GRIDDED DATASETS

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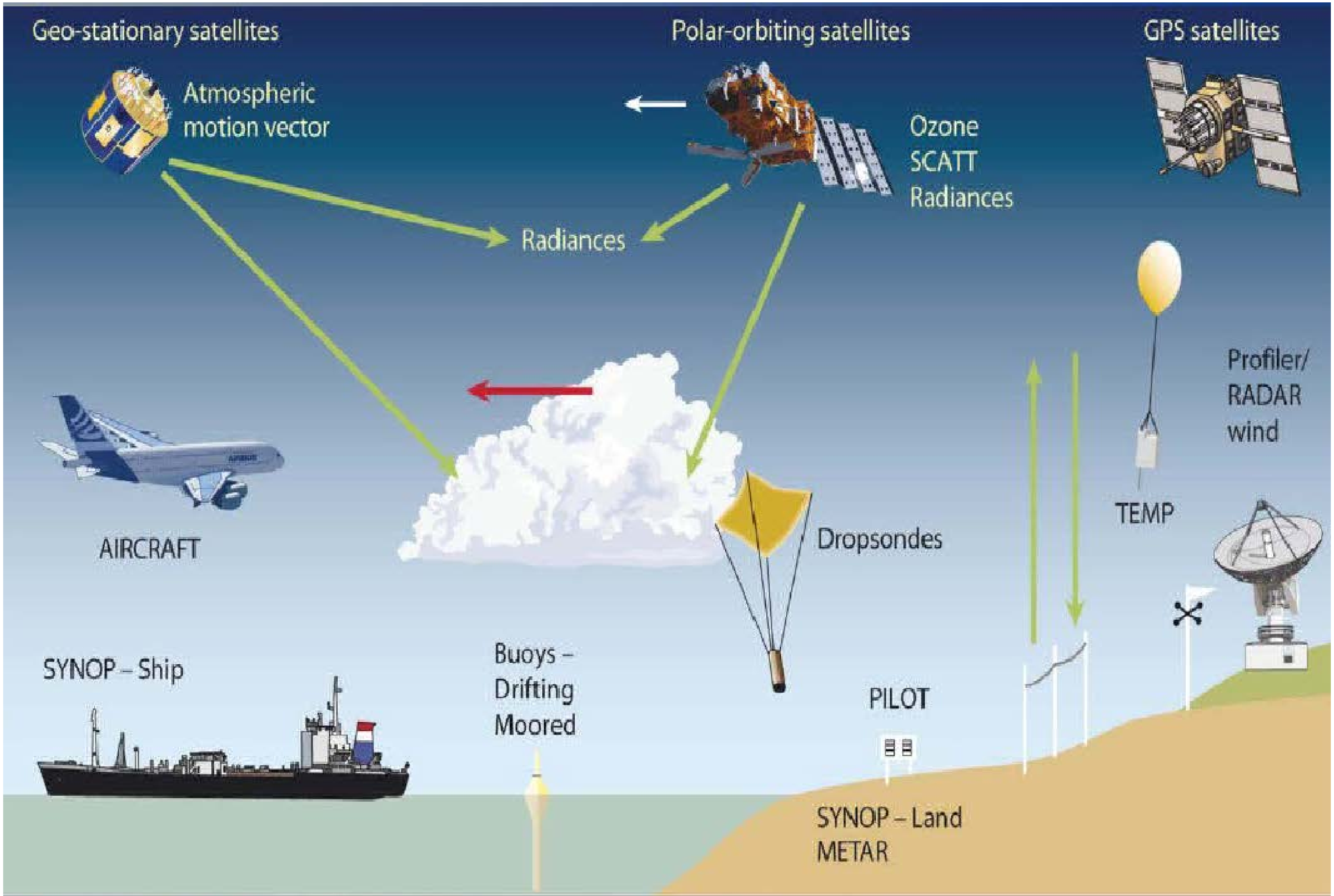
GRIDDED DATASETS

- Gridded data refers to the format of data stored in series of points spaced at regular intervals.
- This can be in 2-D, 3-D grids and can also cover 4-D formats.
- What would be examples of gridded datasets??

What is Reanalysis Data?

- Technique to produce multiple climate variables;
- Previously observed climate data for temperature, wind speed, and pressure;
- Observations are analyzed; interpolated onto a system of grids;
- 3-D forecasting model is initialized with observational data;
- Output is a simulated data set at, 6-hourly, daily, and monthly time steps of many unobservable climate variables.

Observing System



Source: http://ecmwf.org/newsevents/training/meteorological_presentations/2013/PA2013/Keeley/ECMWF-Past-FuturePA_final_forprint.pdf

Reanalysis Data

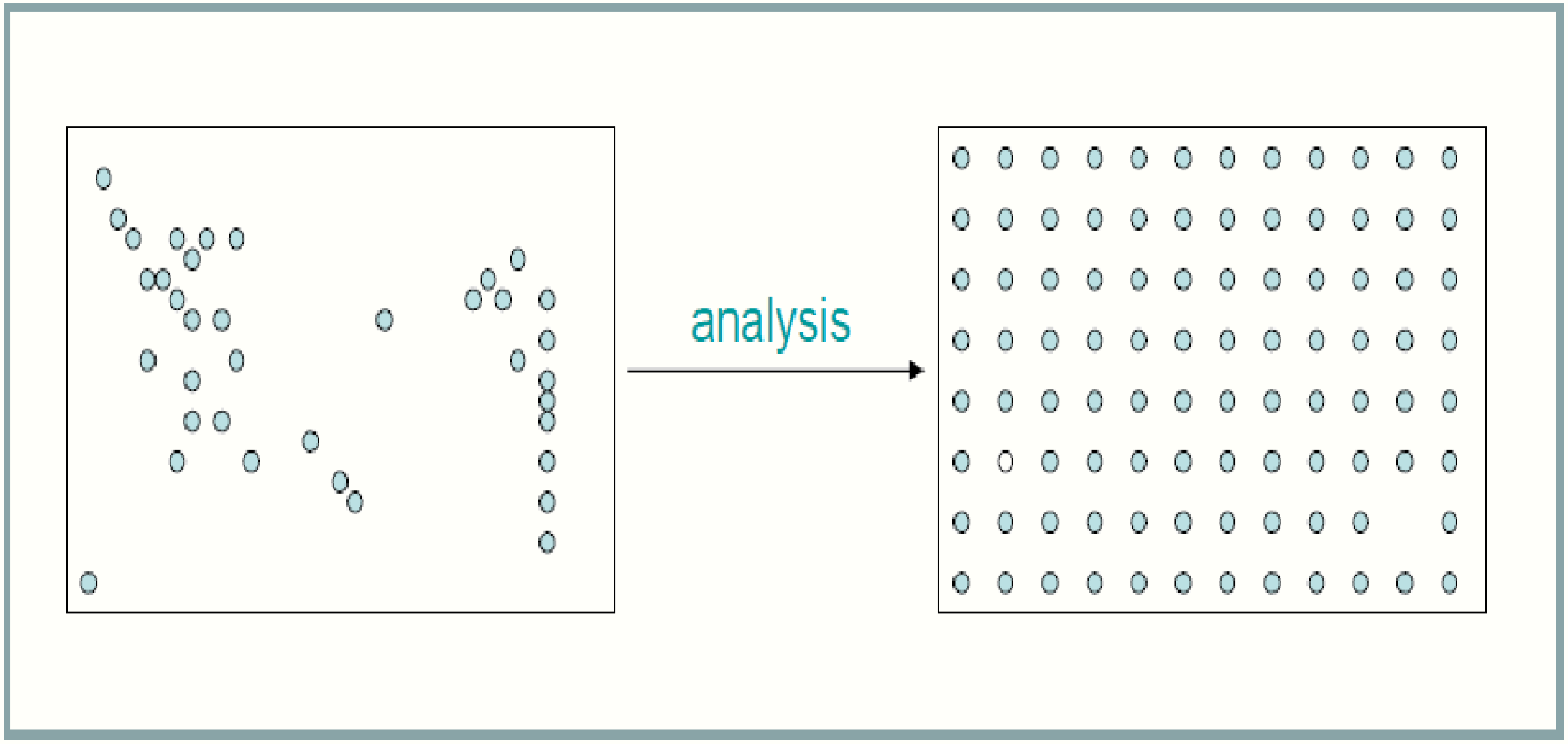
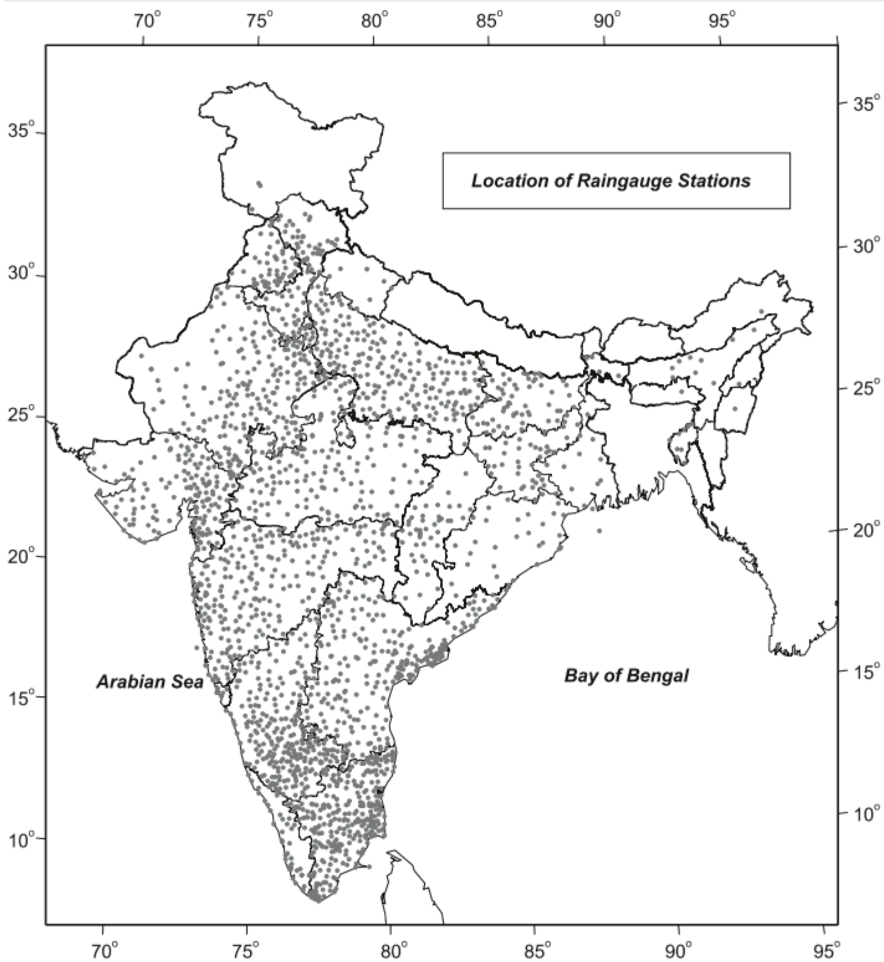
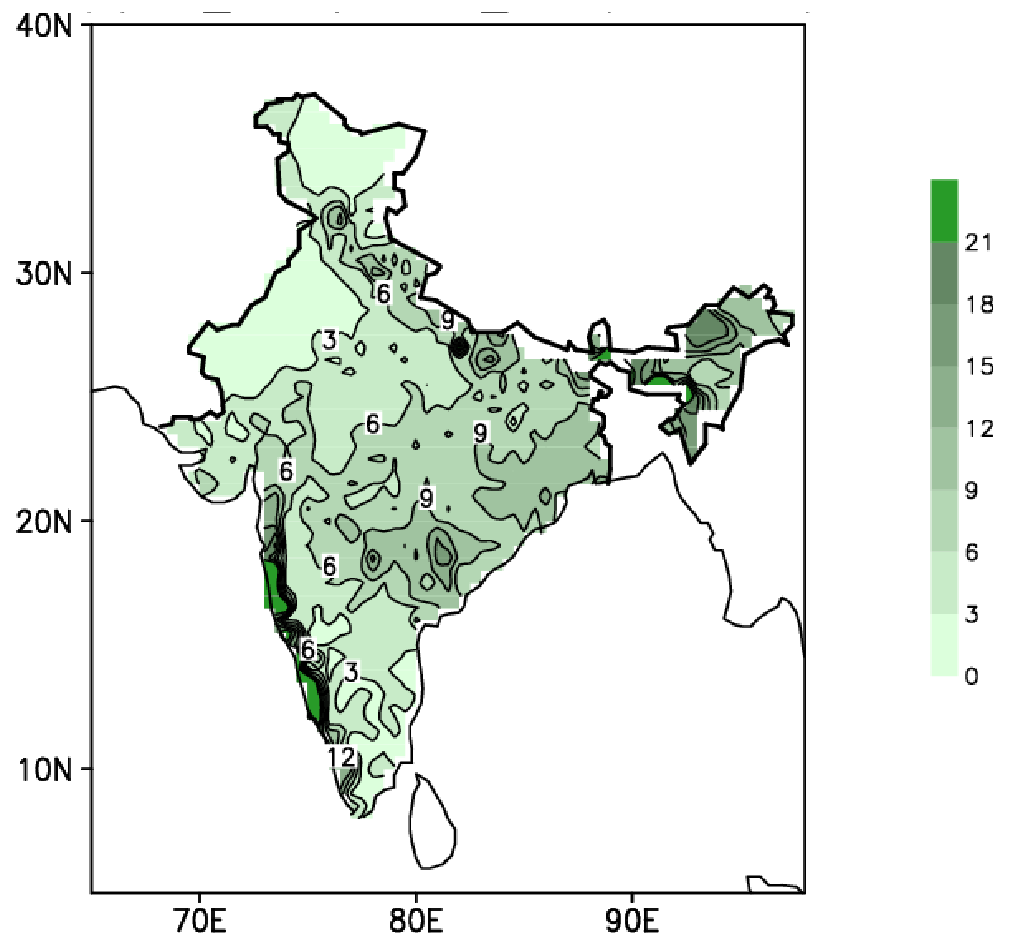


Figure showing Rain Gauge Stations over India

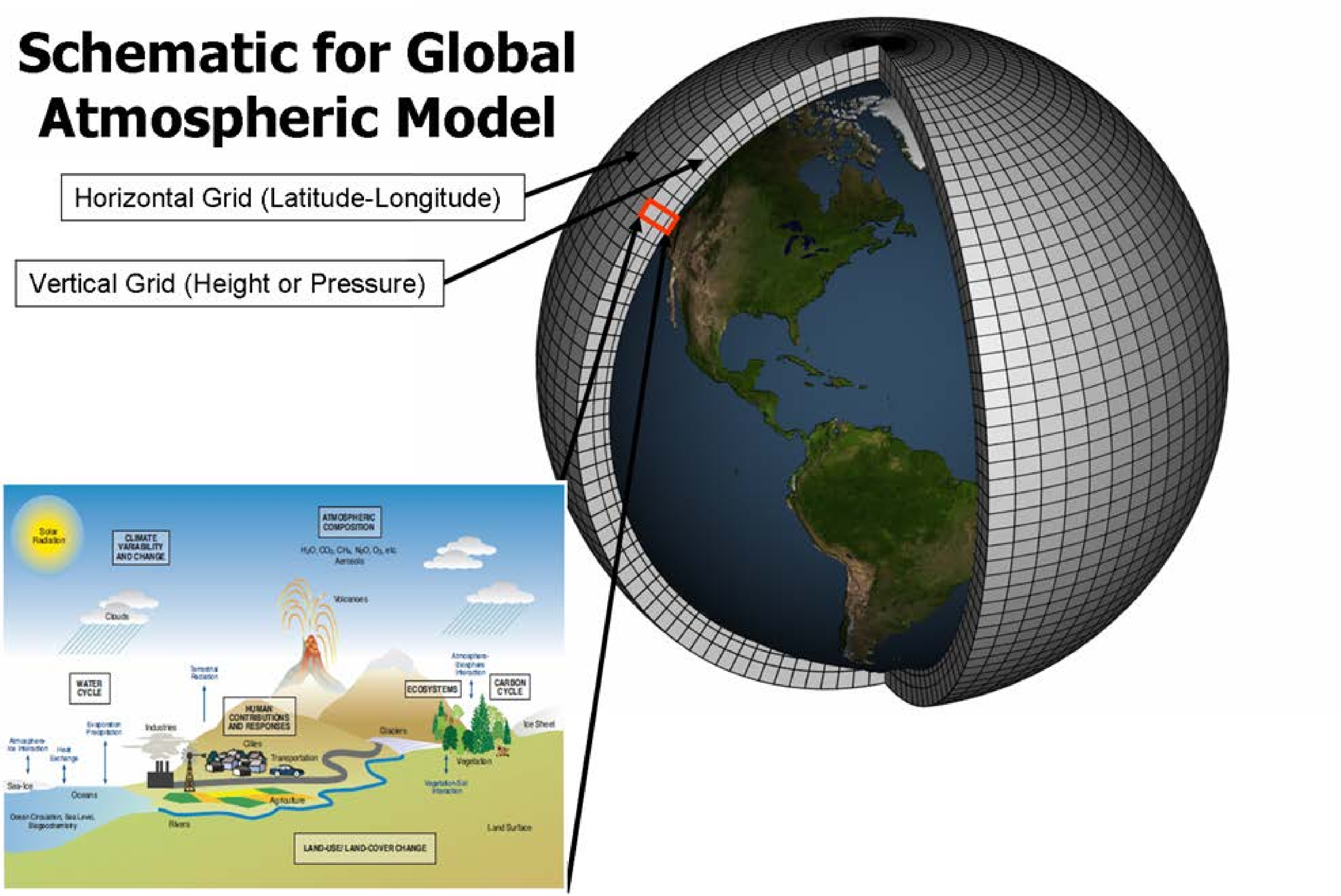


Source: Rajeevan et al. (2008)



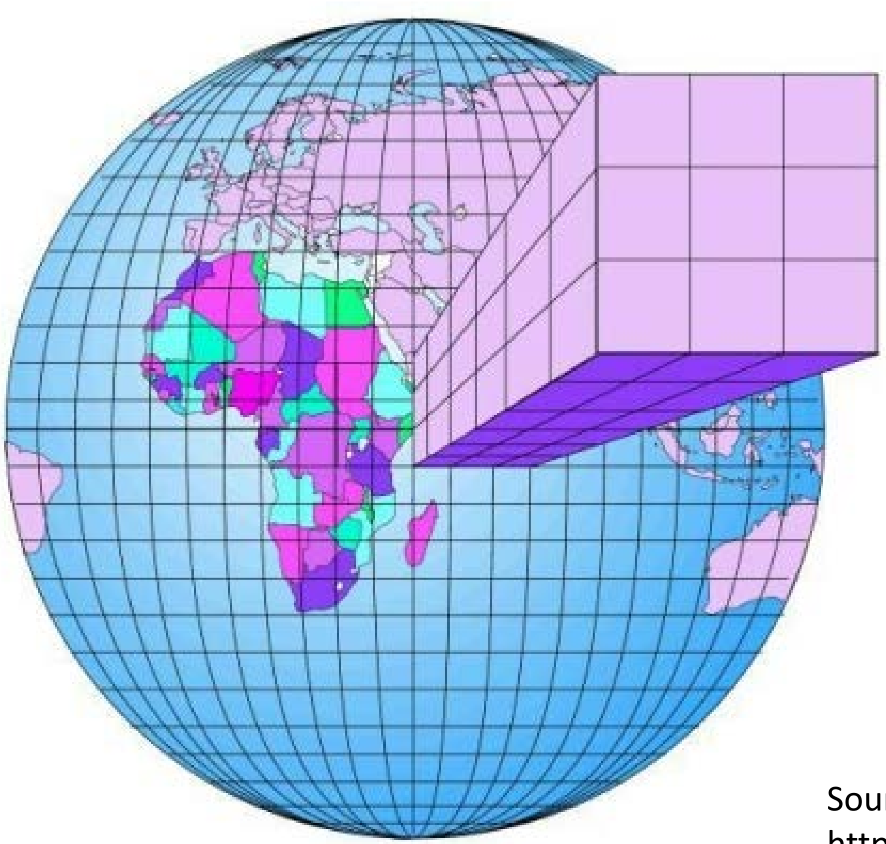
Dataset: IMD 0.5km rainfall data

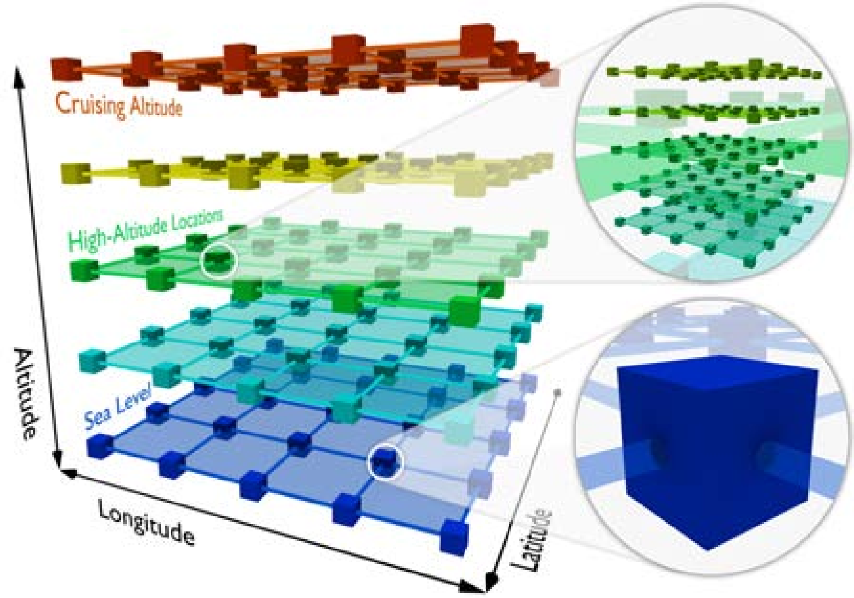
GRID SYSTEM



Source: http://upload.wikimedia.org/wikipedia/commons/thumb/b/b1/Global_Climate_Model.png/100px-Global_Climate_Model.png

GRID SYSTEM

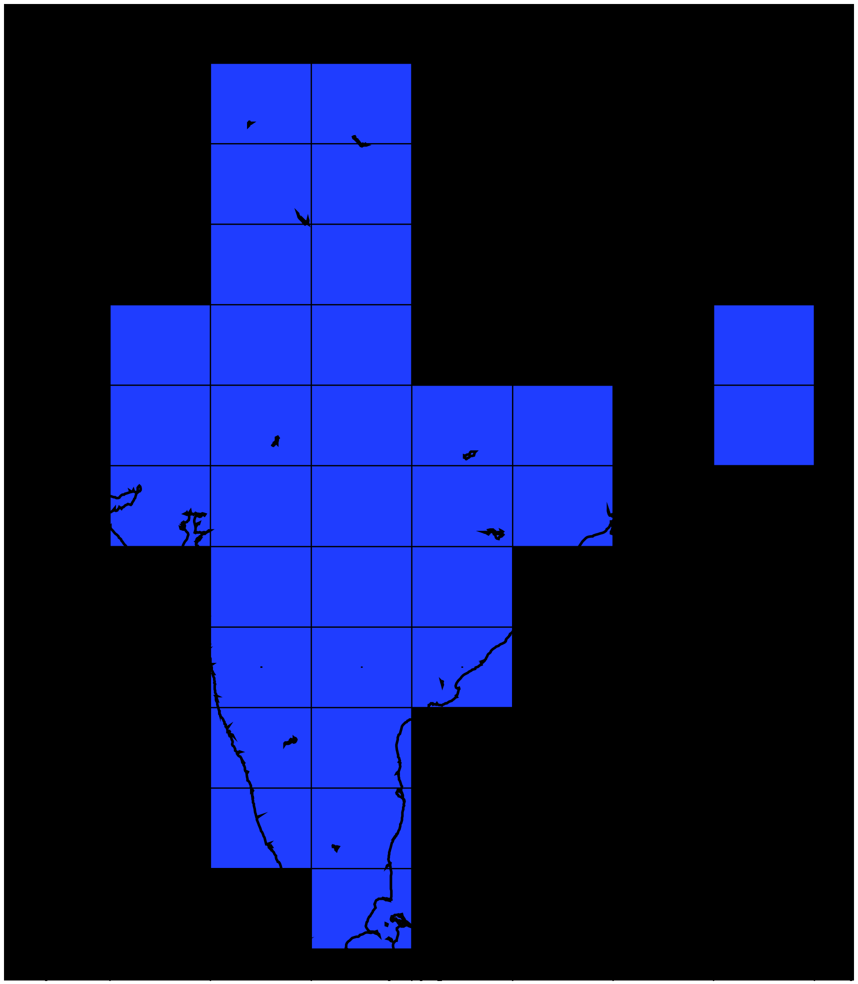




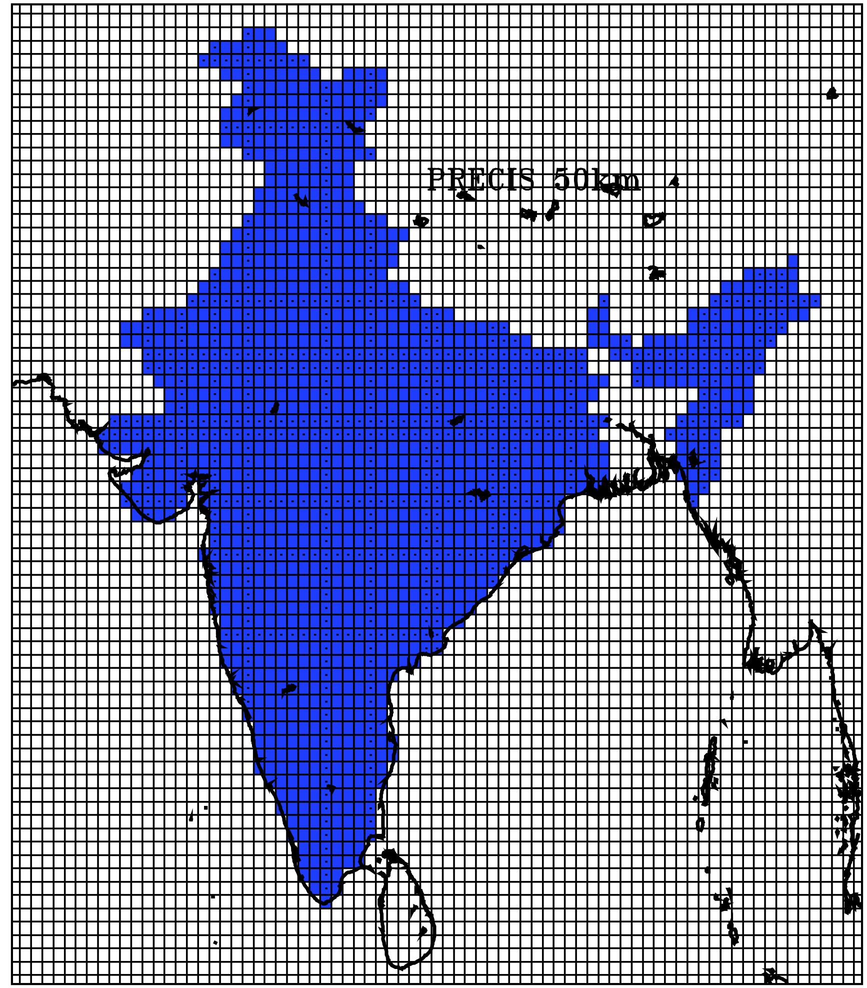
Source:
https://wiki.ucar.edu/display/NNEWD/Data+Models+and+Formats

Source: http://atoc.colorado.edu/~dcn/ATOC7500/

RESOLUTION

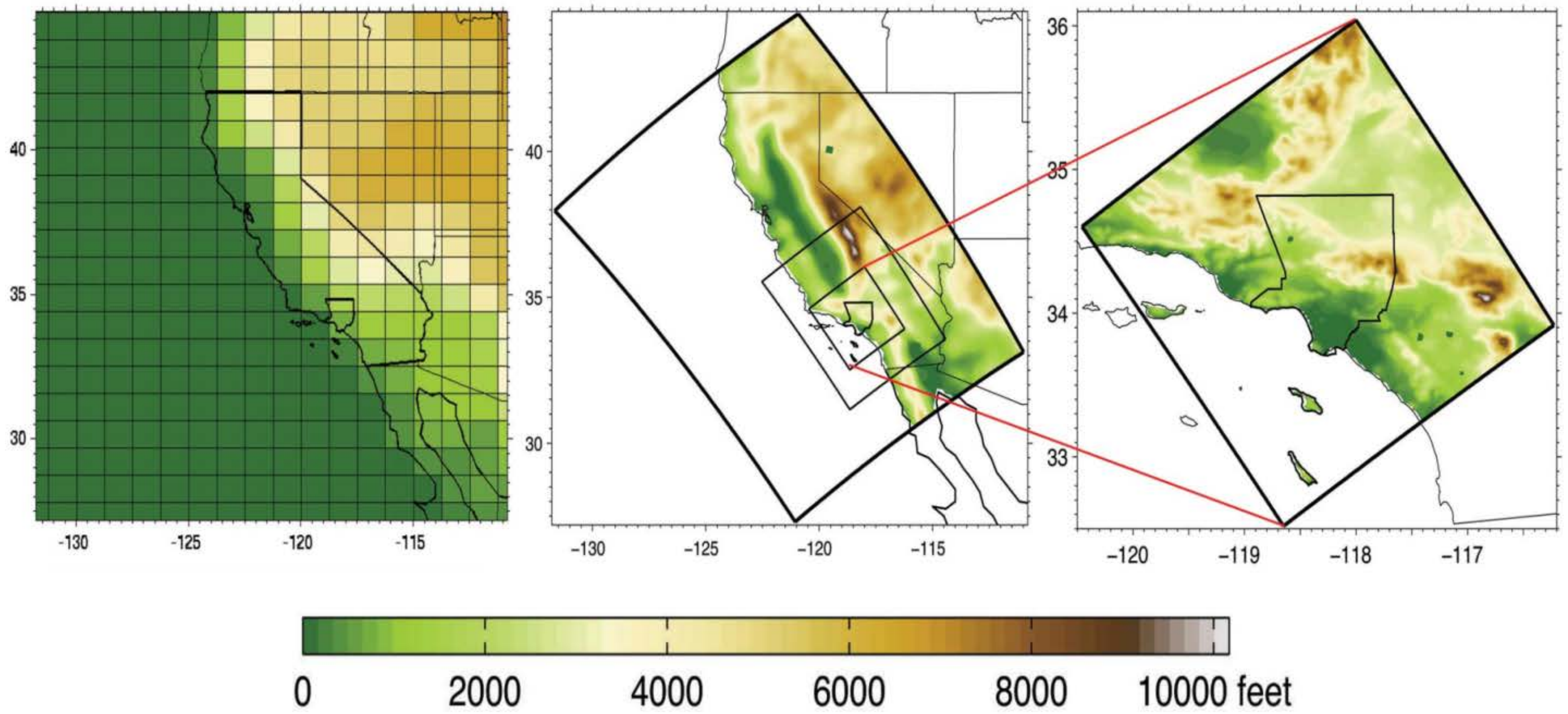


HadCM3 ($3^o \times 2.5^o$)



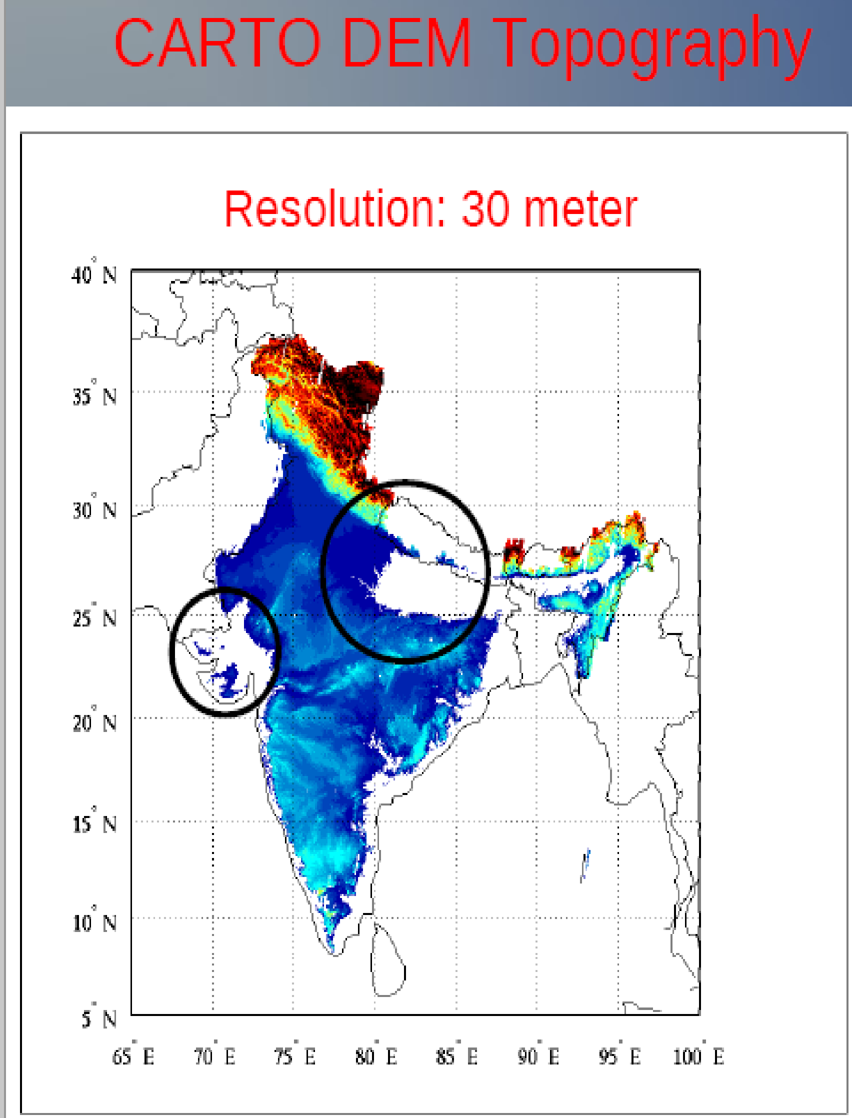
PRECIS ($0.44^o \times 0.44^o$)

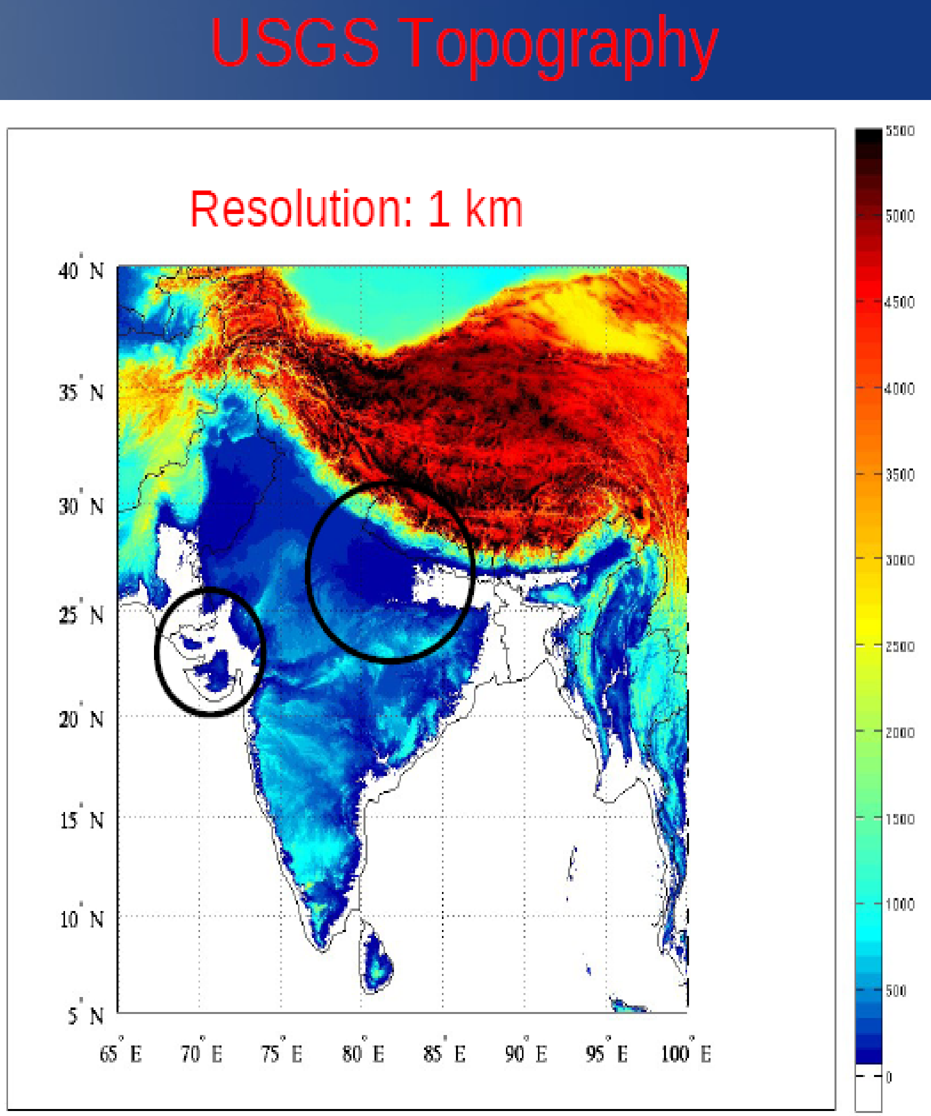
RESOLUTION



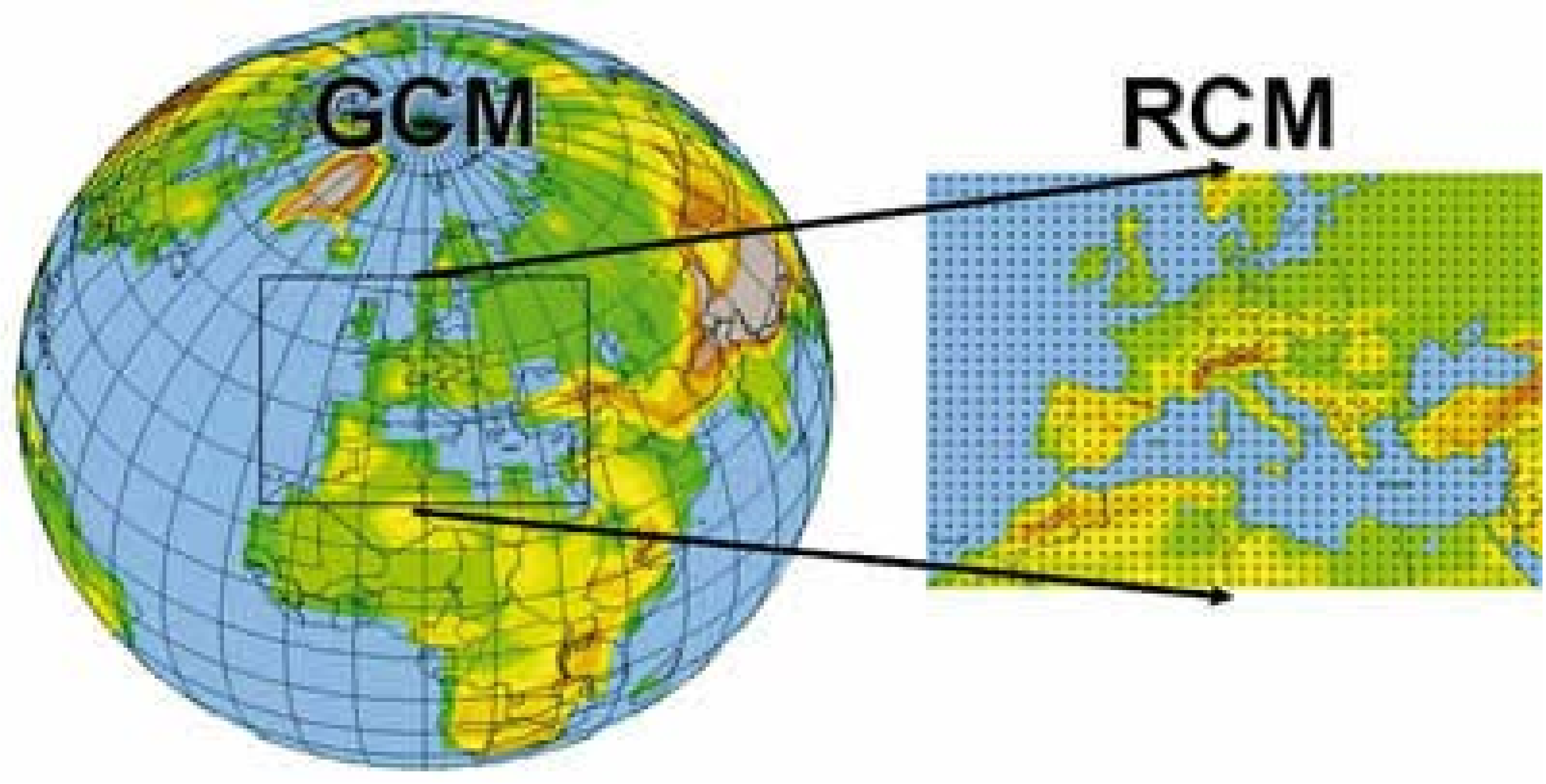
Source: http://www.psc.edu/science/2012/climate/

Terrain


CARTO DEM Topography
Resolution: 30 meter
40° N
35° N
30° N
25° N
20° N
15° N
10° N
5° N
65° E
70° E
75° E
80° E
85° E
90° E
95° E
100° E


USGS Topography
Resolution: 1 km
40° N
35° N
30° N
25° N
20° N
15° N
10° N
5° N
65° E
70° E
75° E
80° E
85° E
90° E
95° E
100° E
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0

GLOBAL MODELS vs. REGIONAL MODELS

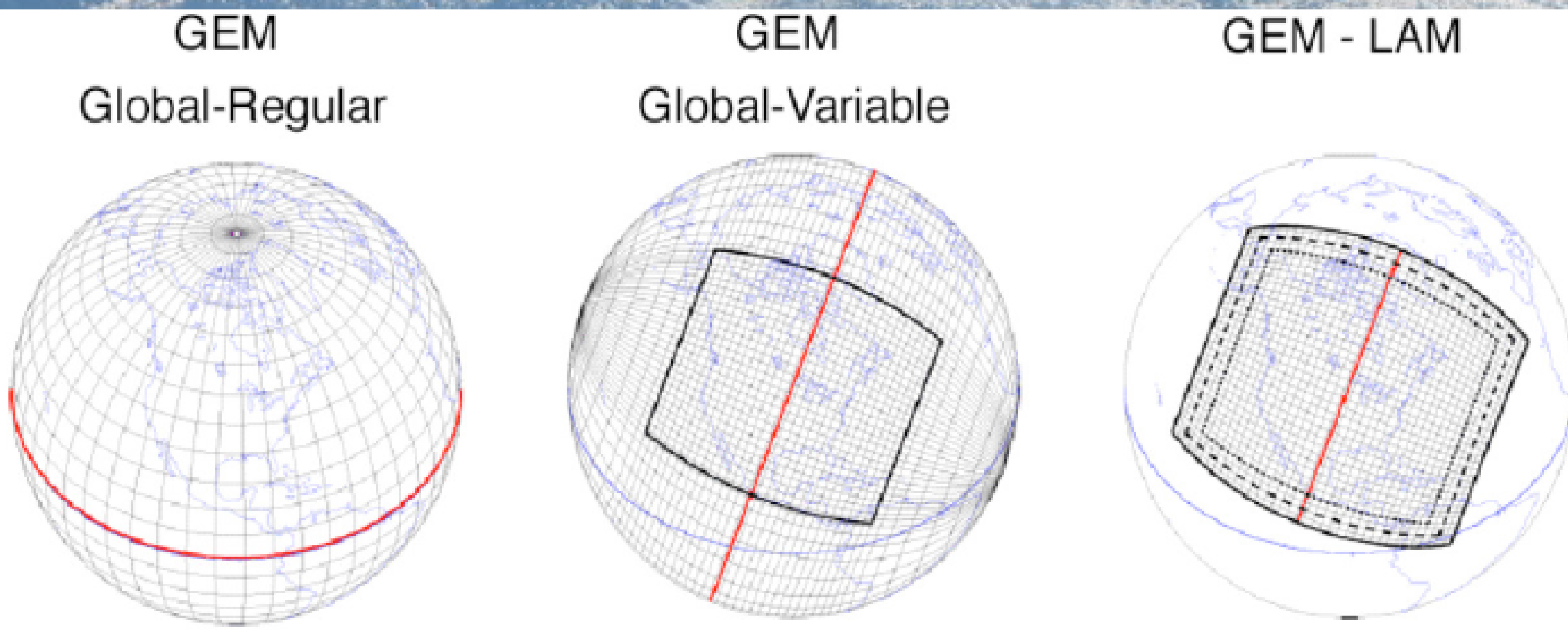


Source: http://www.wmo.int/pages/themes/climate/climate_models.php

Dynamical downscaling is a method for obtaining high-resolution climate or climate change information from relatively coarse-resolution global climate models (GCMs) which do not capture the effects of local and regional forcing in areas of complex surface physiography.

Increasing GCM resolution by a factor X leads to an increased compute cost of ~X^3. **A 10km model is ~1000 times the cost of a 100km model**

Locally increased resolution over a region of interest offers an alternative method for representing specific local phenomena and providing climate information at spatial scales required for planning & decision making



- Downscaling is a method for obtaining high-resolution climate or climate change information from relatively coarse-resolution global climate models (GCMs). Typically, GCMs have a resolution of 150-300 km by 150-300 km. Many impacts models require information at scales of 50 km or less, so some method is needed to estimate the smaller-scale information.
    - Dynamical downscaling uses a limited area, high-resolution model (a regional climate model, or RCM) driven by boundary conditions from a GCM to derive smaller-scale information using dynamical numerical weather prediction techniques.
    - Statistical downscaling first derives statistical relationships between observed small-scale (often station level) variables and larger (GCM) scale variables, using either analogue methods (circulation typing), regression analysis, or neural network methods.

- Lateral Boundary condition variables:
    - –Wind
    - –Temperature
    - –Water vapour
    - –Surface pressure

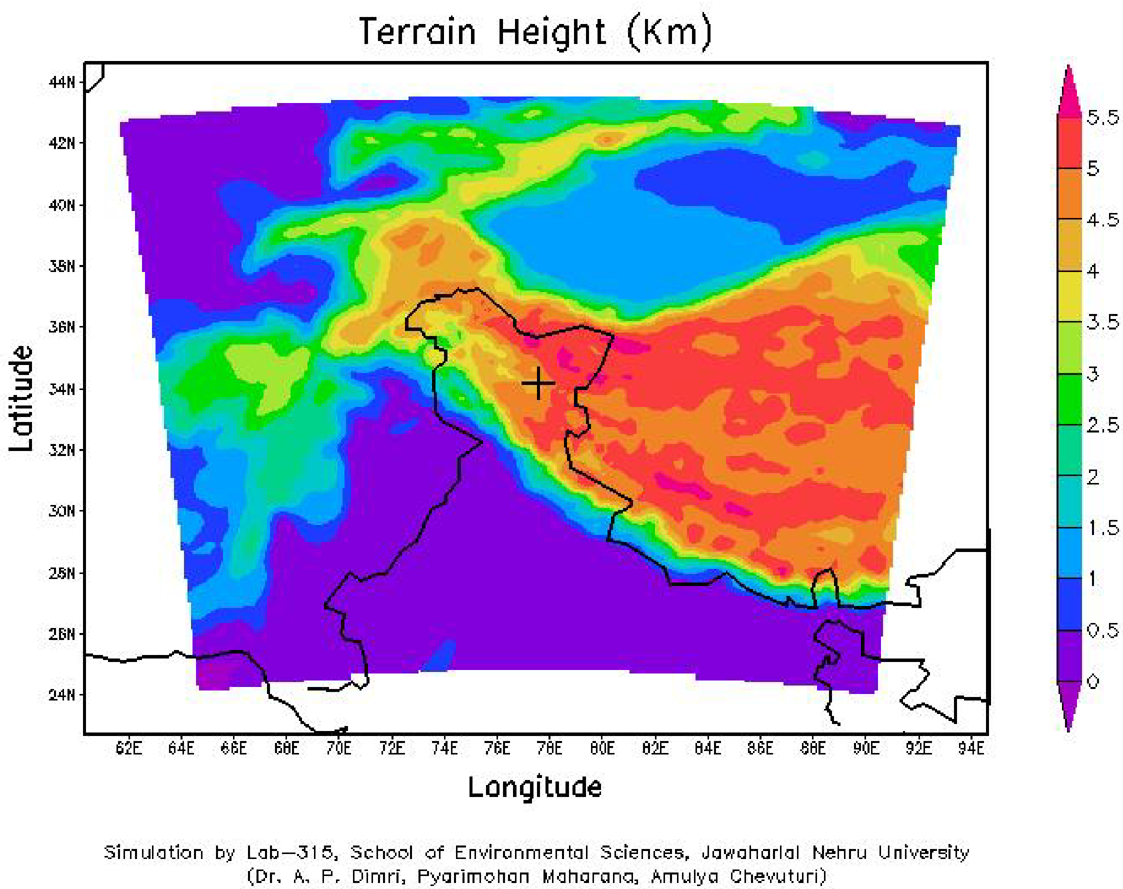
Lower boundary condition variables:
- SST
- Land Use & Land cover

Initial condition variables:
- Temporal

Some example plots from gridded datasets for WEATHER and CLIMATE analysis

GRIDDED DATA OUTPUTS

LEH CLOUDBURST



ARW Simulation of Leh Cloudburst

Leh: 77.57 ; 34.15

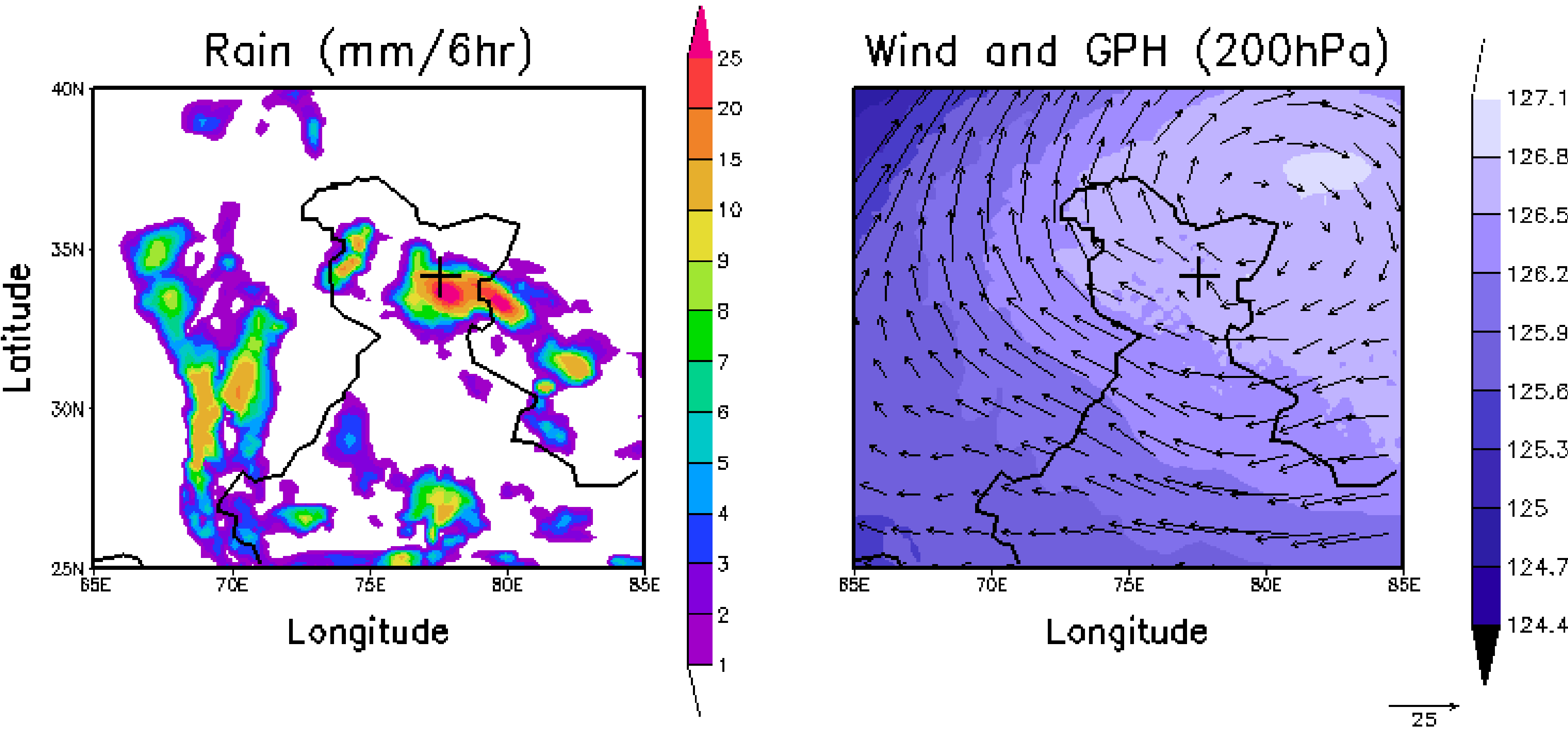
Run: 2010-08-04_00:00 – 2010-08-08_00:00

Spatial Resolution: 27km

Temporal Resolution: 6hr

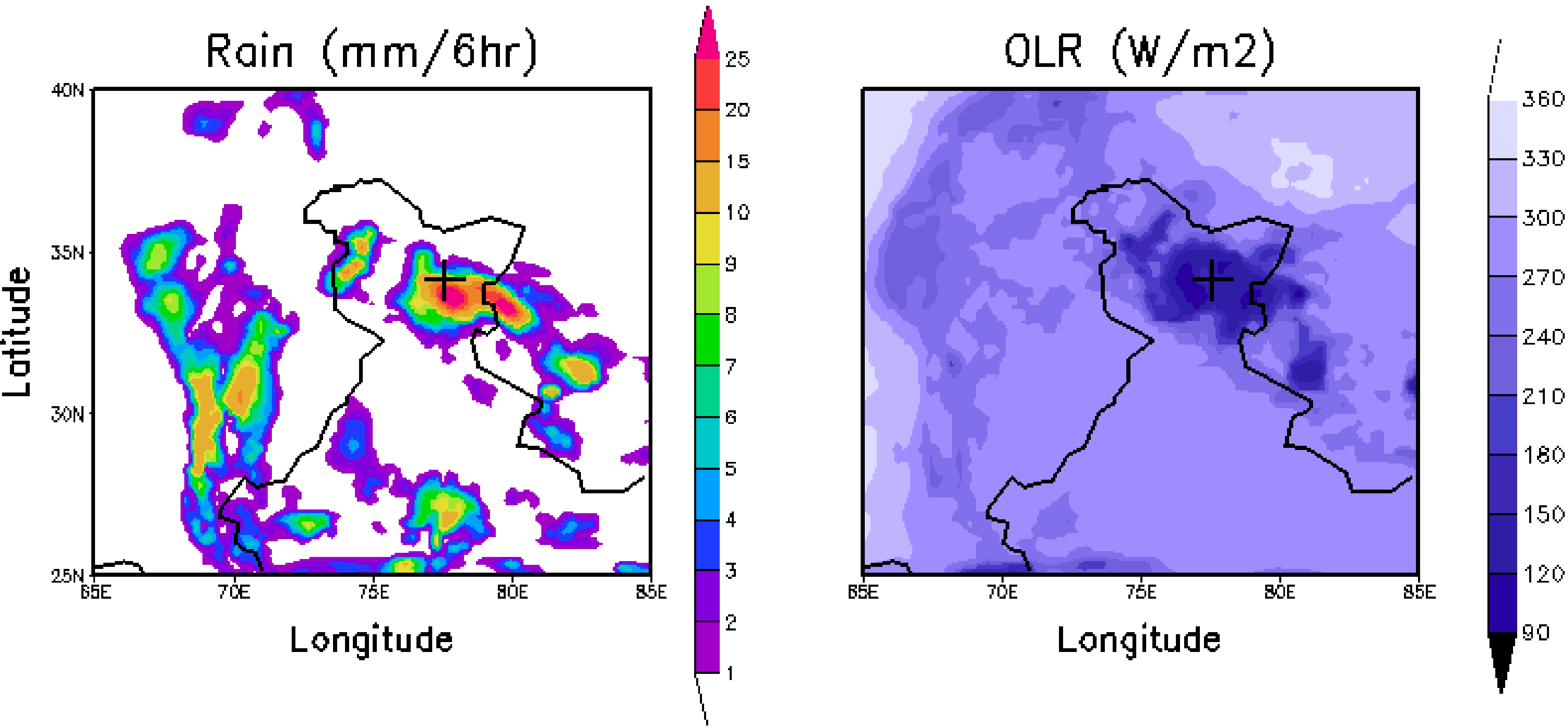
Map Projection: Lambert Conformal

Leh Cloudburst 04AUG2010 11:30IST



This simulation has been brought to you by Lab-315, School of Environmental Sciences, Jawaharlal Nehru University
(Dr. A. P. Dimri, Pyarimohan Maharana, Amulya Chevuturi)

Leh Cloudburst 04AUG2010 11:30IST



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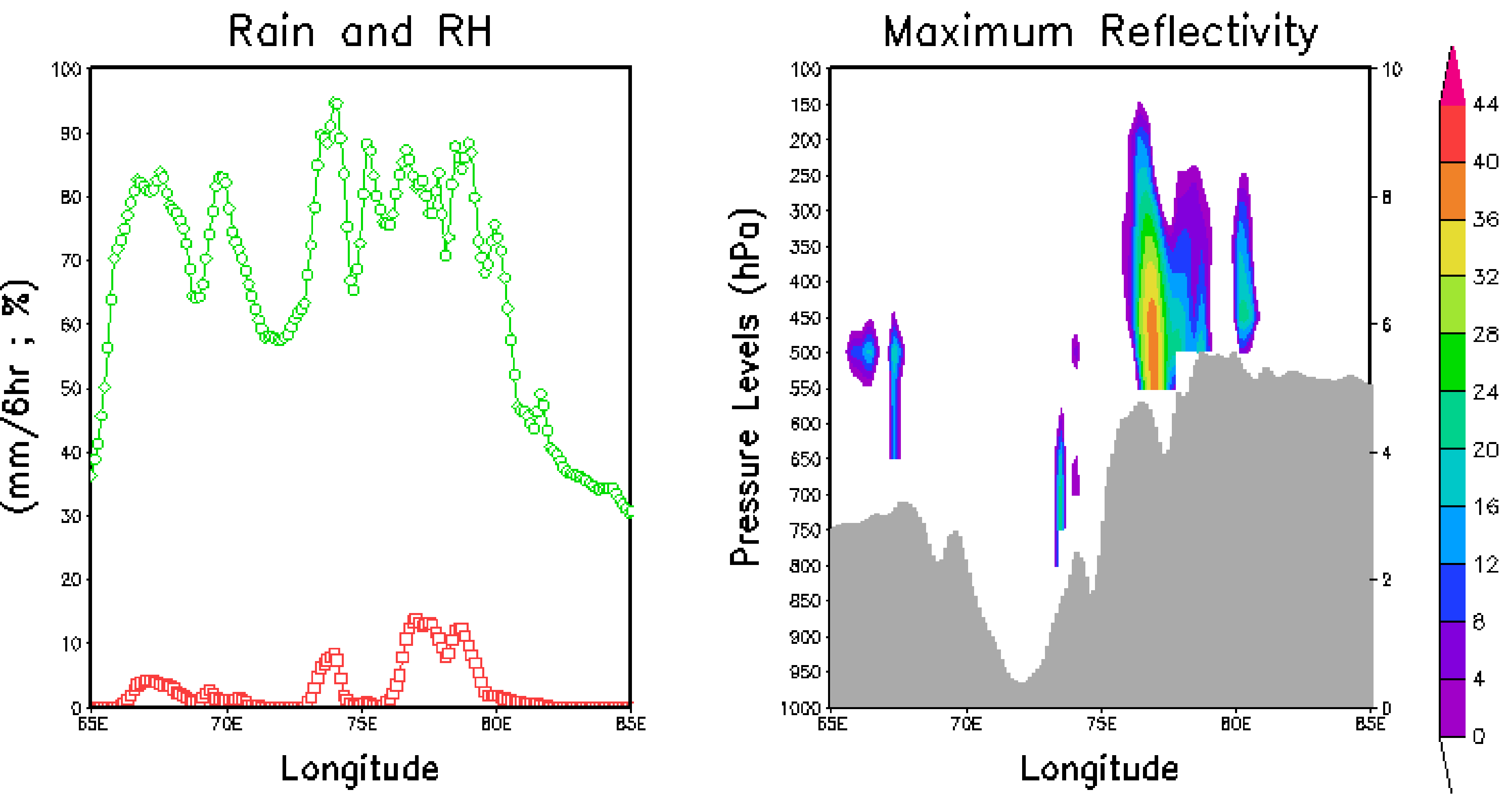

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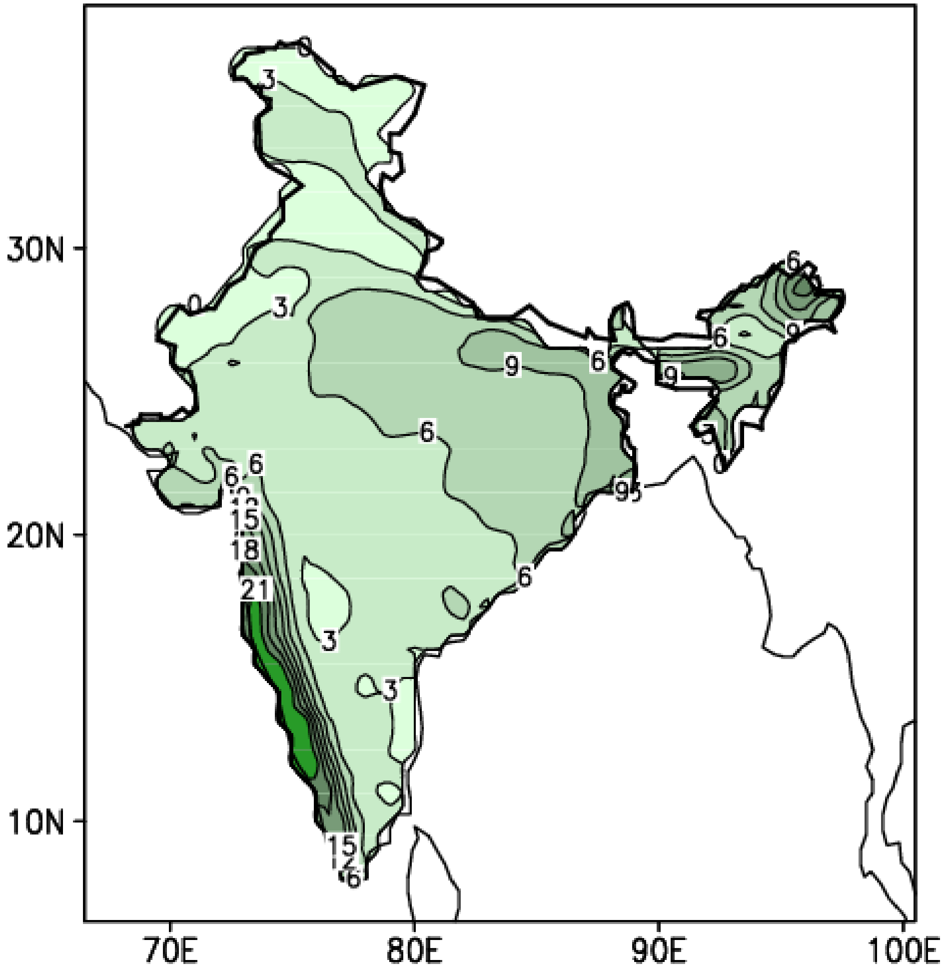
INDIAN SUMMER MONSOON



Model and Reanalysis datasets are used to understand ISM

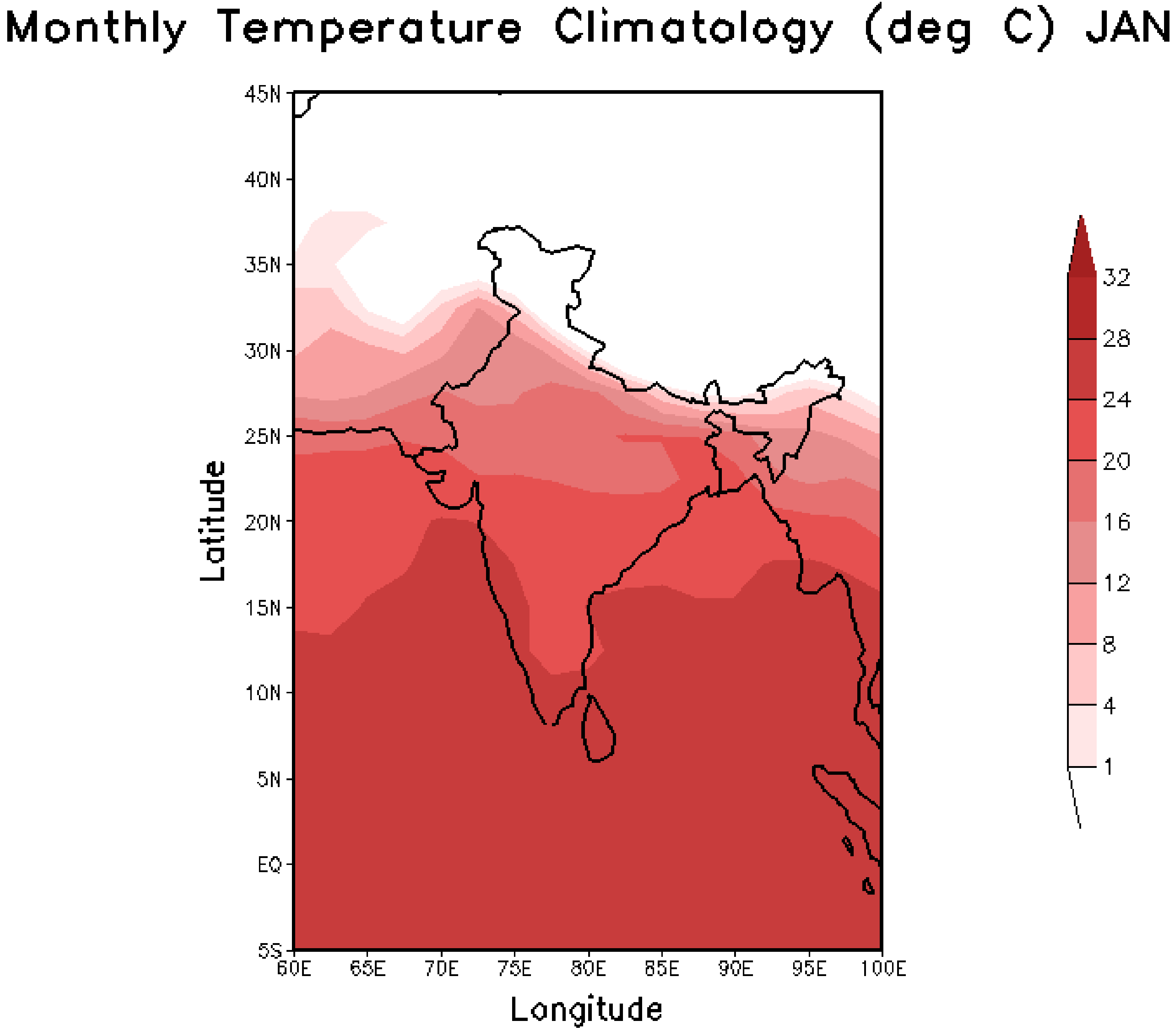
Domain – Indian region

Run: 1989-2005

Spatial Resolution: 0.5km

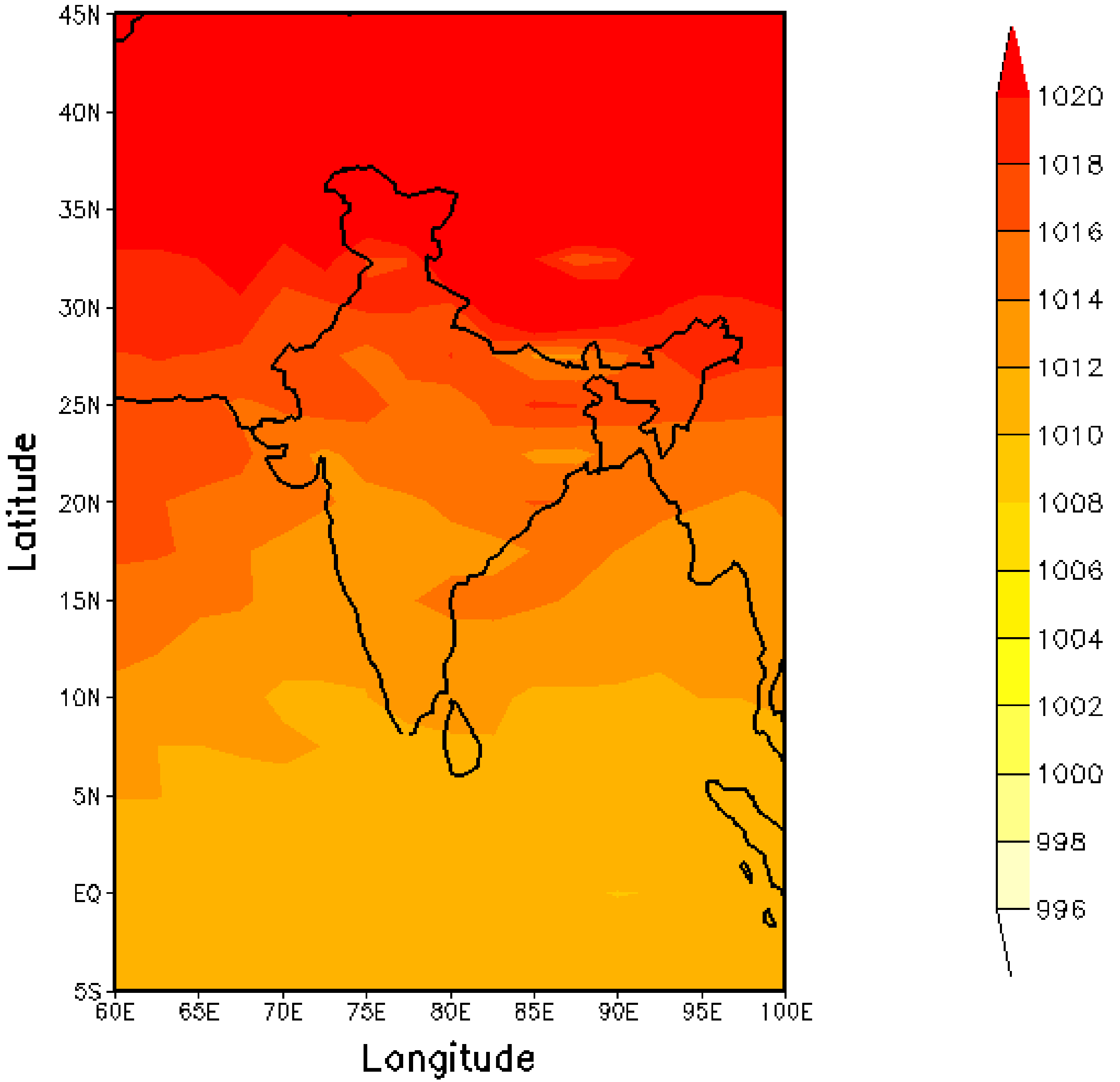
Temporal Resolution: 1 month

Map Projection: Normal Meractor

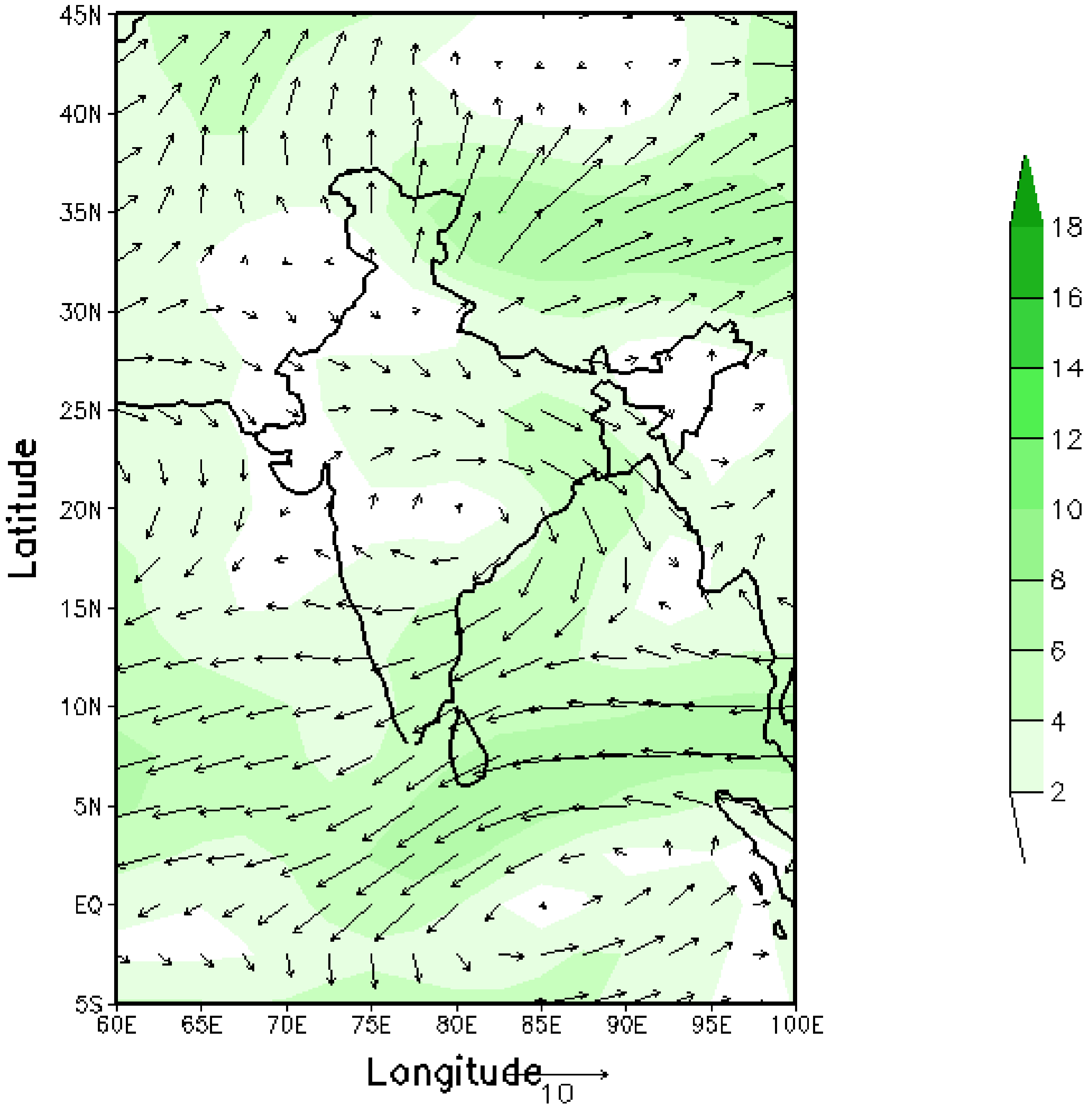


Monthly Temperature Climatology (deg C) JAN
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
60E
65E
70E
75E
80E
85E
90E
95E
100E
Latitude
Longitude
32
28
24
20
16
12
8
4
1

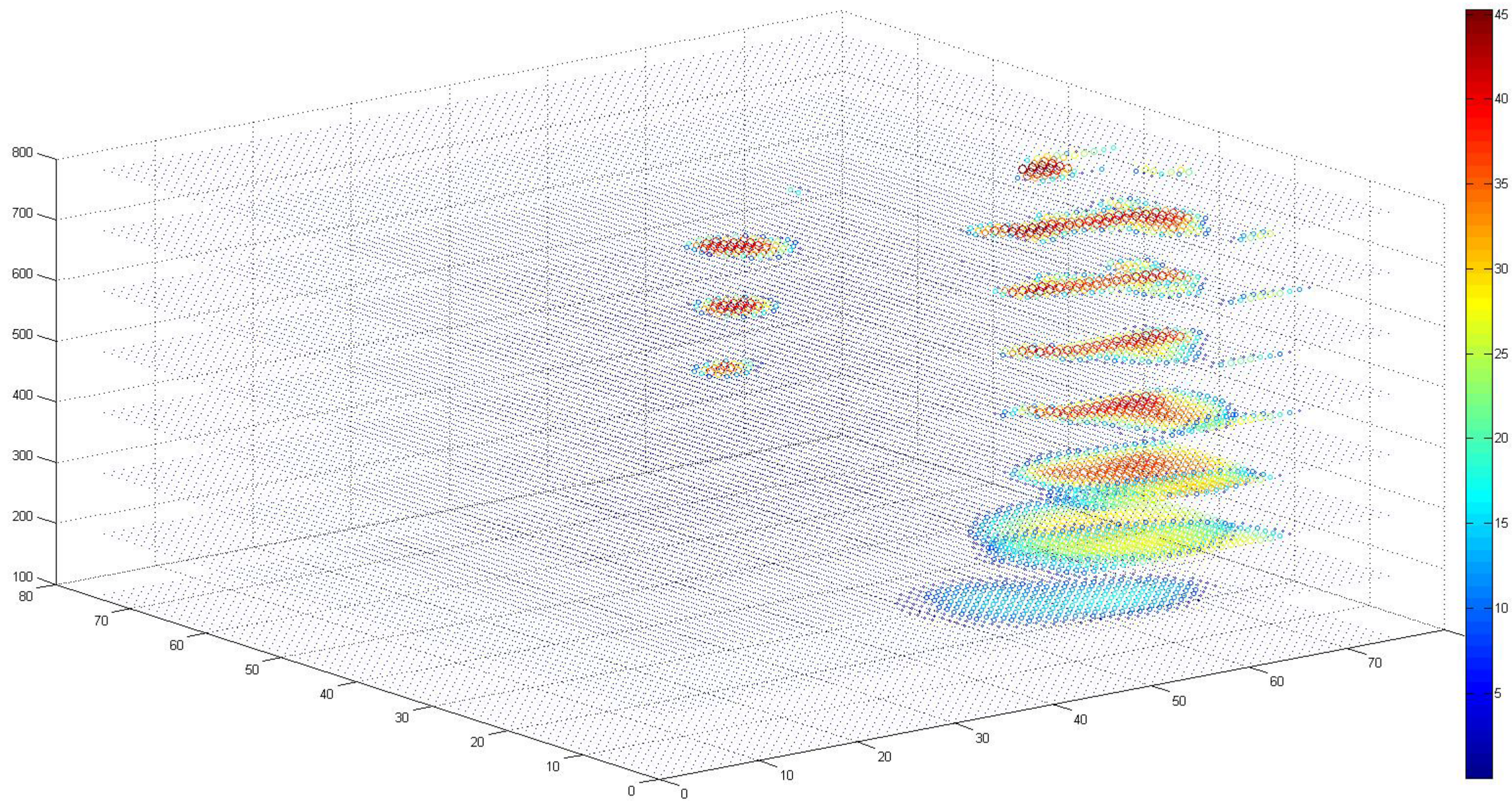
Monthly Sea Level Pressure Climatology (hPa) JAN



Monthly Wind Climatology at 850hPa (m/s) JAN



GRIDDED DATA VISUALIZATION



800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
45
40
35
30
25
20
15
10
5

VISUALIZATION OF GRIDDED DATA

The Grid Analysis and Display System (GrADS) is an interactive tool for the access, manipulation, analysis and display of earth science data.

It implements a 4-D data model, where the dimensions are usually latitude, longitude, vertical level and time.

This helps in performing various research operations on the data and ultimately is used to provide an graphical output.

IMD DATA

Source: Rajeevan et al., 2008 <http://www.imd.gov.in/>

```
DSET ^rf0.5_2005.grd
*options byteswapped template
*options template
TITLE 0.5 degr analyzed normal grids
UNDEF -999.0
XDEF  69  LINEAR  66.5 0.5
YDEF  65  LINEAR  6.5 0.5
ZDEF   1 linear 1 1
TDEF 365 LINEAR 1jan2005 1DY
* FOR LEAP YEARS CHANGE NO. OF RECORDS TO 366 *
VARS  1
rf 0 99 GRIDDED RAINFALL
ENDVARS
```

APHRODITES’ DATA

Source: Yatagai et al., 2004 < http://www.chikyu.ac.jp/precip/>

```
dset      ^APHRO_MA_025deg_V1003R1.2007
undef      -99.9
options    little_endian template
title      APHRO_MA V1003R1 daily precipitation with 0.25deg grids
xdef   360 linear  60.125 0.25
ydef   280 linear -14.875 0.25
zdef     1 levels 1
tdef 365 linear 01jan2007 1dy
*
vars 2
precip  1 00 daily precipitation analysis interpolated onto 0.25deg grids
     [mm/day]
rstn    1 00 ratio of 0.05deg-grids with station [%]
endvars
```

OLR DATA

Source: Liebmann B. and C.A. Smith, 1996 < http://www.esrl.noaa.gov/psd/data/gridded/data.interp_OLR.html >

```
dset ^olr.day.mean.dat
undef 200000000000000000000.000000
options little_endian yrev
*
xdef 144 linear 0.000000 2.500000
*
ydef 73 linear -90.000000 2.500000
*
zdef 1 linear 1 1
*
tdef 14125 linear 01jun1974 24hr
*
vars 1
olr 0 99 Daily OLR [W/m^2]
endvars
```

SNOWCOVER DATA

Source: Kalnay et al., 1996 < http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.html>

```
dset ^snowcover.mon.mean.dat
undef 200000000000000000000.000000
options little_endian yrev
*
xdef 360 linear 0.500000 1.000000
*
ydef 90 linear 0.500000 1.000000
*
zdef 1 linear 1 1
*
tdef 297 linear 01jan1971 744hr
*
vars 1
snowcover 0 99 Monthly Means Snowcover Extent [%]
endvars
```

For further queries: amulya.chevuturi@gmail.com; maharanapyarimohan@gmail.com

THANK YOU