CORDEX South-Asia Training Workshop, Pune, India
17-20 October, 2012

Uncertainties in the regional climate models simulations of South-Asian summer monsoon and climate change

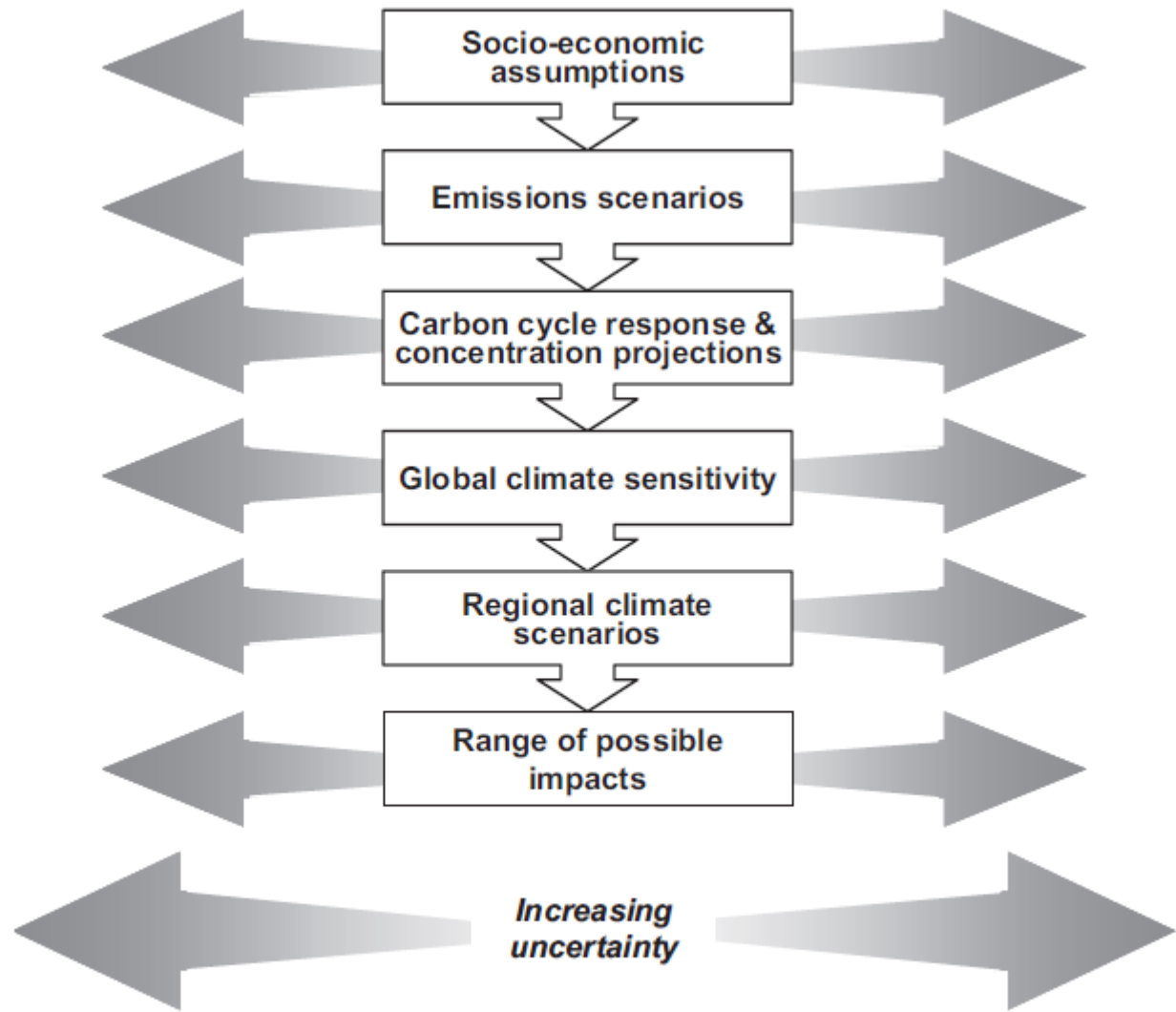Faisal S. Syed, W. Iqbal, A. Bukhari and G. Rasul

Pakistan Meteorological Department
Government of Pakistan

Climate Change

Cascade of Uncertainties

Socio-economic assumptions

Emissions scenarios

Carbon cycle response & concentration projections

Global climate sensitivity

Regional climate scenarios

Range of possible impacts

Increasing uncertainty

'Uncertainty explosion' of major typical uncertainties

Source: Jones (2000b)

RegCM4 simulations:

Control & Initial condition perturbation Runs

1990-2005, 50km resolution, NCEP Initial and boundary condition
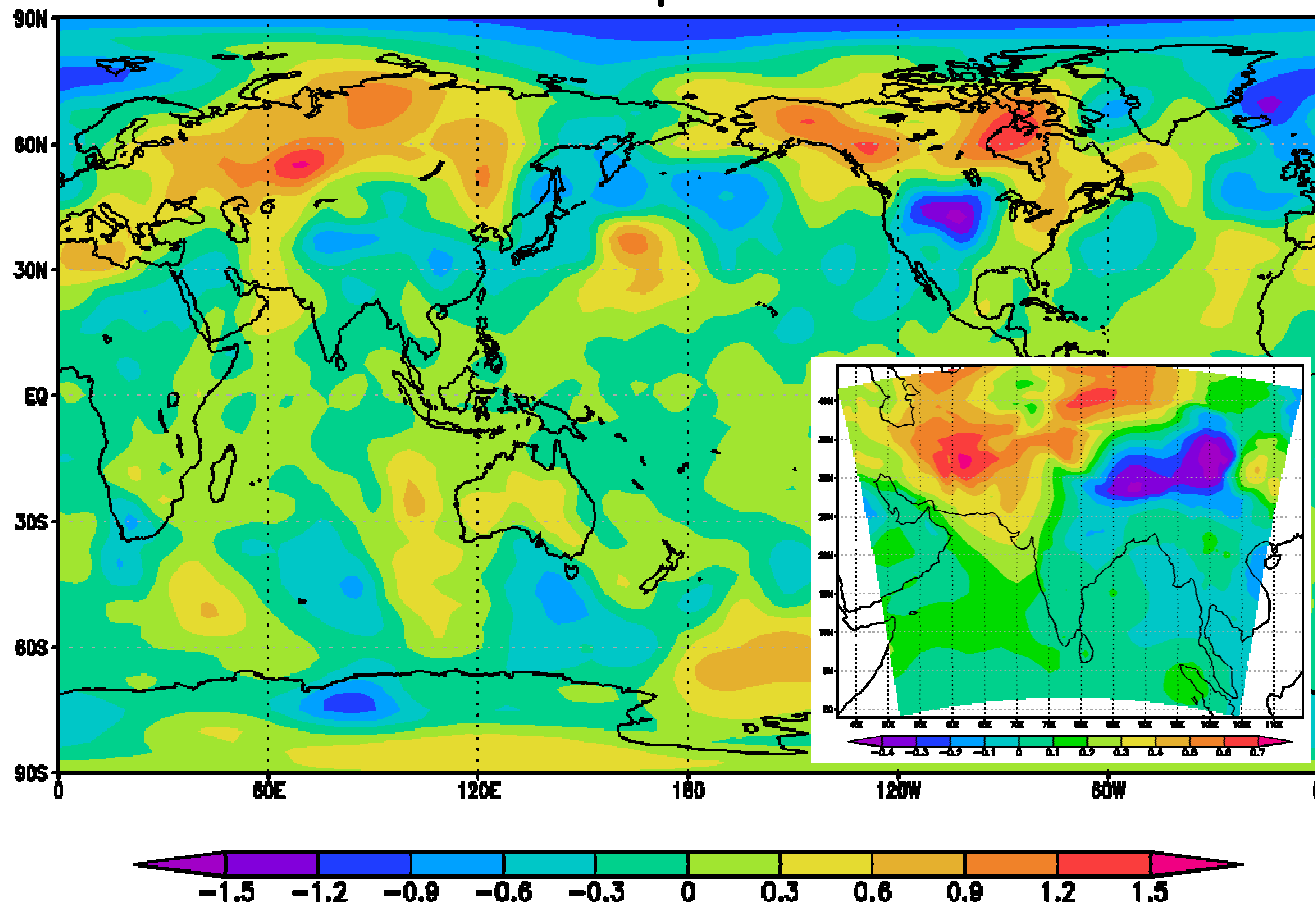
Initial Condition Perturbation:

For the atmospheric state vector "y"

y_perturbed(date, year) = y(same date, same year) +/- alpha *
            [y(same date, random year)-y(same date, multi-year mean)]
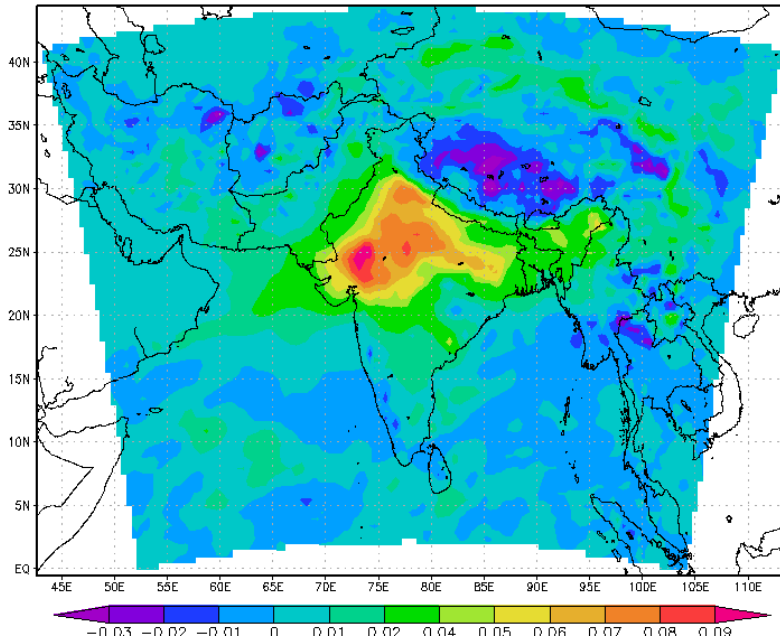
 control parameter alpha = 0.1

Initial Condition Perturbation
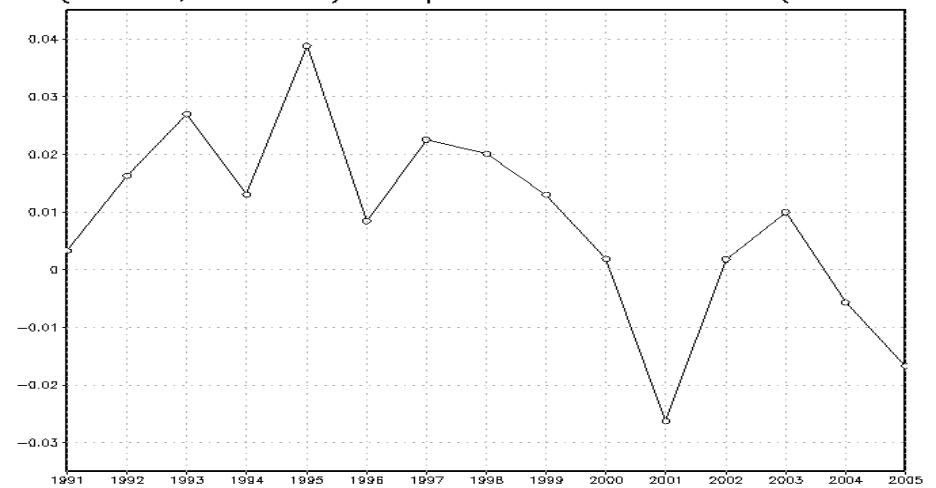

Perturbation Temperature 850 hPa C
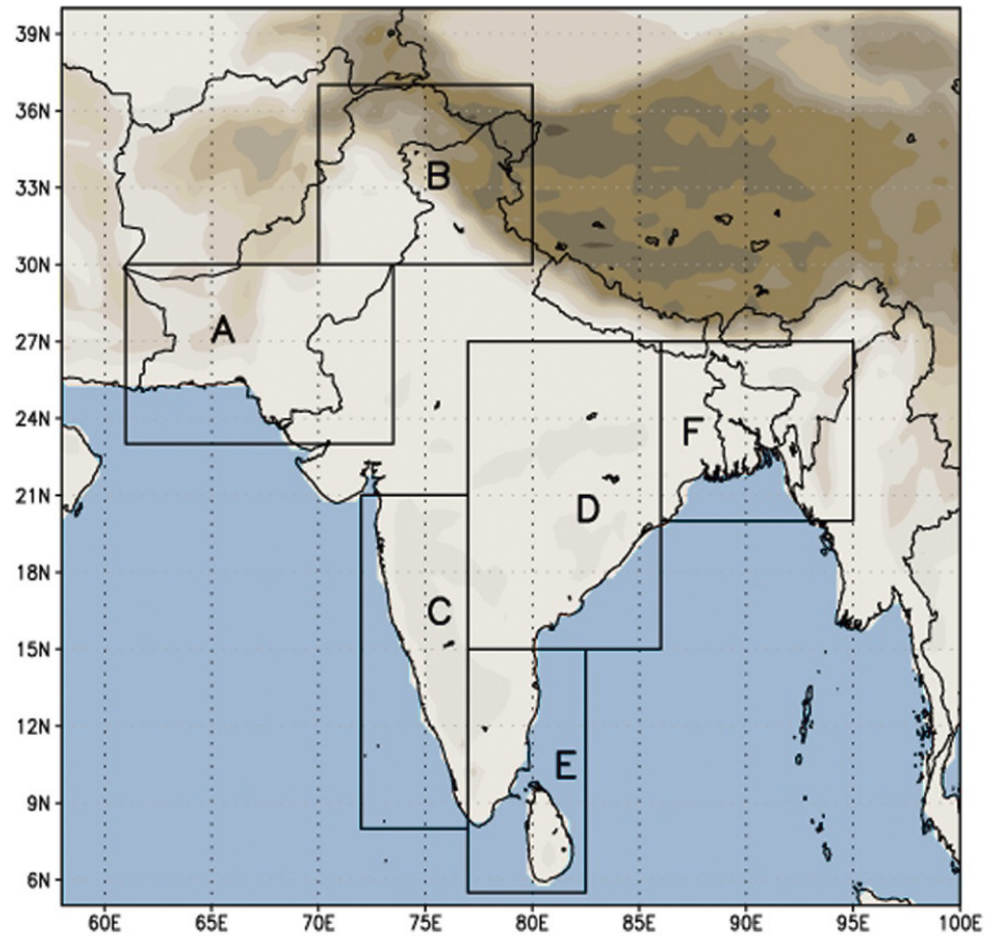
Initial Condition Perturbation - Response

DJF(1991-2005) Temperature 850 hPa Diff(Con-Pert)

DJF(5-40N,55-100E) Temperature 850 hPa Diff(Con-Pert)

Domain and Selected Regions

Experiments Design
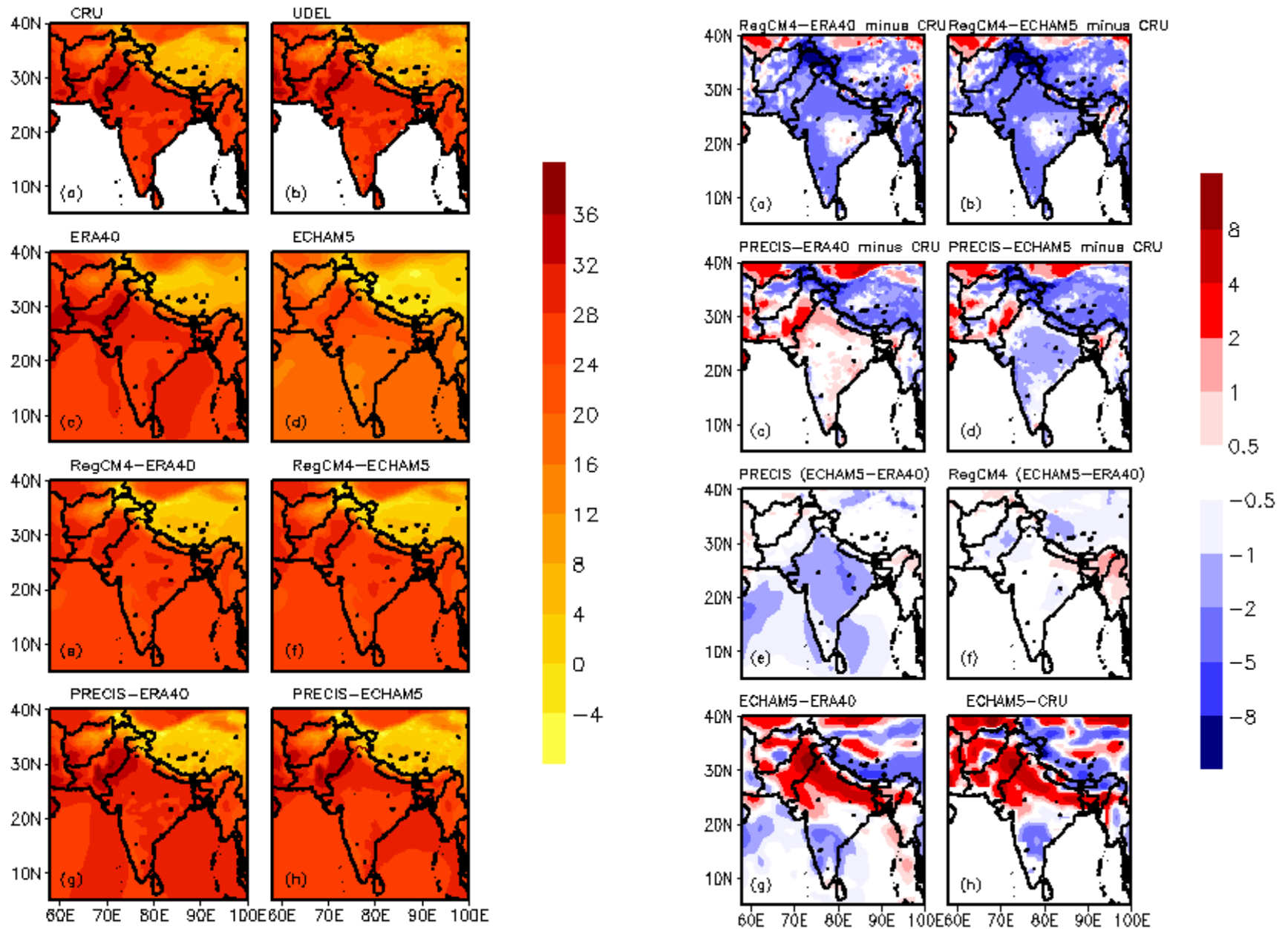
RCMs / Global Data	RegCM4		PRECIS	
	RF	A1B	RF	A1B
ECHAM5	1970-2000	2070-2100	1970-2000	2070-2100
ERA40 (observed SSTs)	1970-2000		1970-2000	

- RegCM4 – International Centre for Theoretical Physics, Italy

- PRECIS - Hadley Centre, UK

Horizontal resolution – 50 km
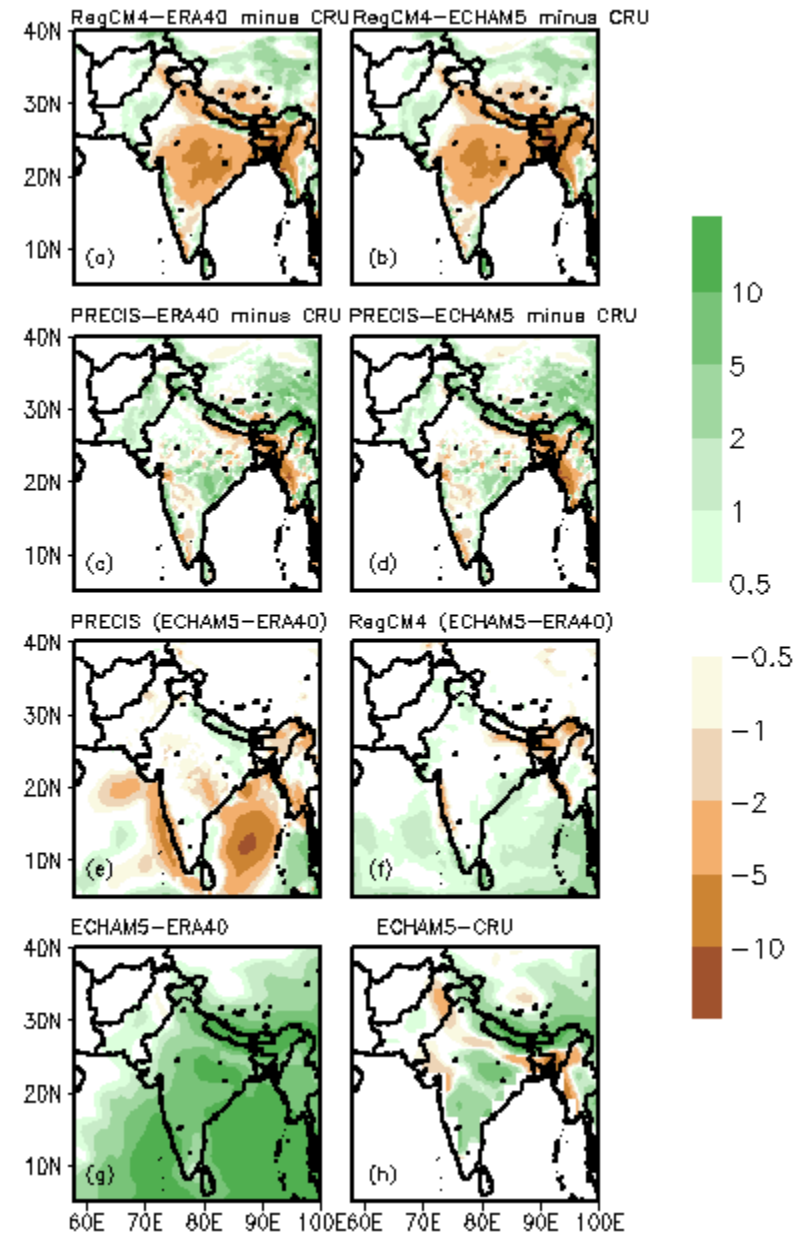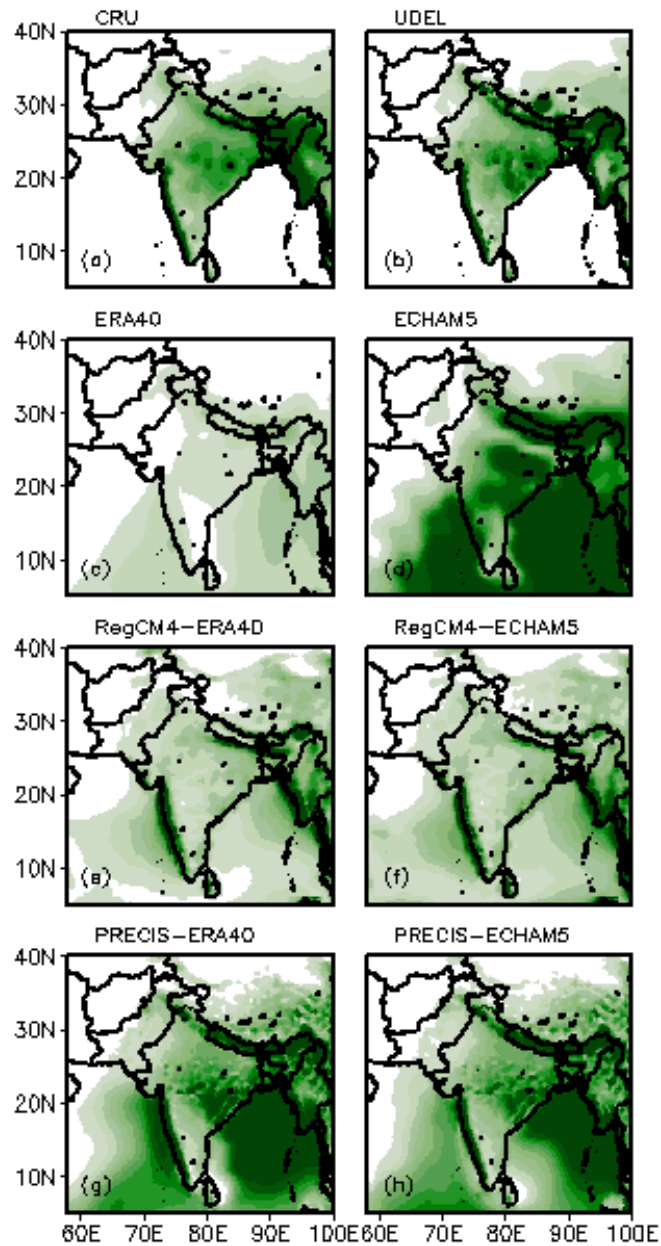Vertical Levels - 18

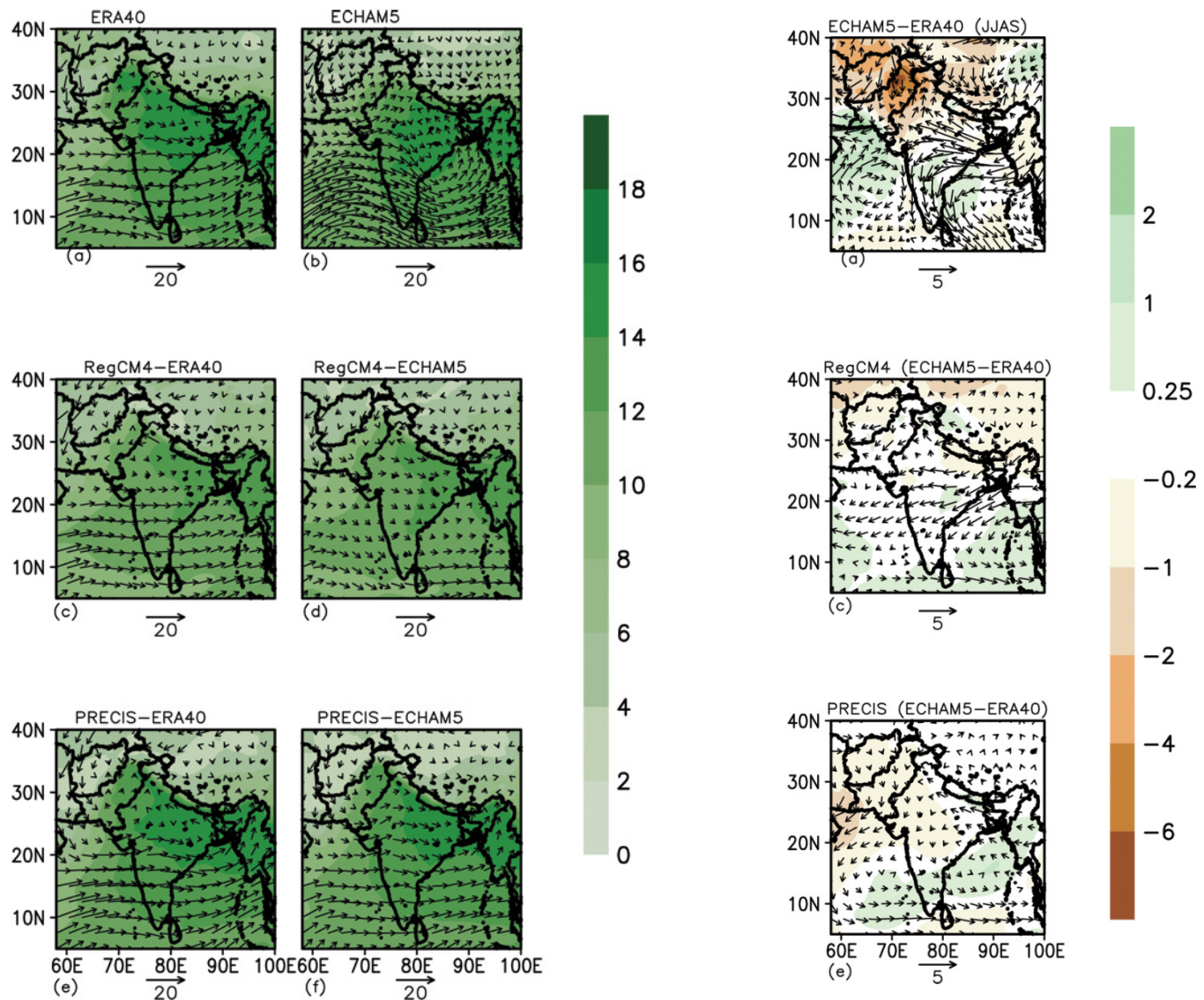# Mean (1971-2000) & Bias Temperature (°C)

Mean (1971-2000) & Bias   Precipitation (mm/day)
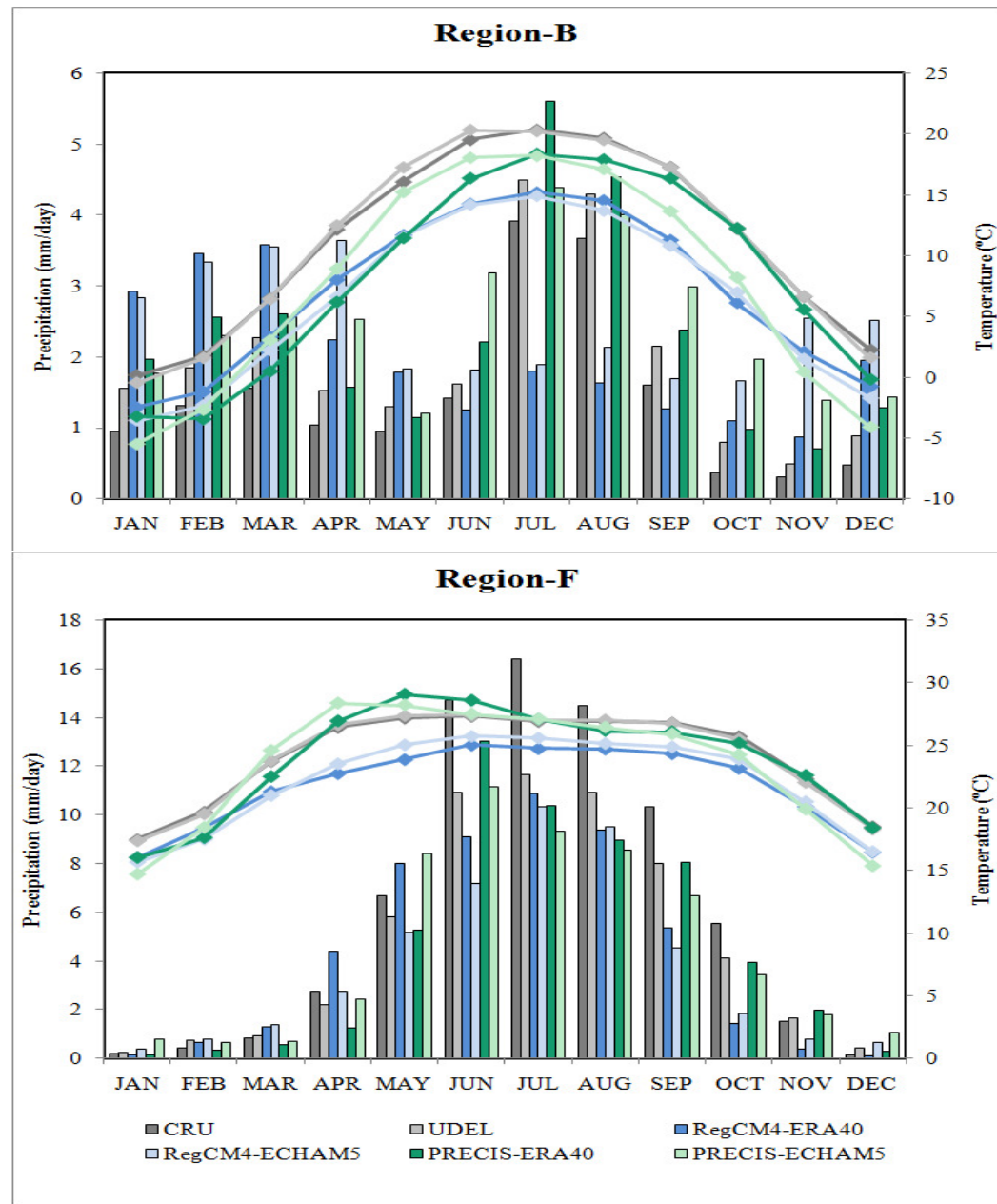
Mean (1971-2000)   Difference

850 hPa Winds (m/s) & Specific Humidity (g/kg)
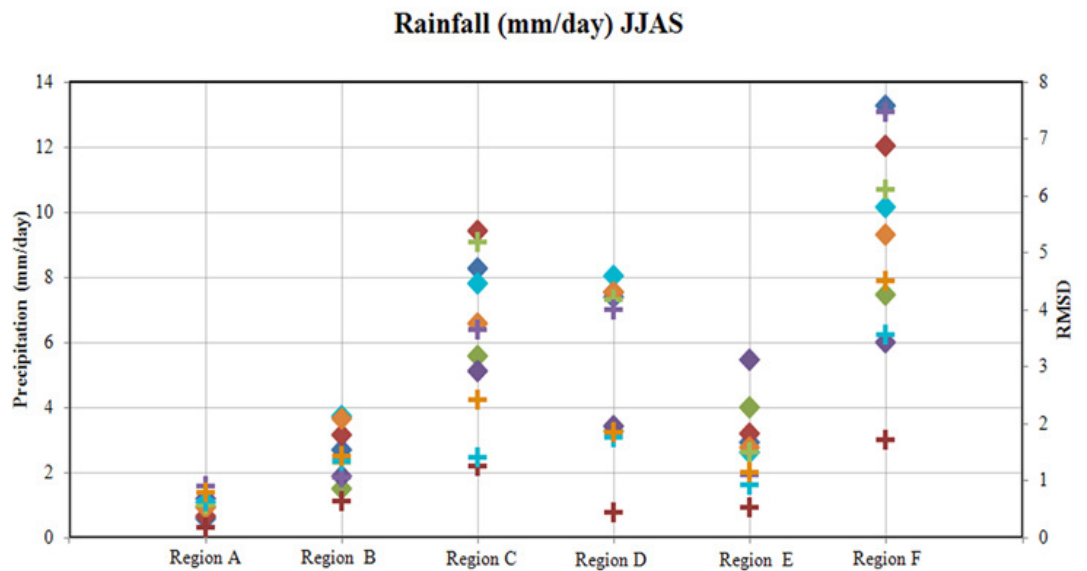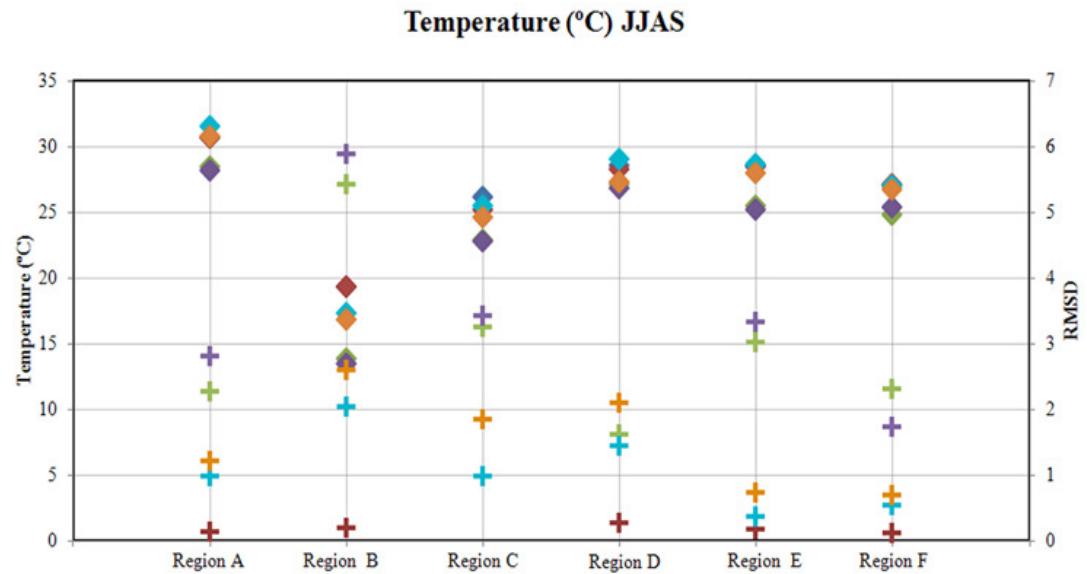
Selected Regions

Annual Cycle (1971-2000)

Precipitation (mm/day)
 &
Temperature (°C)

Temperature (°C) JJAS

Rainfall (mm/day) JJAS

Selected Regions

Mean (1971-2000) & Root mean square difference
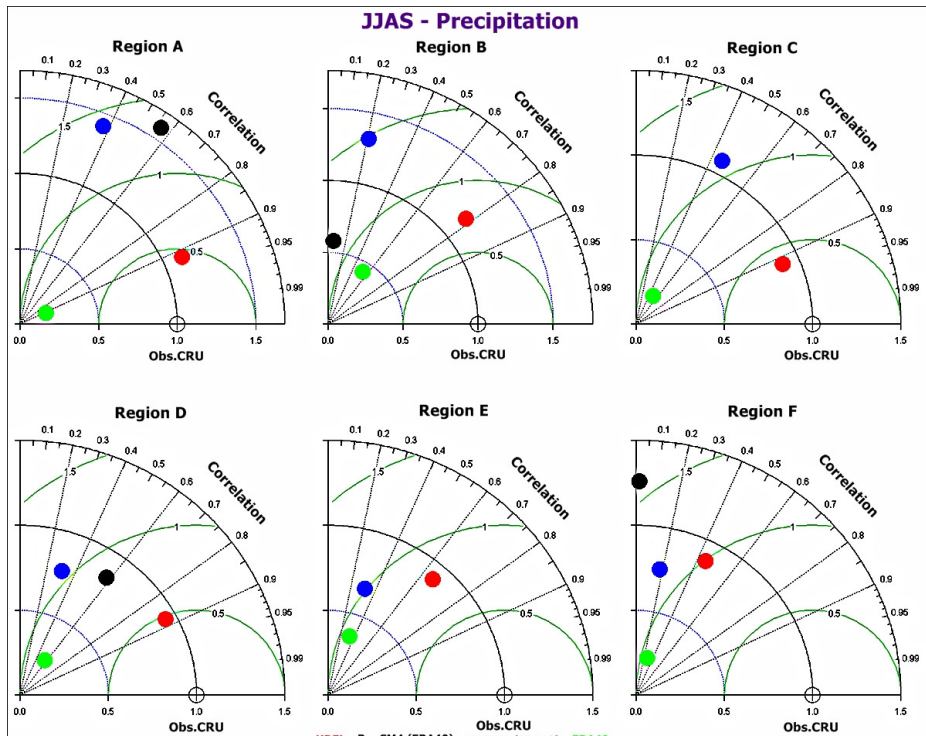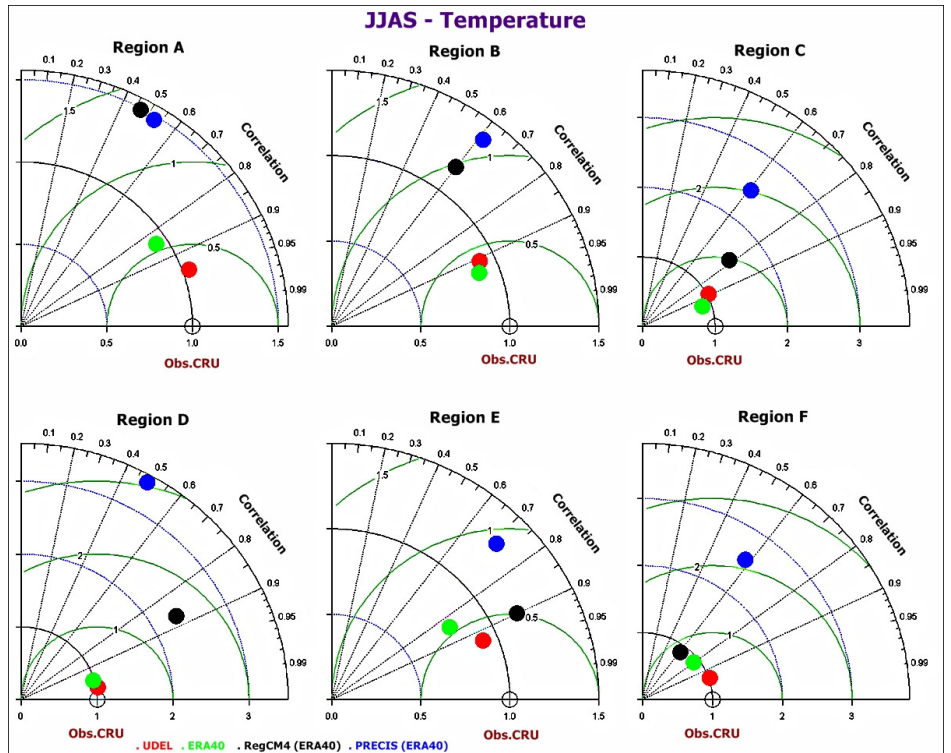
Precipitation (mm/day)
 &
Temperature (°C)

◆ CRU   ◆ UDEL   ◆ RegCM4-ERA40   ◆ RegCM4-ECHAM5

◆ PRECIS-ERA40   ◆ PRECIS-ECHAM5   ✚ RMSD(UDEL minus CRU)   ✚ RMSD(RegCM4-ERA40)

✚ RMSD(RegCM4-ECHAM5)   ✚ RMSD(PRECIS-ERA40)   ✚ RMSD(PRECIS-ECHAM5)
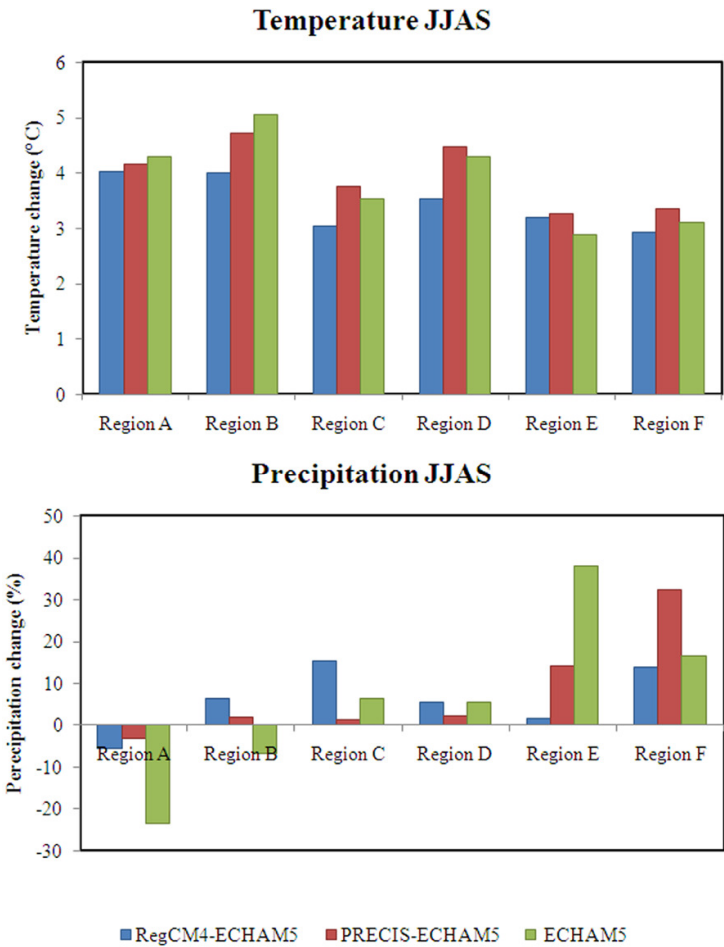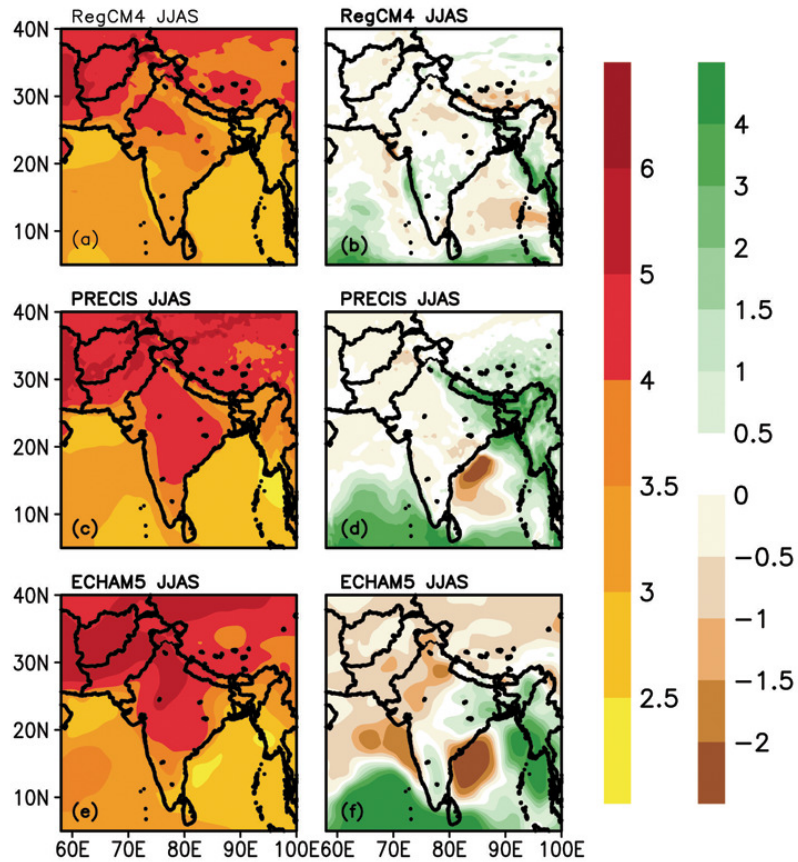
Selected Regions

JJAS Inter-annual Variability

Precipitation (mm/day)
 &
Temperature (°C)

Climate Change (2071-2100) minus (1971-2000)

Precipitation (mm/day) & Temperature (°C)

Conclusions

- RCMs internal variability is small but can not be ignored

- GCMs should be carefully selected by different RCM groups in the CORDEX South-Asia project. There should be some common GCMs in order to quantify the uncertainties associated with RCMs

- Before the dissemination of CORDEX data to the impacts community there should be some documentation explaining the associated uncertainties

Pliny the Elder (Roman scholar, AD 23–79):
'The only certainty is uncertainty'

Thanks !

For your Attention