

WHAT CAN INDIA DO ABOUT CLIMATE CHANGE ?

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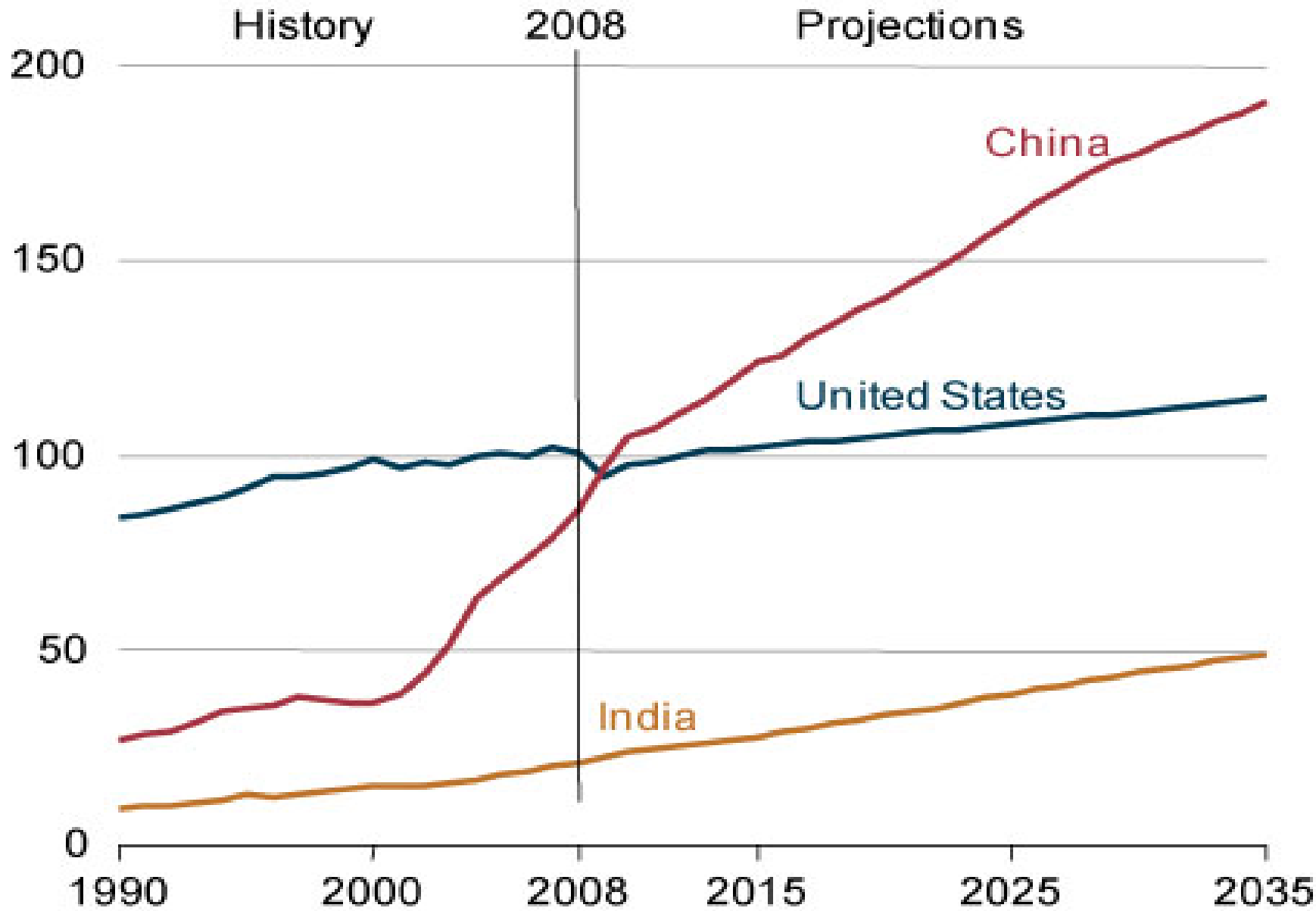
**DIVECHA CENTRE
FOR CLIMATE CHANGE**

Climate Change and India

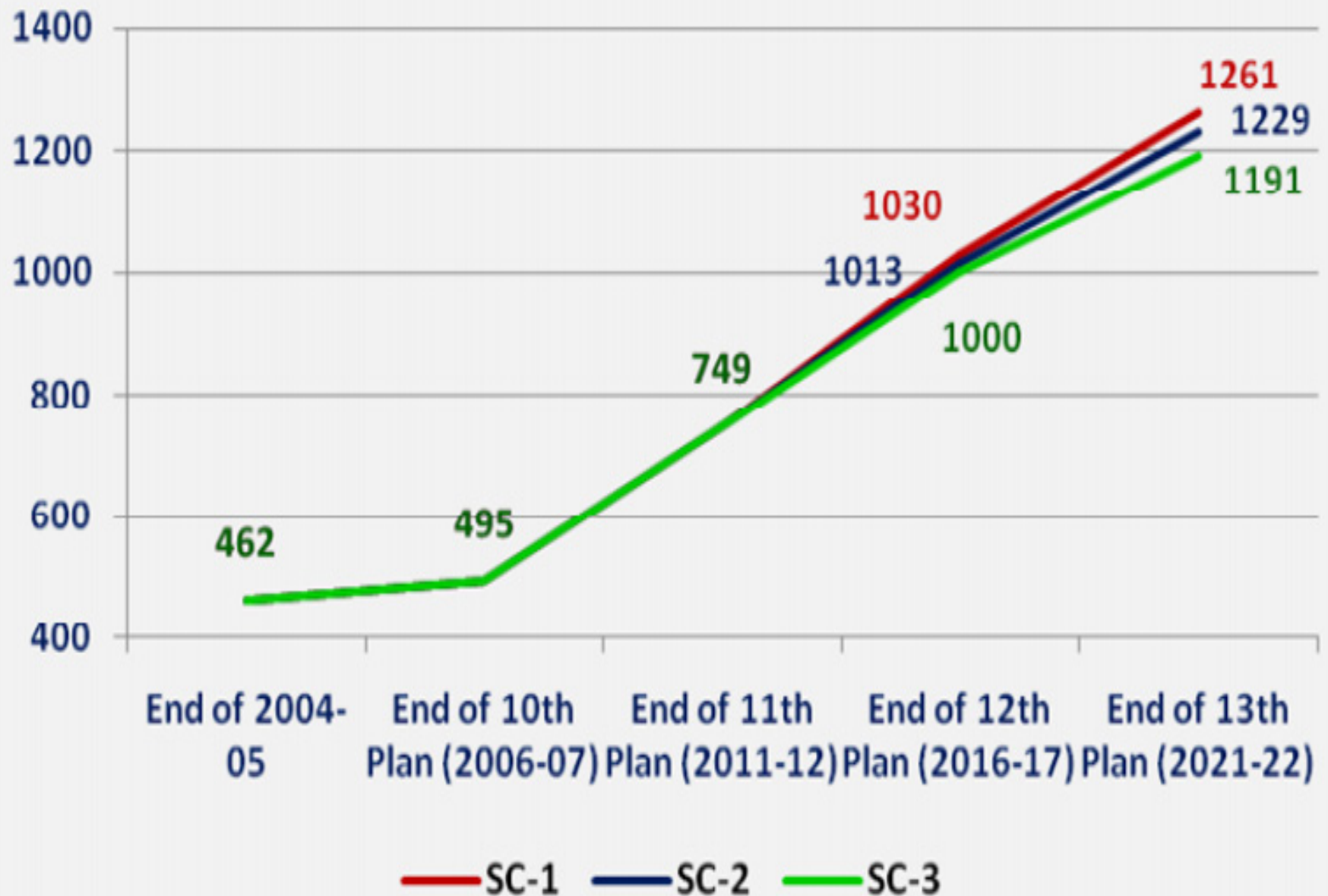
- **India contributes less than 6% to global CO2 emissions**
- **India has many more urgent and short term challenges related to population growth, air pollution, water shortage**

Figure 13. Energy consumption in the United States, China, and India, 1990-2035

(quadrillion Btu)

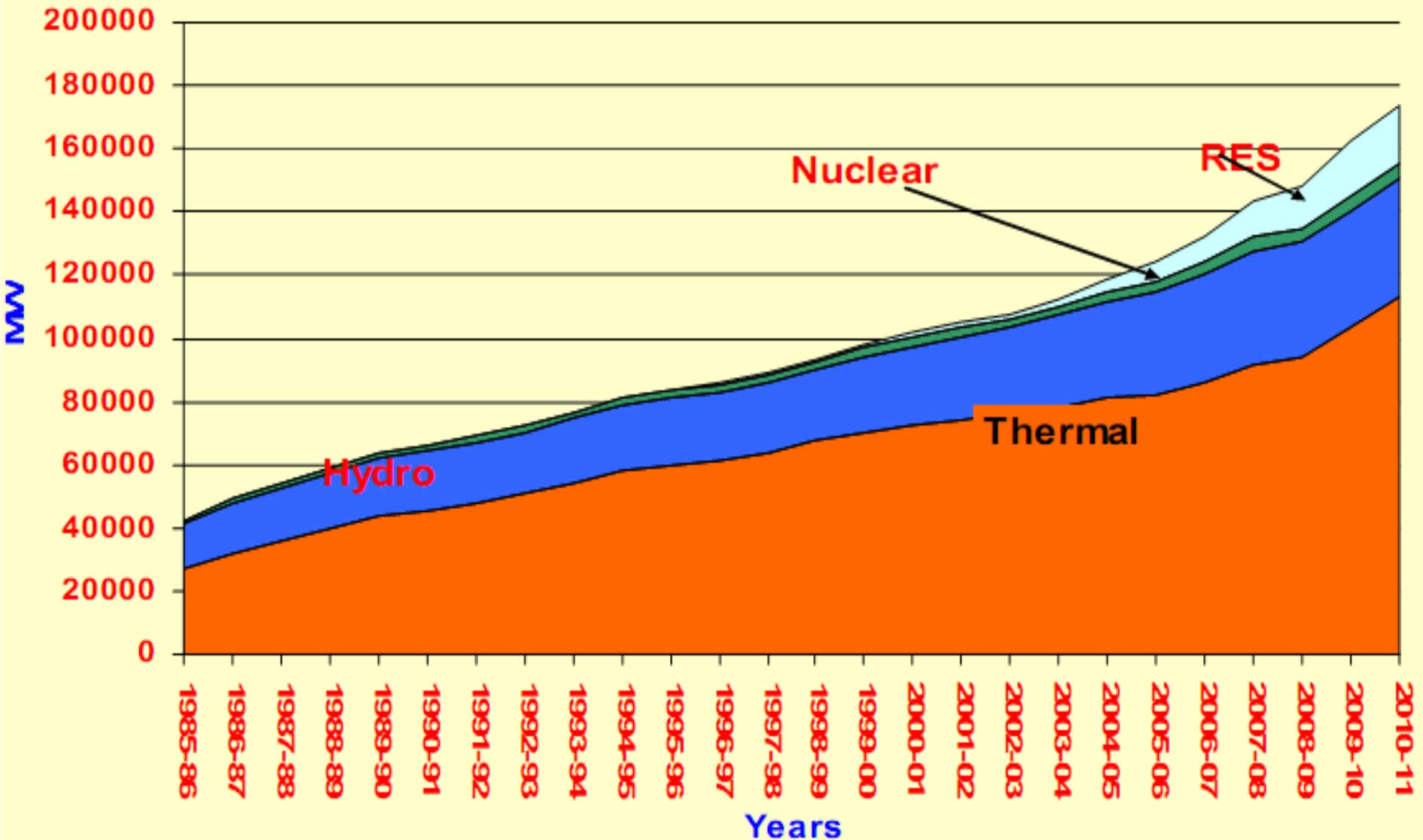


Total CO2 Emission (MT) from Thermal Generation

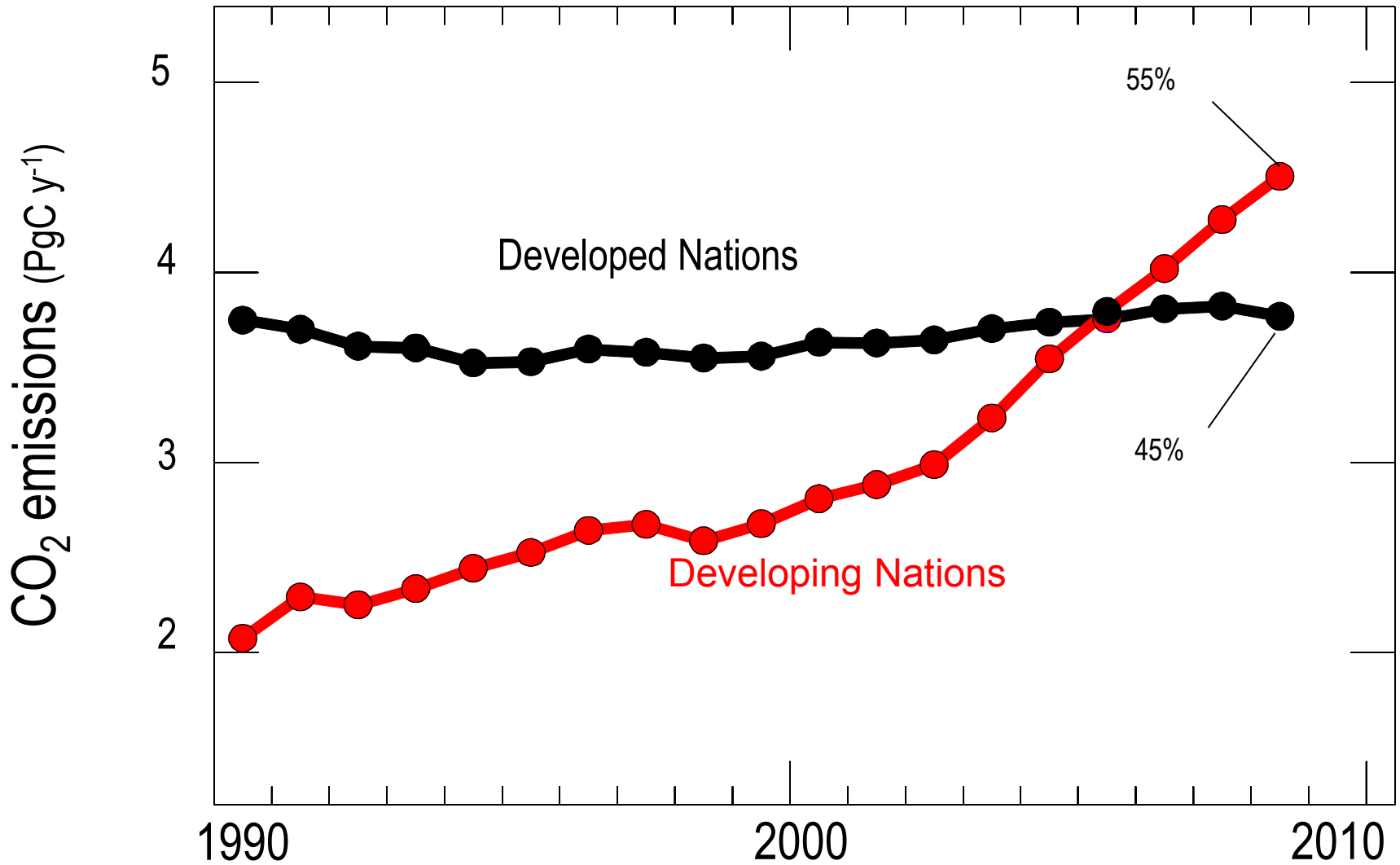


CENTRAL ELECTRICITY AUTHORITY

ALL INDIA INSTALLED CAPACITY



CO₂ Emissions (from fossil fuels)

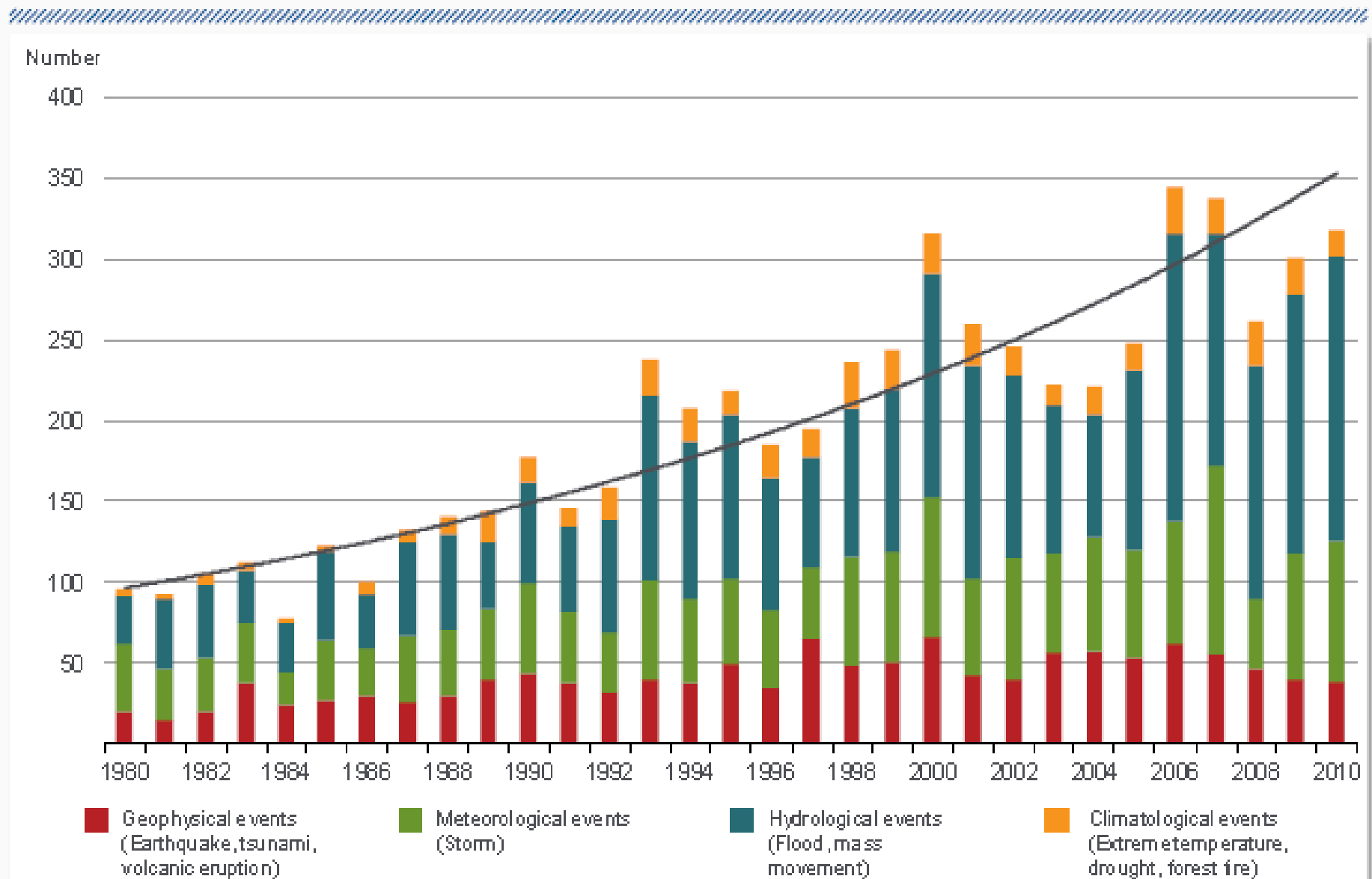


Le Quéré et al. 2009, Nature-geoscience; CDIAC 2009

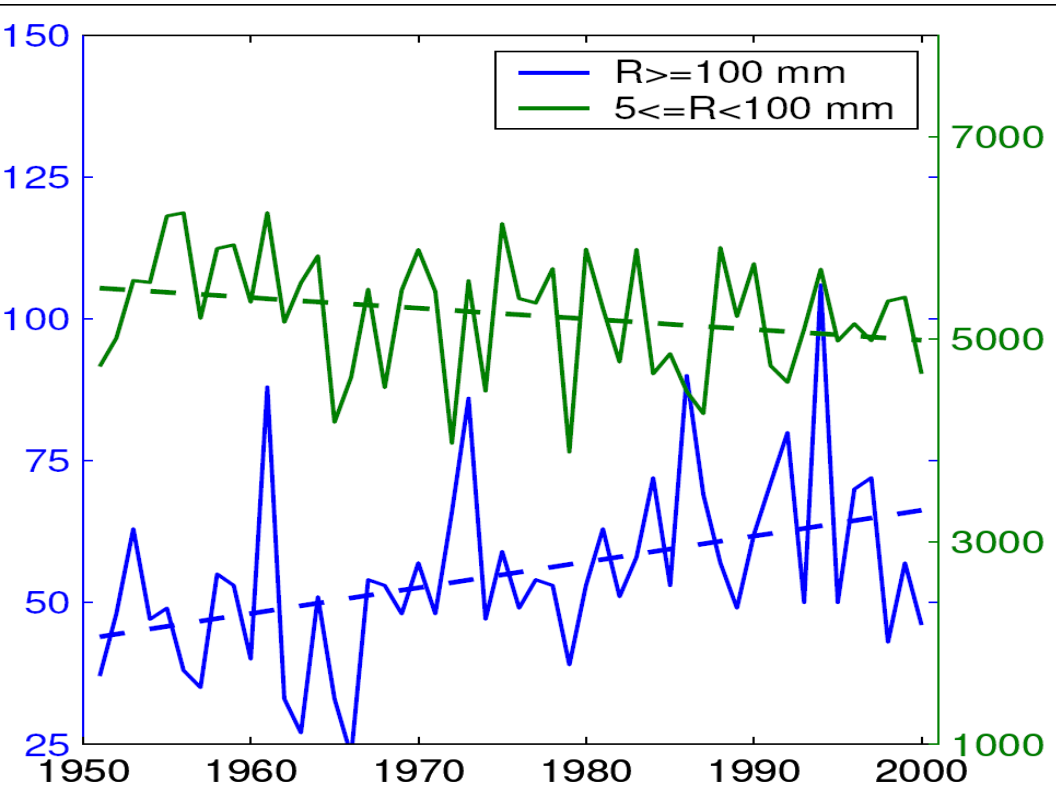
**POLLUTION IS A
PRICE WE MUST PAY
FOR PROGRESS**

Natural catastrophes in Asia 1980 – 2010

Number of events with trend



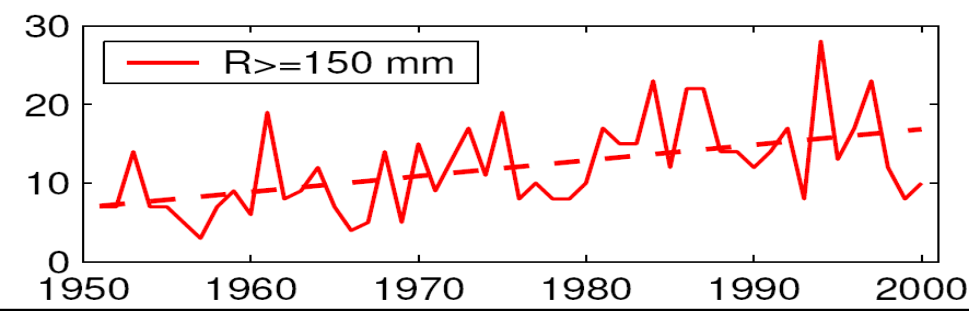
Heavy precipitation events over Central India have increased by 50% during last 50 years



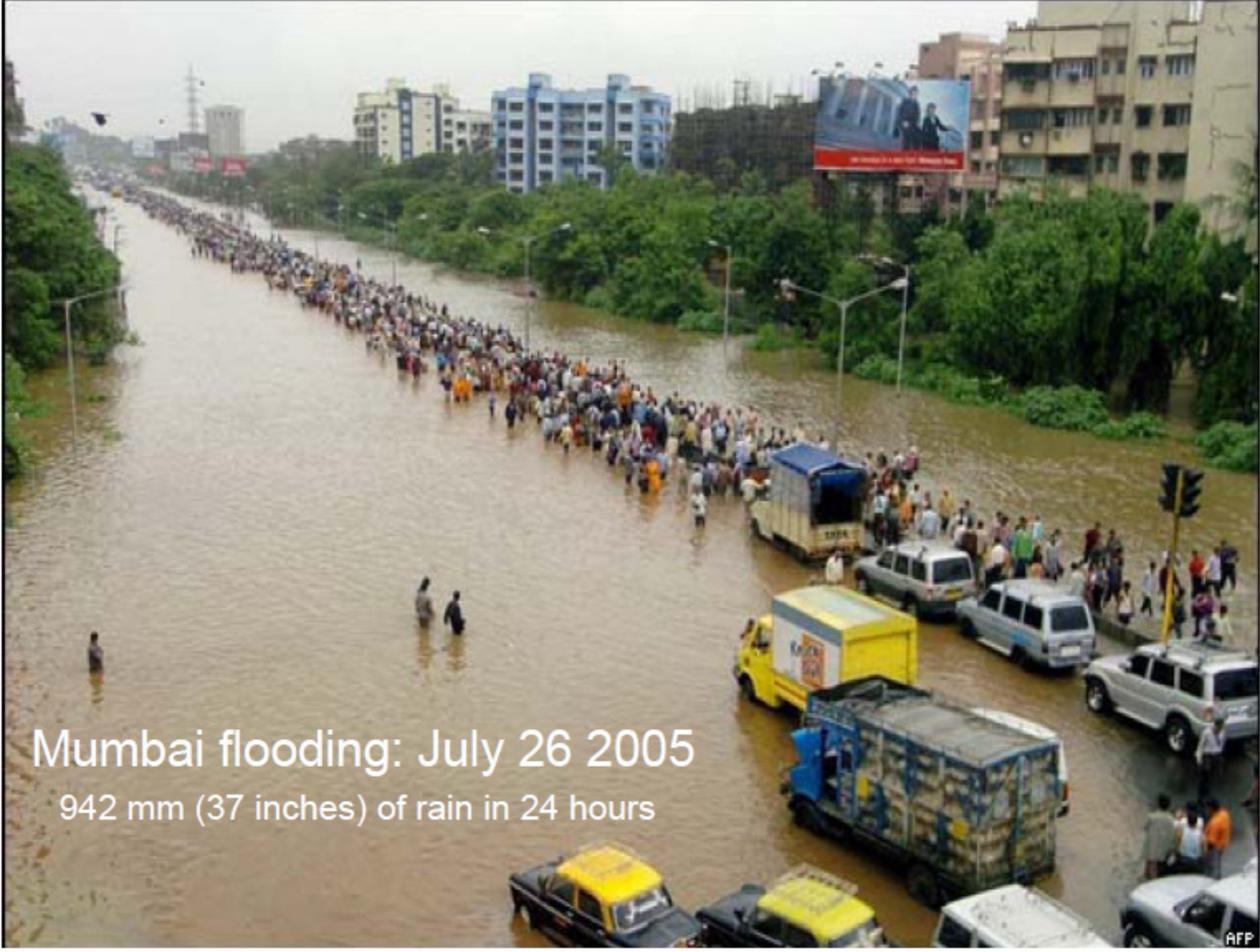
← Light to moderate rainfall events (5-100 mm)

← Heavy rainfall events (>10cm)

← Very heavy rainfall events (>15cm)

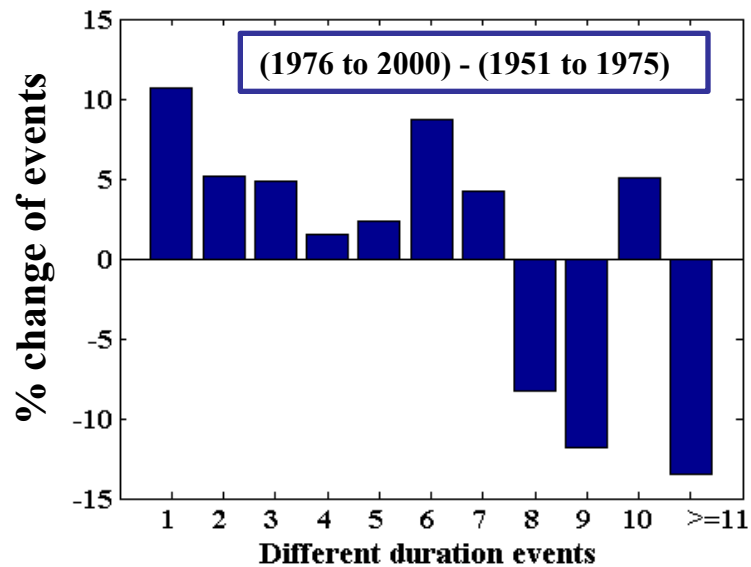
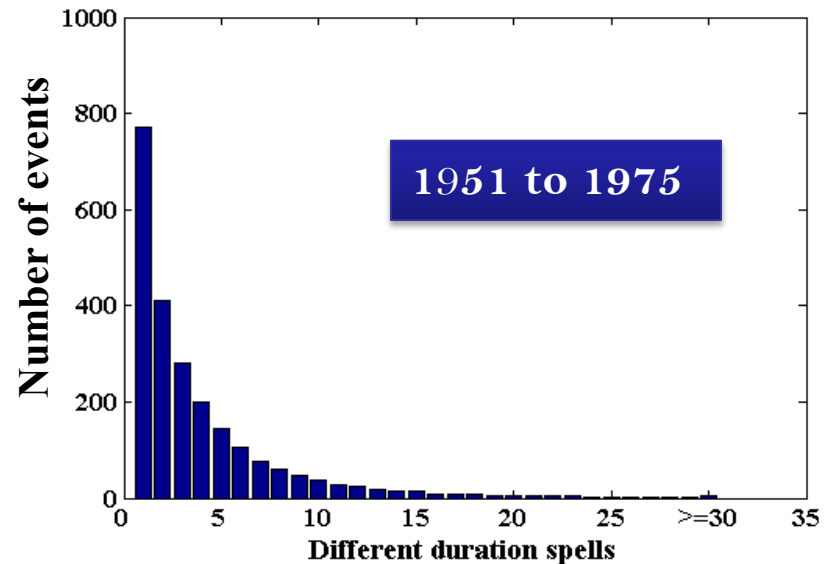
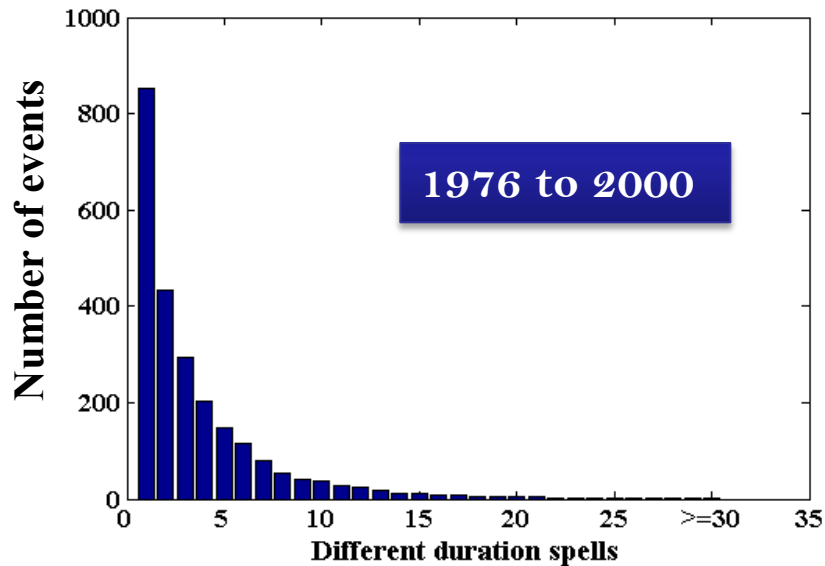


Source: IITM, Goswami et al. 2006; data is the frequency in each of 143 grids in the region



Mumbai flooding: July 26 2005

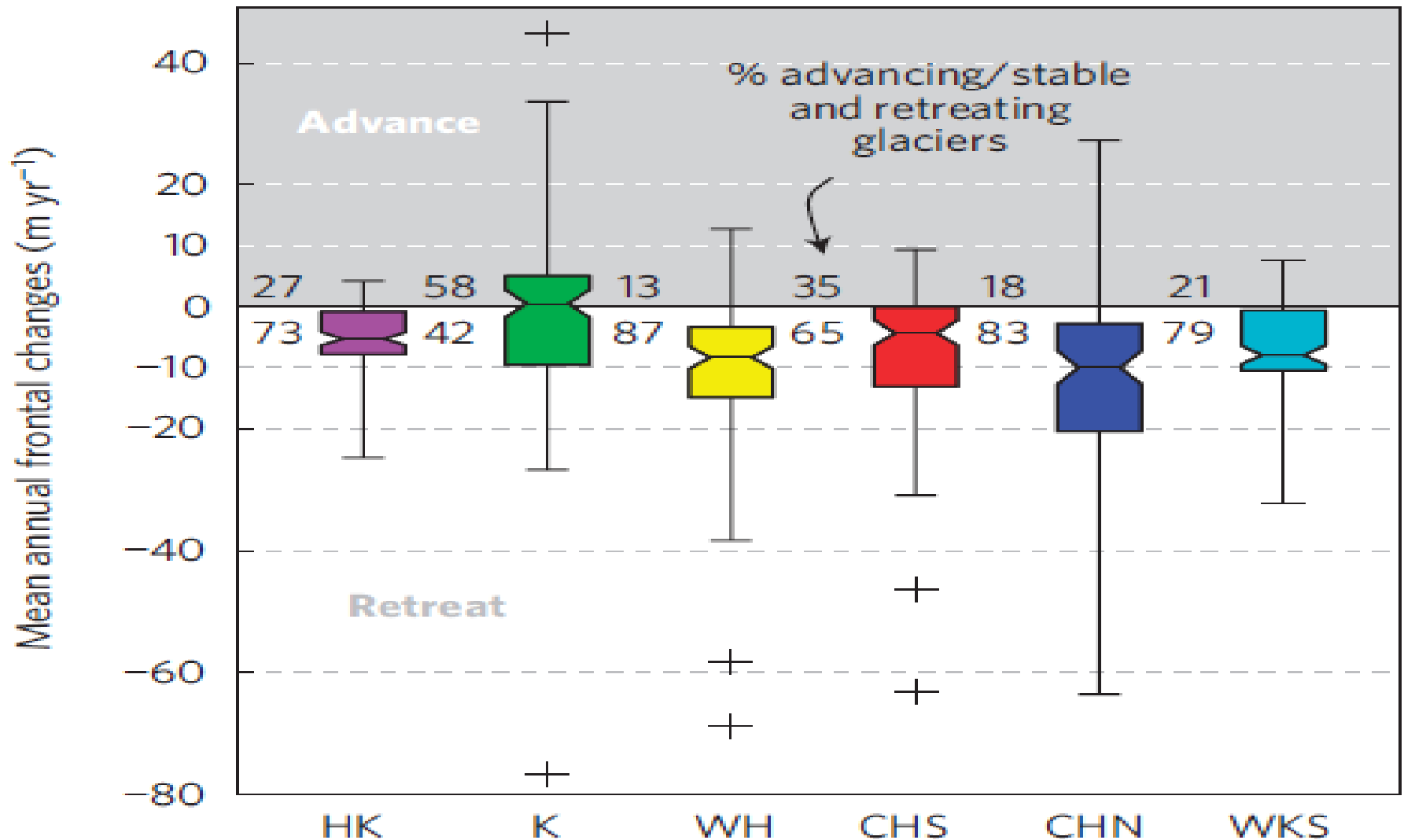
942 mm (37 inches) of rain in 24 hours



Comparison of number of wet spells for second 25 years (1976-2000) and first 25 years (1951-1975) over Central Indian region

Spatially variable response of Himalayan glaciers to climate change affected by debris cover

Scherler et al., Nature Geoscience, 23 Jan 11





What do we know today?

- **Crop yields start decreasing at 1°C in tropics, but increase in temperate upto 3°C**
- **Indian studies: Impacts on some crops, processes, and regions:**
 - **Methodological concerns in most of these studies**
- **Very little information on fish and livestock**
- **Nil information on pests, microbes**
- **Integrated story not clear: Weak links with climatic scenarios, changed availability of resources, trade, and policy**

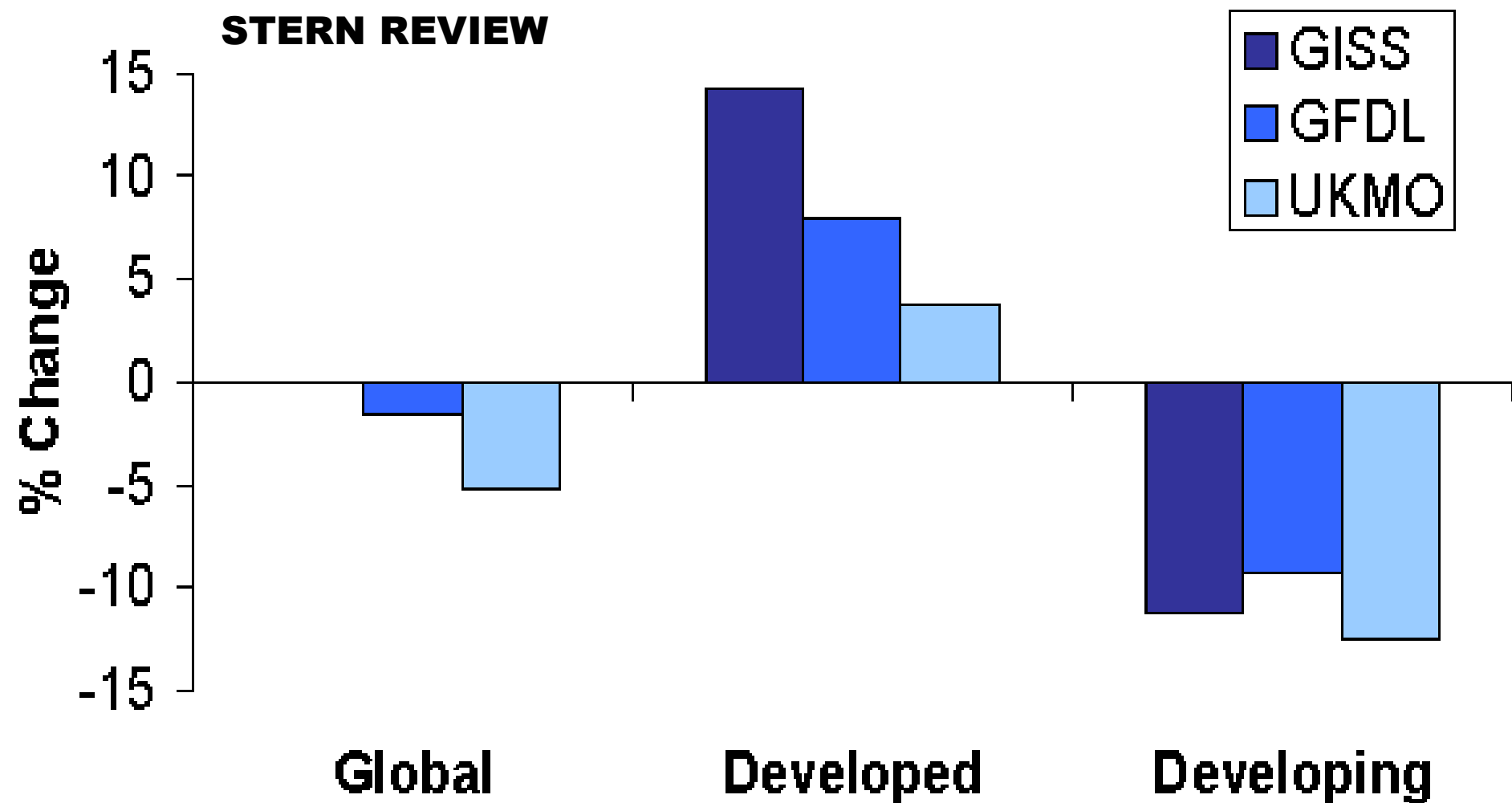


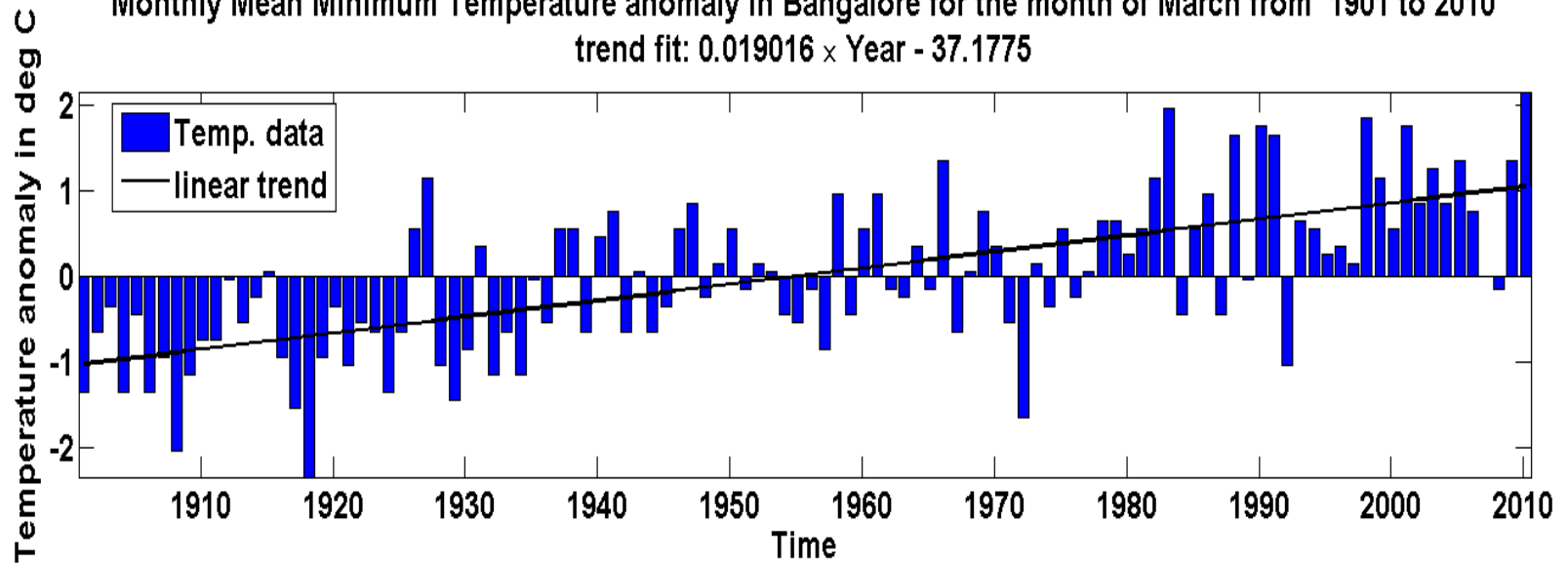
Figure 3.5 Change in cereal production in developed and developing countries for a doubling of carbon dioxide levels (equivalent to around 3°C of warming in models used) simulated with three climate models (GISS, GFDL and UKMO Hadley Centre)

Parry *et al.* (2005) analysing data from Rosenzweig and Parry (1994)

**REGIONAL CLIMATE
CHANGE
VERSUS
GLOBAL CLIMATE
CHANGE**

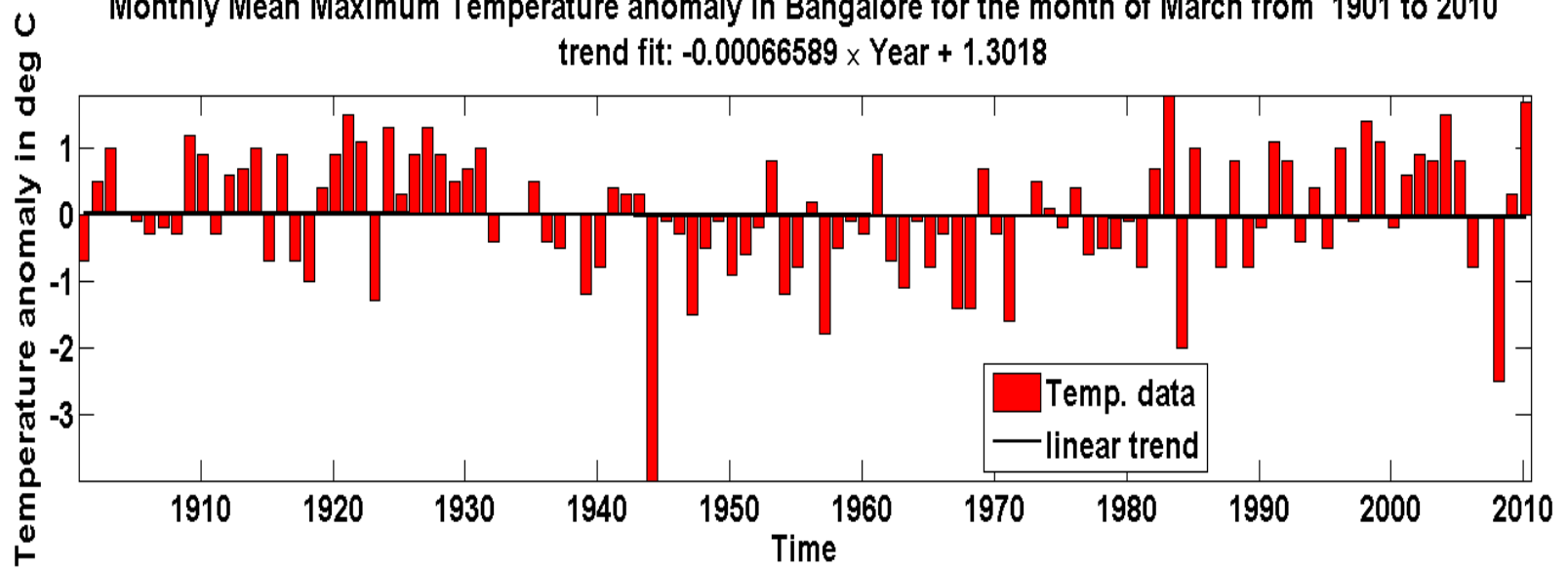
Monthly Mean Minimum Temperature anomaly in Bangalore for the month of March from 1901 to 2010

trend fit: $0.019016 \times \text{Year} - 37.1775$



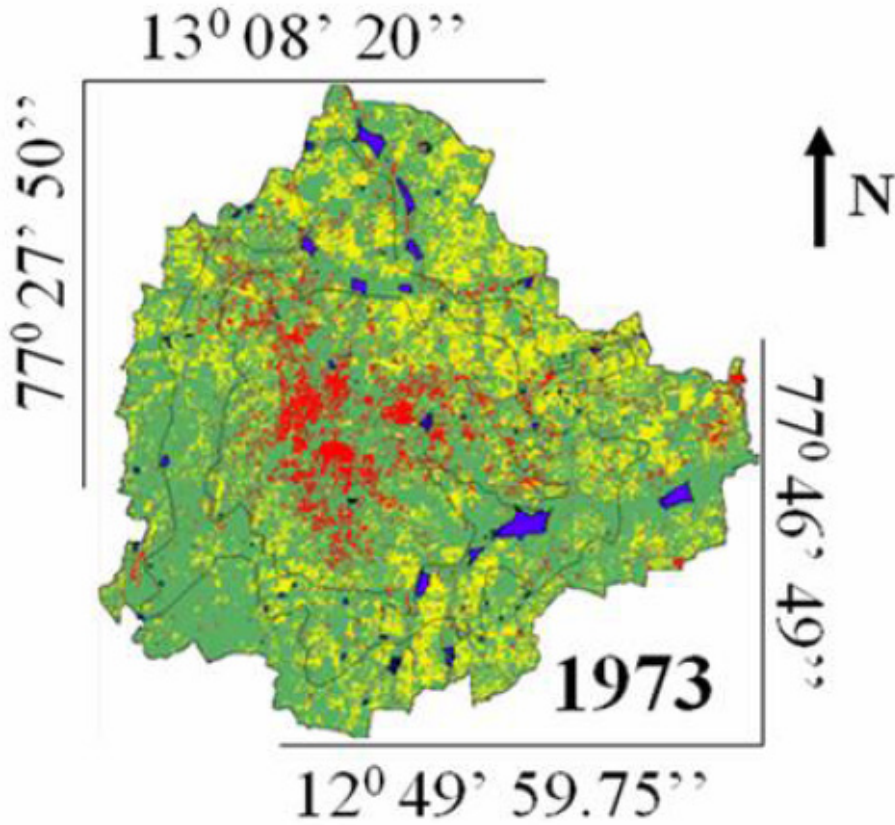
Monthly Mean Maximum Temperature anomaly in Bangalore for the month of March from 1901 to 2010

trend fit: $-0.00066589 \times \text{Year} + 1.3018$

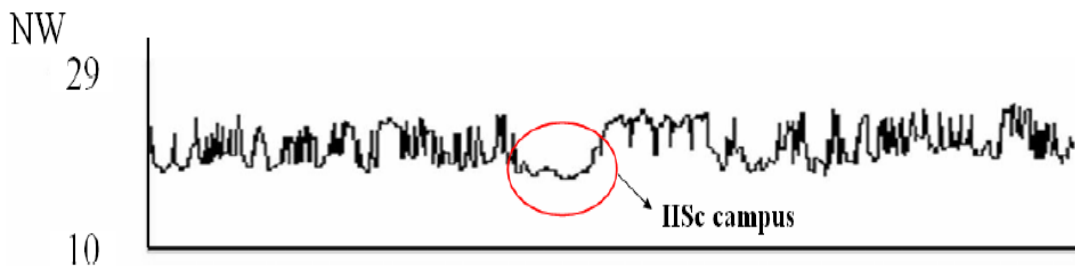
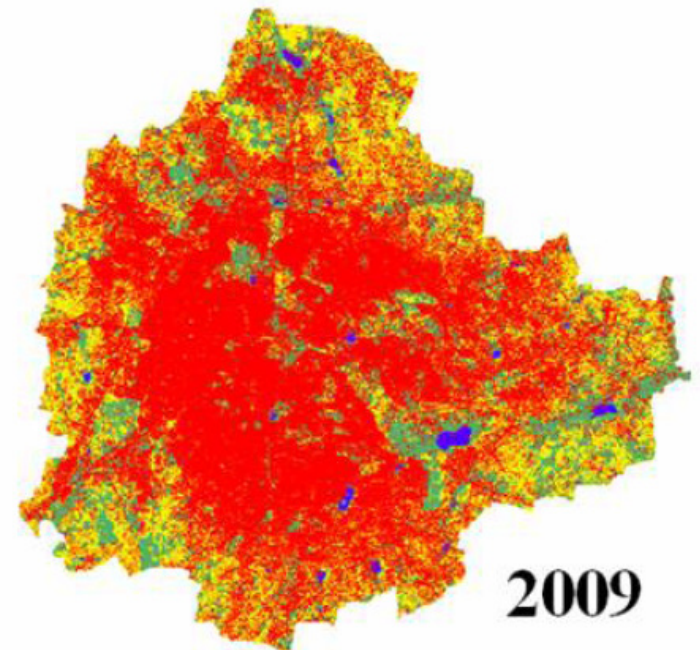


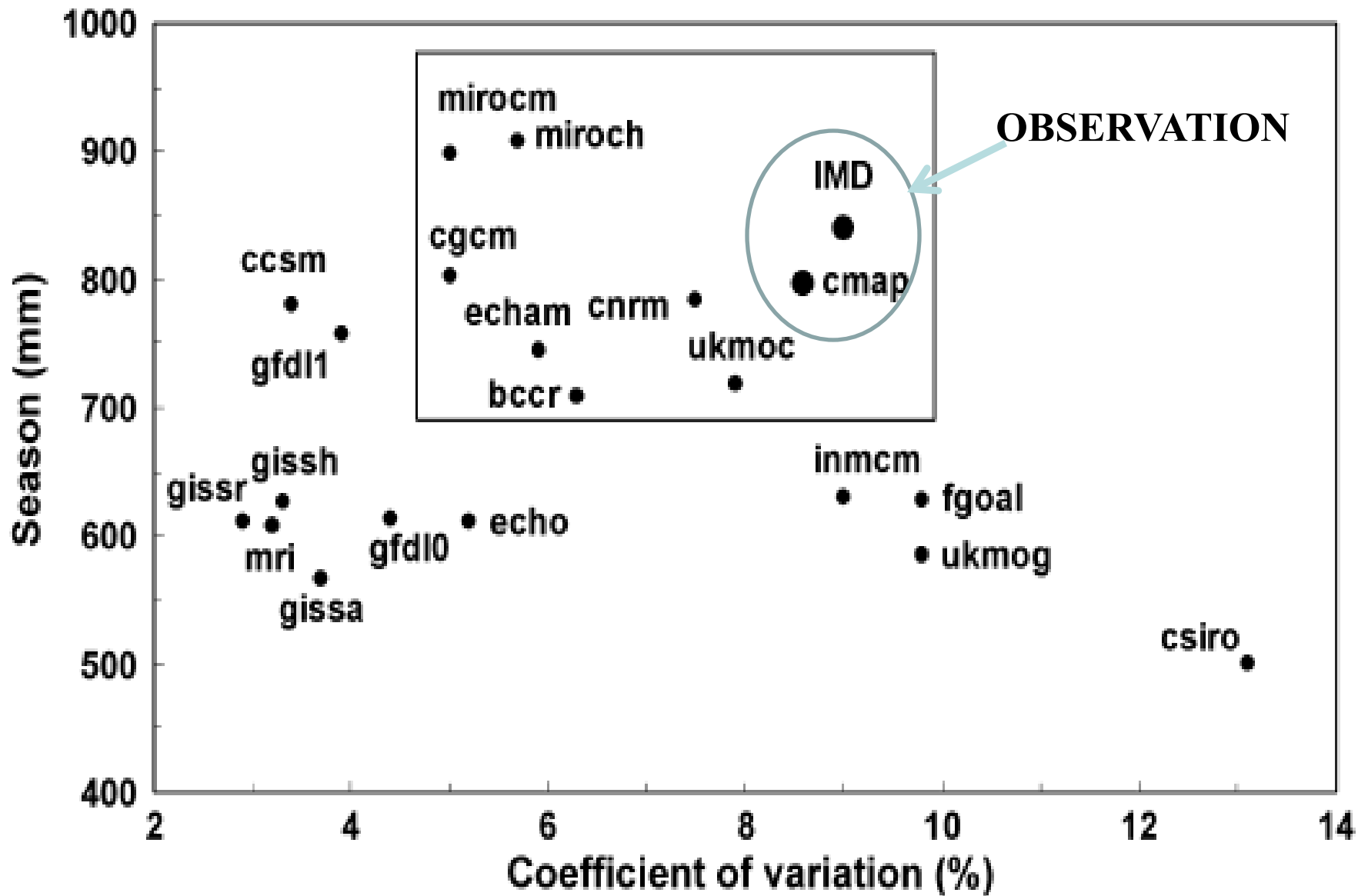
BANGALORE WARMING = GLOBAL + LOCAL

Courtesy: T.V.Ramachandra & Uttam Kumar, 2010
Bangalore Urban Heat Island



- Built up
- Vegetation
- Water Bodies
- Others



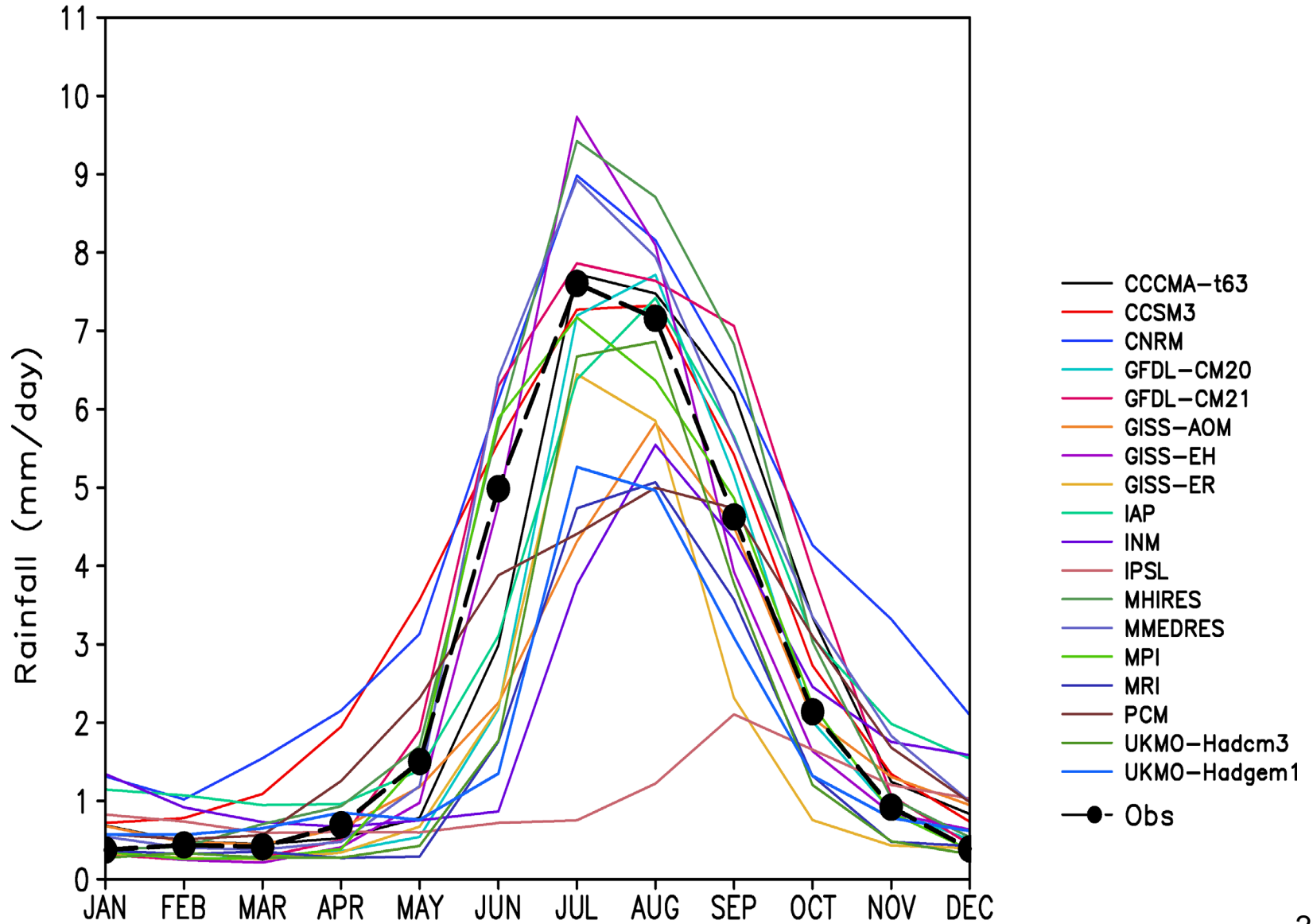


Kripalani et al, Theor & App. Clim, 2007

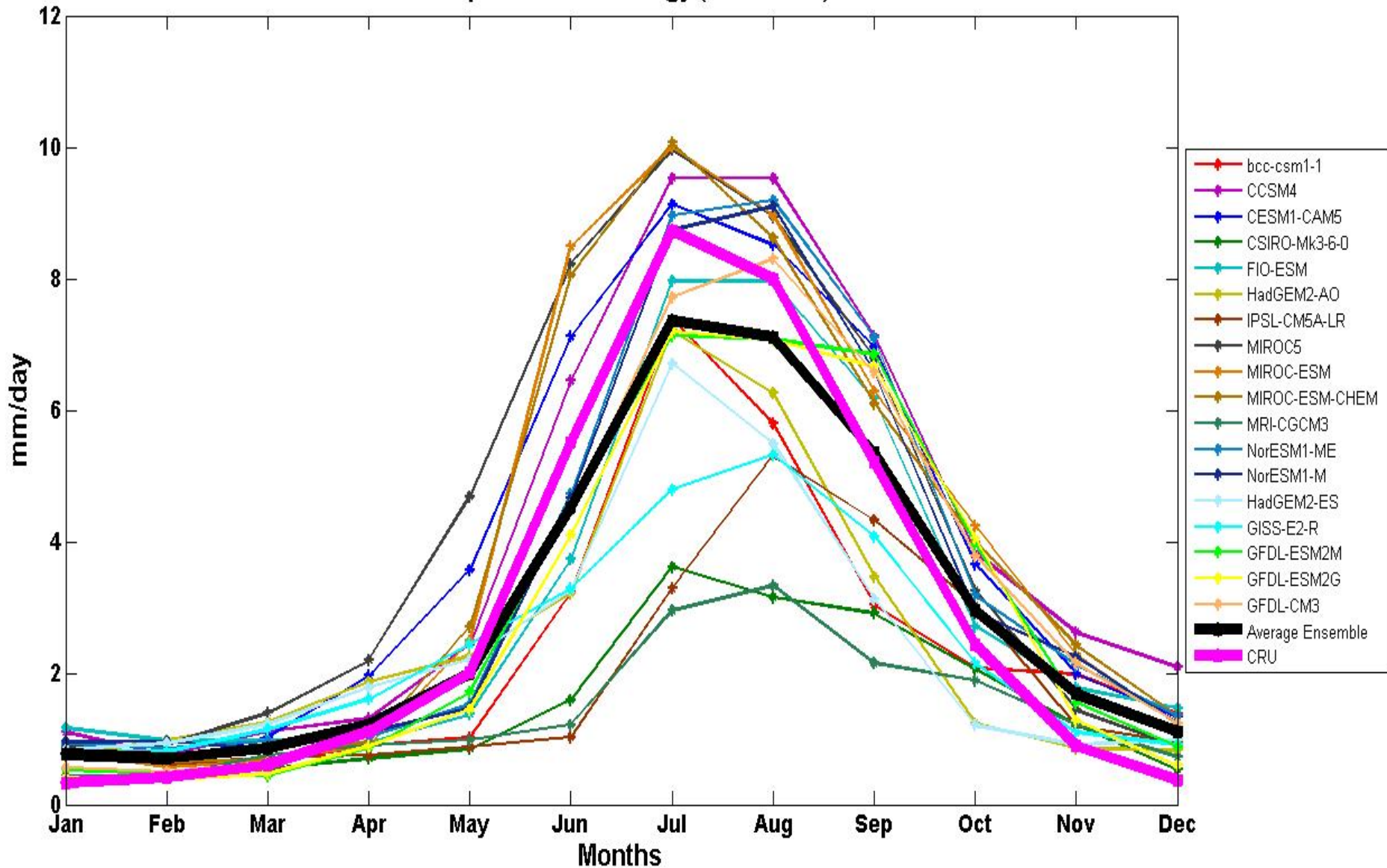
ukmohadcm3 :3.75 x 2.4657

ukmohadgem1: 1.875 x 1.24

Seasonal Cycle in Rainfall for 20thCentury climate
over Indian land region(70–90E;10–30N)



Precipitation Climatology (1971-2000)

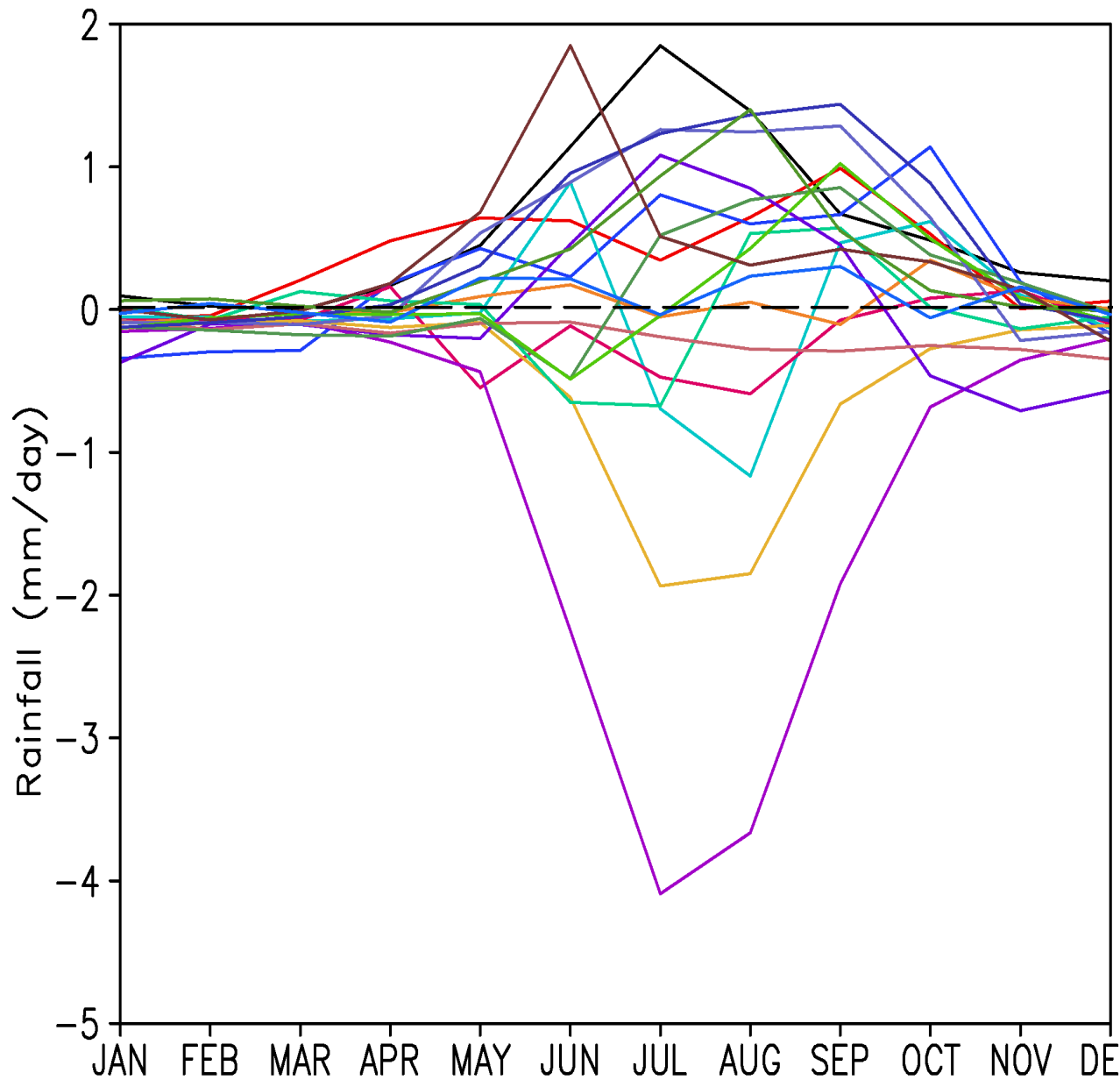


Courtesy: G.Bala, Divecha Centre for Climate Change

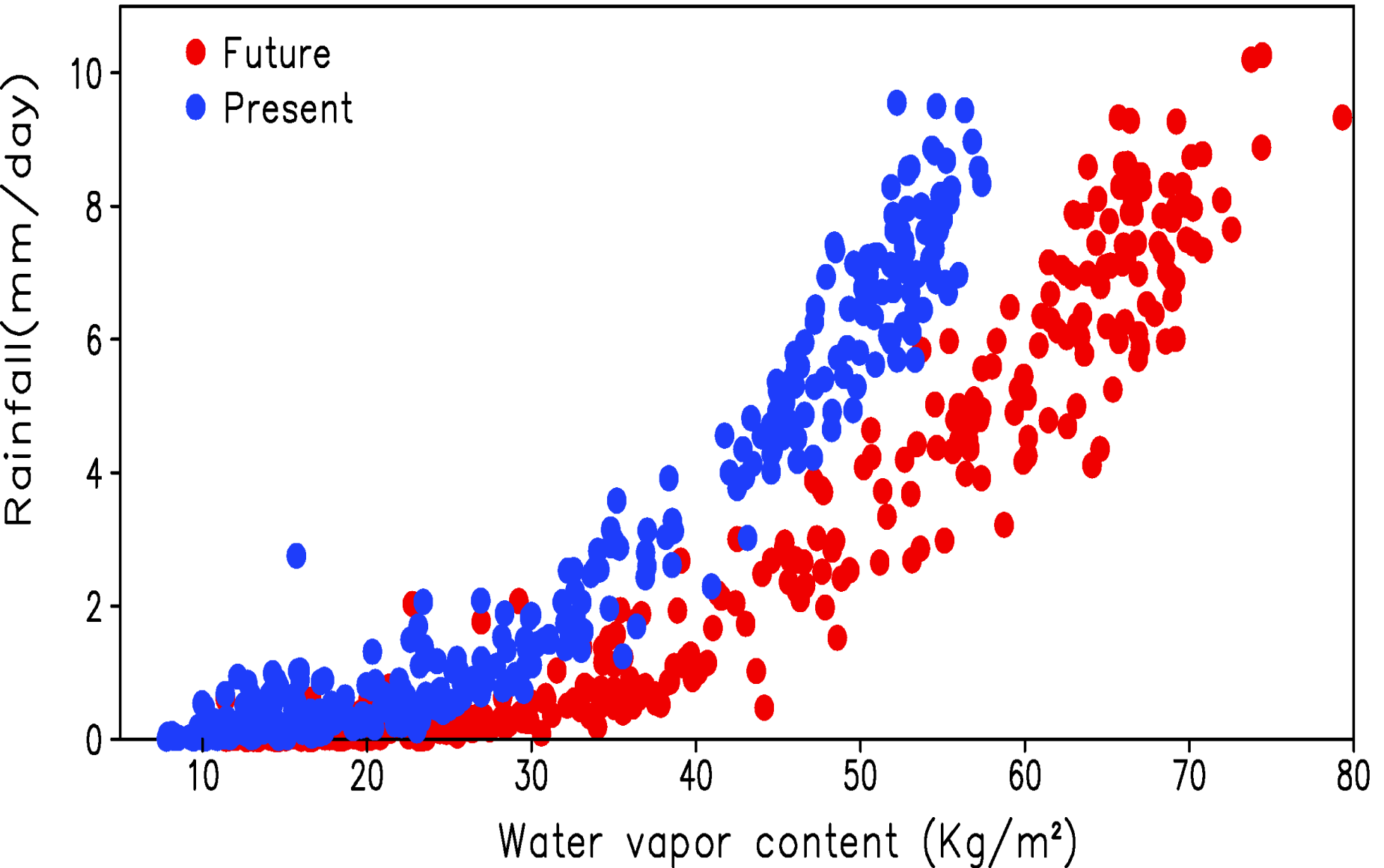
Difference in Rainfall (Future-20thCentury climate)

over Indian land region(70-90E;10-30N)

**Future
CO2
720 ppm**



Scatter plot of Water vapor content Vs Rainfall, for MPI/ECHAM5 Model averaged over Indian land region(70–90E,10–30N)





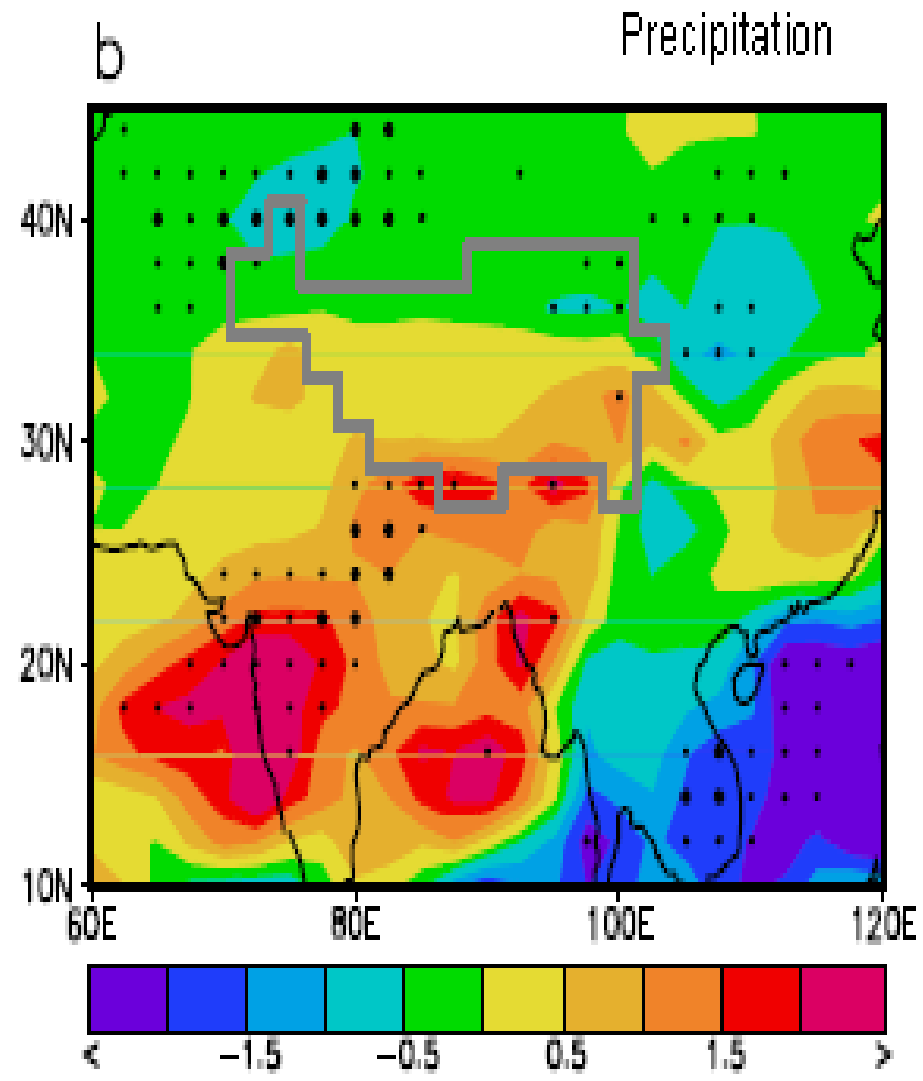
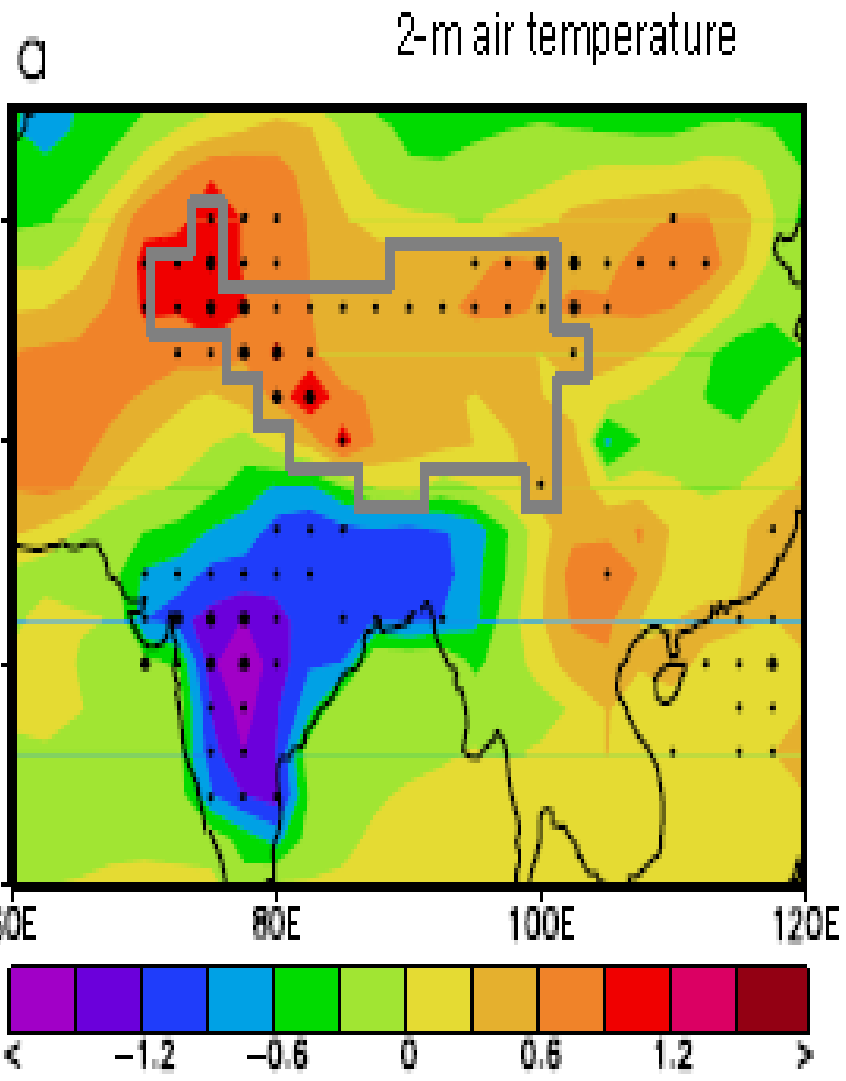
December 21 2001

Aerosols and Monsoon

All aerosols cool the earth's surface

According to land-sea contrast theory of monsoon cooling the land surface by aerosols should weaken the monsoon

GEOS GCM, Aerosol-minus-No Aerosol, for month of May



Global Warming is a
symptom of a much
larger problem:

The degradation of the
quality of **air, water**
and soil

SCIENTIFIC AMERICAN

November 2009

www.ScientificAmerican.com

The Long-Lost
Siblings of
OUR SUN

page 40



A Plan for a **Sustainable Future**



How to get all energy from
wind, water and solar power
by 2030



Chronic Pain
What Goes Wrong

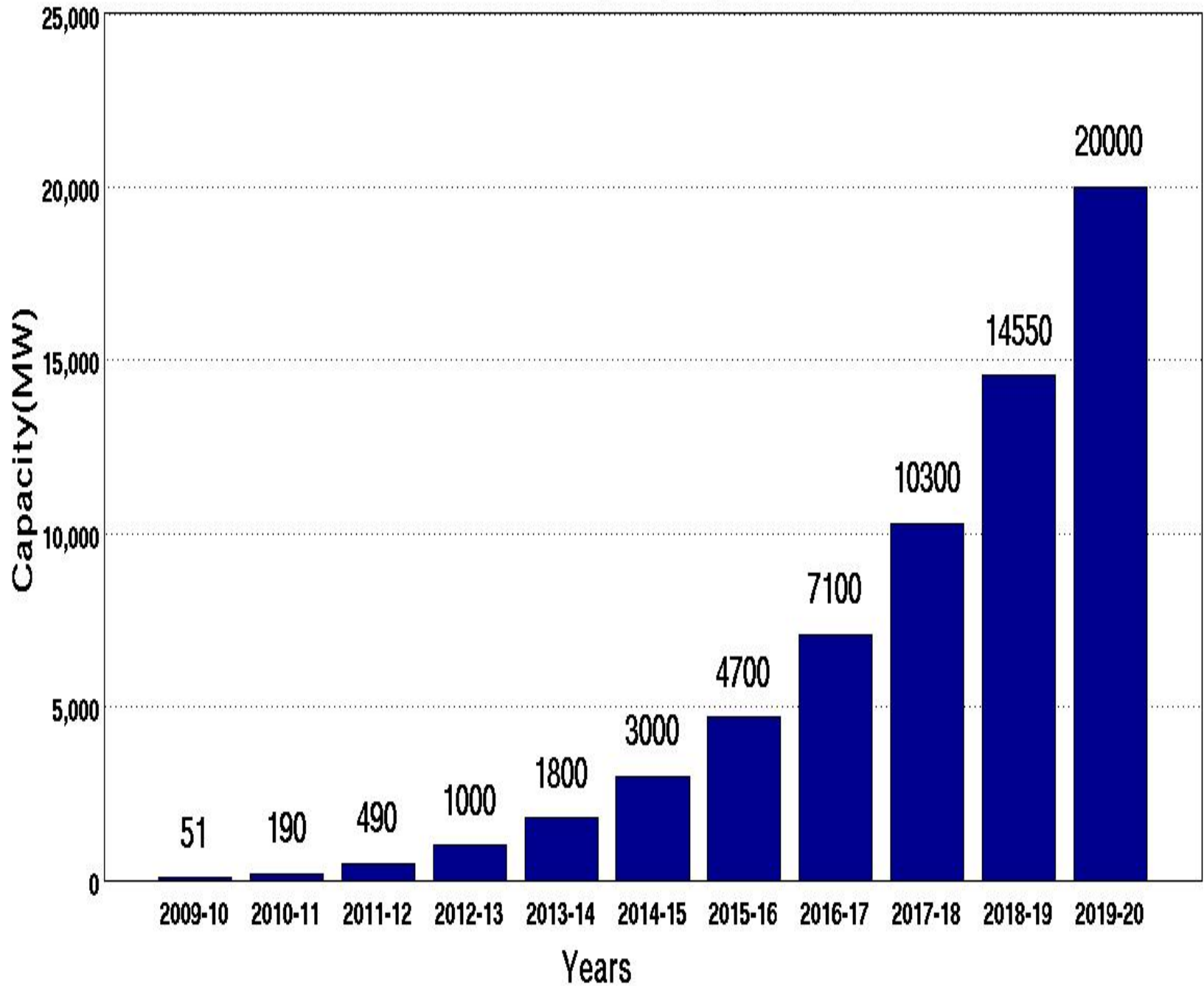
Plus:

- The Future of Cars
- Farms in Skyscrapers

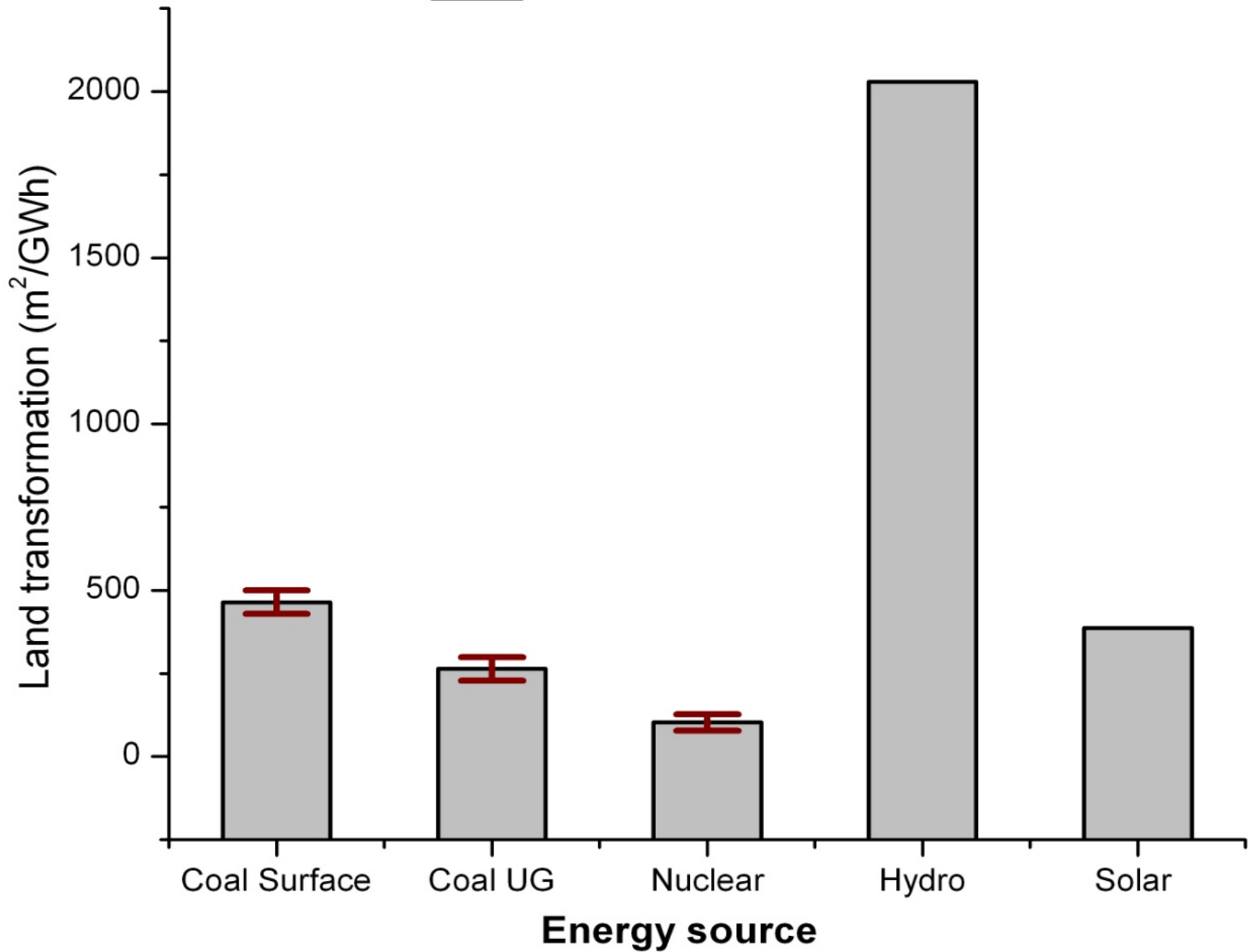


\$6.99

Cumulative Solar Power Installed Capacity as proposed by National Solar Mission



Land area transformed across their life cycles





CONCLUSIONS

India does not contribute much to global CO2 emissions but the impact of global warming in India could be large

India should look for renewable energy technology since it ensures energy independence

Air pollution a more serious immediate threat to India than global warming

THANK YOU