WCRP CORDEX South Asia Planning Workshop

25 – 26, February 2012

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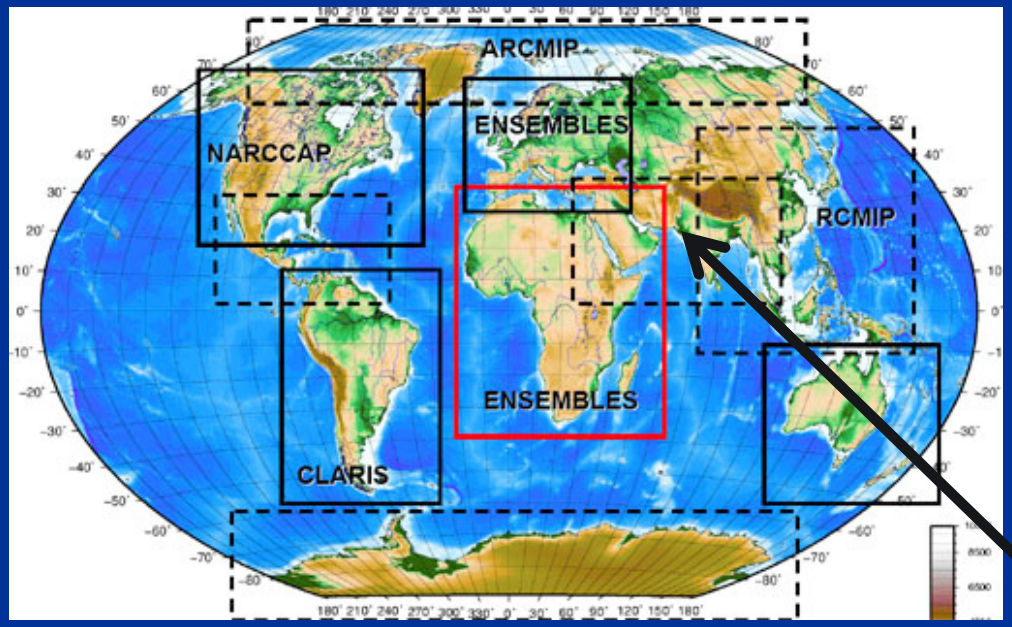
Assessment of impacts of regional climate change

Co-ordinated Regional Downscaling Experiment (CORDEX)

CORDEX South Asia
CCCR, IITM



High resolution dynamic downscaling of the South Asian monsoon

- Quantify and reduce uncertainties in regional climate projections
- Dynamic downscaling based on multiple model ensemble simulations

Domain: South and West Asia

Co-ordinated Regional Downscaling Experiment (CORDEX): South Asia

LMDZ: High resolution zooming (~ 35 – 50 km) over CORDEX domain

- Historical run (1886– 2005): *Includes natural and anthropogenic (GHG, aerosols, land cover etc) climate forcing during (1886 – 2005) ~ 120 years.* About 60 years run completed. Expected to finish by May 2012.

- Historical Natural (1886-2005): *Includes only natural climate forcing during (1886–2005) ~ 120 years* . About 45 yrs of run completed. Expected to finish by June 2012

- RCP4.5 (2006-2100): *Future projection run including both natural and anthropogenic forcing based on the IPCC AR5 RCP 4.5 climate scenario . The evolution of GHG and anthropogenic aerosols in RCP 4.5 scenario produces a global radiative forcing of + 4.5 W* m^{-2} *by 2100 .* About 60 years of run completed. Expected to finish by April 2012

- ERA-Interim Baseline run (1989 – 2008): Nudging the model run with ERA-Interim fields. Started and expected to finish early May 2012

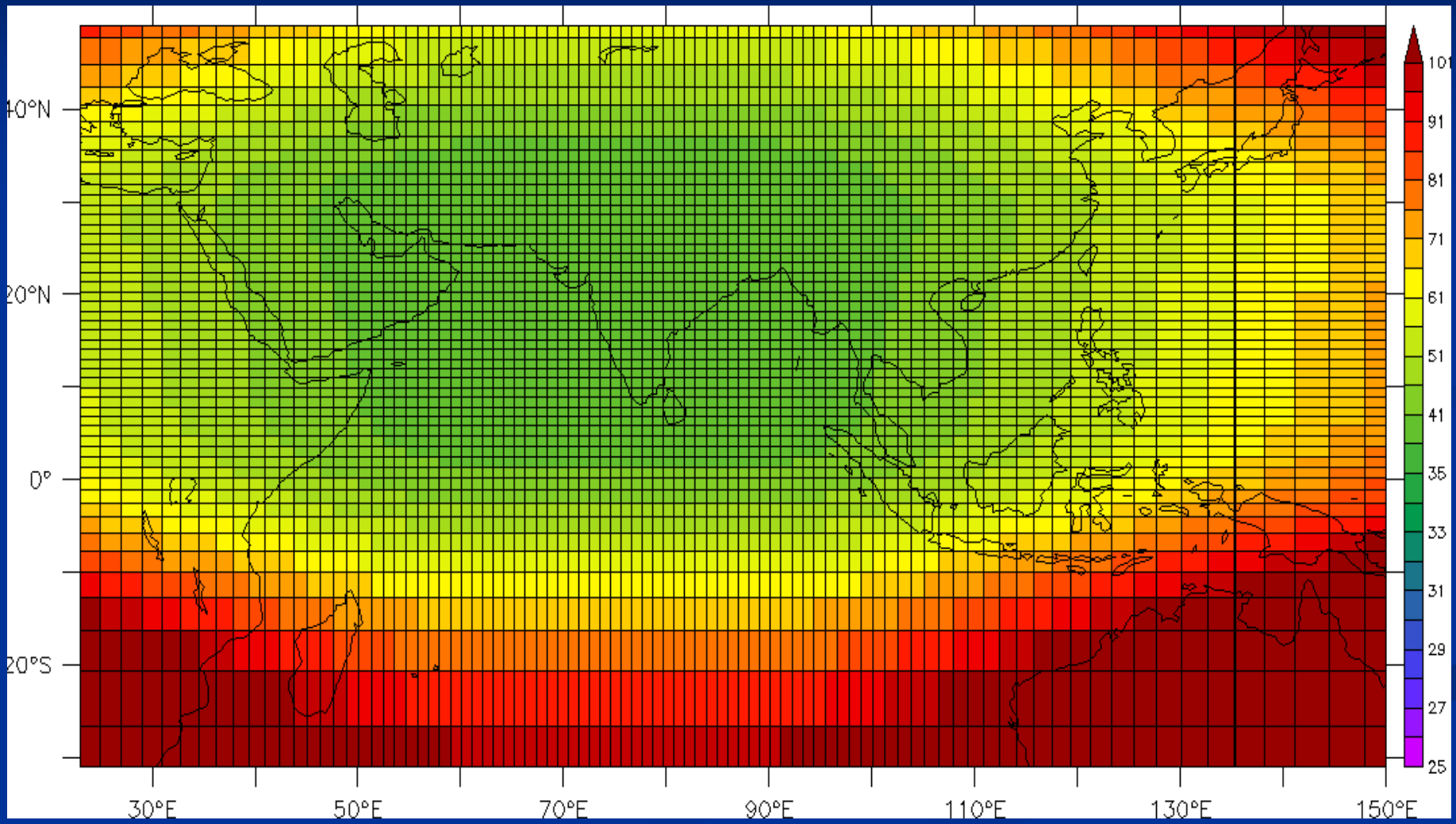
  - RegCM (~ 50 km)

  - WRF (~ 50 km)

  - PRECIS (~ 50 km)

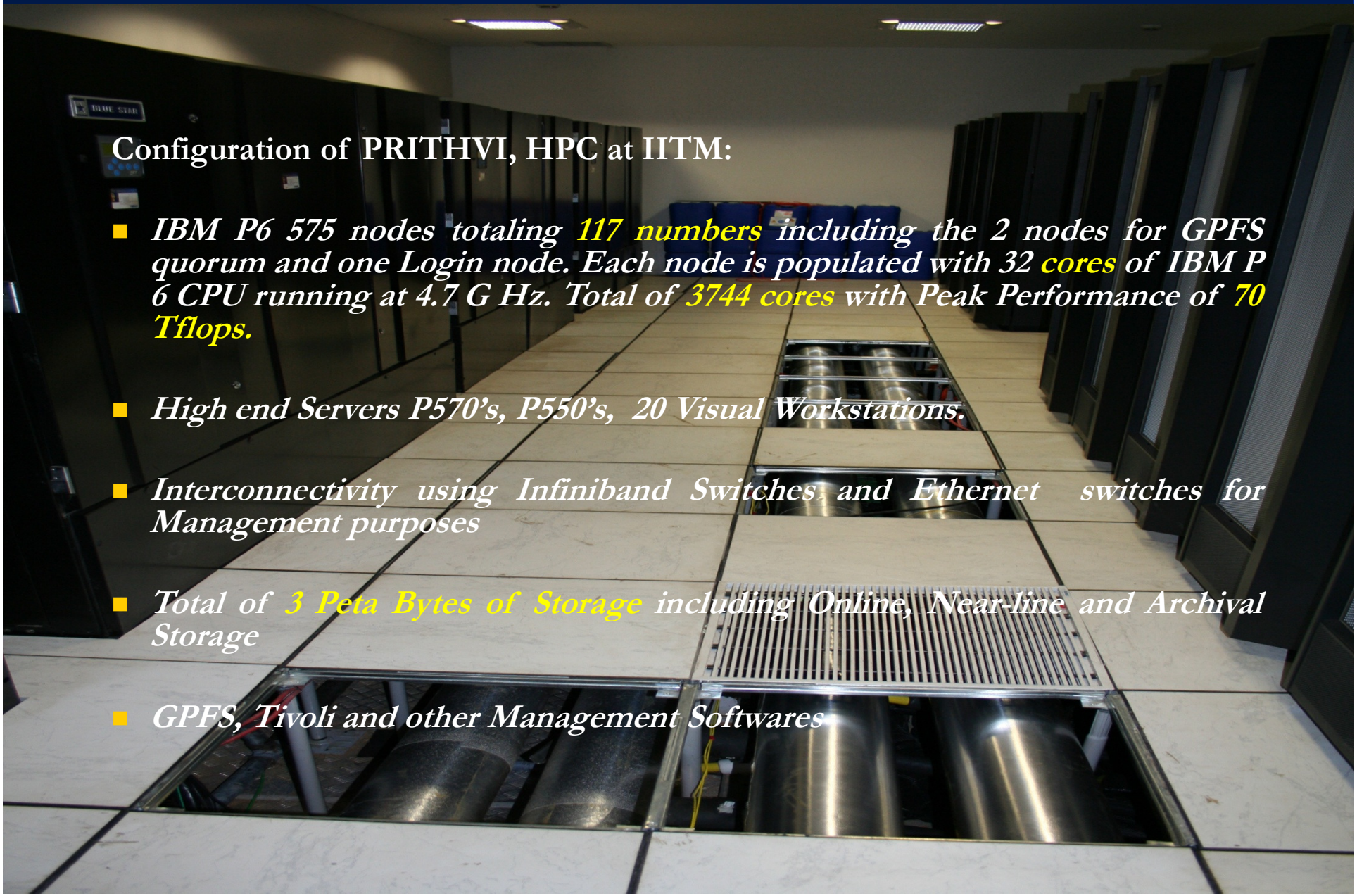
High resolution dynamic downscaling of monsoon climate change scenarios and quantification of uncertainties

LMDZ global atmospheric model: Variable resolution with zooming capability



Source: Sabin, CCCR

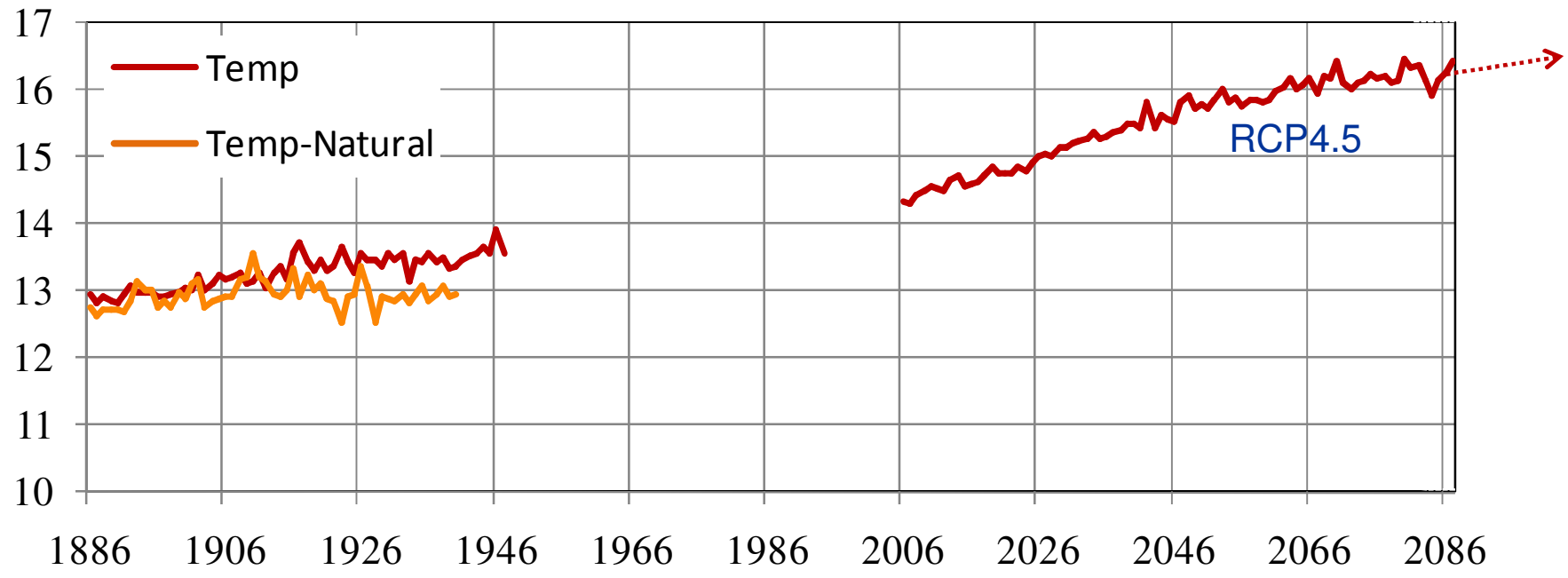
PRITHVI (High Performance Computing System)
IITM, Pune



Configuration of PRITHVI, HPC at IITM:

- ***IBM P6 575 nodes totaling 117 numbers including the 2 nodes for GPFS quorum and one Login node. Each node is populated with 32 cores of IBM P 6 CPU running at 4.7 G Hz. Total of 3744 cores with Peak Performance of 70 Tflops.***
- ***High end Servers P570's, P550's, 20 Visual Workstations.***
- ***Interconnectivity using Infiniband Switches and Ethernet switches for Management purposes***
- ***Total of 3 Peta Bytes of Storage including Online, Near-line and Archival Storage***
- ***GPFS, Tivoli and other Management Softwares***

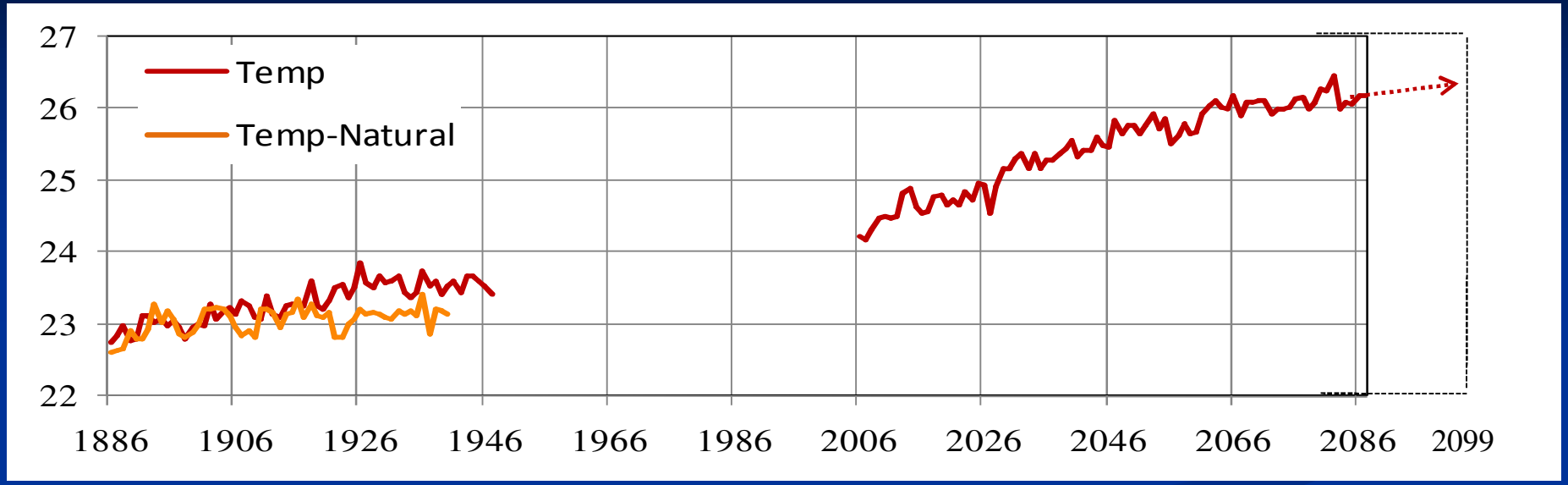
Global Mean Temperature



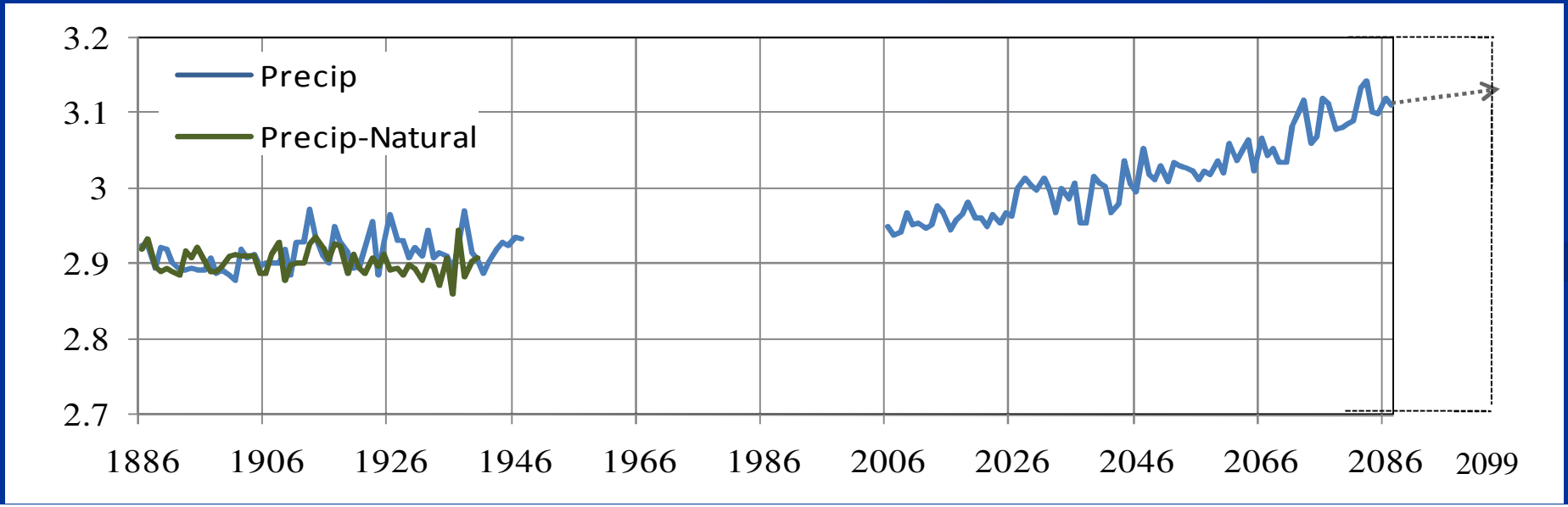
LMDZ runs on PRITHVI

CCCR / IITM

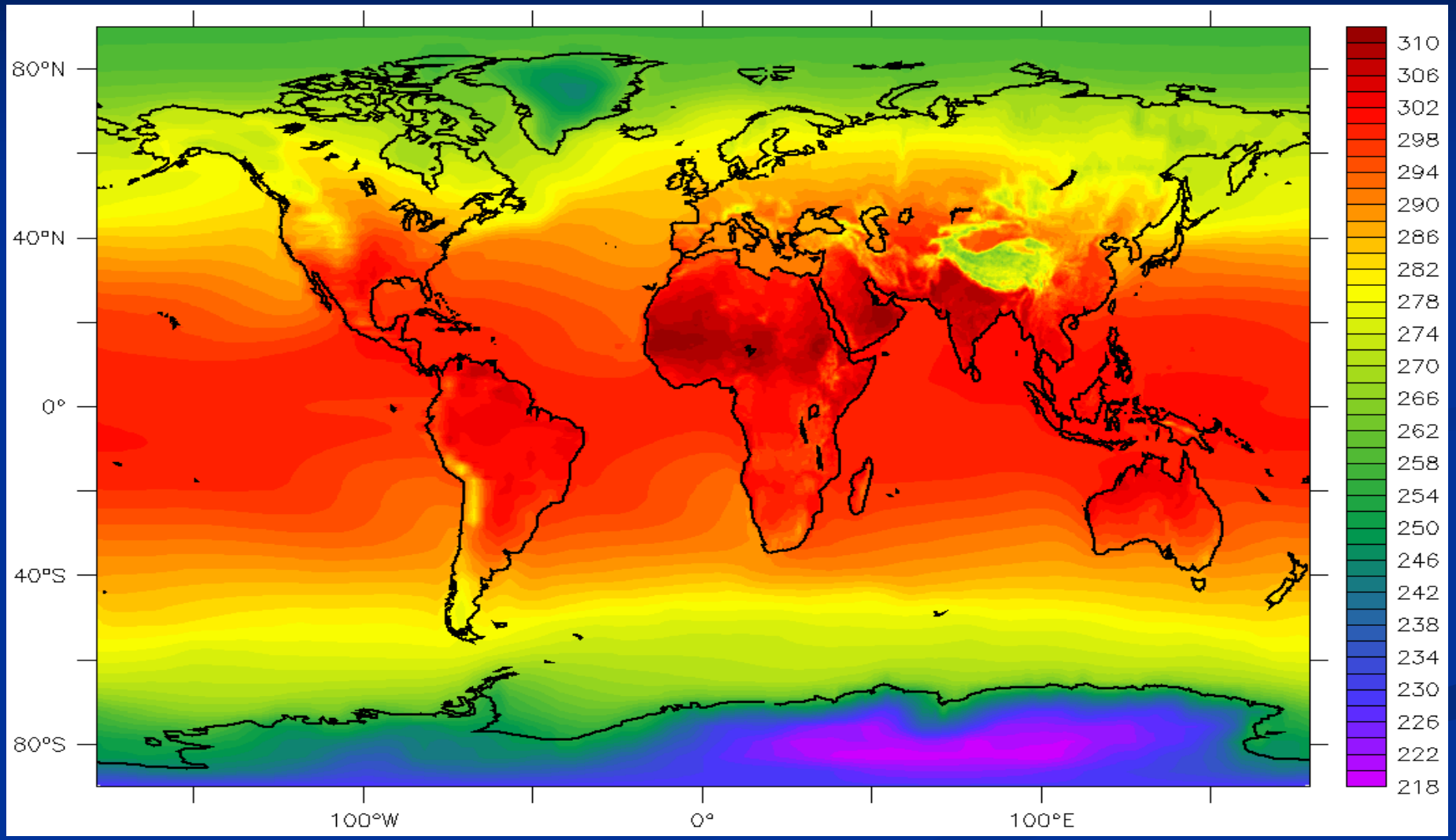
Annual mean precipitation and surface temperature
Global Tropics: 30°S-30°N



Historical and RCP runs are ongoing and expected to be completed by Jun 2012



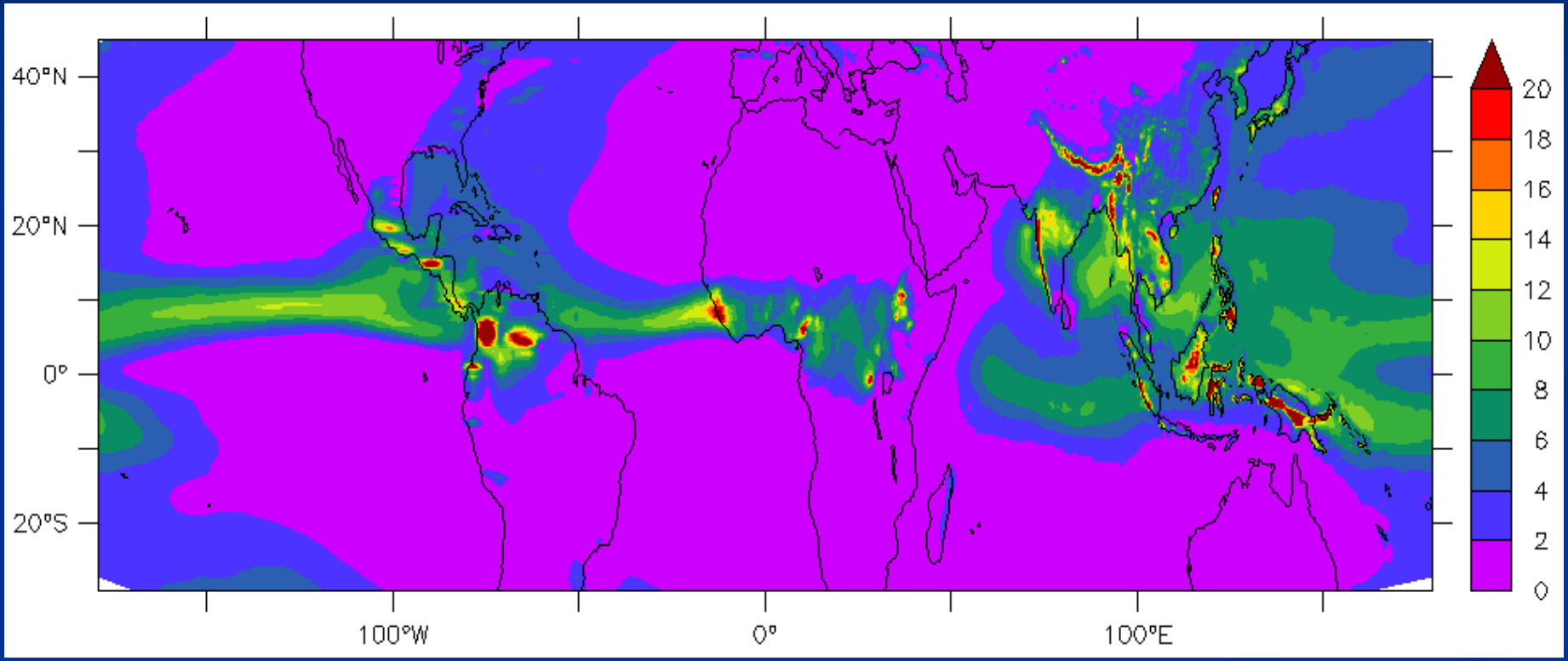
Surface temperature (Tmax)
March – April – May – June
Historical run (1889 :: 1938) - LMDZ



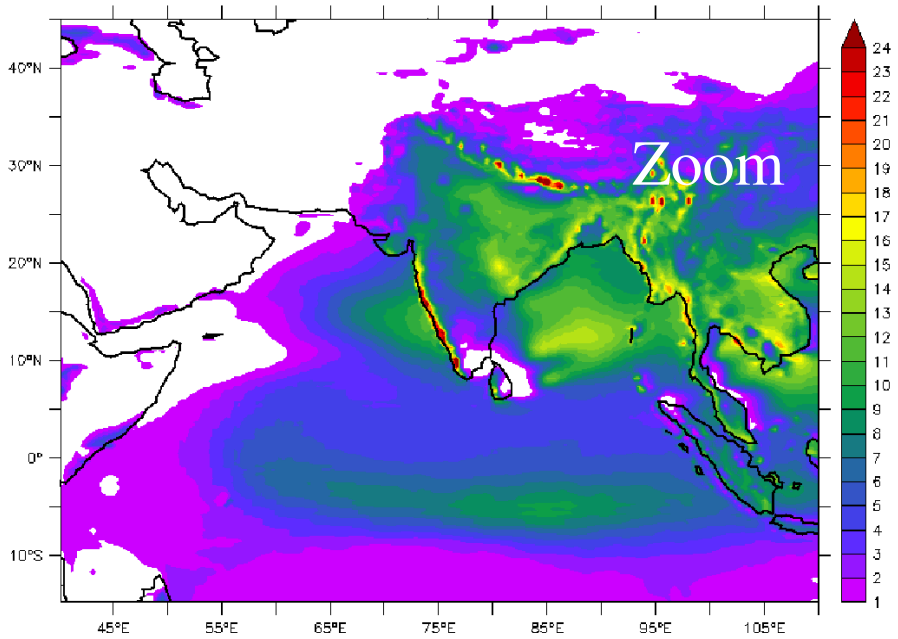
LMDZ simulations at CCCR on PRITHVI

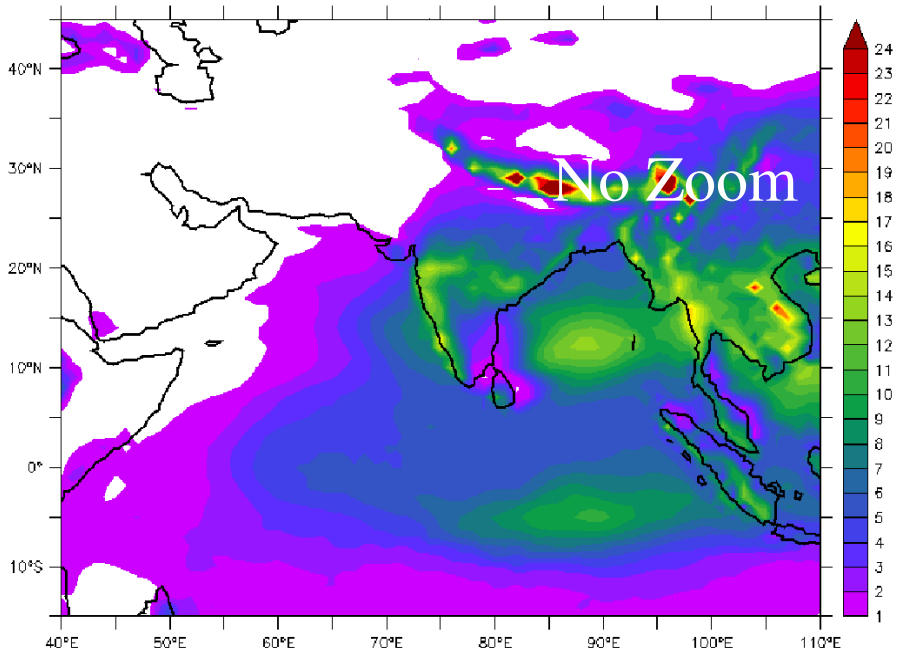
Mean precipitation
June – July – August – September

Historical run (1889 :: 1938) - LMDZ

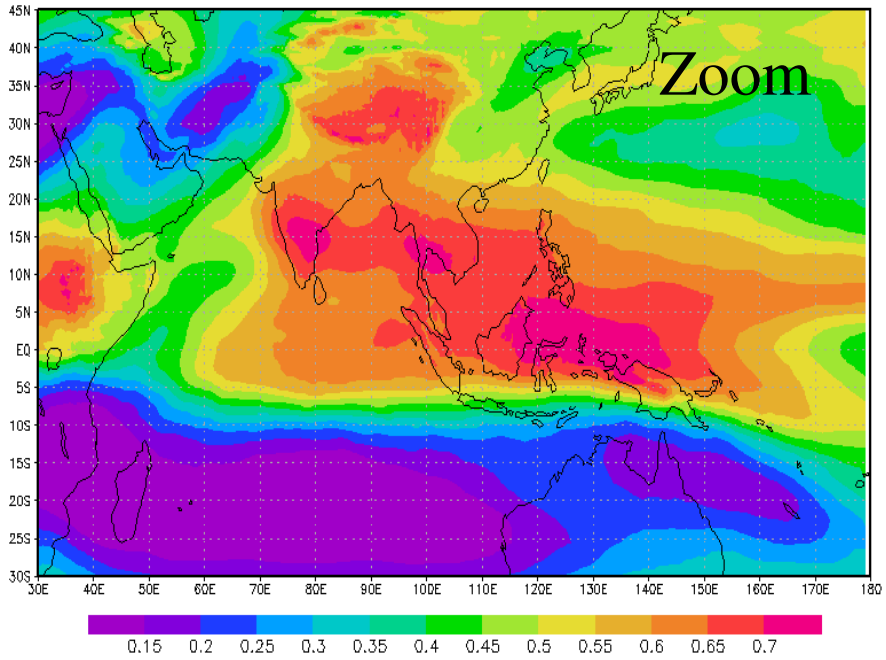


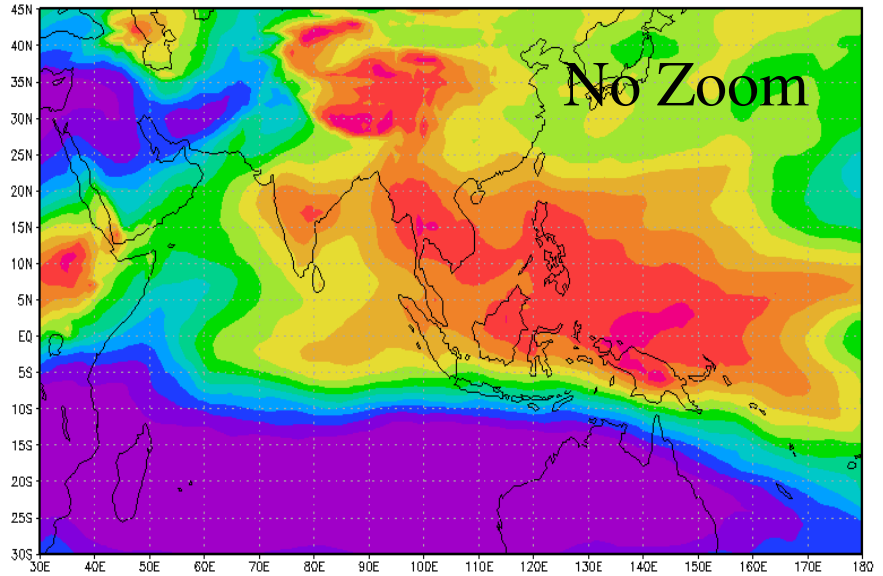
Monsoon rainfall (JJAS)

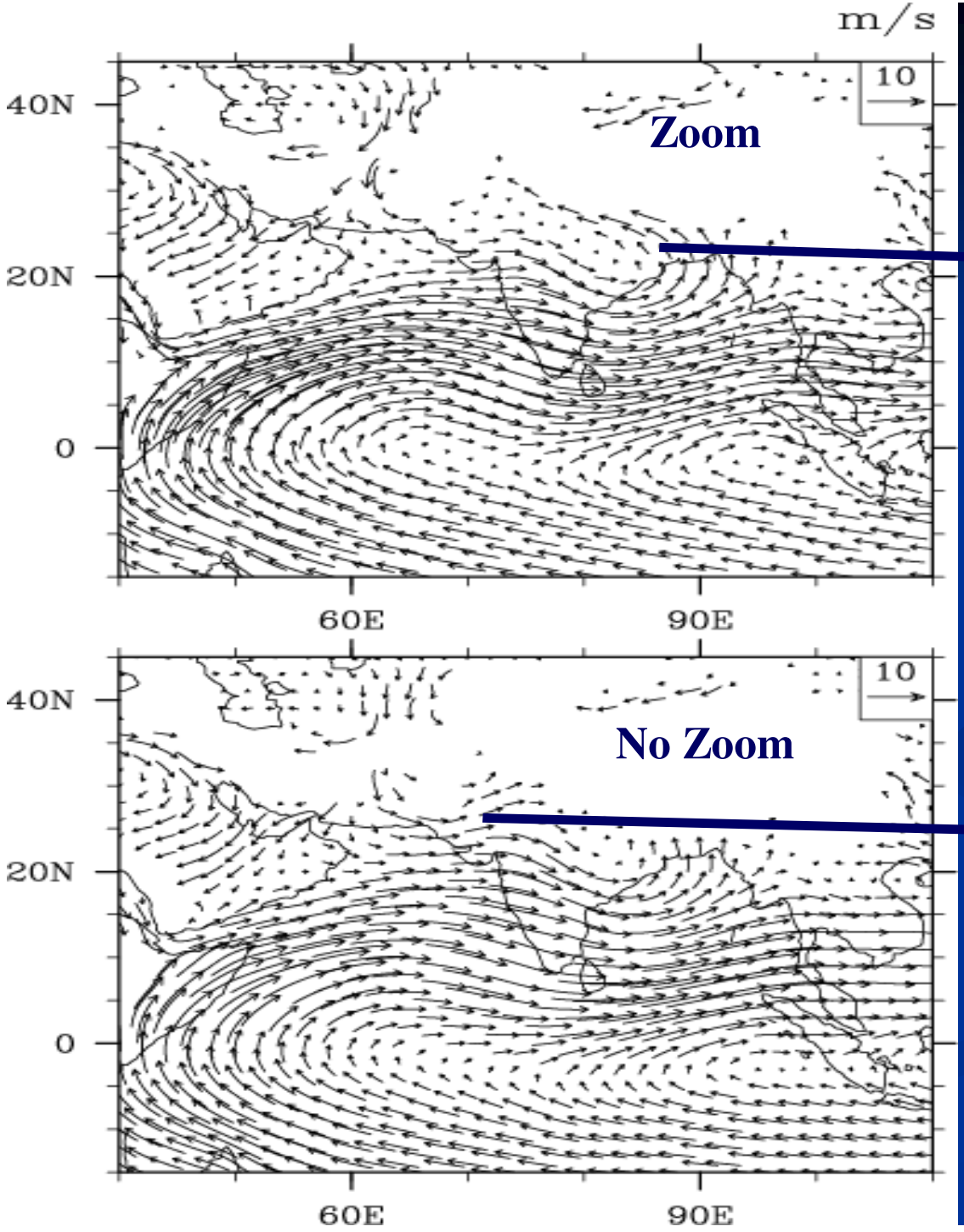




Relative Humidity 500 hPa (JJAS)







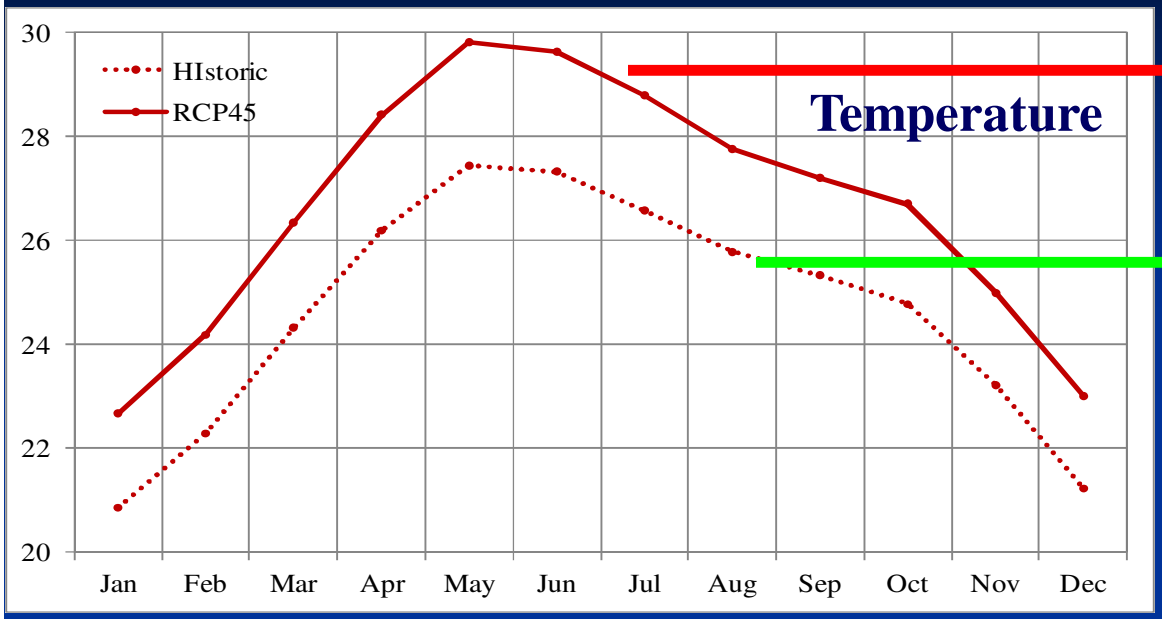
850 hPa winds (JJAS)

Cyclonic turning of moist winds from Bay of Bengal

Dry westerly winds from Indo-Pak and adjoining areas

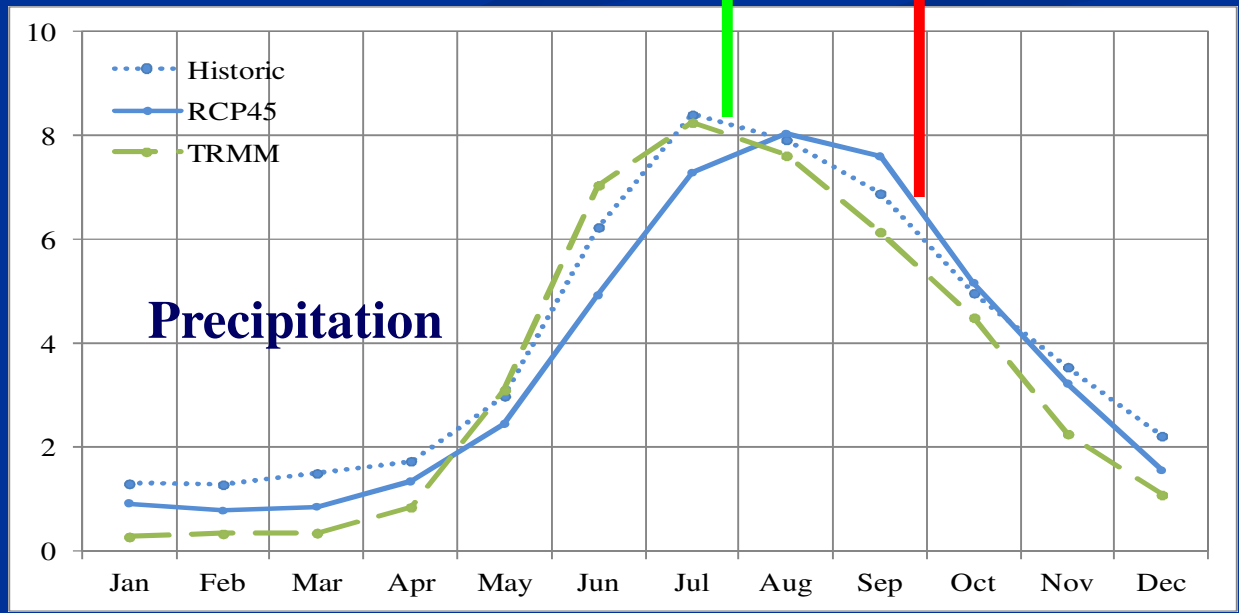
Annual cycle of precipitation and surface temperature over South Asian region

High resolution (~ 35 km) model simulations



RCP4.5

HIST

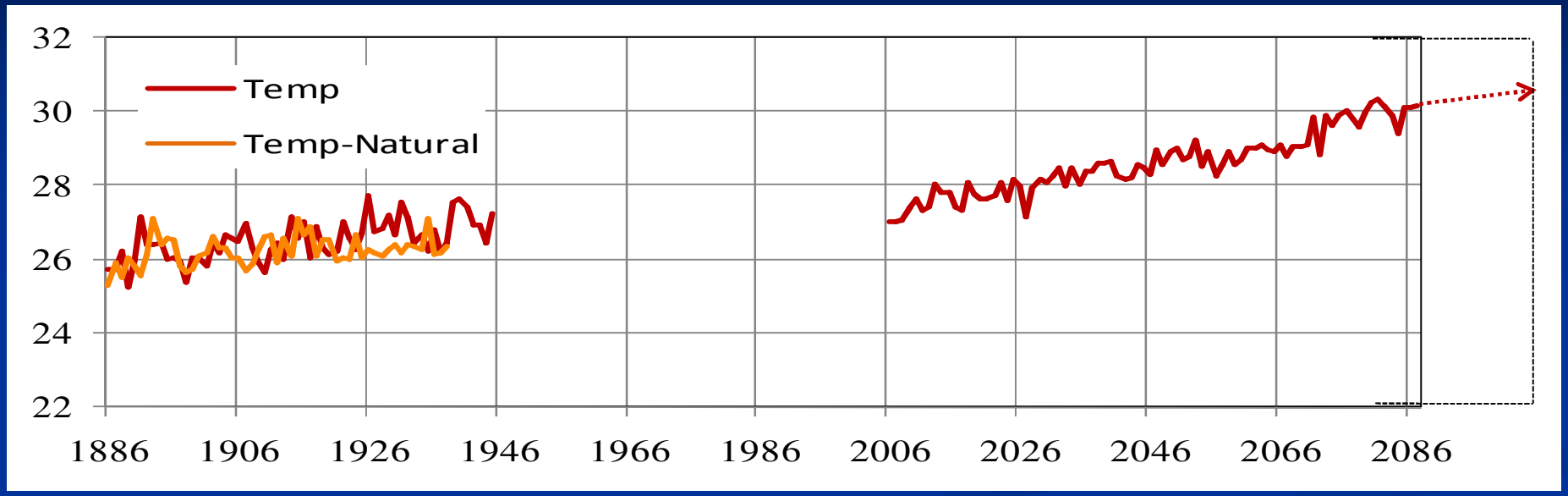


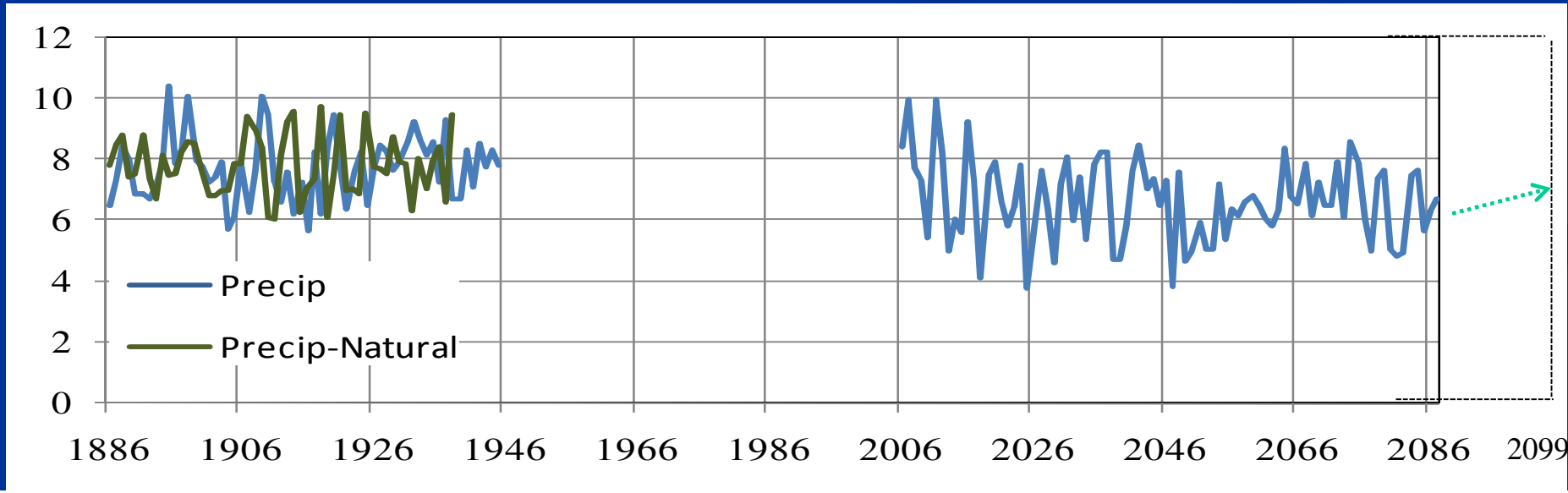
LMDZ runs

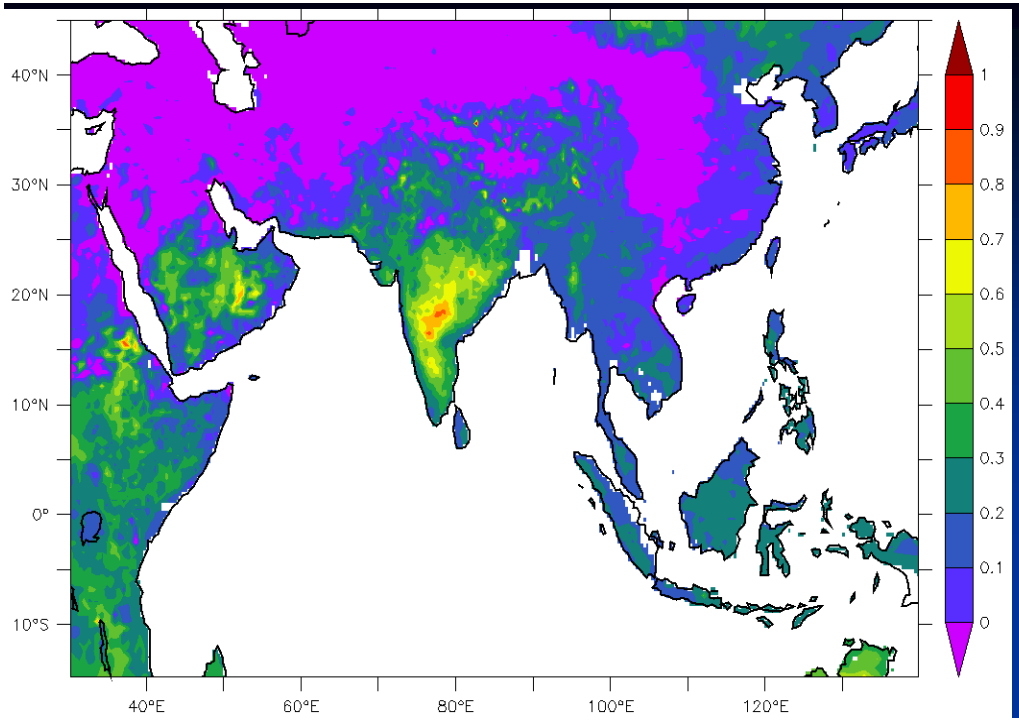
CCCR / IITM

High resolution (~ 35 km) simulations over South Asia

Precipitation and surface temperature over monsoon region (JJAS)
70°E-90°E ;10°N-25°N



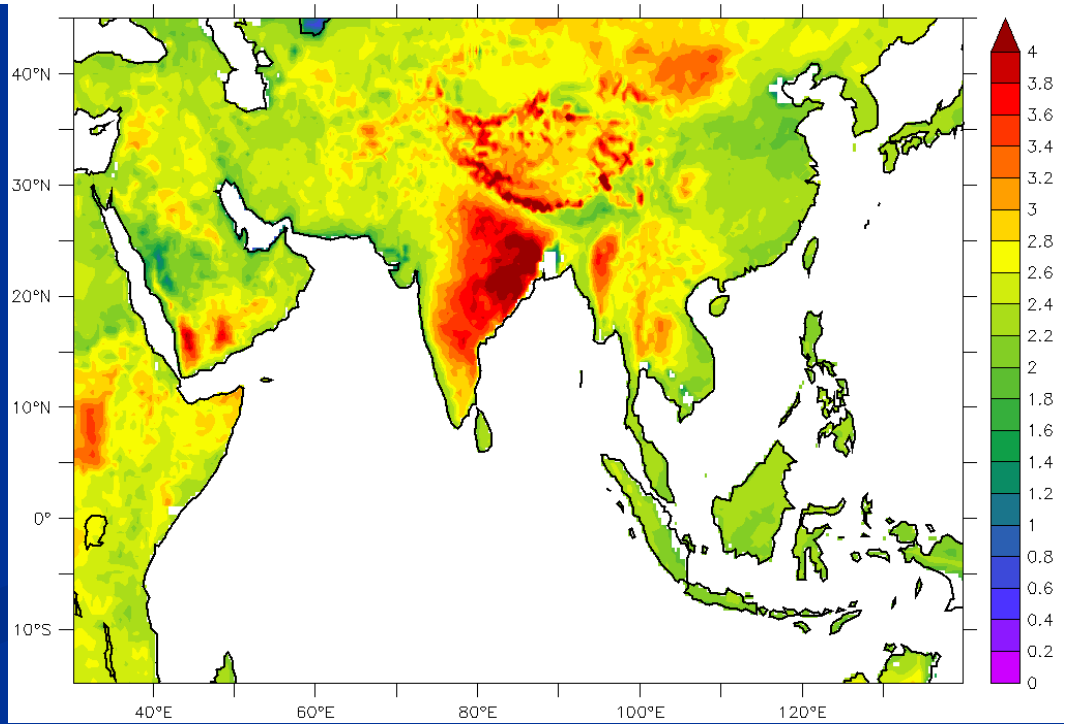




Surface temperature
Mar – Apr – May - June

Historical minus Historical Natural
(1889 :: 1938)

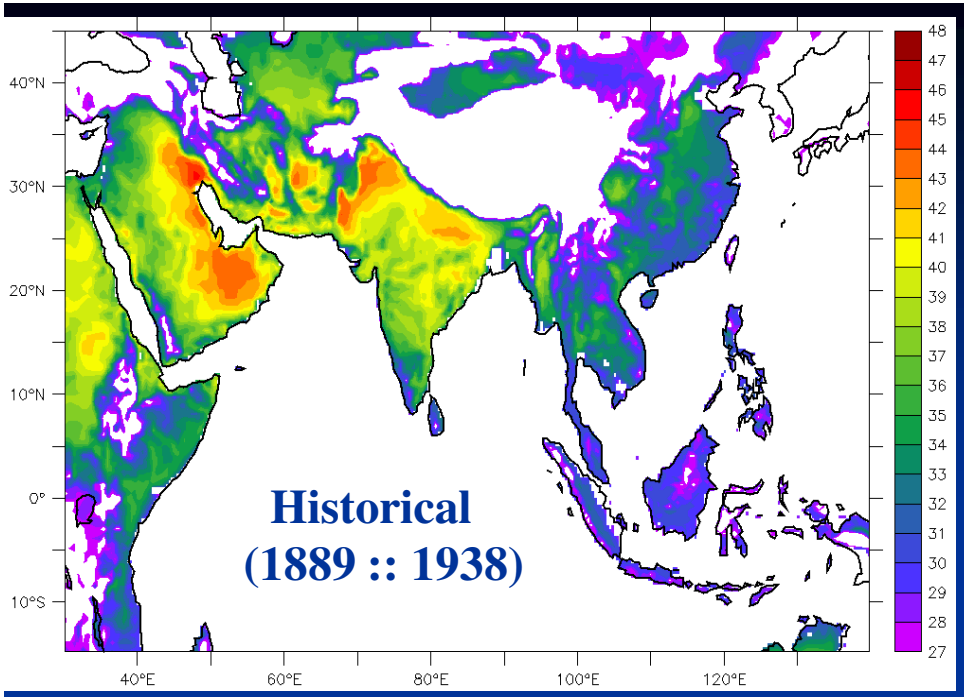
RCP4.5 minus Historical
RCP4.5 (2006 :: 2055) minus HIST (1889 :: 1938)



Proposed implementation strategy for CORDEX South Asia

Timeline - 1: Target towards publication of results from CORDEX models to meet the IPCC AR5 (WG1) publication deadline (Submission of manuscript during summer 2012)

Timeline – 2: Target towards completion of CORDEX simulations, preparation and archival of model outputs according to CORDEX protocol (Early 2013)



Temperature Extremes

Mar – Apr – May – June (season)

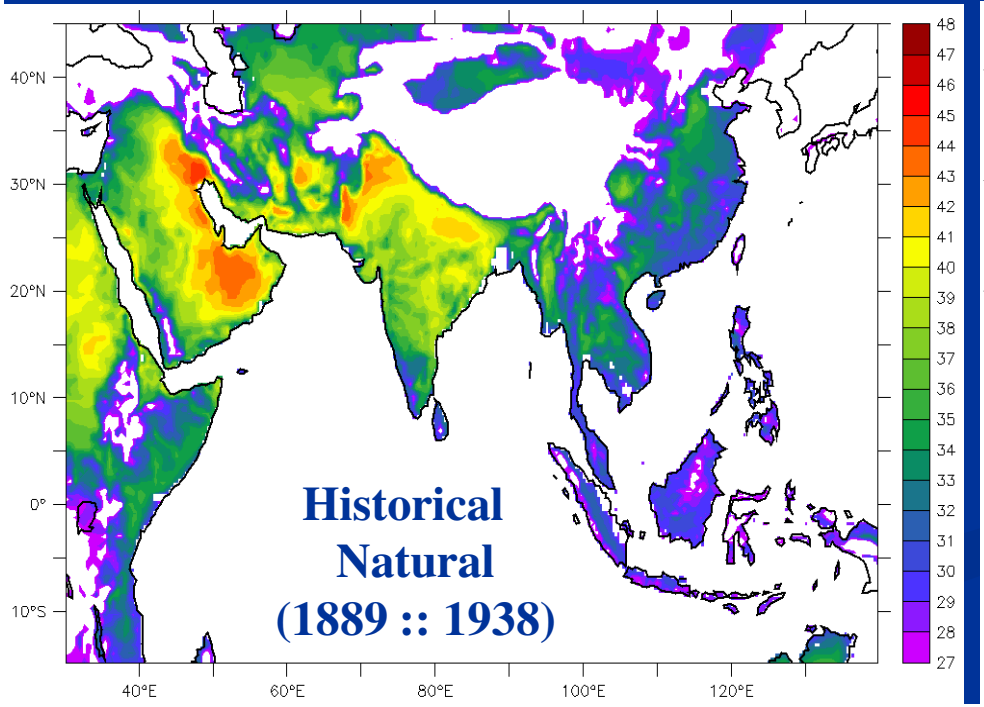
Tmax > 27 C shown only for land areas

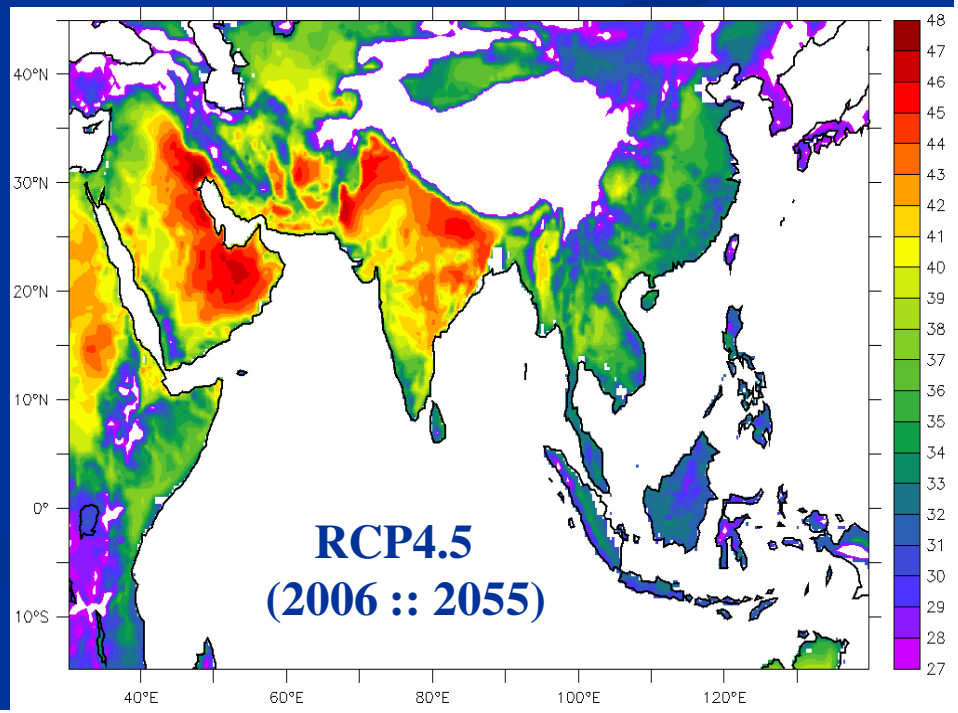
95 percentile threshold
(50 year time-slices)

Maximum Temperature

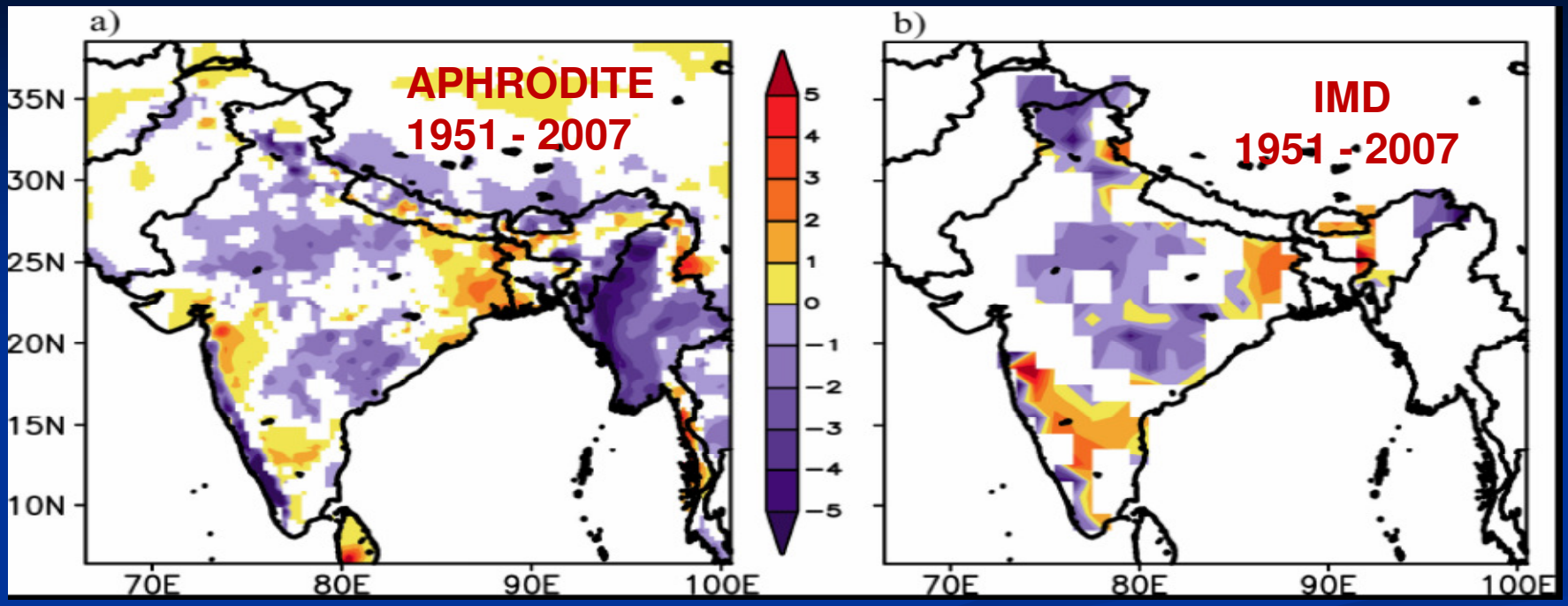
LMDZ runs

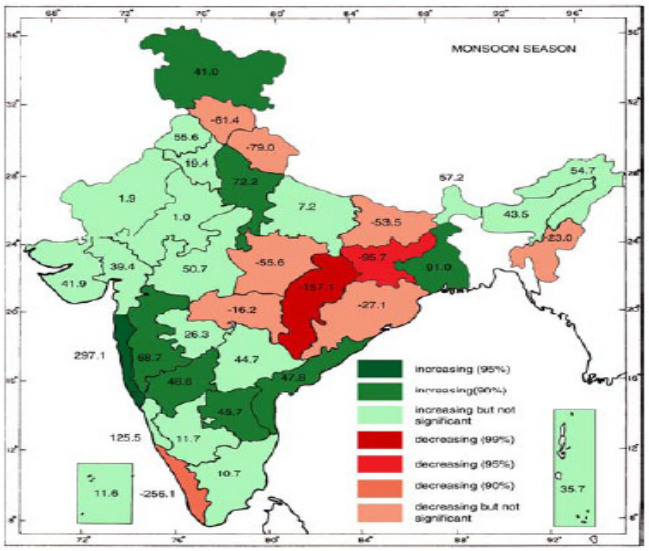
CCCR / IITM





Spatial map of linear trend: JJAS rainfall



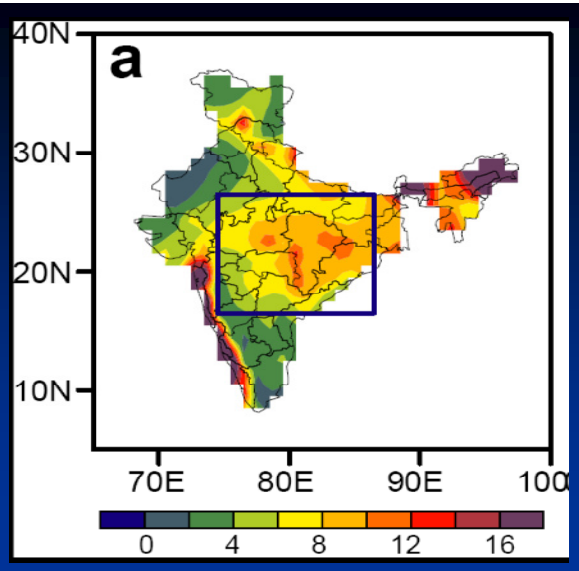


Guhathakurtha and Rajeevan, 2006: Trends in the rainfall pattern over India (1901-2003)

Significant negative trends: Kerala, Jharkhand, Chattisgarh

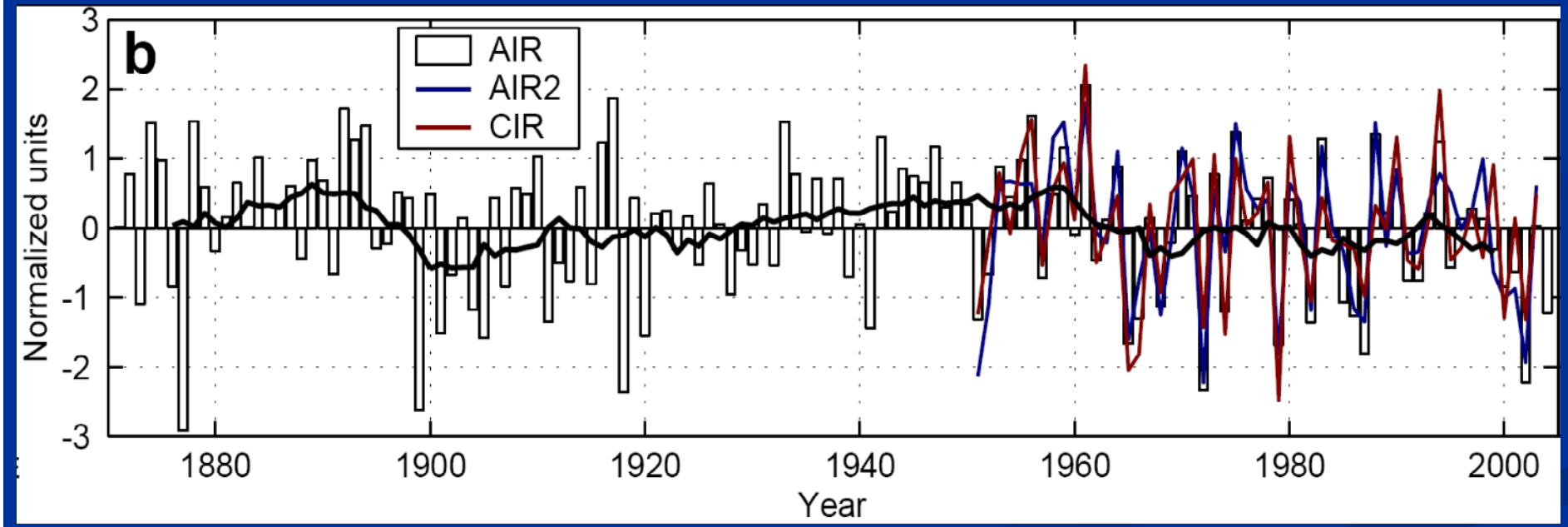
Increase/Decrease in rainfall in mm in 100 year for each of 36 subdivisions for the south-west monsoon season. Different levels of significance are shaded with colors

All India summer monsoon rainfall variability

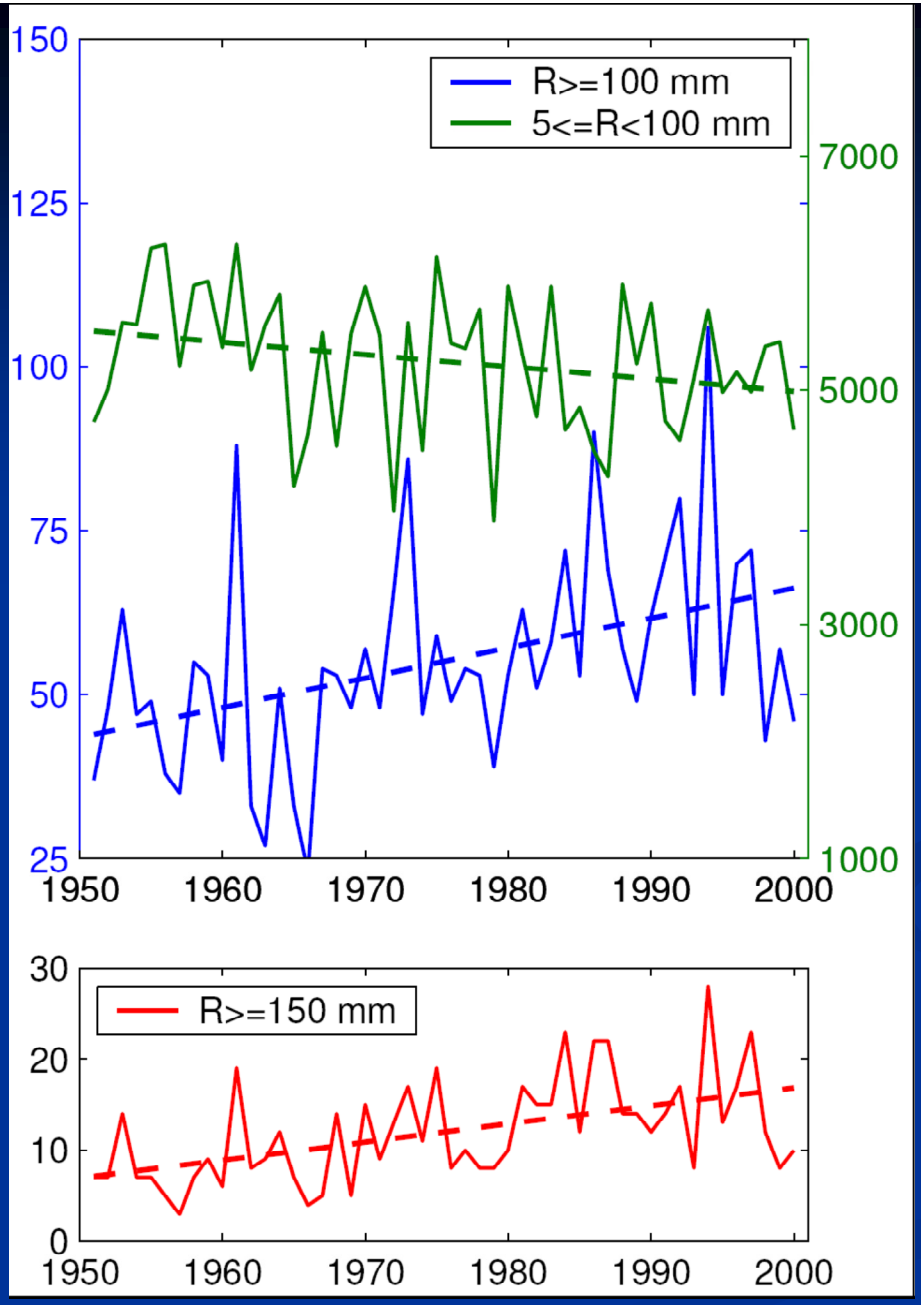


Climatological Mean (JJAS)

Interannual Variability



Goswami et al., Science, 2006



Time series of count over CI

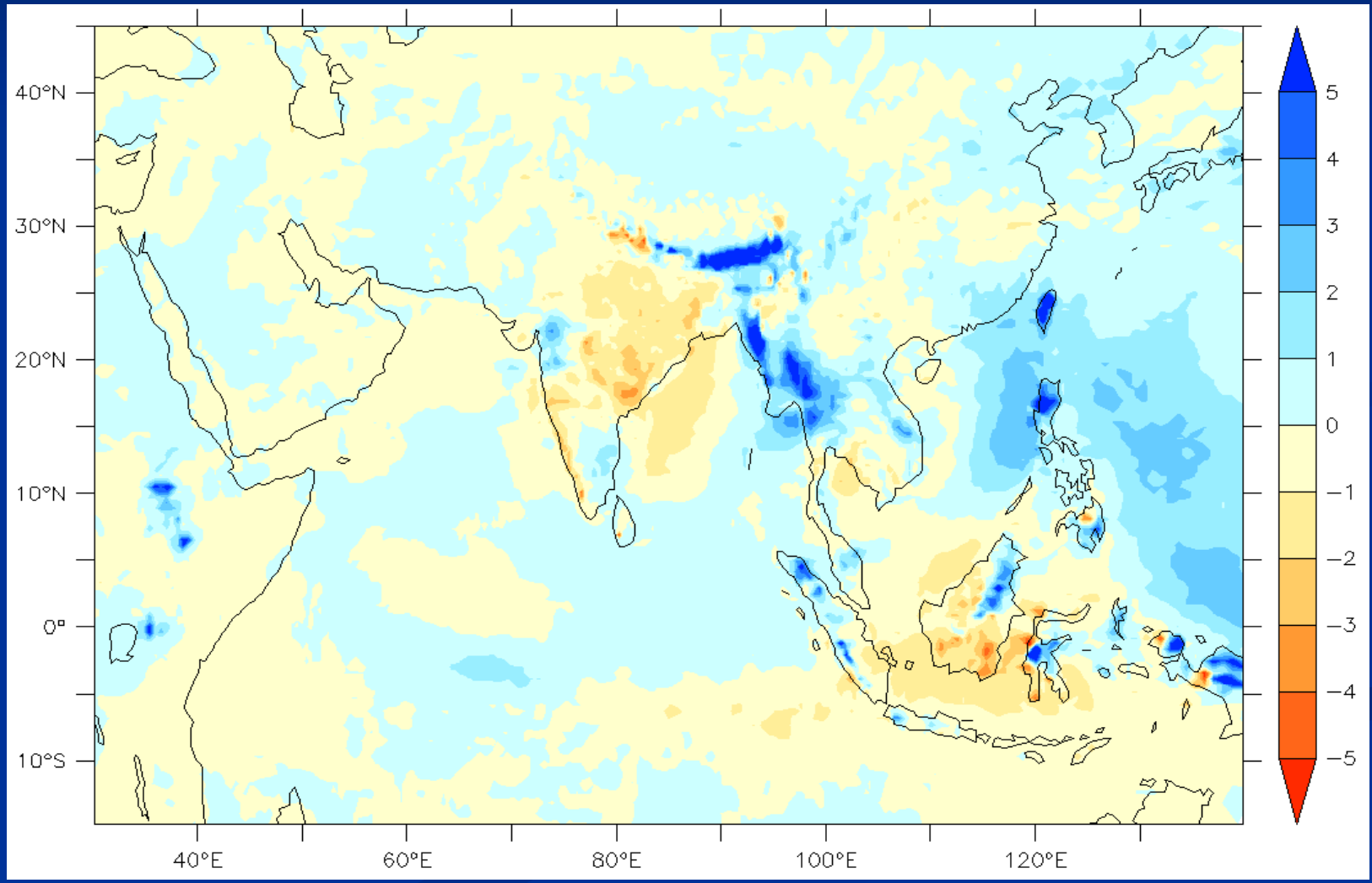
Low & Moderate events

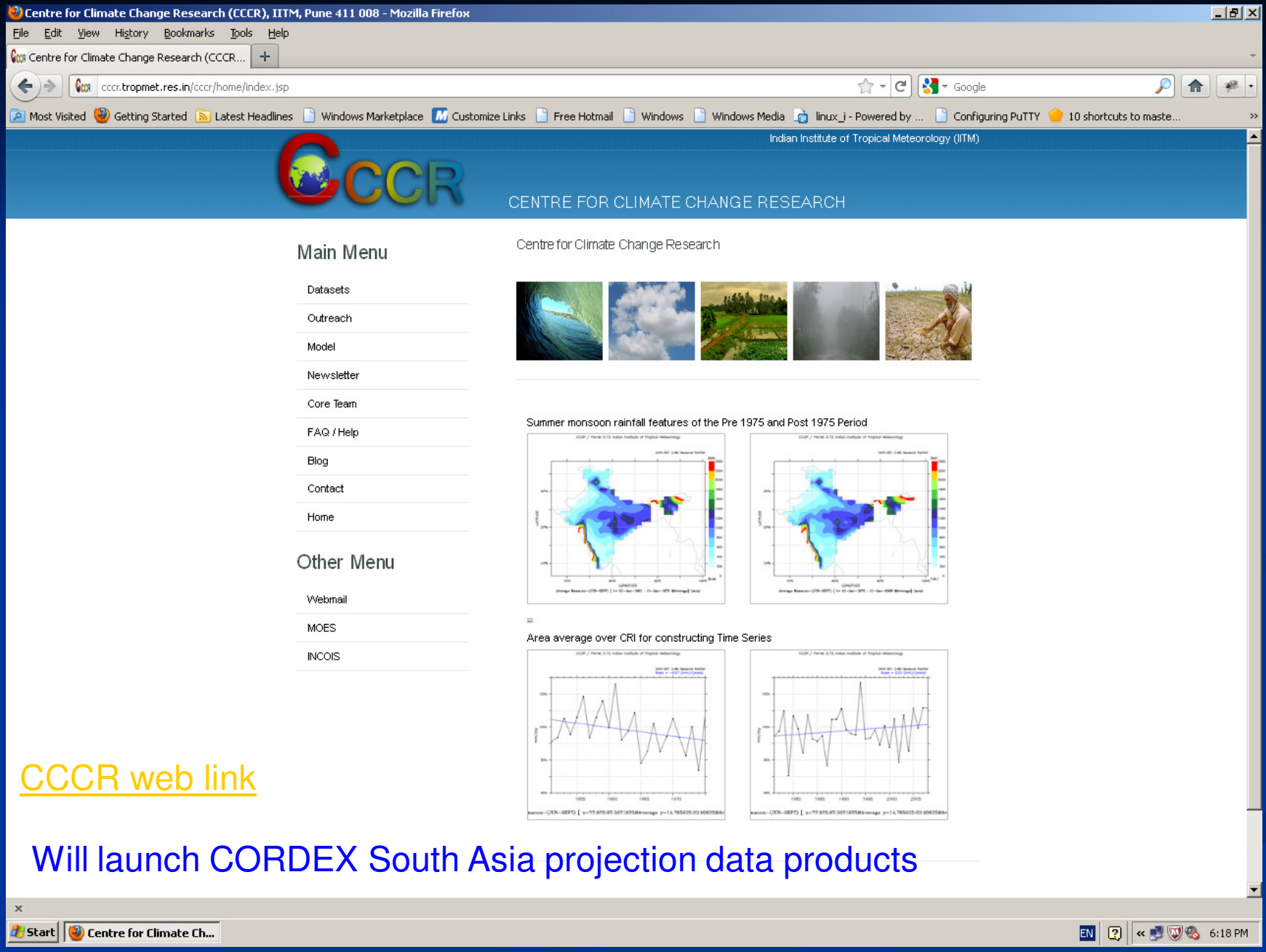
Heavy events (>10cm)

V. Heavy events (>15cm)

Precipitation change (Jun – Jul – Aug – Sep)

RCP4.5 (2006 :: 2055) minus HIST (1889 :: 1938)





[CCCR web link]

Will launch CORDEX South Asia projection data products

Sandeep, Sabin, Revadekar and Mujumdar

Thank you