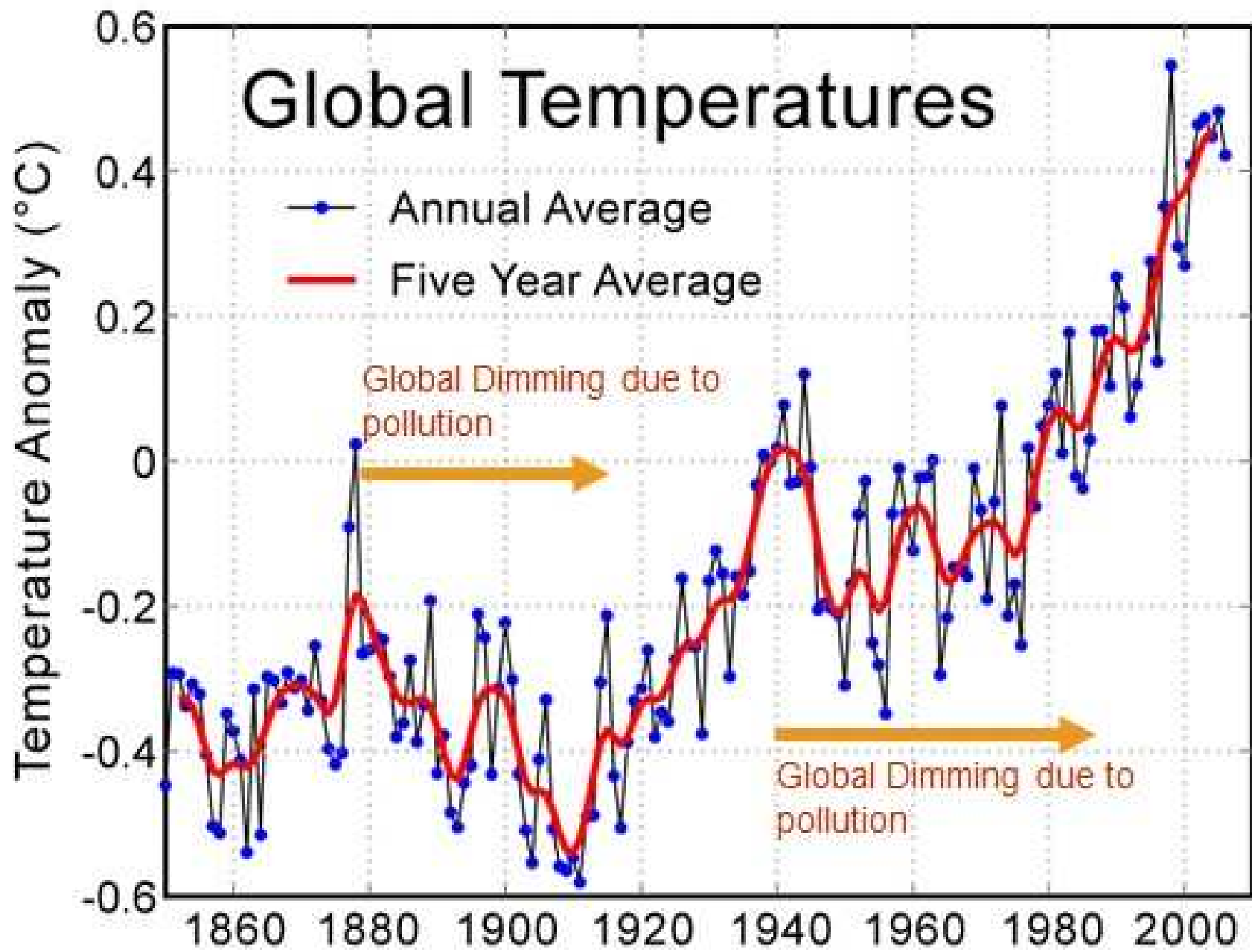
SOURCE: HADLEY CENTRE

Source: IPCC, 2007

The emissions of CO₂ have been dramatically increased since 1958 (within the last 50 years) and are still increasing by about 1.5 ppmv/annum



Source: IPCC, 2007



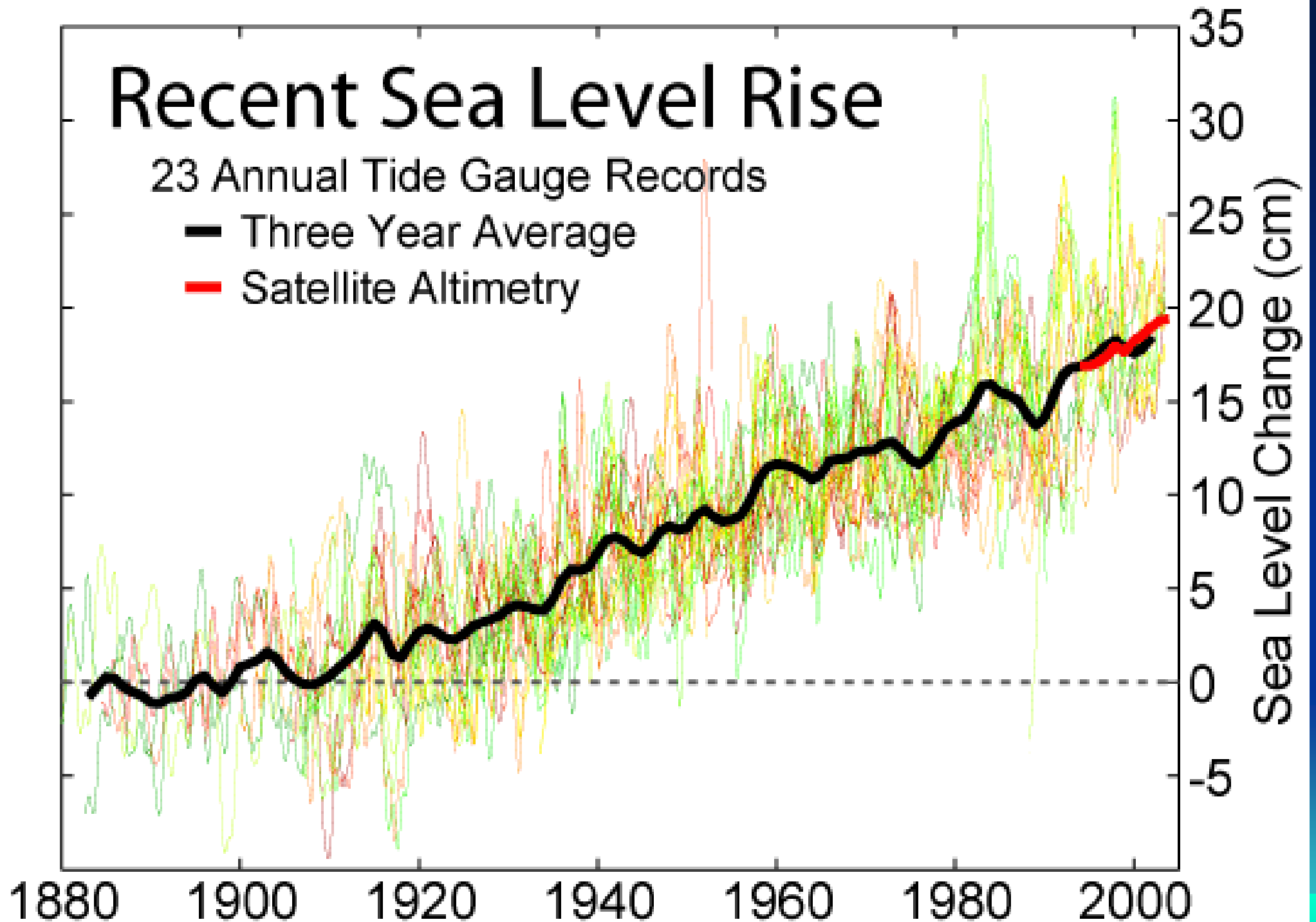
During 1880-1935, the temperature anomaly was consistently negative. In contrast, from 1980 it is constantly positive having highest anomalies of +0.4 to +0.6 $^{\circ}\text{C}$.

Recent Sea Level Rise

23 Annual Tide Gauge Records

— Three Year Average

— Satellite Altimetry



Consequences of global warming and sea level rise on Bangladesh agriculture and food security

Long-term effects

- Inundation of low-lying coastal areas
- Incursion by salinity in coastal cultivable lands & loss of soil fertility & ecosystem productivity
- Changes in the land-use pattern that includes coastal agriculture, fisheries, livestock & mangroves

Disastrous effects

- Occurrence of frequent cyclones, tornadoes, floods & droughts
- Infrastructural damage including roads & highways, dwelling houses & embankments
- Erosion of river banks, estuaries, channels & canals
- Destruction of standing crops, shrimp hatcheries & fresh water aquifers in the coastal areas

All these should have cumulative results as

food insecurity & production of climatic refugees

Rise in temperature in Bangladesh

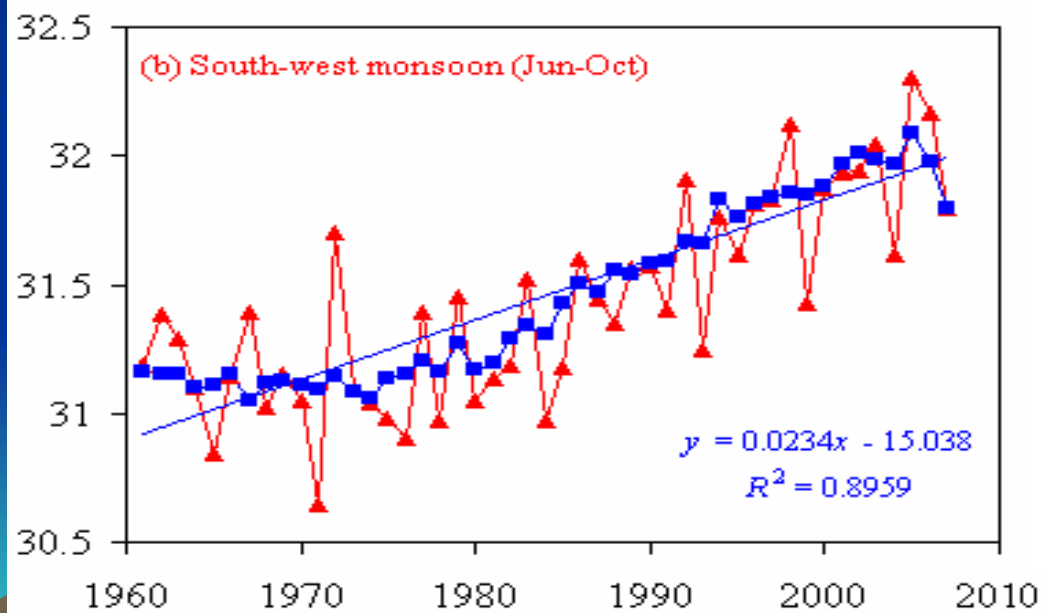
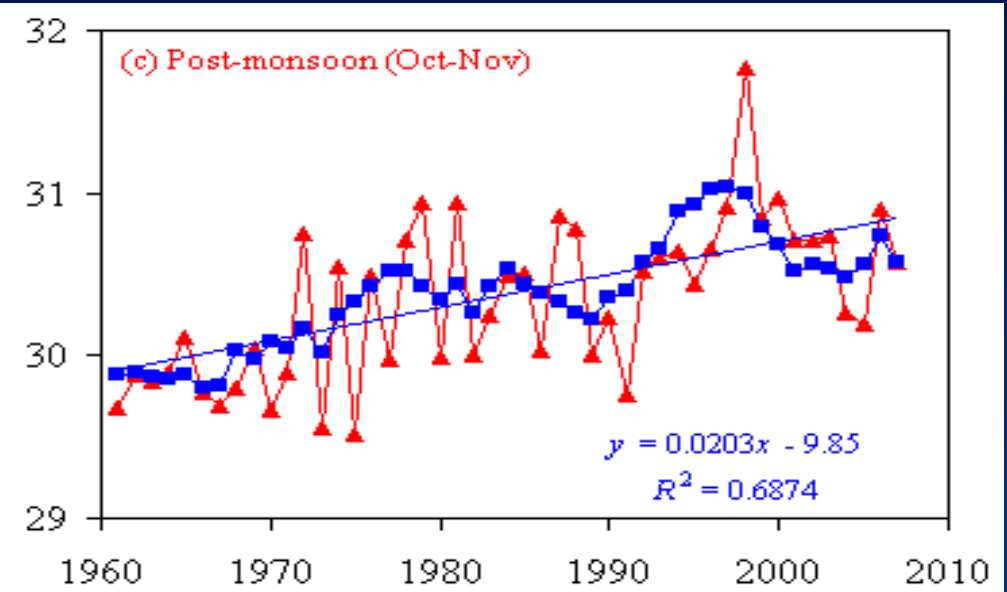
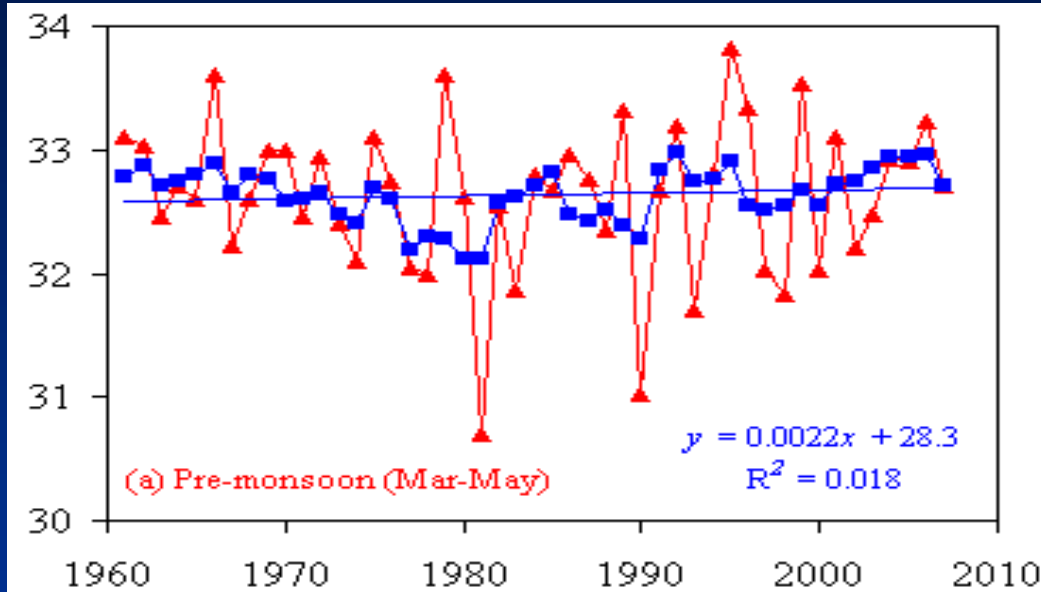
Between 1961-2007,

- mean **south-west monsoon** (June-October) as well as **post-monsoon** (October-November) **temperature** increased by **0.8°C**.
- annual mean **maximum temperature** has risen by **0.6°C**, while, more alarmingly, the annual mean **minimum as well as the winter (December-February) mean minimum** temperature has increased by **0.3°C** over the same period.



Trends of variation of seasonal mean maximum temperature

Mean maximum temperature (°C)

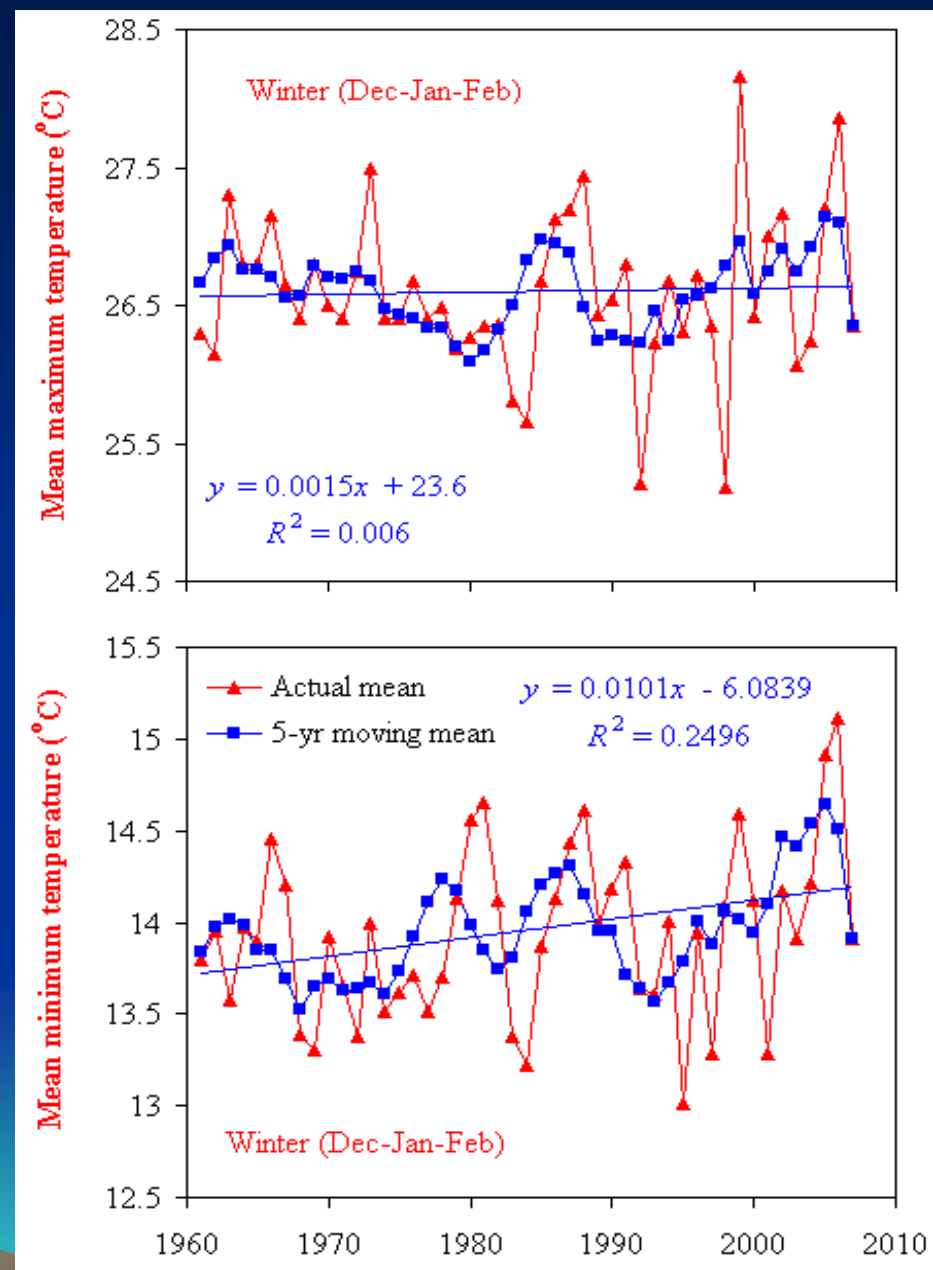
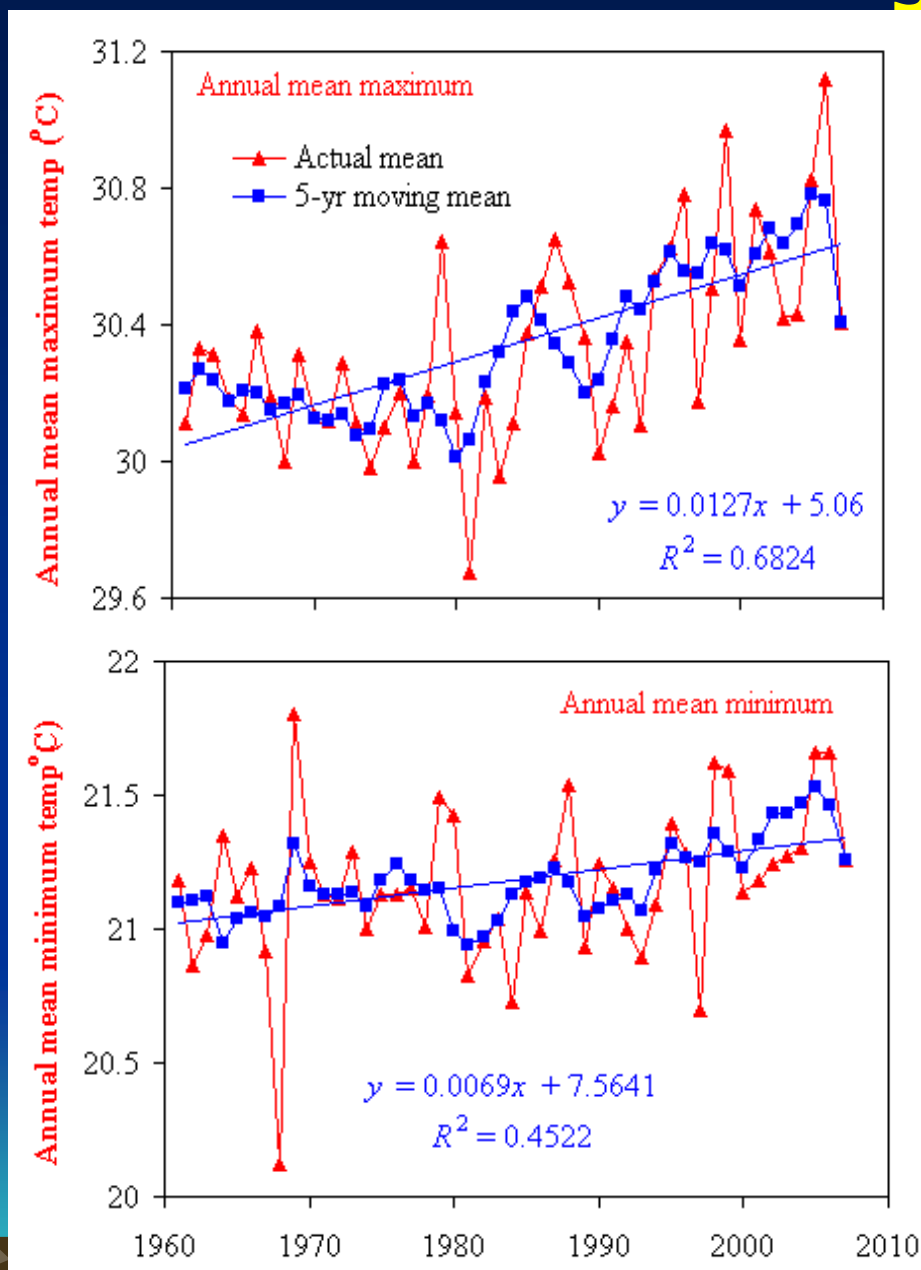


▲ Actual mean
■ 5-yr moving mean

Despite great fluctuations the mean temperature in pre-monsoon appeared to be static while south-west monsoon and post-monsoon temperatures are continually increasing since 1961

Source: BMD, Country average (mean from 24-34 stations throughout the country) temperature in Bangladesh from 1961 to 2007.

Trends of maximum/minimum temperatures in Bangladesh



Source: BMD, Country average (mean from 24-34 stations throughout the country) temperature of Bangladesh from 1961 to 2007.

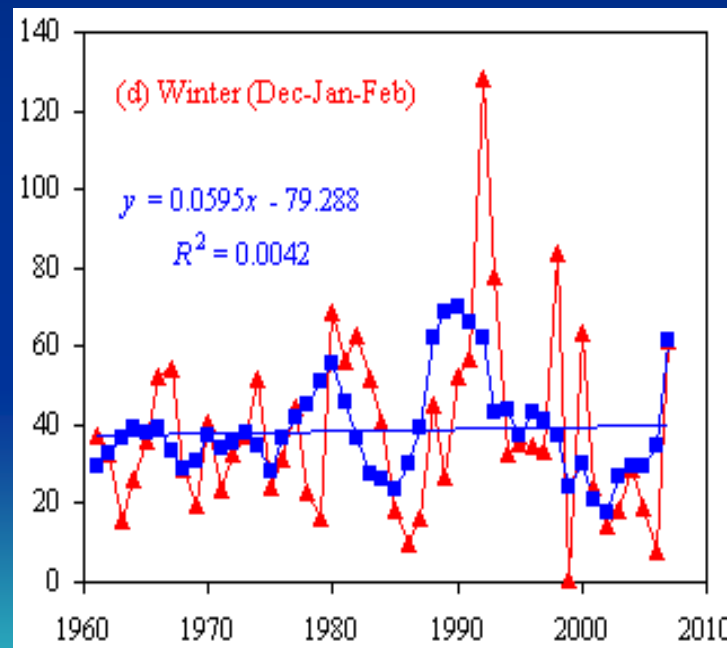
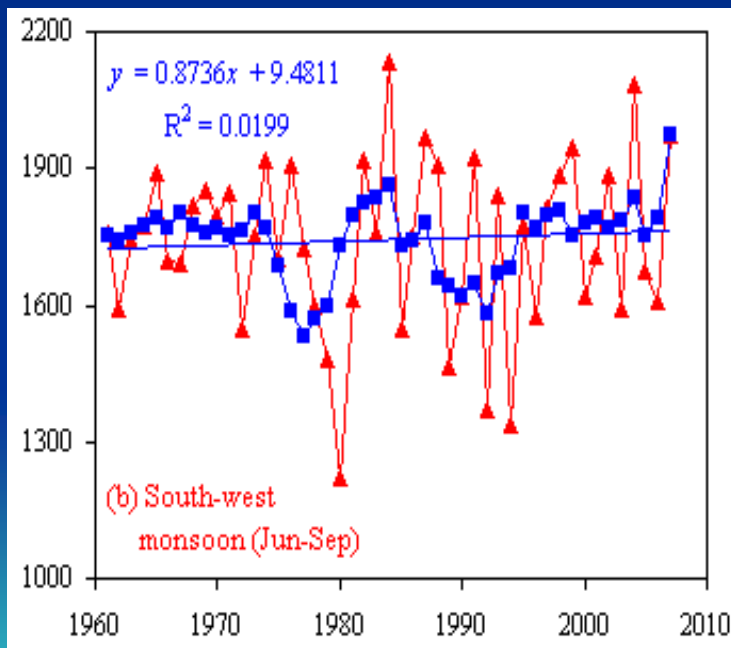
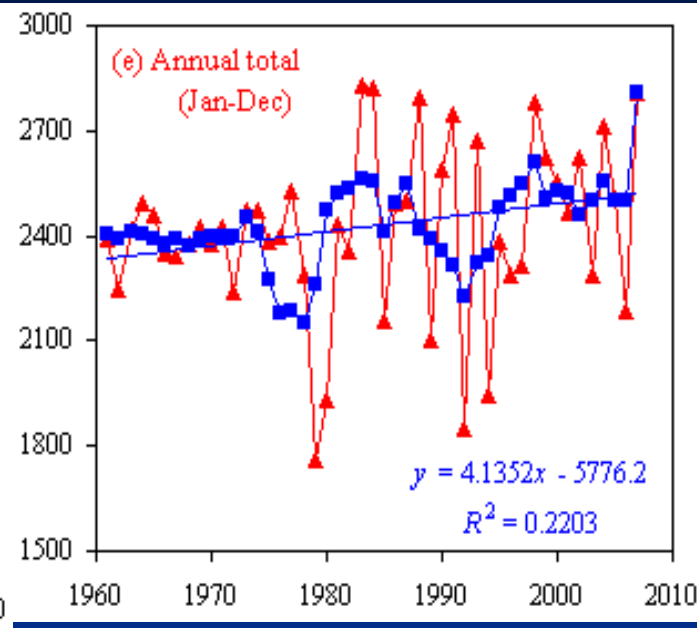
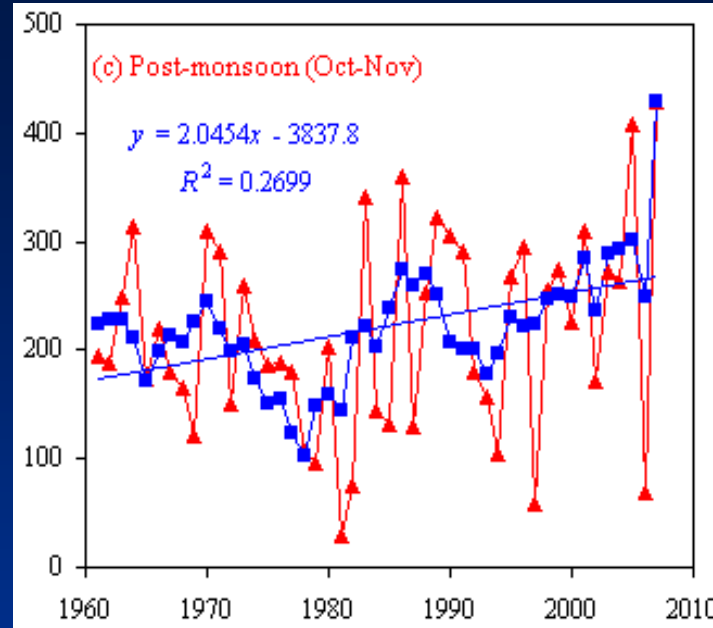
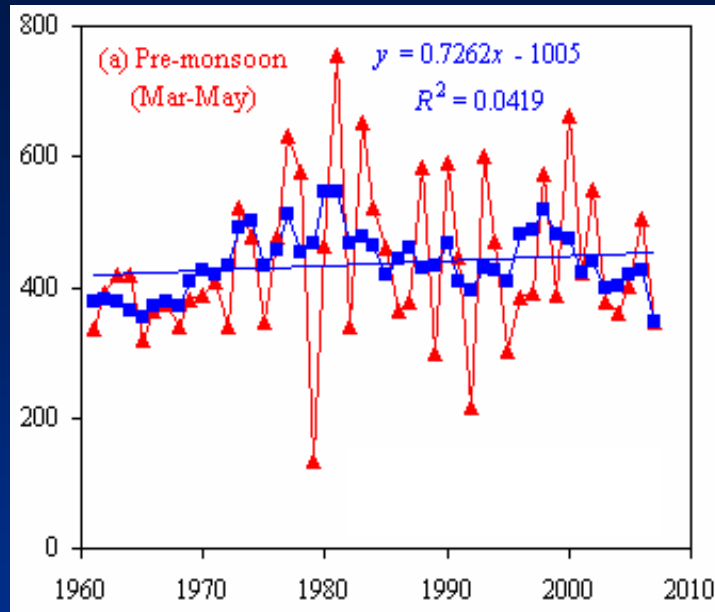
Increased rainfall in Bangladesh

Between 1961-2007,

- Annual total rainfall increased by 120 mm
- Post-monsoon (October-November) rainfall increased by about 60 mm



Trends of seasonal and annual total rainfall in Bangladesh



▲ Actual mean
 ■ 5-yr moving mean

Extreme yearly fluctuations are noticeable since 1961. However, the regression lines computed from 5-year moving average indicate increasing trend in the amount of total rainfall

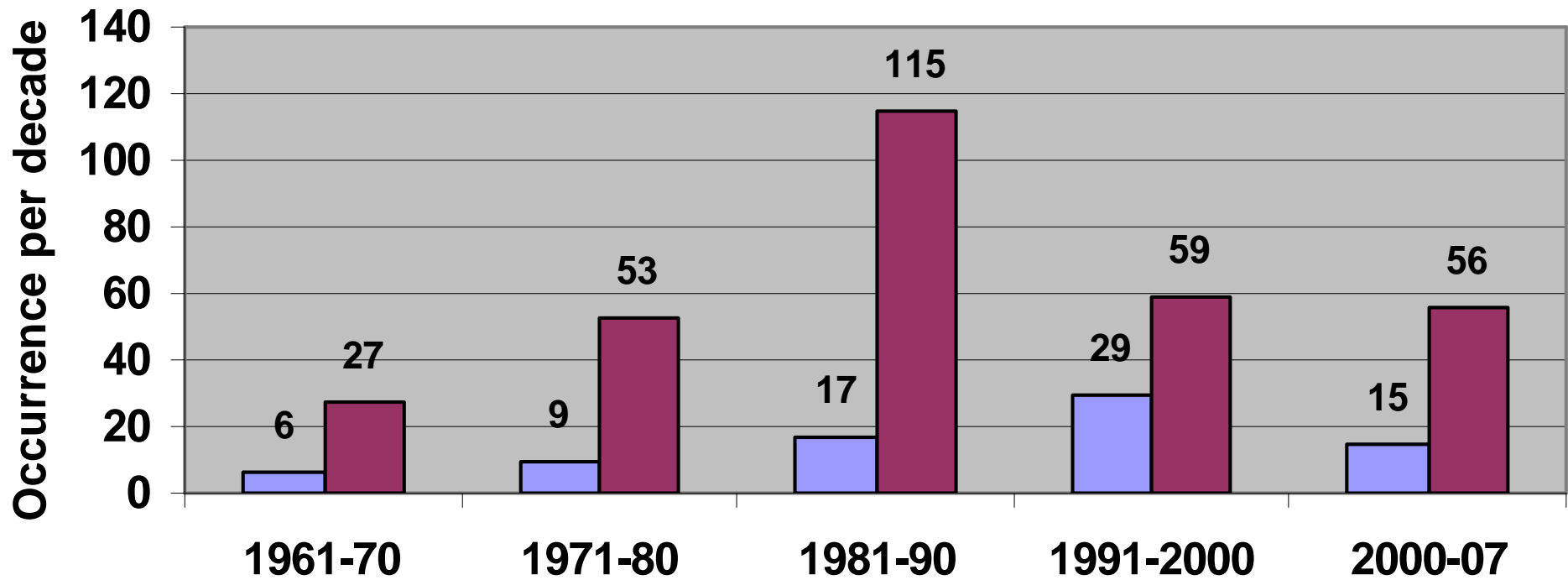
Source: BMD, Country average (mean from 24-34 stations throughout the country) rainfall in Bangladesh from 1961 to 2007

Increased occurrence of floods in Bangladesh



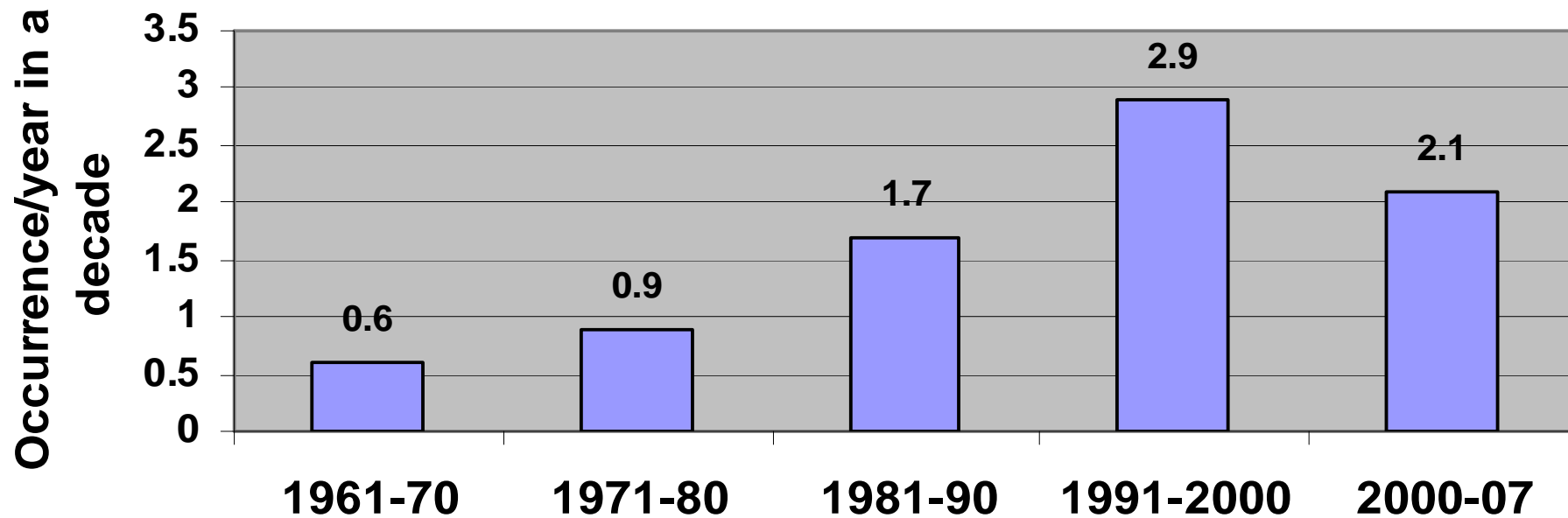
Decade-wise occurrence of floods and the number of population affected in Bangladesh, 1961-2007

■ Total occurrence ■ Population affected, million



*Source: Center for Research on the Epidemiology of Disasters (CRED),
Université Catholique de Louvain.*

Yearly occurrence of floods in Bangladesh in the decades from 60's till now



*Source: Center for Research on the Epidemiology of Disasters (CRED),
Université Catholique de Louvain.*

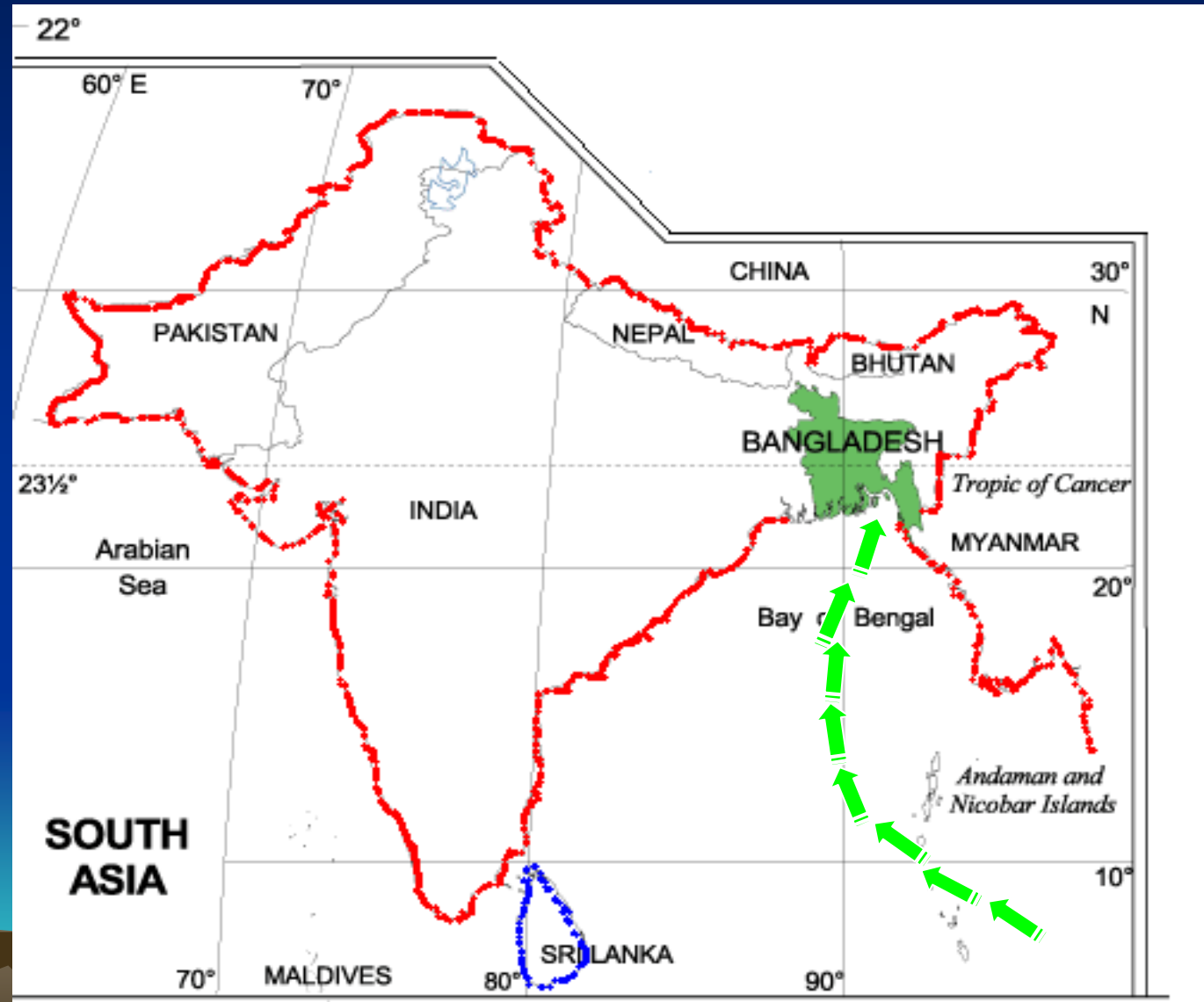
Increased occurrence of tropical cyclones in Bangladesh



The Cyclone Sidr's devastation in Kakchira village, Patharghata District

Why the global warming/sea-level rising is important to Bangladesh?

Presence of a specialized cone/funnel shaped Bay guides most of the cyclones to strike Bangladesh coast

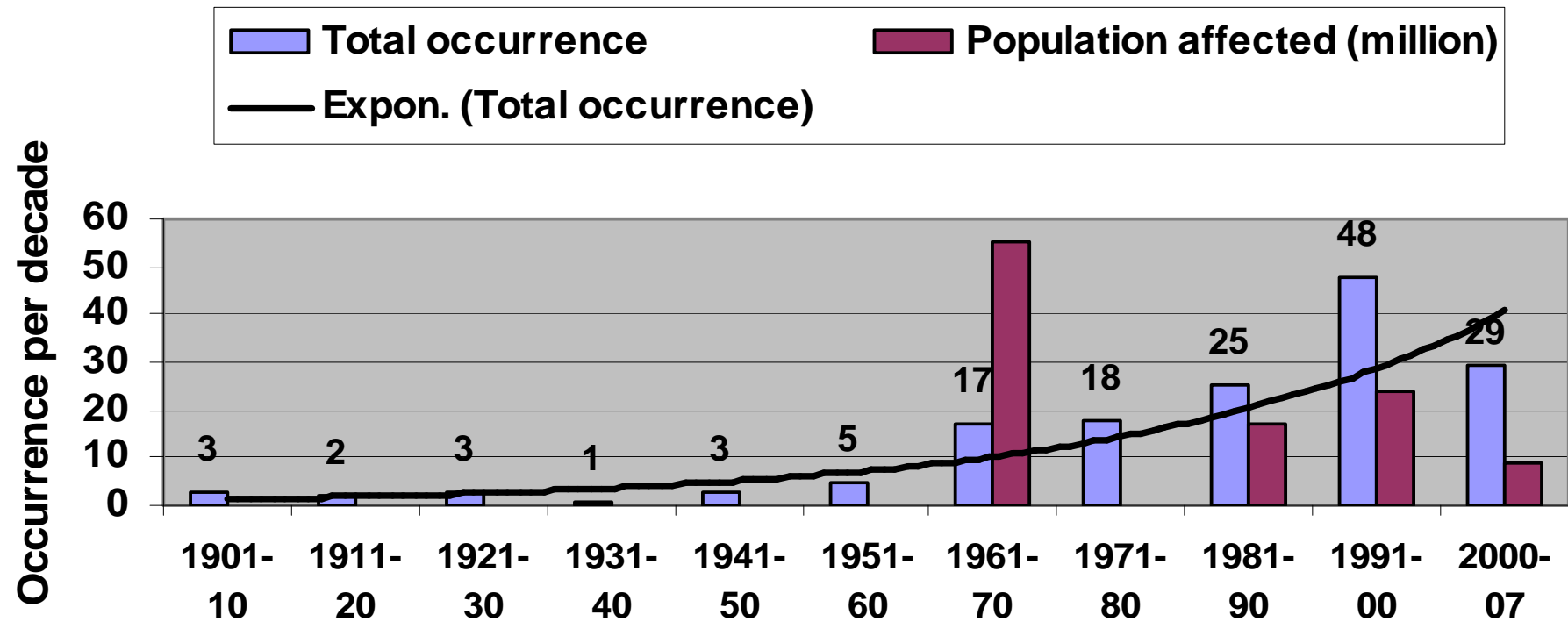


The 13 Deadliest Tropical Cyclones of World History

Rank	Name/Area of largest loss	Year	Sea/Ocean	Deaths
1	Great Bhola Cyclone, Bangladesh	1970	Bay of Bengal	550,000
2	Hooghly River Cyclone, India	1737	Bay of Bengal	350,000
3	Haiphong Typhoon, Vietnam	1881	West Pacific	300,000
4	Backerganj Cyclone, Bangladesh	1584	Bay of Bengal	200,000
5	Great Backerganj Cyclone, Bangladesh	1876	Bay of Bengal	200,000
6	Bangladesh	1897	Bay of Bengal	175,000
7	Super Typhoon Nina, China	1975	West Pacific	171,000
8	Cyclone 02B, Bangladesh	1991	Bay of Bengal	140,000
9	Great Bombay Cyclone, India	1882	Arabian Sea	100,000
10	Hakata Bay Typhoon, Japan	1281	West pacific	65,000
11	Calcutta Cyclone, India	1864	Bay of Bengal	60,000
12	Bangladesh	1822	Bay of Bengal	50,000
13	Bengal Cyclone, Calcutta, India	1942	Bay of Bengal	40,000

Source: J. Masters
 (<https://me.tocph.nmci.navy.mil/jt/wc.php>)

Decade-wise occurrence of cyclonic storms and the number of population affected in Bangladesh, 1901-2007



*Source: Center for Research on the Epidemiology of Disasters (CRED),
Université Catholique de Louvain.*

Sea level rise

- @ 4 mm/year at Hiron point of the Sundarbans
- @ 6 mm/year at Char Changa
- @ 7.8 mm/year at Cox's Bazar

Source: SAARC Meteorological Centre, Dhaka



Projected global warming and rainfall scenarios in Bangladesh

Year	Sea level rise (cm)	Temperature increase (°C)			Rainfall fluctuation compared to 1990 (%)	
		Monsoon	Winter	Annual	Monsoon	Winter
2030	14	+ 0.8	+ 1.1	1.0	+ 6	- 2
2050	32	+ 1.1	+ 1.6	1.4	+ 8	- 5
2100	88	+ 1.9	+ 2.7	2.4	+ 12	- 10

Source: Coastal Developmental Strategy, 2006. Water Resources Planning Organization, Ministry of Water Resources

Land area* inundation due to projected sea-level rise in Bangladesh

Year	Sea level rise (cm)	% of total land area inundation in Bangladesh
2030	14	8
2050	32	10
2100	88	16

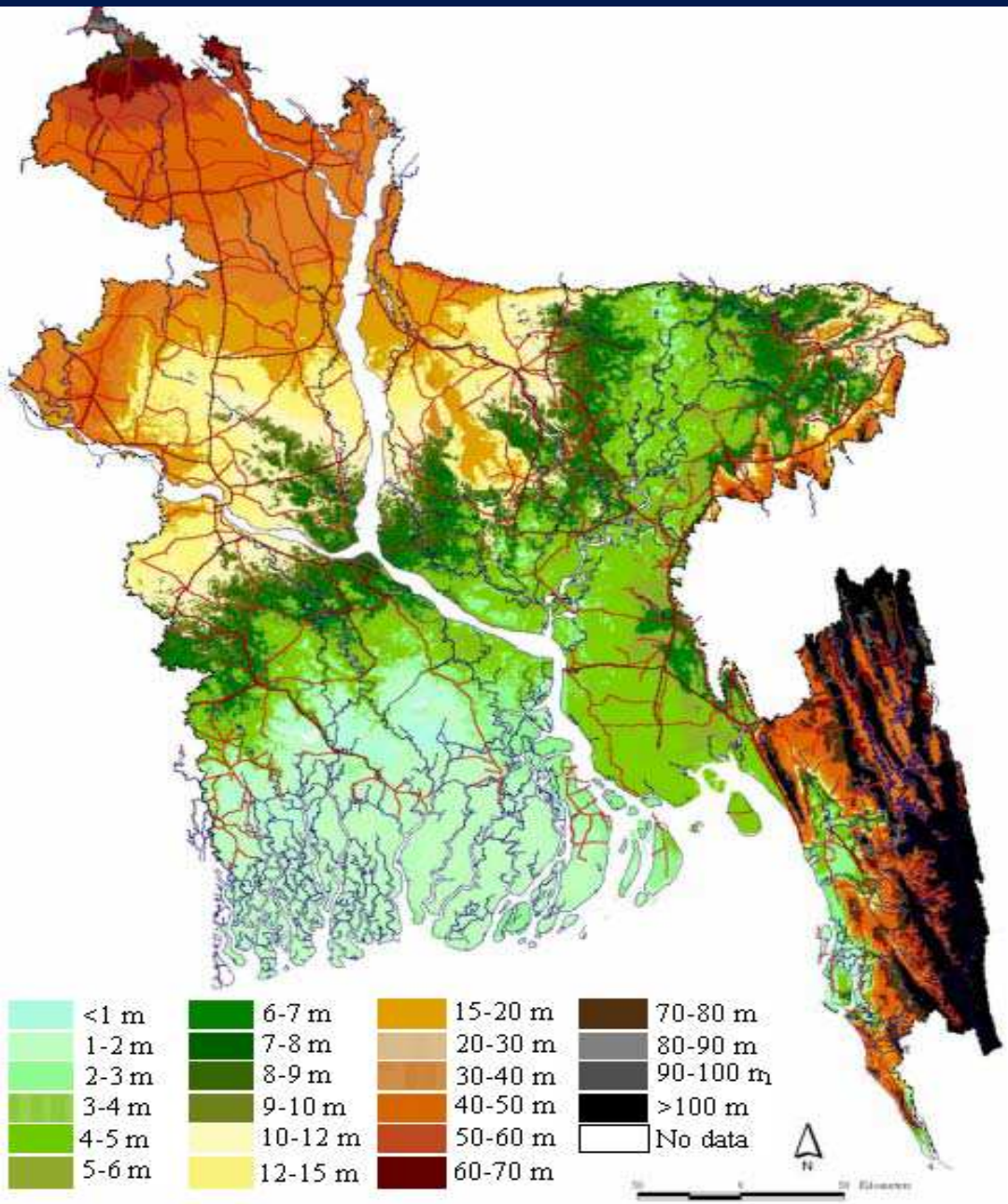
*Barisal, Patuakhali and Khulna regions are most at risk from sea level rise.

Source: Coastal Developmental Strategy, 2006. Water Resources Planning Organization, Ministry of Water Resources

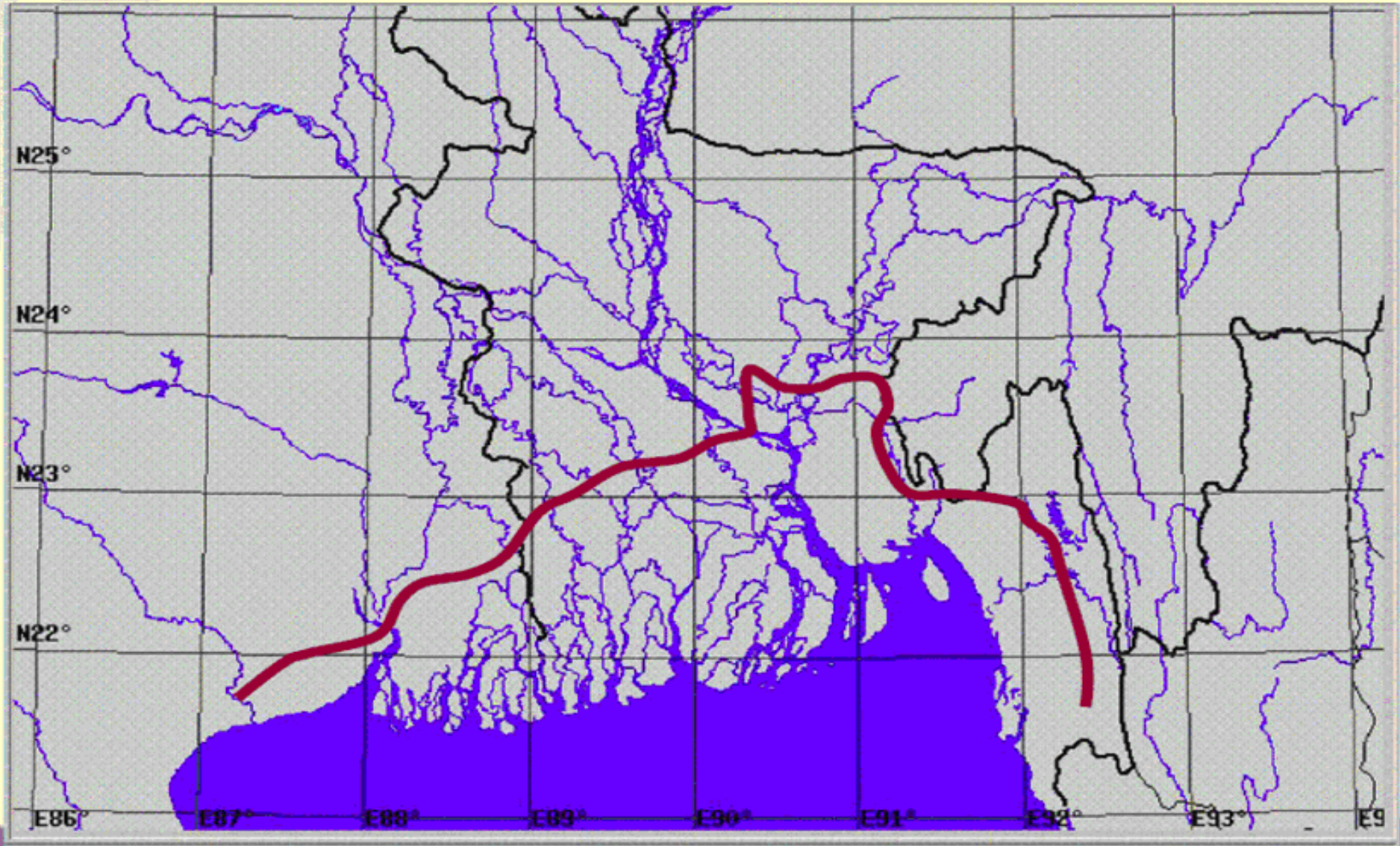
Topography of Bangladesh

Most of the coastal parts and associated inland of Khulna and Barisal divisions lie within 1m from sea level where incursion of saline water is common. And these areas will be inundated and unsuitable for crop production due to sea-level rise in next 50 years.

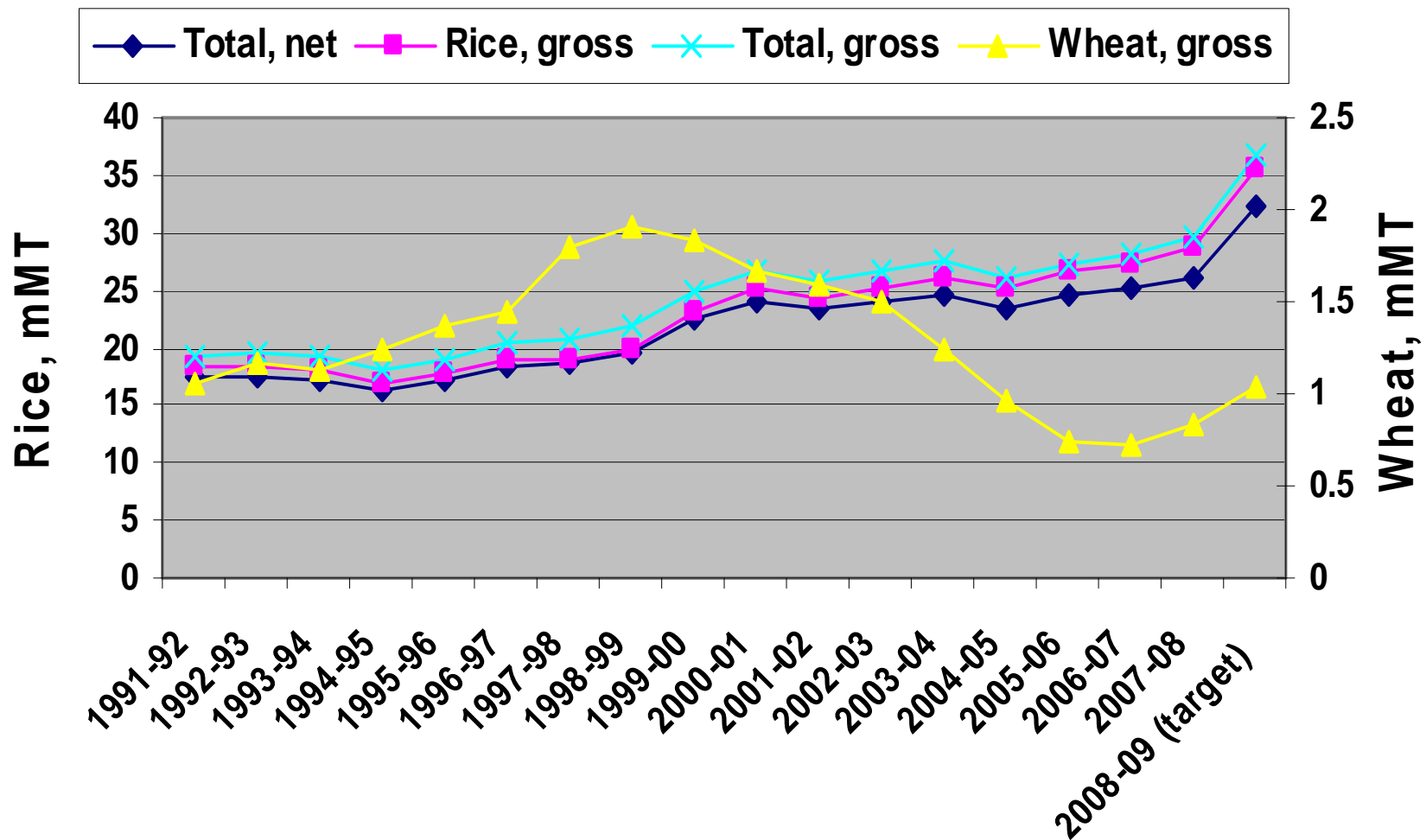
A one meter rise in sea level would inundate 17% of Bangladesh (*Ali and Huq 1989*).



Area of Bangladesh that will be lost to cultivation due to sea-level rise in next 50 years



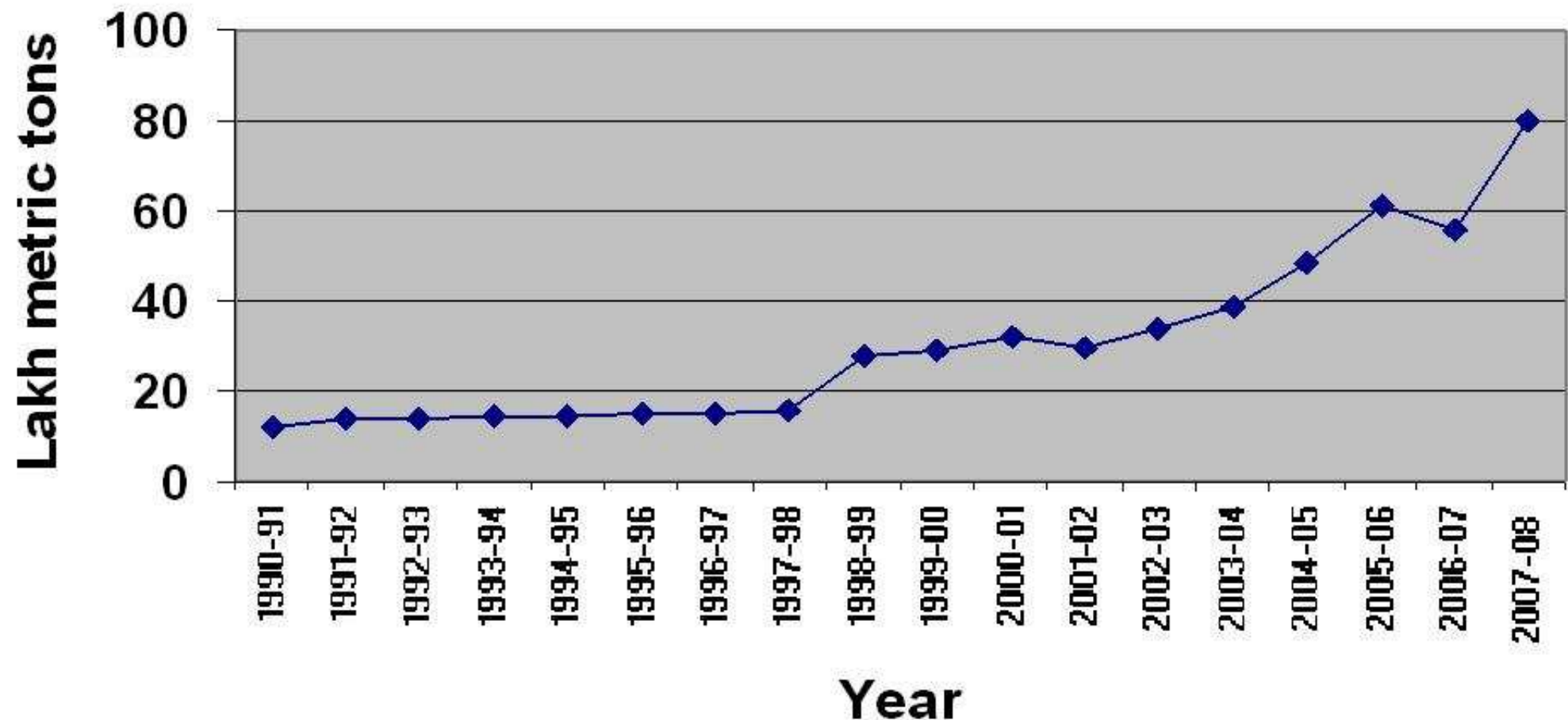
Foodgrain production in Bangladesh, 1991-2008



Rice production increased 57.2% between 1991-92 and 2007-08
Even between 2006-07 and 2007-08, rice production increased by 1.4 mMT despite losses of about 2.0 mMT due to floods and Sidr in 2007.

There was also a bumper harvest of potato in 2007/08, nearly 2.5 mMT more than in the previous year

Increase in potato production in Bangladesh, 1991-2008

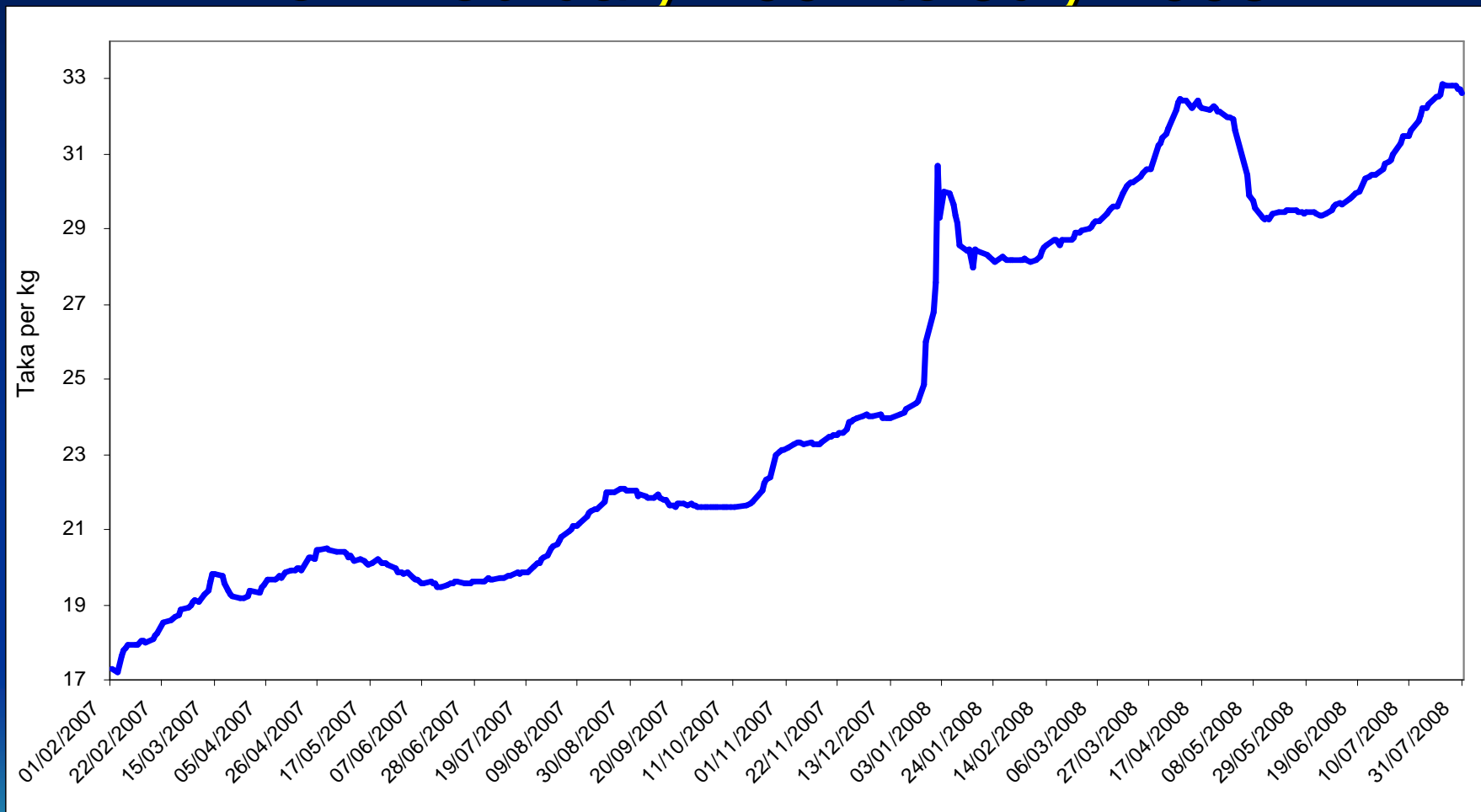


Climate change and food price

- The year of 2007 is marked by an unprecedented rise in food price all over the world, that continued till now in 2008.
- Experts attribute these food price hikes due to record low global food stock caused by crop failures in many countries, e.g. prolonged drought in Australia (wheat).



Daily national average retail price of rice: from February 2007 to July 2008



Average change July 2008 on July 2007 = 60.6%

- Rise in food price affects the poor most, pushing them into more intense poverty and pulling more people into poverty.
- Between 2000 and 2005, poverty prevalence in Bangladesh came down from 49% to 40% (56 million); **in mid-2008, an additional 8.5% (i.e. 12 million) are feared to have slid down below poverty line due to food price rise** (now poverty prevalence **48.5%** (Source: CPD, 2008)).
- This makes attaining the Millennium Development Goal #1 more difficult.

- **Also, increase in price of the staple food rice forces the poor to have less diversified diet, plunging into the risk of having more widespread malnutrition, especially among women and young children.**
- **Between 2000 and 2005, child underweight rate came down from 48% to 40%, but now the prevalence is apprehended to increase.**
- **Thus, the situation is such that Bangladesh makes a leap forward in development (reduction in poverty and malnutrition) but then slips two steps backward.**



Conclusions

Climate change at the **global, regional and country level**, is becoming as **an emerging threat to food security** in the longer run in Bangladesh in **all its dimensions** by affecting:

- **Production and availability** - by shifts in temperature and rainfall;
- **Accessibility – physical, social and economic**, by lowering people's incomes, e.g. from coastal fishing because of rising sea levels; or lowering a country's foreign exchange earnings by the destruction of its export crops because of the rising frequency and intensity of tropical cyclones; and
- **Utilization of food for nutrition** - by threatening food safety and quality through pollution of water and degradation of environmental sanitation.



Thank You

