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Indian Institute of Tropical Meteorology (IITM) Pune, India

## CORDEX Simulations for South Asia

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## Multiyear simulation of the Indian climate using RCMs with the high resolution ERA-interim reanalysis

- The credibility of the RCMs in reproducing the observed regional climate is a good measure for providing reliable regional climate change projections with it
- The new European Center for Medium Range Weather Forecast (ECMWF) ERA-interim reanalysis is used to provide initial and "perfect" lateral boundary conditions for the RCM simulations



## ARW\_West\_Asia Configuration:

Version: ARW 3.1.1

Domain: 17.15°E - 120.86°E; 18.03°S - 48.50°N (Includes 5 grid-point boundary relaxation zone)

Horizontal resolution: 50 km Mercator projection; 211x151 grids

Vertical resolution: 28 vertical levels

Initial & Lateral boundary data: Global 6-hourly ERA Interim data at 0.75° x 0.75° resolution on 60 ECMWF model hybrid levels

Model time step: 4 minutes

Output history interval: 3 hourly

Restart interval: Monthly

SST\_update: 6 hourly

Physics	BMJ	KF2
Microphysics	WSM 5-class	WSM 5-class
Deep Cumulus convection	Betts-Miller-Janjic	Kain-Fritsh new eta
Shortwave Radiation	RRTMG	RRTMG
Longwave Radiation	RRTMG	RRTMG
Atmospheric Boundary Layer	YSU	YSU
Surface Fluxes	Monin-Obukhov	Monin-Obukhov
Land Surface	Unified Noah	Unified Noah



## RegCM3\_West\_Asia Configuration:

Version: RegCM3.1

Domain: 17.15°E - 120.86°E; 18.03°S - 48.50°N (Includes 5 grid-point boundary relaxation zone)

Horizontal resolution: 50 km Normal Mercator projection; 256x170 grids

Vertical resolution: 23 vertical levels; ptop=50 hPa

Initial & Lateral boundary data: Global 6-hourly ERA Interim data at 0.75° x 0.75° resolution on 60 ECMWF model hybrid levels

Model time step: 1 minute

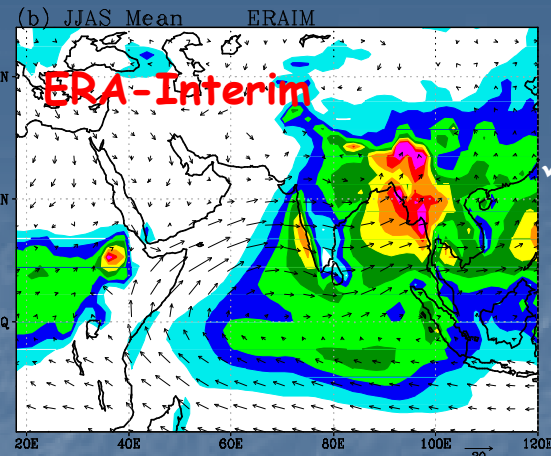
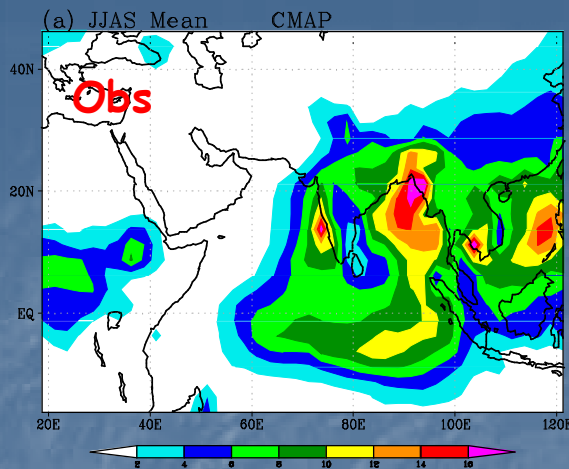
Output history interval: 1 day

Restart interval: Monthly

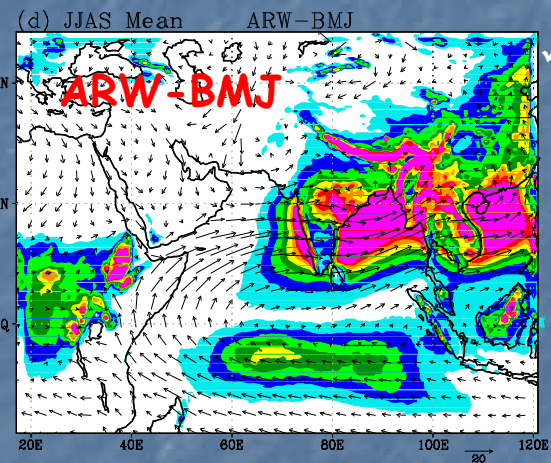
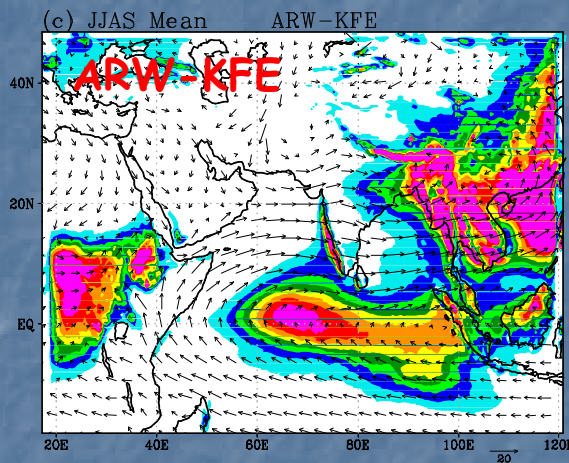
SST\_update: 6 hourly

Physics	RGM-EML	RGM-GRL
Microphysics	SUBEX	SUBEX
Deep Cumulus convection	<b>Emanuel (MIT)</b>	<b>Grell</b>
Shortwave Radiation	NCAR CCM3	NCAR CCM3
Longwave Radiation	NCAR CCM3	NCAR CCM3
Atmospheric Boundary Layer	Holtslag	Holtslag
Surface Fluxes	Monin-Obukhov	Monin-Obukhov
Land Surface	BATS	BATS
Atmospheric Aerosols and Chemistry	off	off

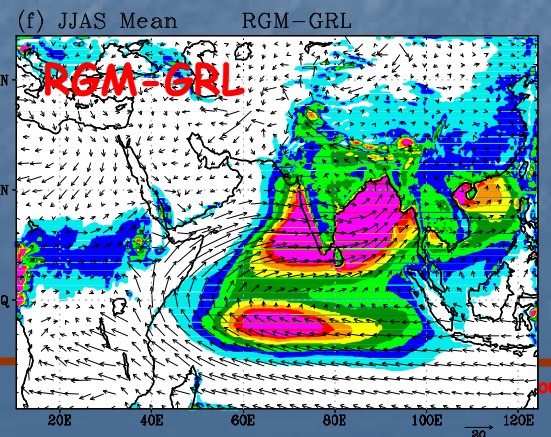
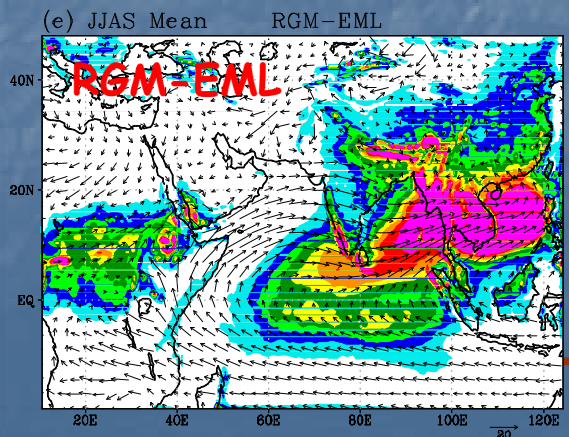




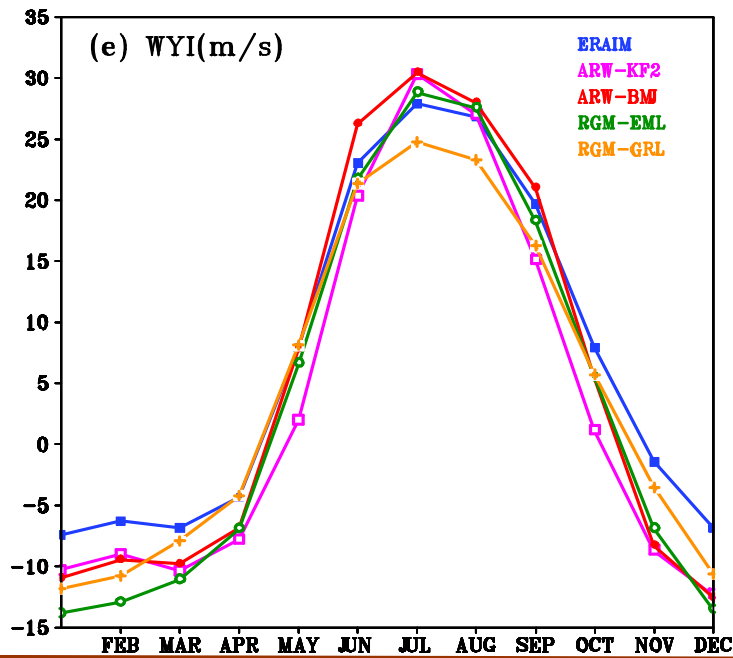
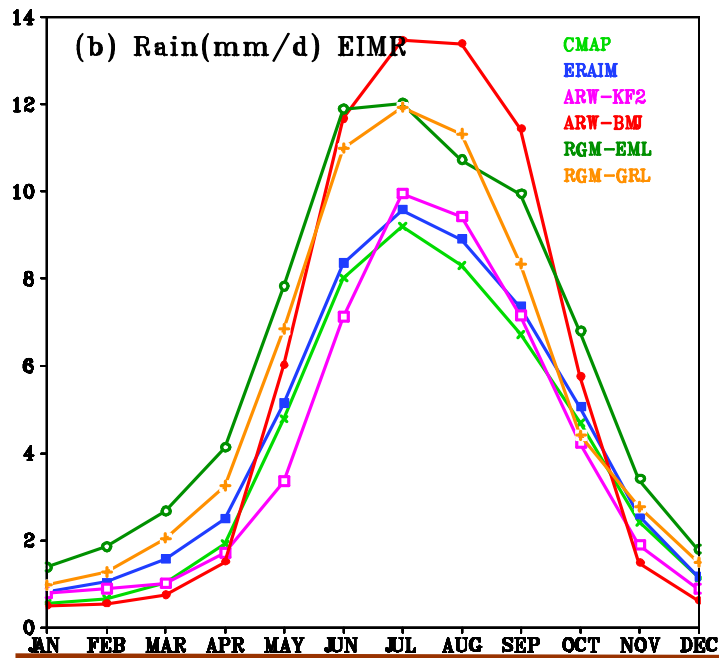
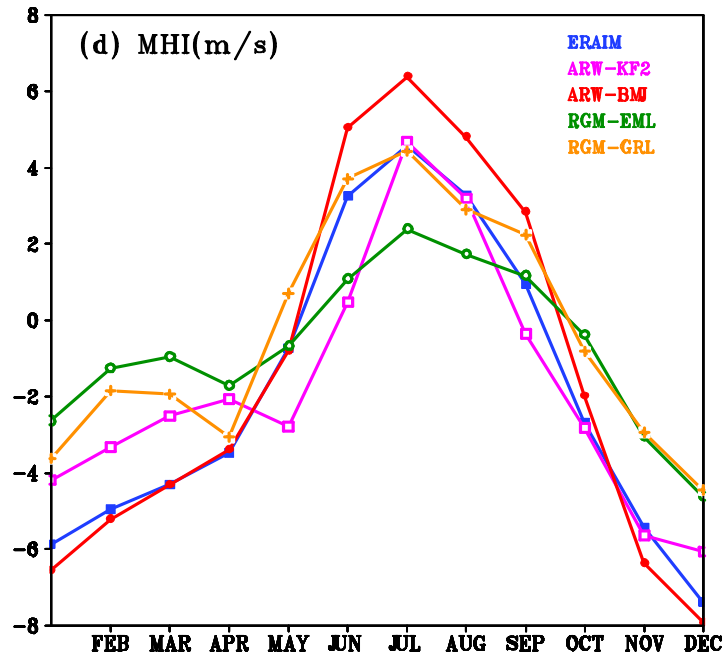
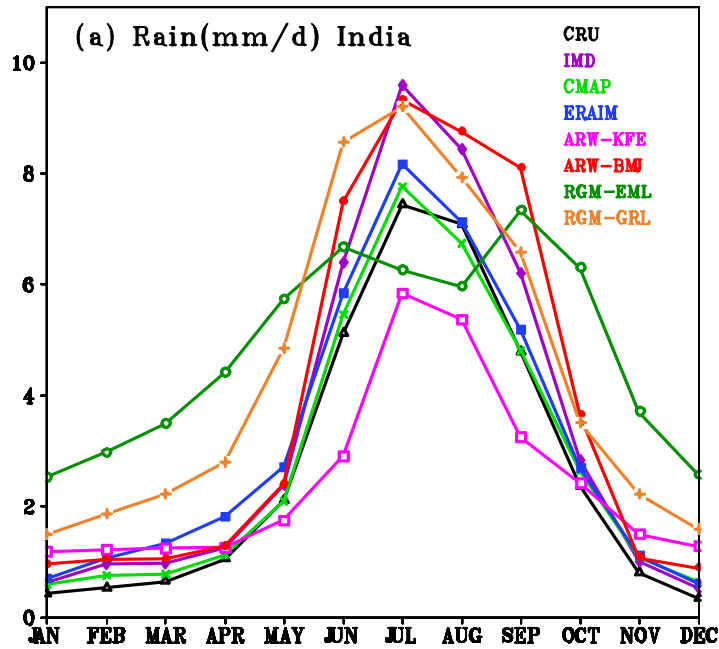
✓ The large scale mean precipitation patterns during Indian summer monsoon season (June-September) are found to be realistically simulated



✓ The regional mean summer precipitation over India is also realistic in these models. However the ARW-BMJ model overestimates the summer precipitation over the Bay of Bengal



✓ The simulation of the large scale seasonal mean precipitation is found to be sensitive to the choice of the deep cumulus scheme in ARW and RegCM3, which in turn impacts the simulation of Indian monsoon interannual variability





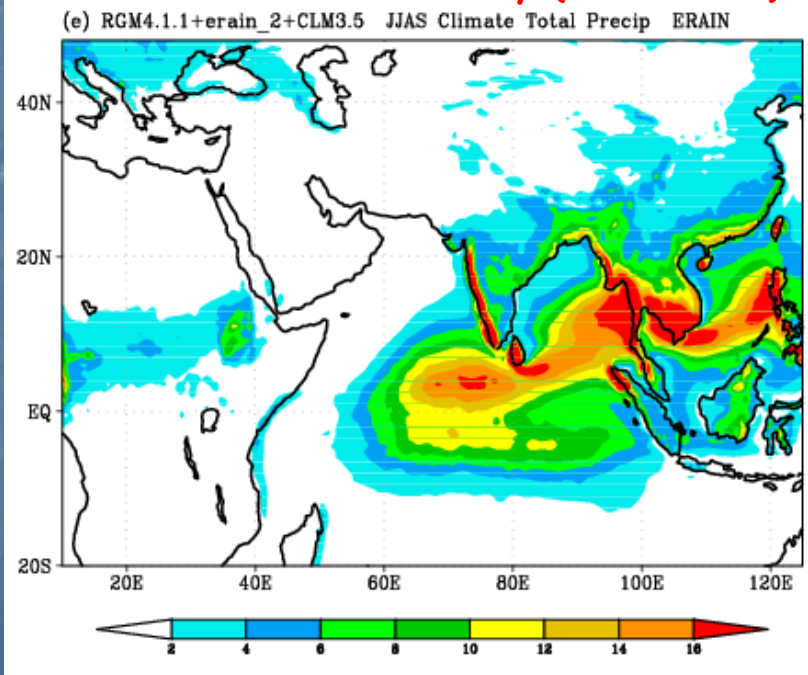
# High resolution dynamical downscaling of regional climate change scenarios over West Asia using RegCM4

J.Sanjay, T.Sabin, R.Krishnan

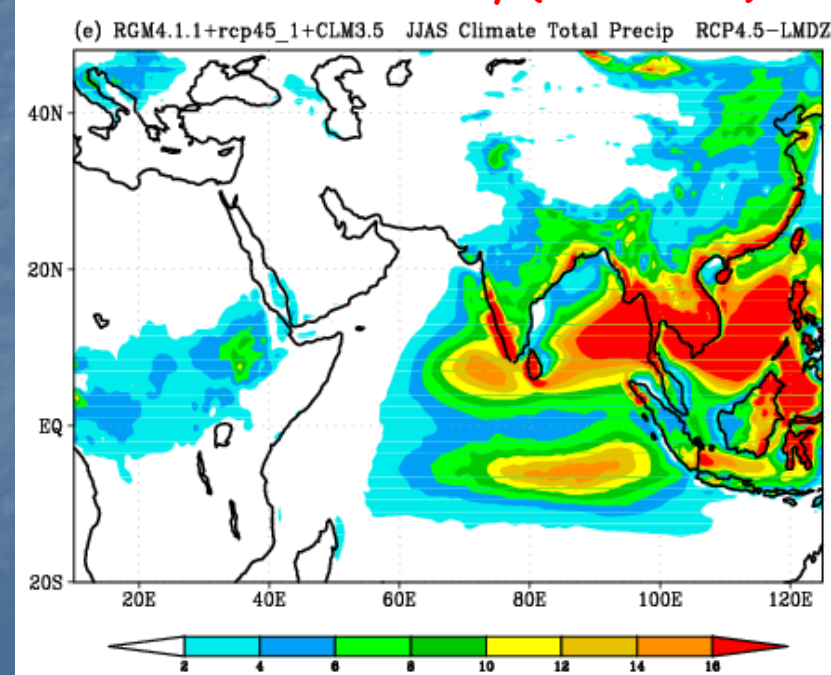
- RCM: RegCM4.1 coupled to CLM3.5 LSM ; 50 km Mercator projection
- Forcing: Daily 3D atmospheric lateral boundary conditions from the LMDZ AGCM with high resolution zooming (~35 km) over India, which was forced with SST from the LMDZ ESM IPCC AR5 RCP4.5 simulations during 2006-2100
- Runs on IITM Prithvi HPC
  - with Mixed Cumulus: Land (Grell) + Ocean (Emanuel)

JJAS Mean Precipitation ( $\text{mm d}^{-1}$ )

ERA-Interim Evaluation 18yr(1989-2006)



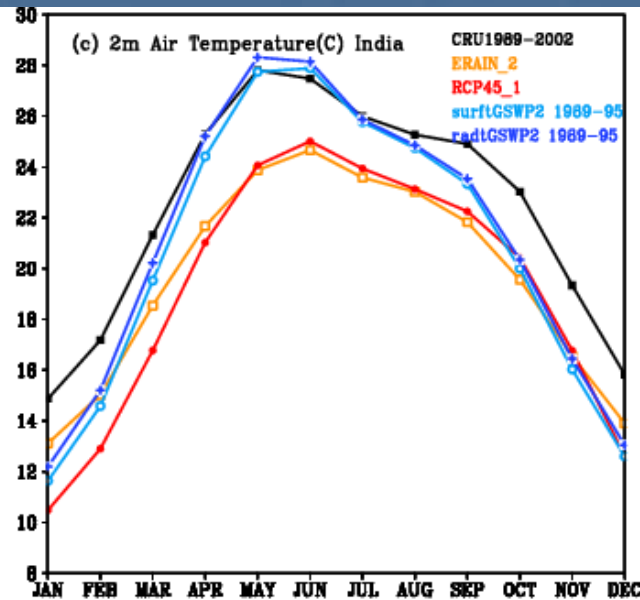
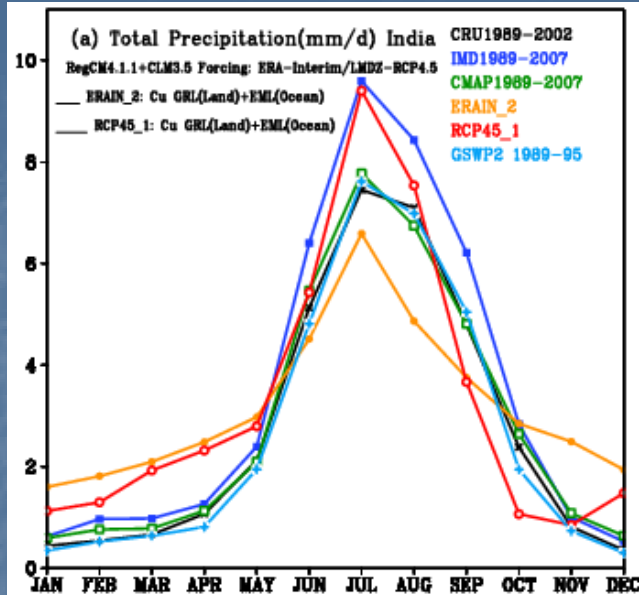
RCP4.5 Scenario 27yr(2006-2032)



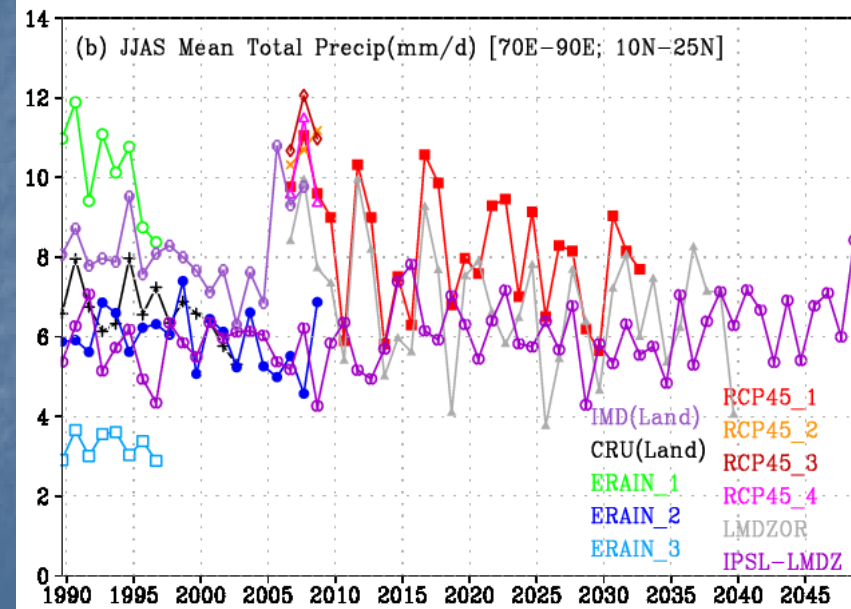
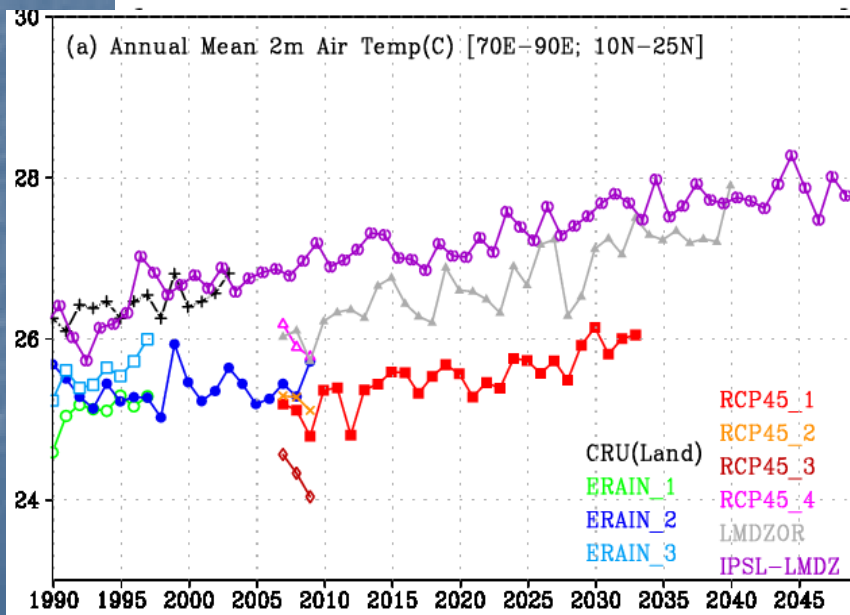




## RegCM4 Monthly Mean Annual Cycle over India



- IMD
- CMAP
- CRU
- ERA-Interim
- RCP4.5







- The Regional Climate Model version 4 (RegCM4.1) is an evolution of the model originally developed at the NCAR and currently maintained at the International Centre for Theoretical Physics (ICTP), Italy
  - grid-point limited area model with a hydrostatic dynamical core (similar to the NCAR/PSU MM5; Grell et al. 1994)
  - full radiation package (CCM3; Kiehl et al. 1996) allowing for the effects of greenhouse gases and atmospheric aerosols
  - non-local planetary boundary layer scheme (Holtslag et al. 1990)
  - multiple convection schemes (e.g., MIT Emanuel 1991; Grell 1993)
  - SUBEX scheme to simulate large-scale precipitation (Pal et al. 2000)
  - NCAR Community Land Model (CLM3.5; Oleson et al. 2008) that includes a physical representation of the coupling between the water, energy and carbon cycles