

The Impact, Mitigation and Adaptation to Climate Change in Sri Lanka



M. M. P. Mendis
Department of Meteorology
Sri Lanka

Variability of Seasonal Rainfall in Sri Lanka

Contribution of seasonal rainfall to annual total

Northeast Monsoon - 25%

Southwest Monsoon - 30%

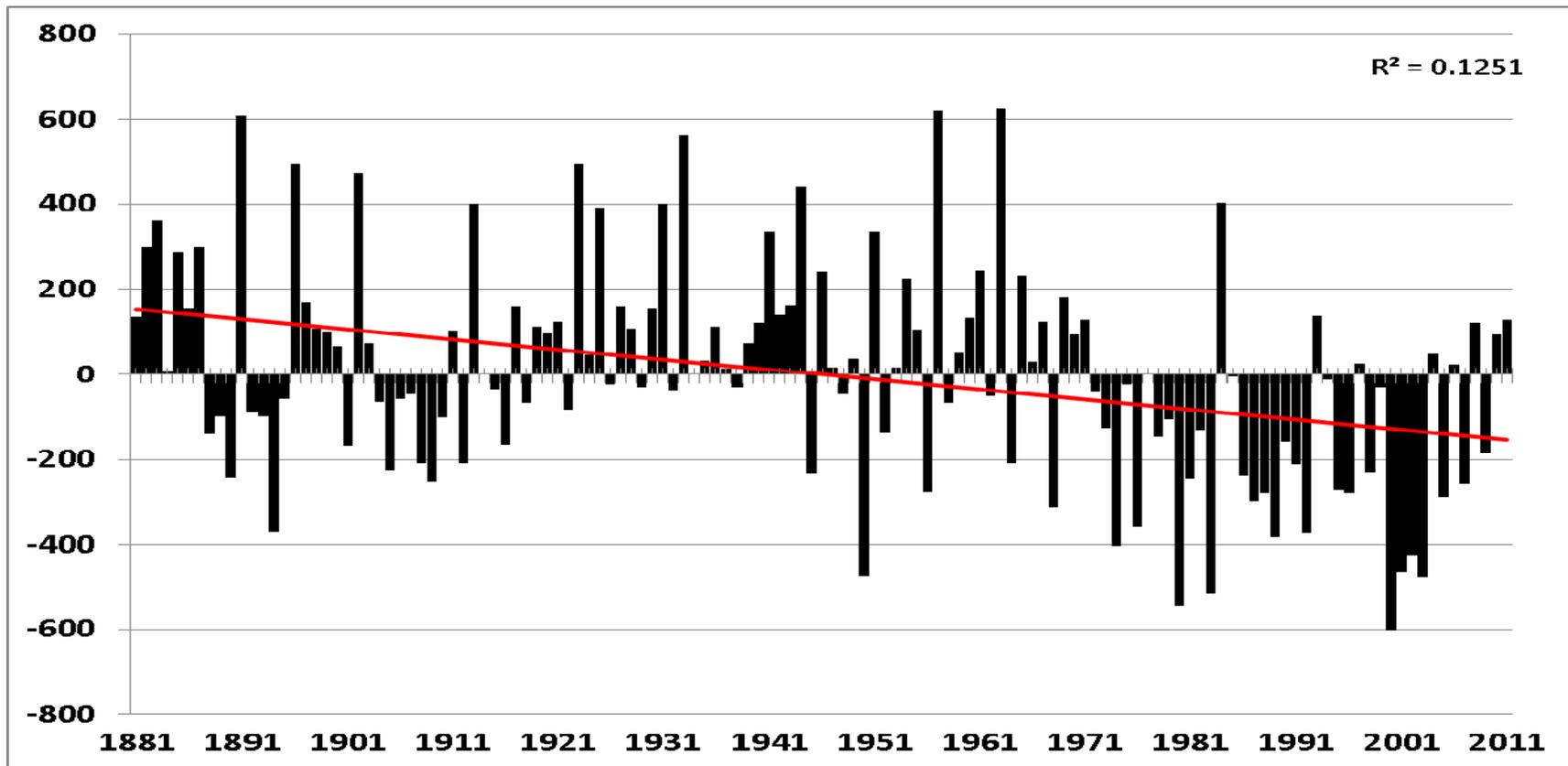
First Intermonsoon - 15%

Second Intermonsoon- 30%

	1901-1930	1931-1960	1961-1990	1991-2010	1881-2010
Northeast Monsoon	529(27%)	582(32%)	459(44%)	459(44%)	517(37%)
Southwest Monsoon	548(22%)	541(22%)	534(17%)	470(22%)	534(22%)
First Intermonsoon	268(33%)	301(23%)	263(29%)	243(36%)	271(29%)
Second Intermonsoon	595(23%)	571(23%)	554(24%)	559(26%)	577(23%)
Annual	1936(10%)	1993(12%)	1813(15%)	1714(13%)	1896(13%)

Coeff. Variation (CV) within parenthesis

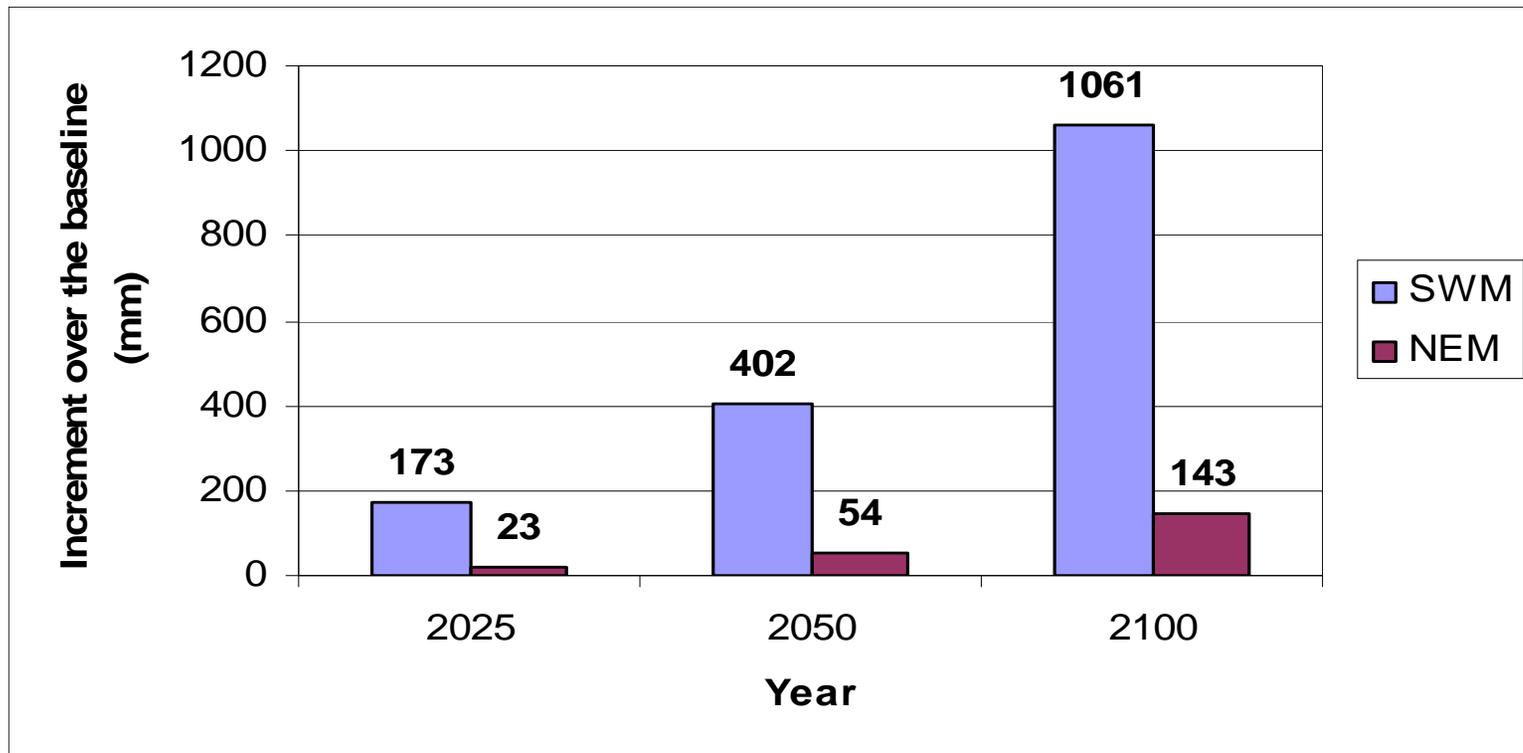
Observed Annual Rainfall – Sri Lanka



In general, a decreasing trend during the last 30 – 40 years

Future Scenarios

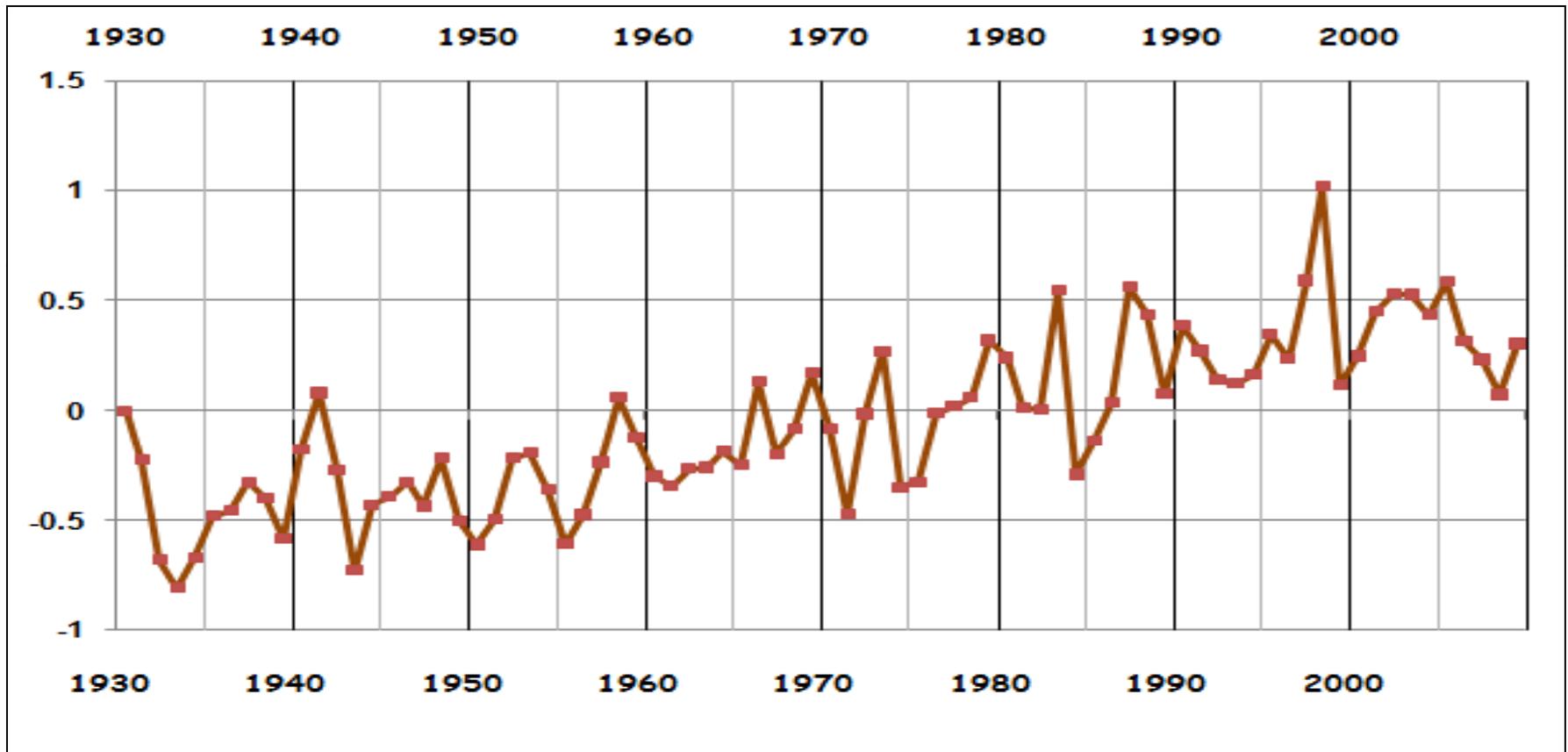
Rainfall Change Scenario under A₂ Storyline



HadCM3 (Hadley Centre Couple Model Version 3)

Observed Air Temperature in Sri Lanka (1931-2009):

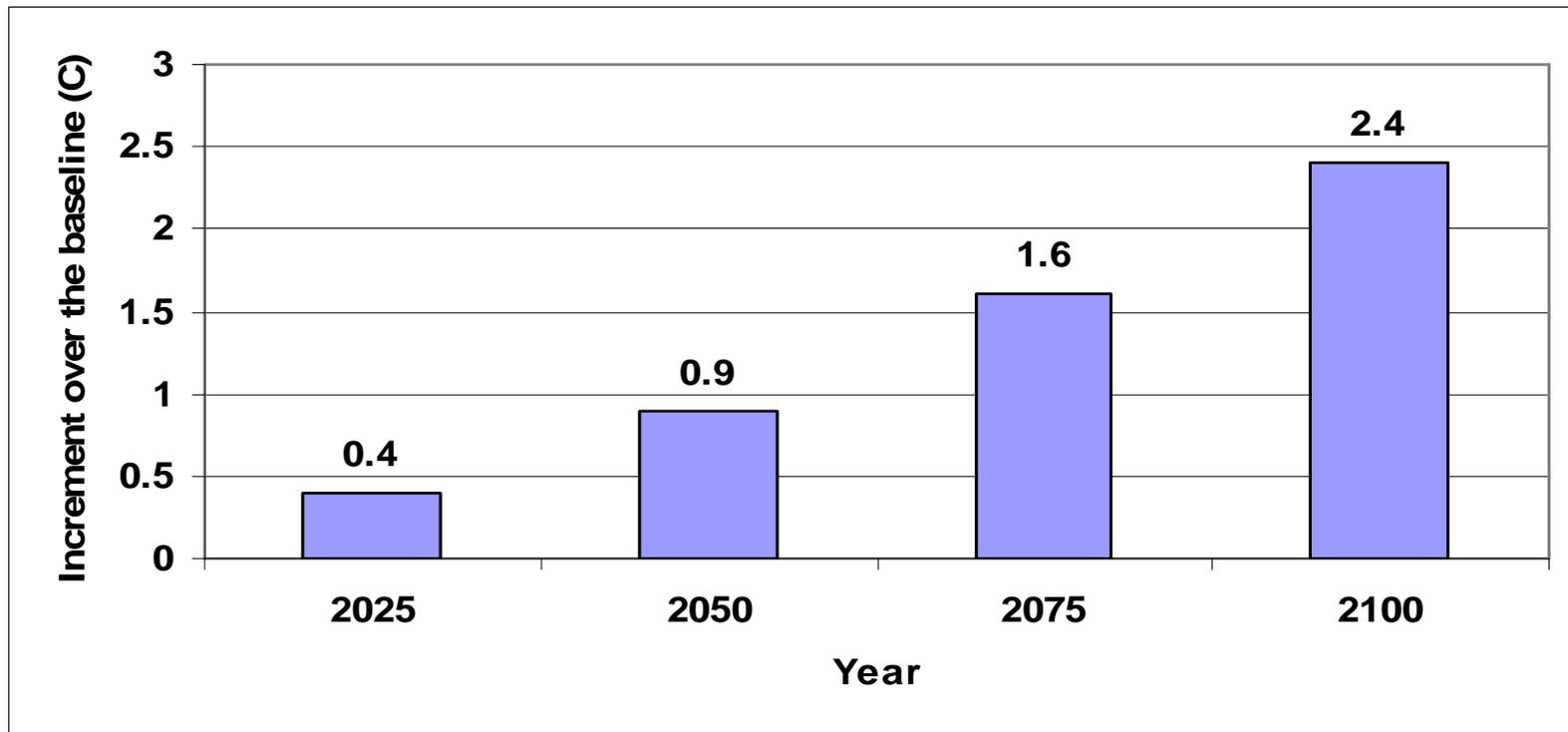
Since 1960, the average temperature rise is of the order of 0.16 °C per decade



During the same period global temp rise 0.13 °C per decade

Future Scenarios

Mean Temperature change scenario under A₂ Storyline (Annual)



HadCM3 (Hadley Centre Couple Model Version 3)

Future Scenarios

Projected increase in mean annual temperature by 2100 in Sri Lanka (base period 1961-1990 and A2 S/L)

Source	Model	Change in °C
Kumar et al., 2006	PRECIS	+2.5 to +4.0
Islam & Rehman, 2004	PRECIS	+2.5 to +4.0
Basnayake et al., 2004	Downscaling	+1.7 to +2.5
De Silva, 2006	Downscaling	+1.6 (by 2050)

General Consensus
SL will become increasingly warmer!
BUT magnitude of warming ?

Impacts of climate change in Sri Lanka

1. Increases in the frequency and intensity of droughts, floods and landslides
2. Variability and unpredictability of rainfall patterns
3. Increase in temperature
4. Sea level rise

Climate Extremes

Frequency of climate extremes, especially those related to rainfall has increased

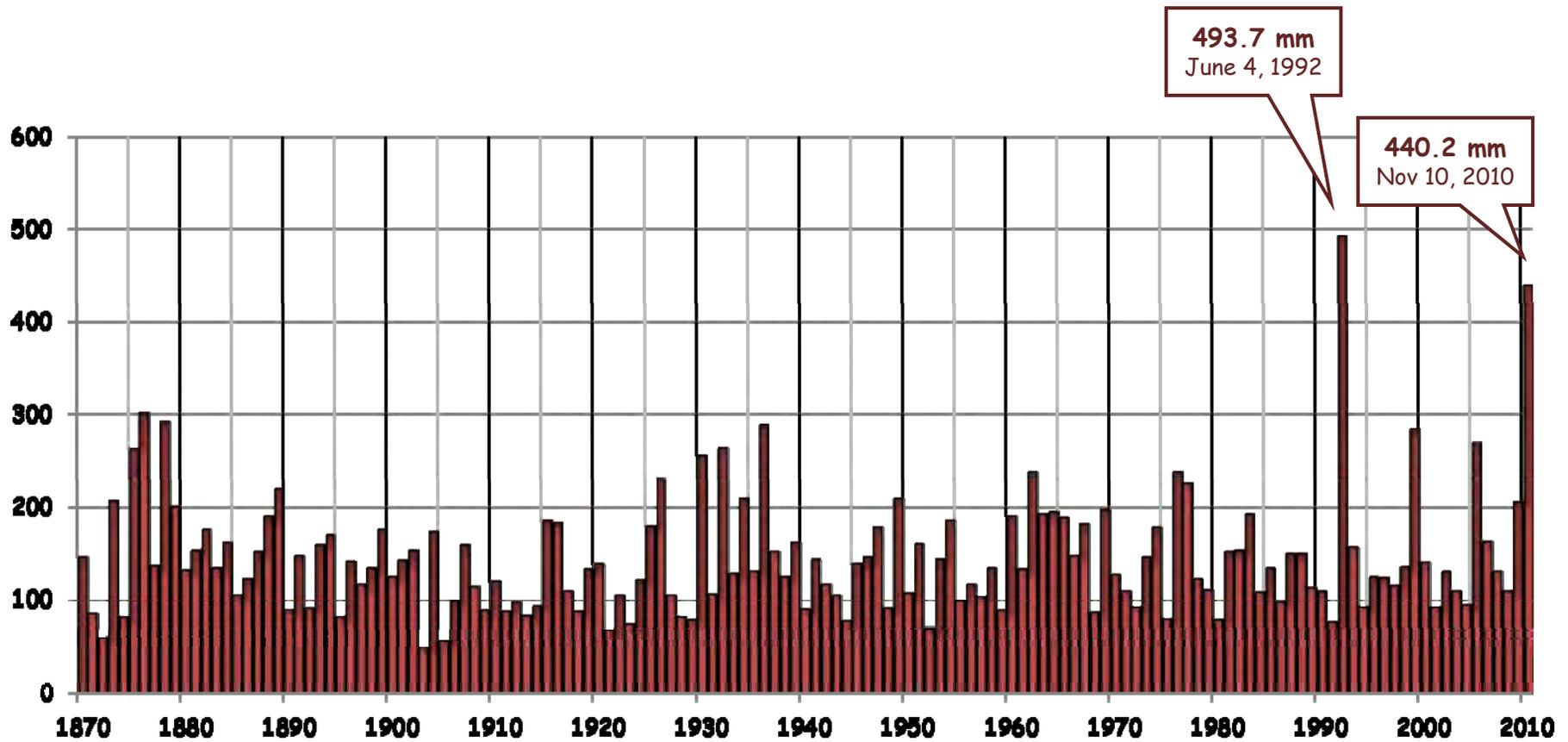
Some of the highest rainfalls have been experienced during the last two decades

e.g.	725 mm at Deniyaya	2003
	522 mm at Kudawa	2003
	493 mm at Colombo	1992
	440 mm at Colombo	2009
	338 mm at Ratnapura	2003
	337 mm at Kandy	2012
	316 mm at Kurunegala	2012

**Leading not only to Floods
But also to severe Landslides**
(a significant increase in landslides)



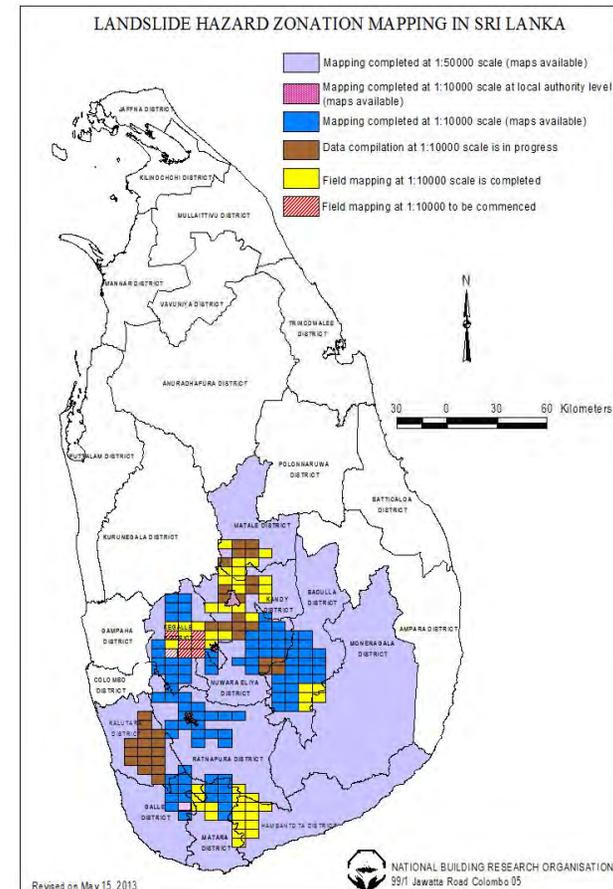
Highest 24H Rainfall in Colombo on yearly basis from 1869



Source: Department of Meteorology, 2010

More and more extreme rain events are experienced.

Landslide



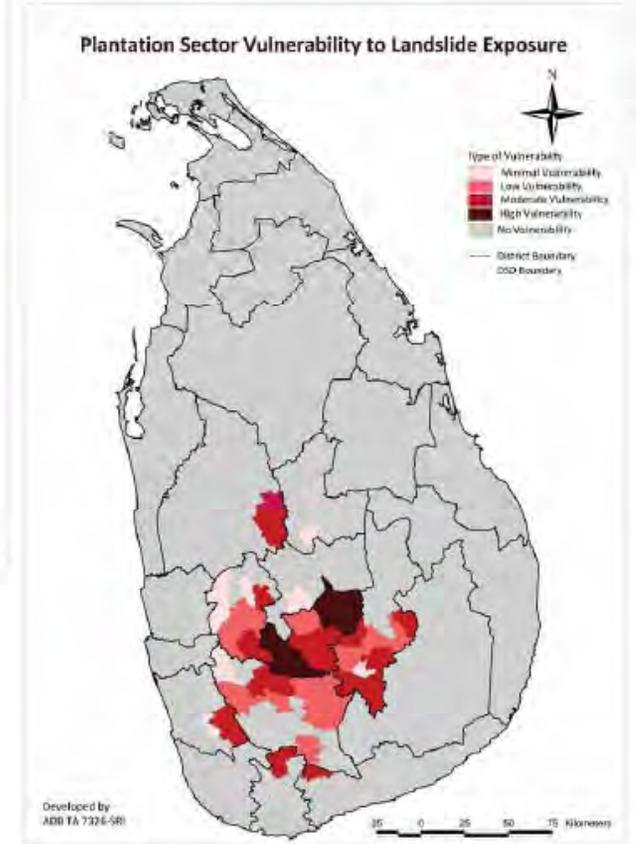
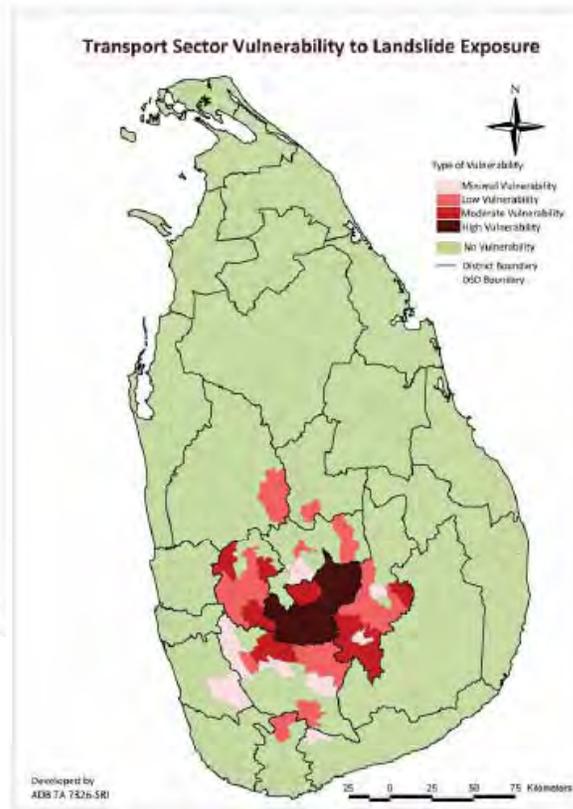
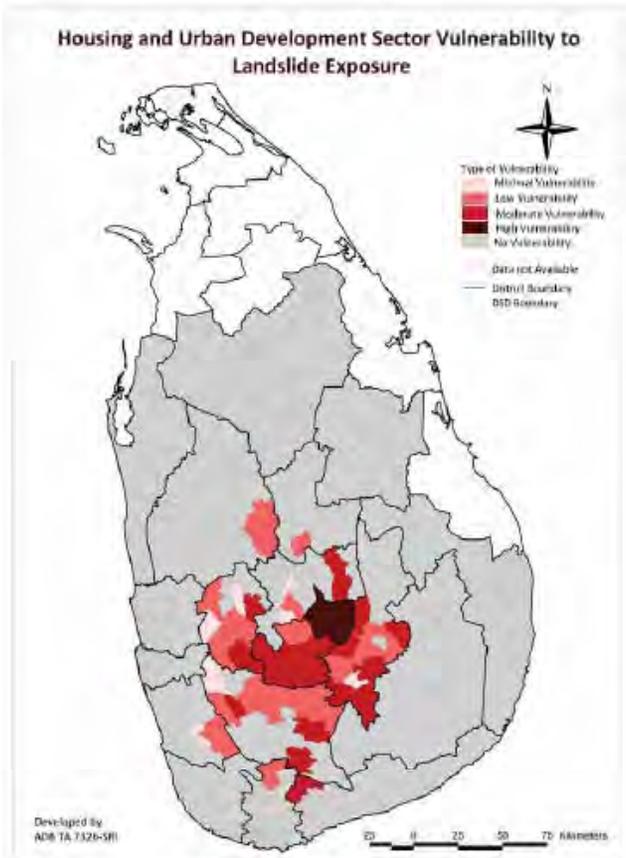
Main triggering mechanism for Landslides is exceptionally heavy rainfall

A significant increase in Landslide occurrences

10 districts out of 25 are vulnerable to landslide.

Almost 30% land area in Sri Lanka

Vulnerability to Landslides



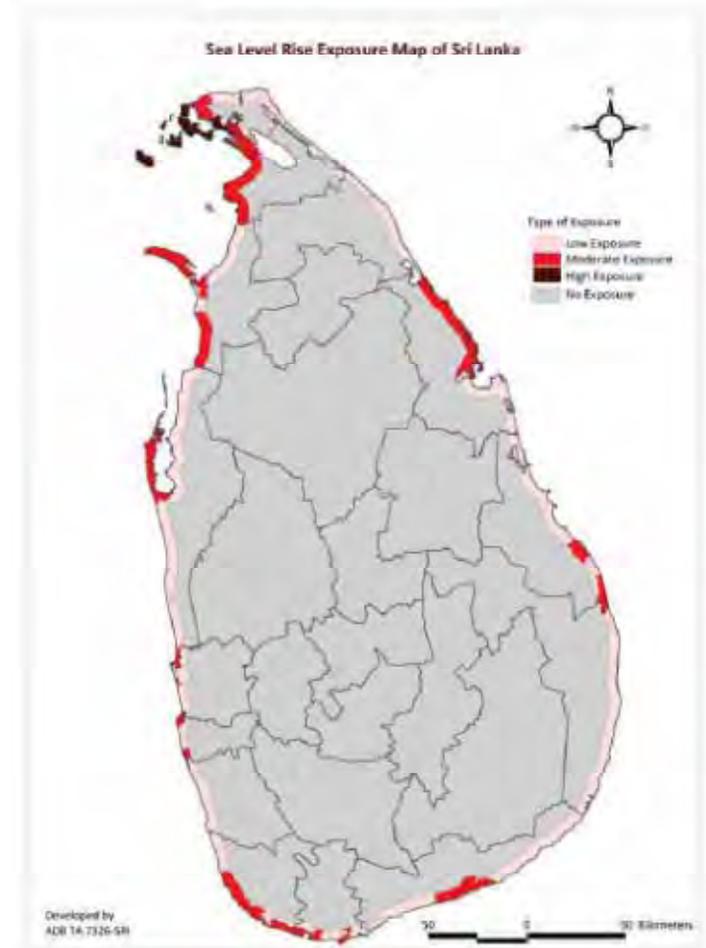
Source : Climate Change Secretariat – Ministry of Environment , Sri Lanka

Vulnerability to Sea Level Rise

Sri Lanka is presently experiencing an erosion rate of 0.30 – 0.35 m per year in 45% - 55% of the coastline

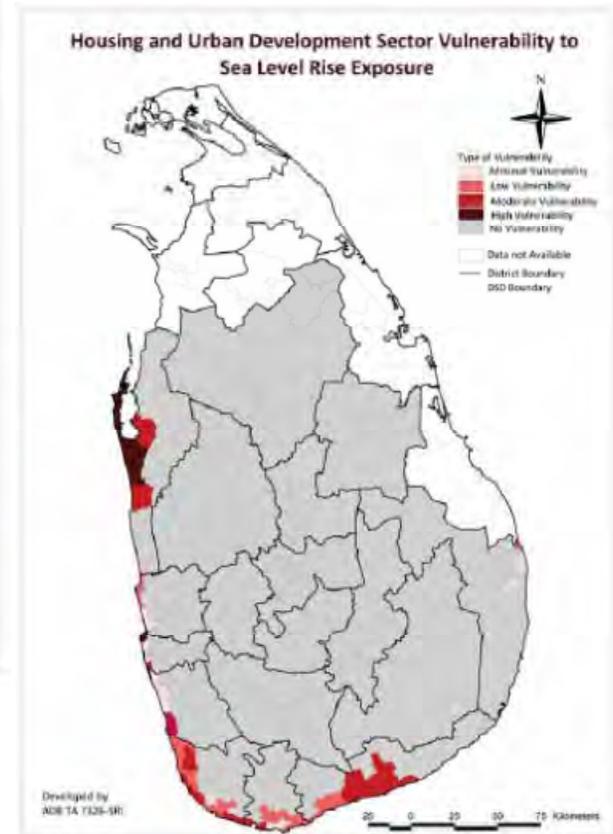
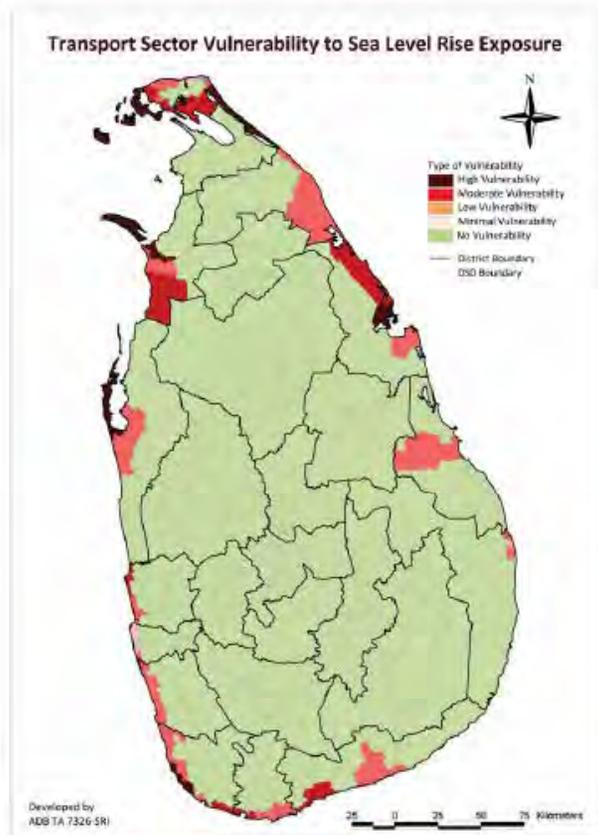
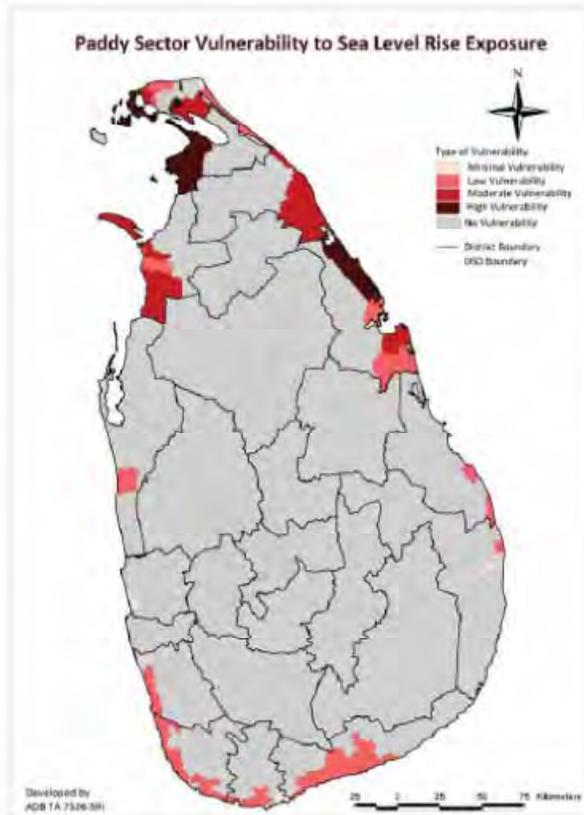
Coastal area in Sri Lanka consists of

- 24% of the land area
- 32% of the population
- 65% of the urbanized land area
- A significant extent of agricultural land



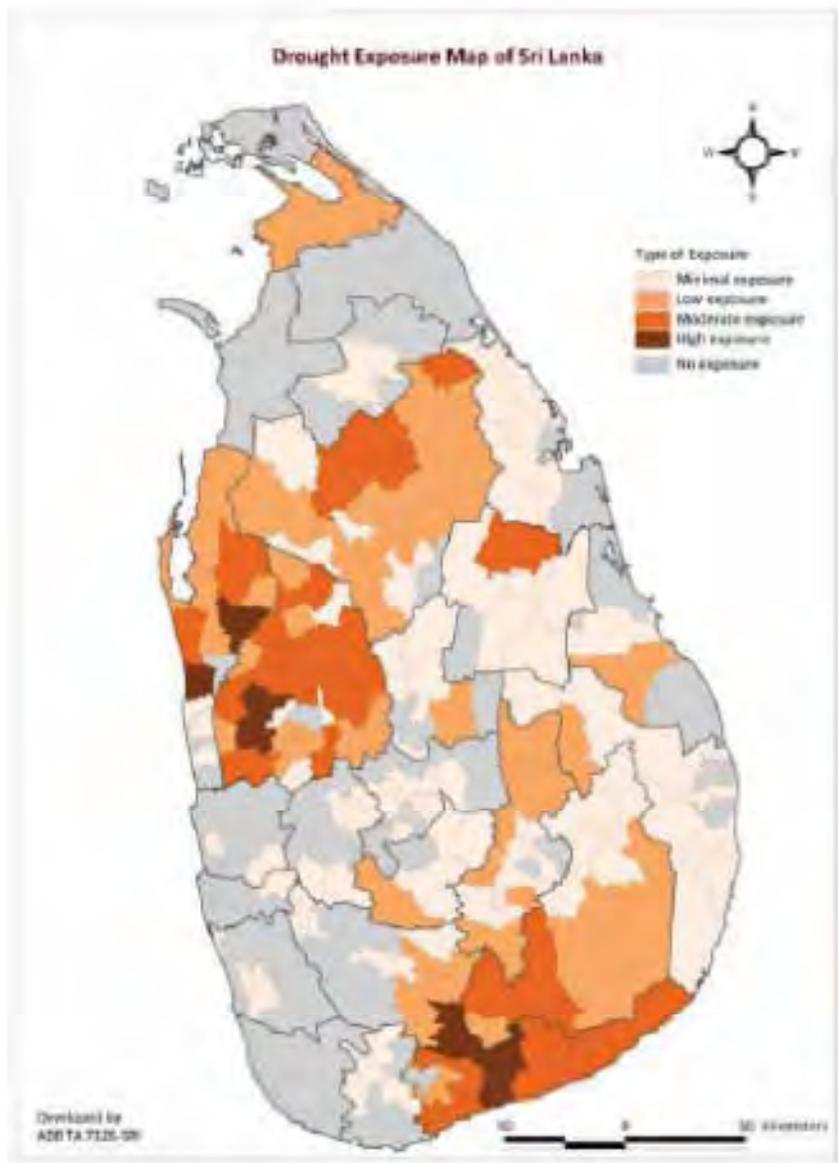
Sea Level Rise together with increased wave heights due to Climate Change can further increase coastal erosion.

Vulnerability to Sea Level Rise



Source : Climate Change Secretariat – Ministry of Environment , Sri Lanka

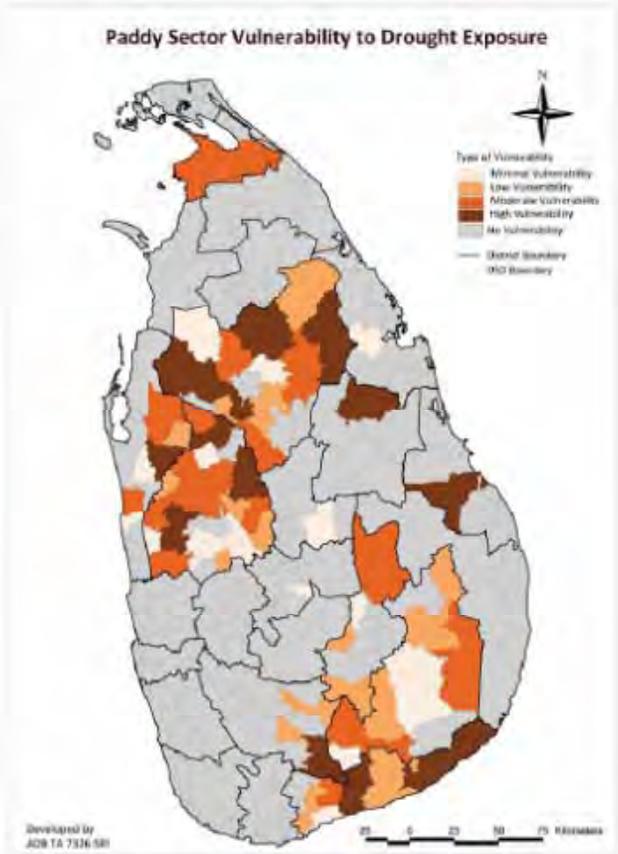
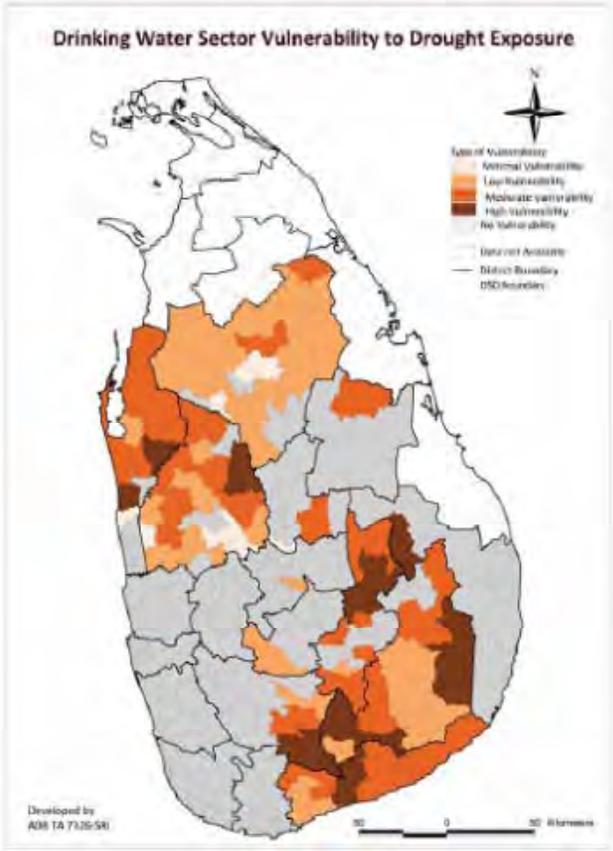
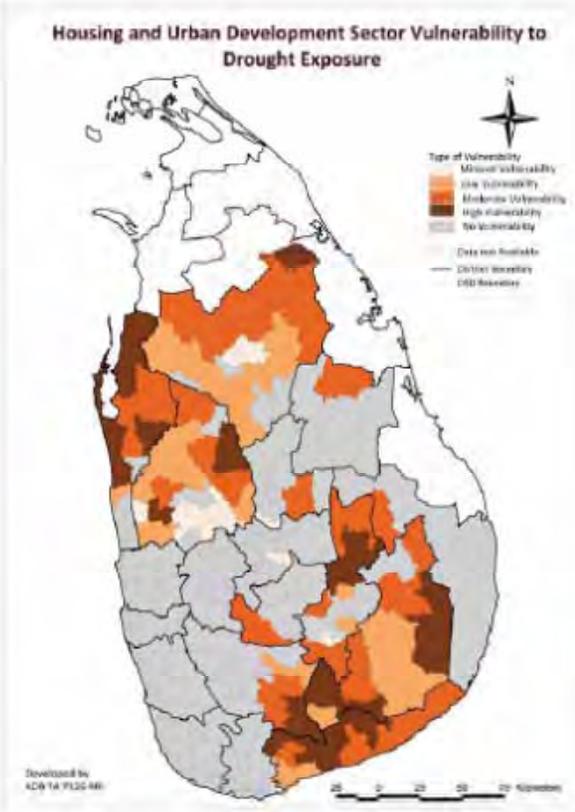
Increased Occurrence of Droughts



On average, Sri Lanka faces drought conditions every 3-4 years. However, in the recent few decades – more and more drought are experience



Vulnerability to Droughts

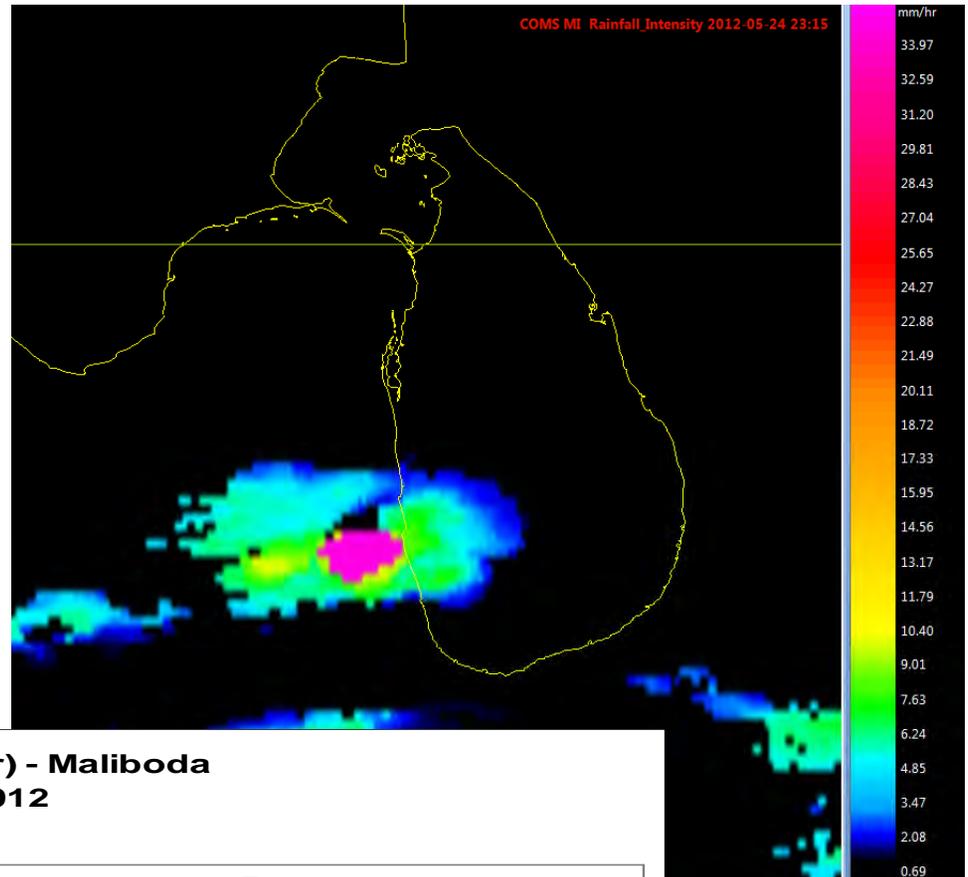
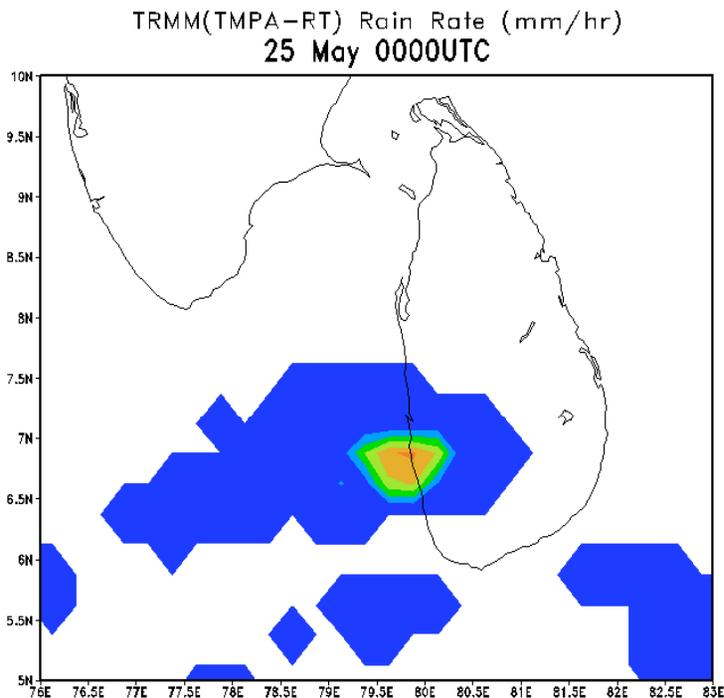


Source : Climate Change Secretariat – Ministry of Environment , Sri Lanka

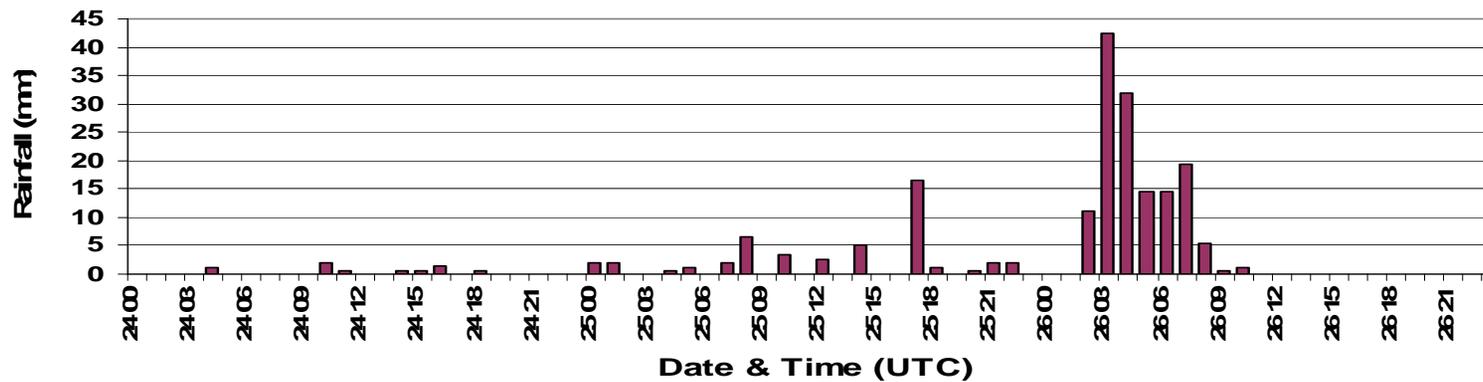
Use of Space Base Information to address Challengers of Climate Change

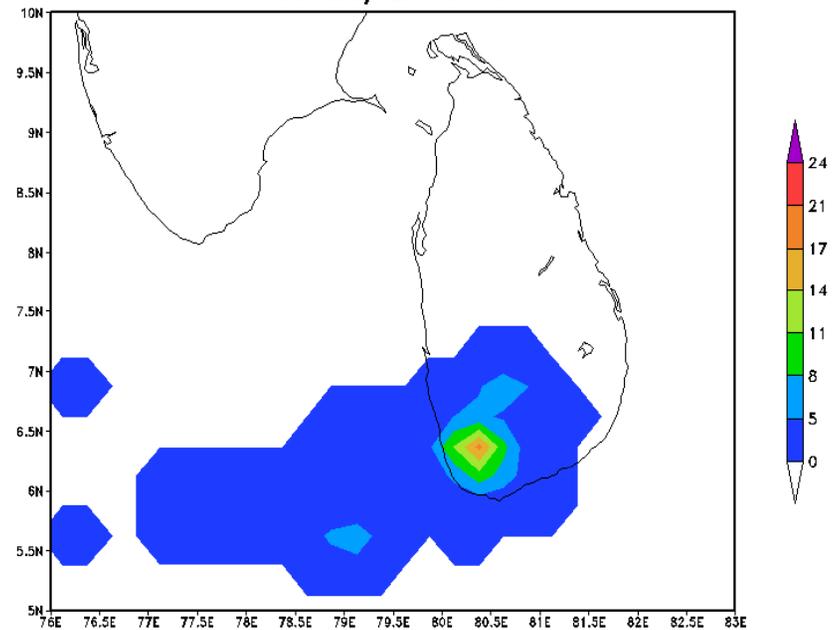
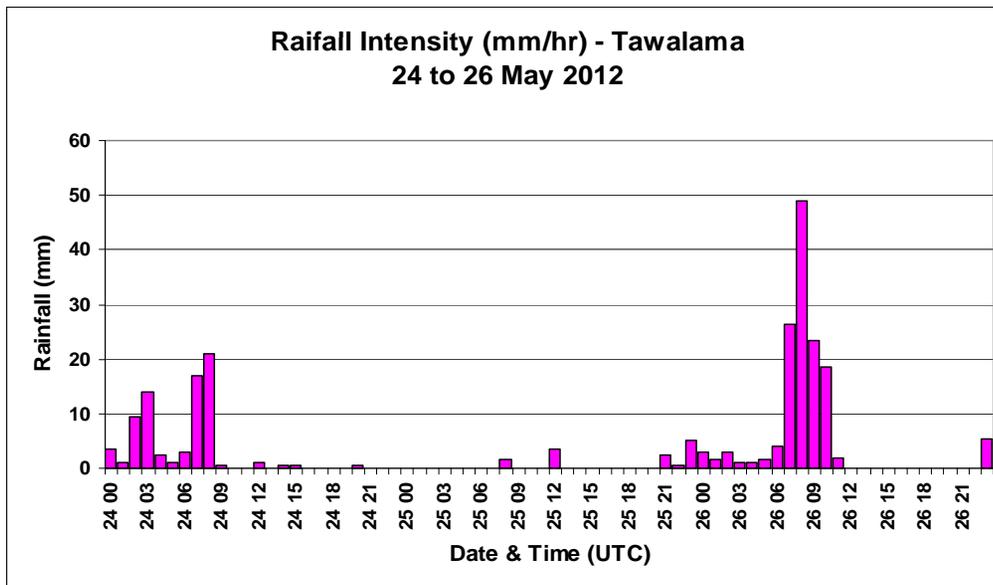
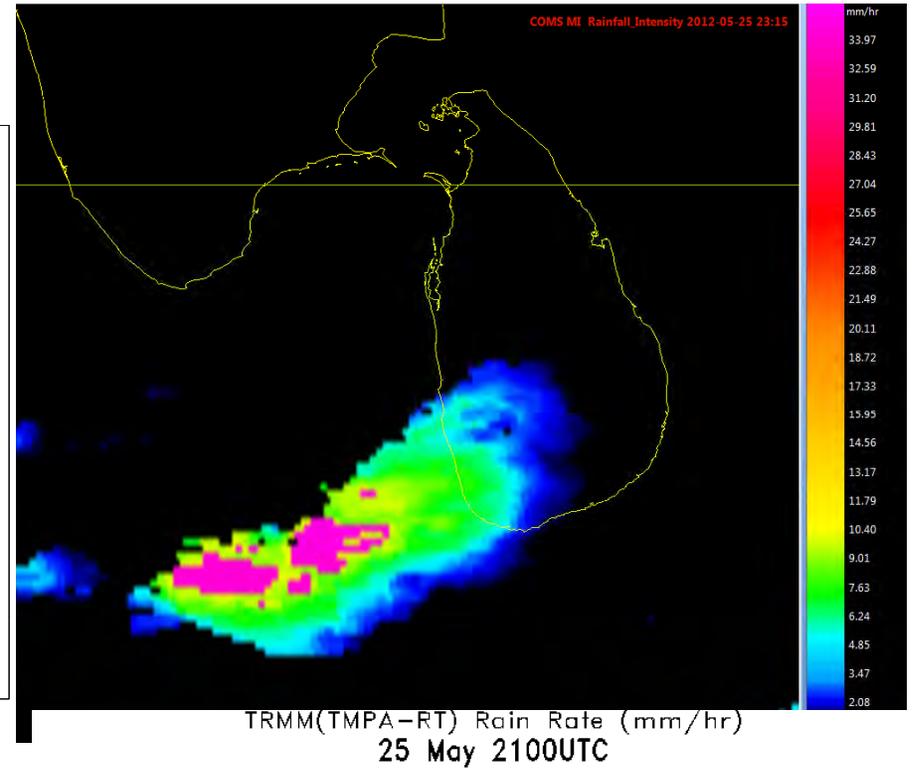
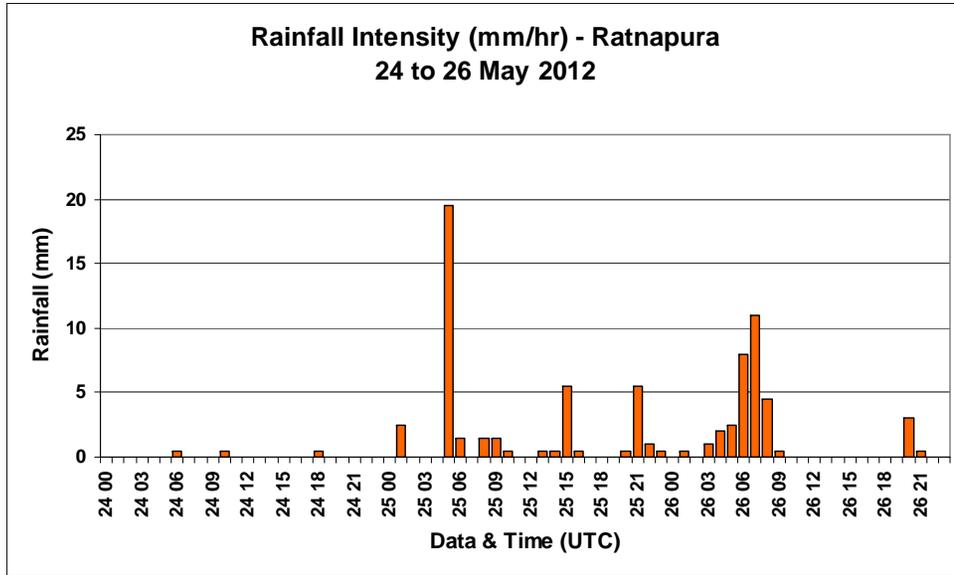
1. Identification of high intensity rainfall events
2. To study the variability of seasonal rainfall patterns

1. Identification of high intensity rainfall events



Rainfall Intensity (mm/hr) - Maliboda
24 to 26 May 2012

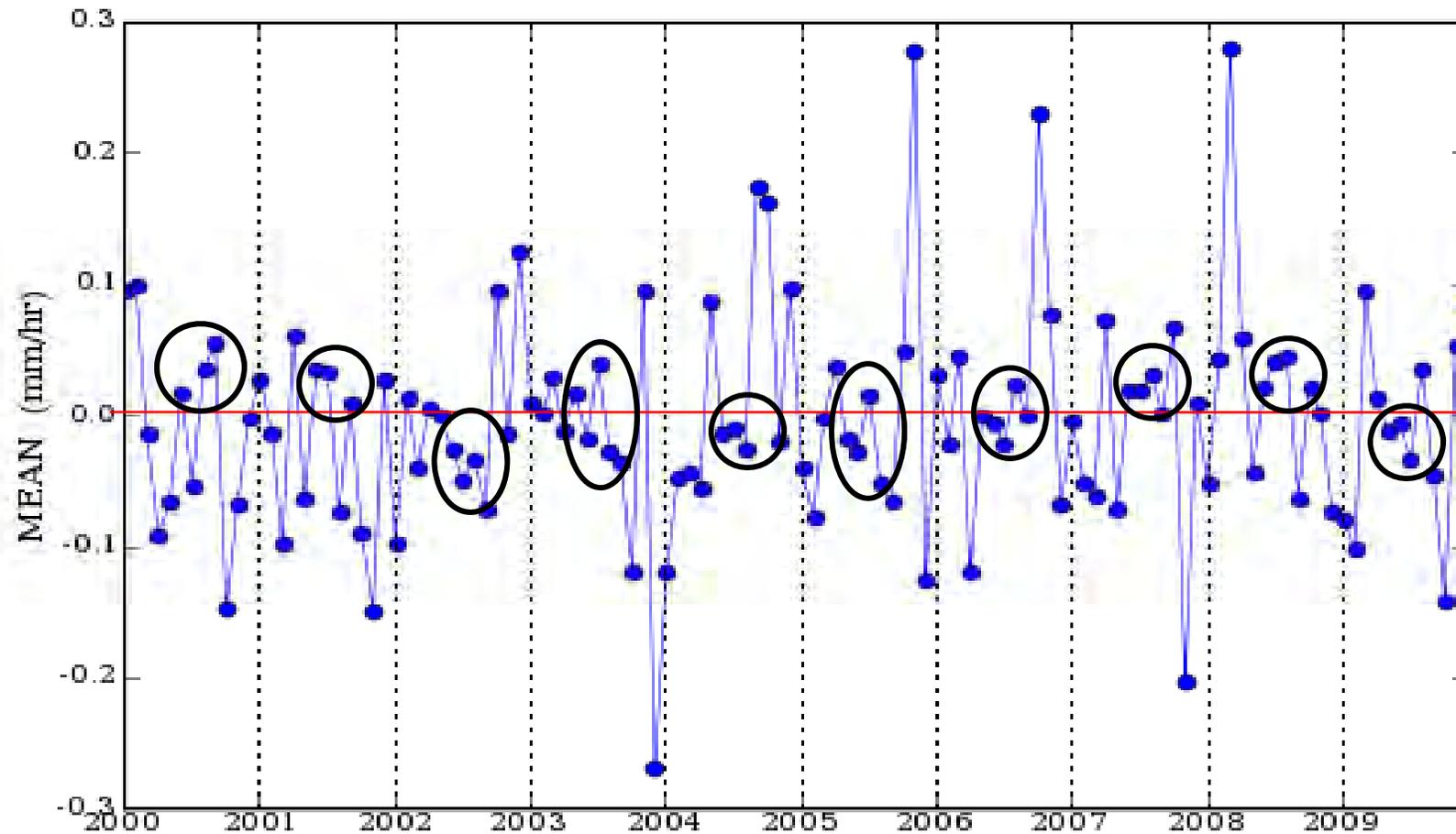




2. To study the variability of seasonal rainfall patterns

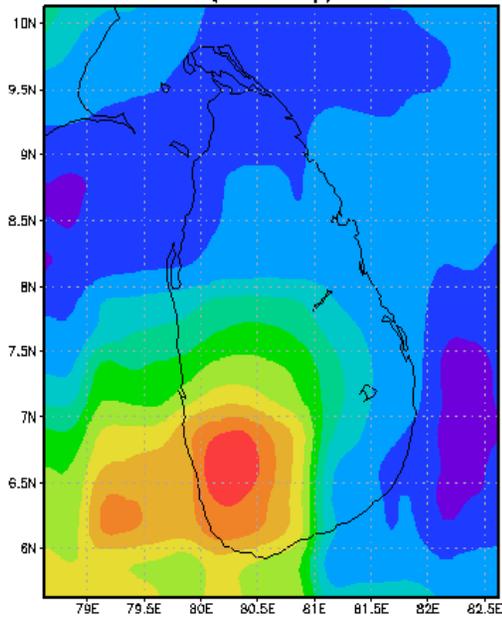
Time Series, Area Statistics
(Region: 79E-81E, 5N-9N)

Anomaly of Rain Rate

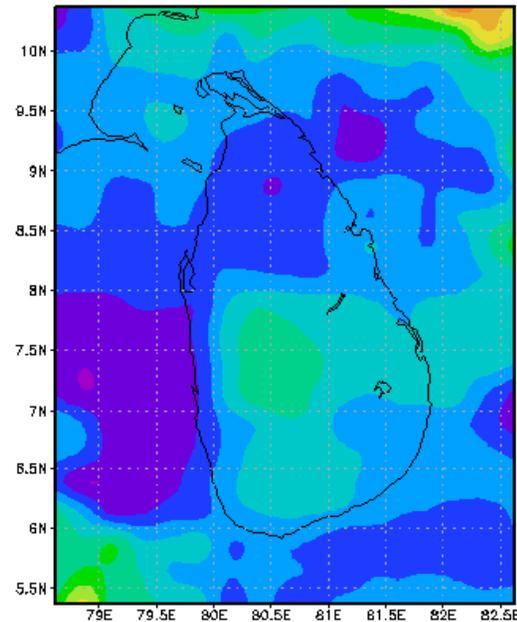


TRMM Level-3 Monthly Rain Rate Anomaly

TRMM 3B43 Climatology Rain Rate (mm/hr) Jun - Sept (1998-2012)

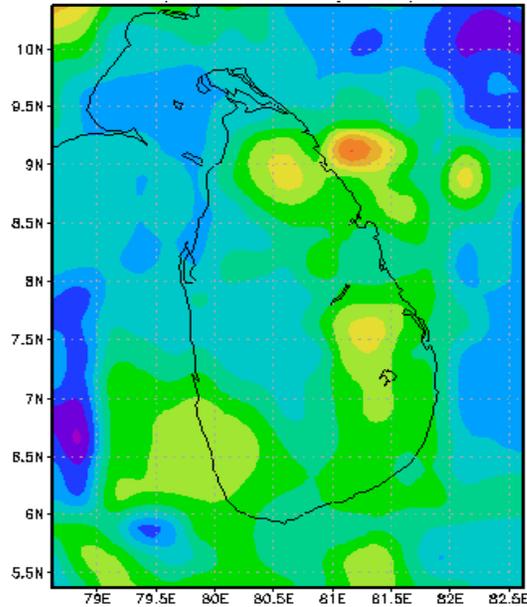


2010 (Jun - Sept) (mm/hr)

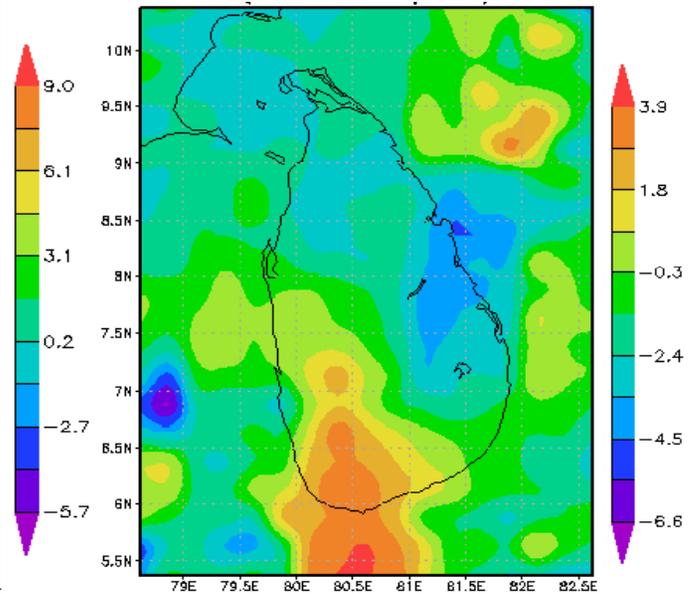


TRMM 3B43 Anomaly of Rain Rate

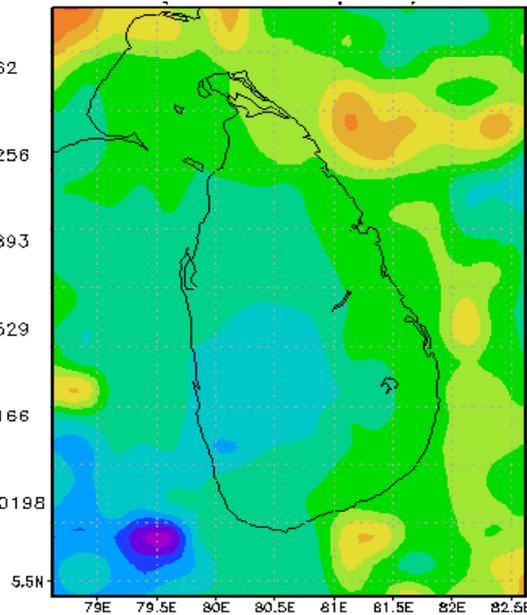
2008 (Jun - Sept) (mm/hr)x10⁻²



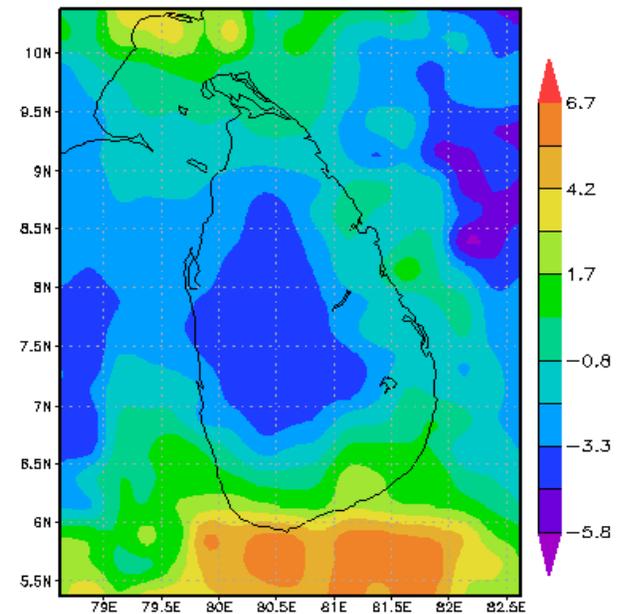
2009 (Jun - Sept) (mm/hr)x10⁻²



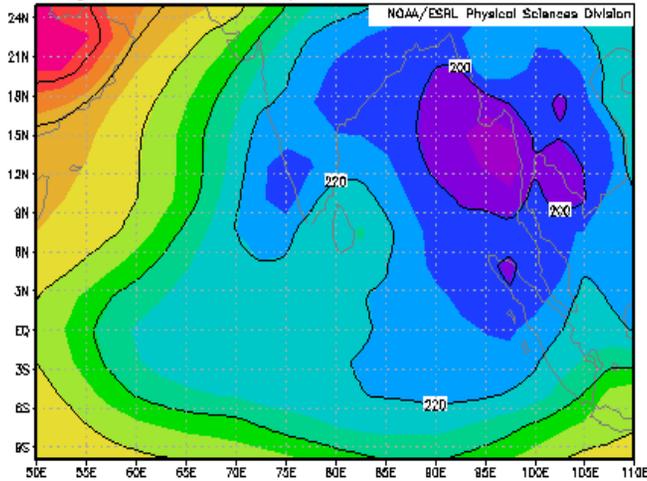
2011 (Jun - Sept) (mm/hr)x10⁻²



2012 (Jun - Sept) (mm/hr)x10⁻²

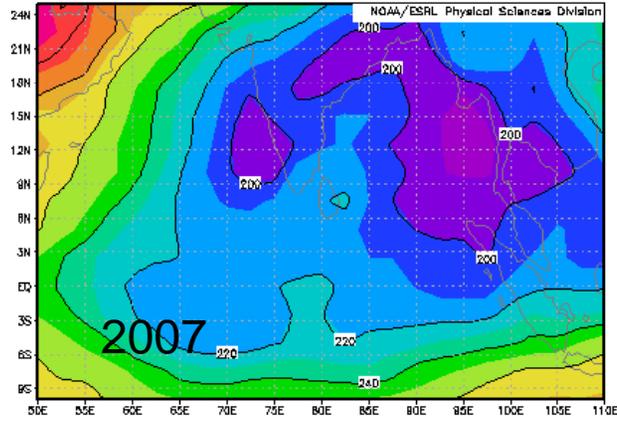


Long Term Mean $olr\ W/m^2$

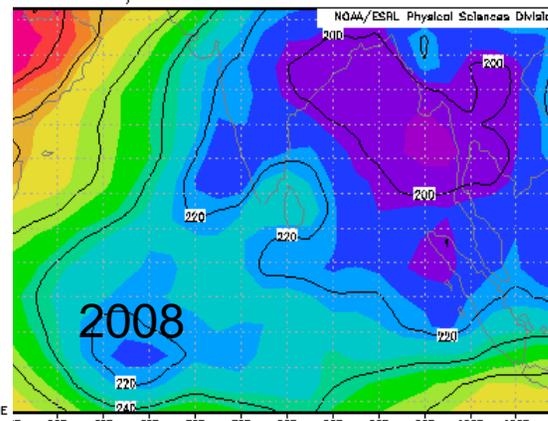


Monthly Outgoing Long wave Radiation (OLR) SWM season (Jun – Sept) Integrated Satellite data from NOAA/CPC

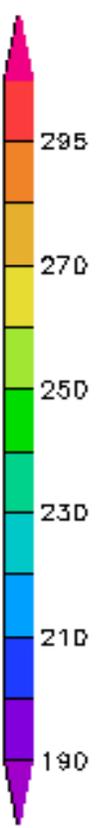
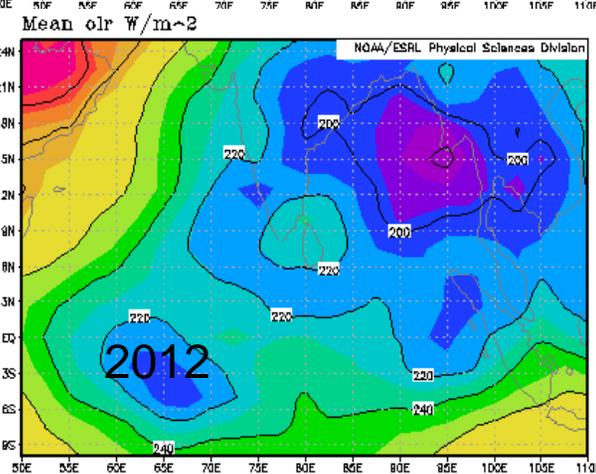
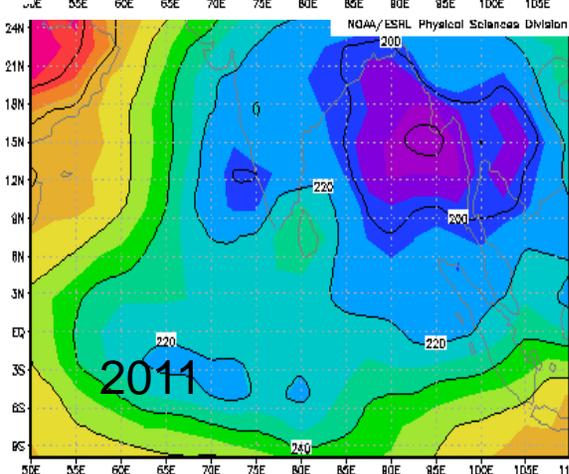
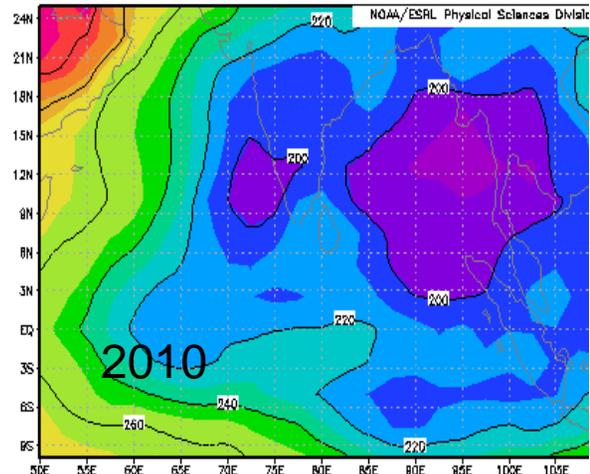
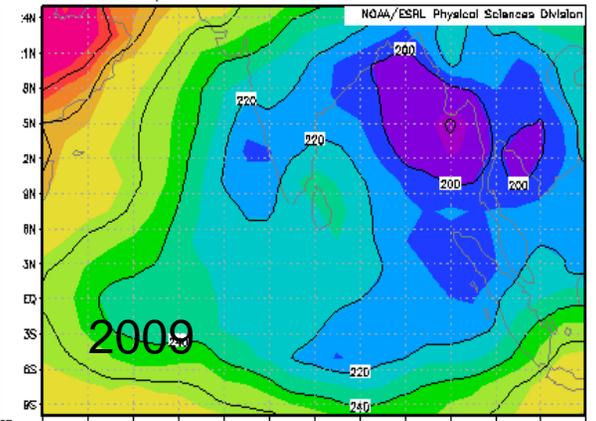
Mean $olr\ W/m^2$



Mean $olr\ W/m^2$

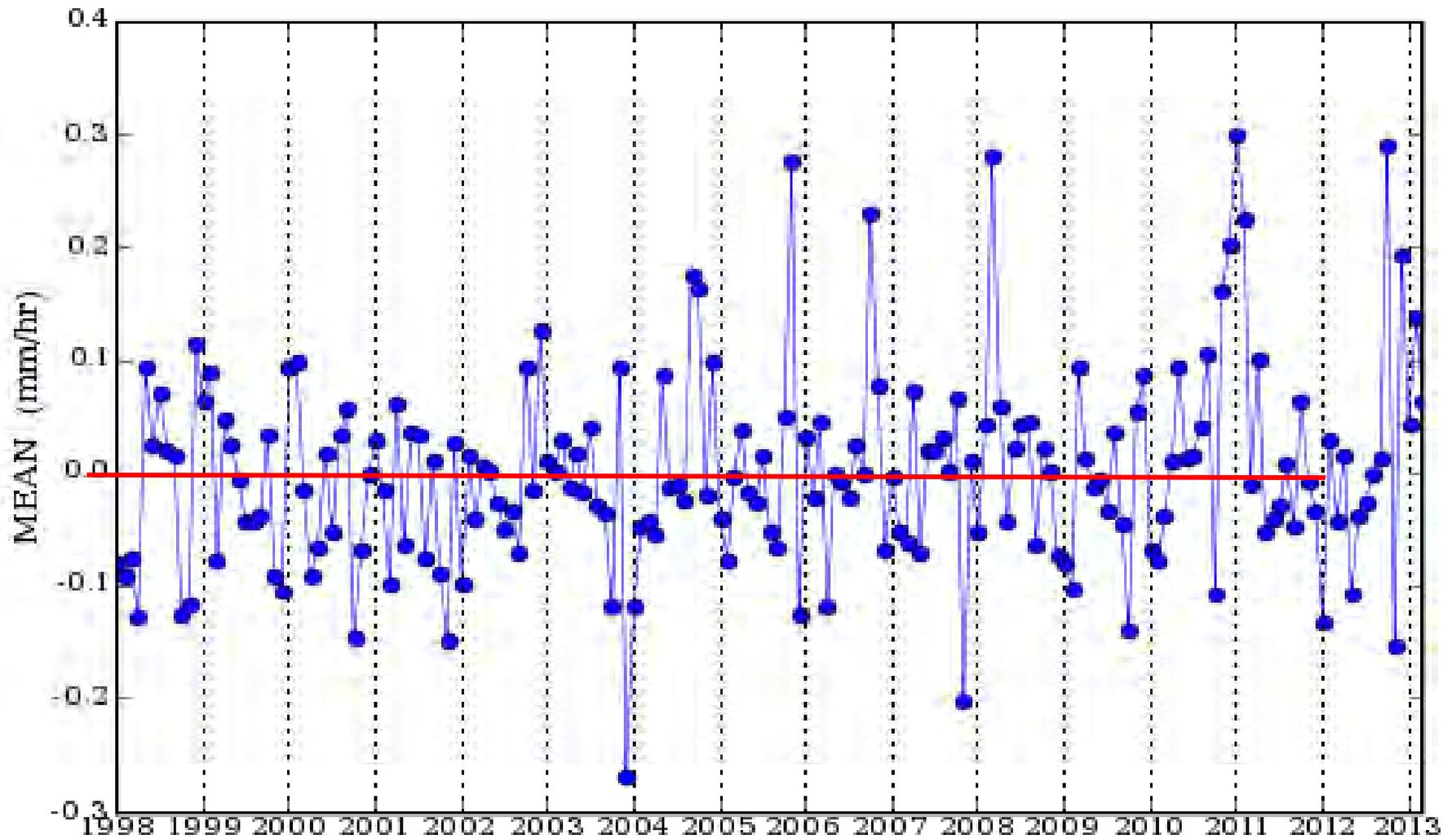


Mean $olr\ W/m^2$



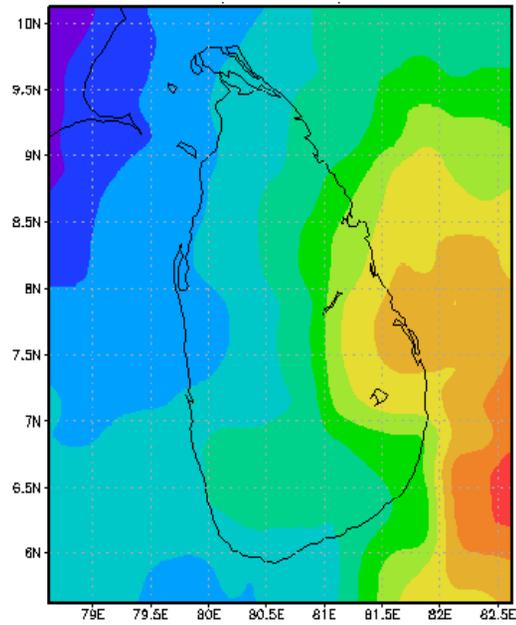
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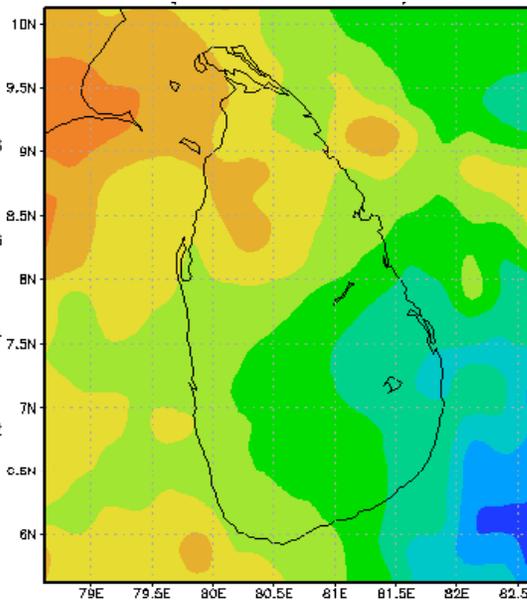
TRMM Level-3 Monthly Rain Rate Anomaly

TRMM 3B43 Climatology Rain Rate (mm/hr)
Dec - Feb (1998-2012)

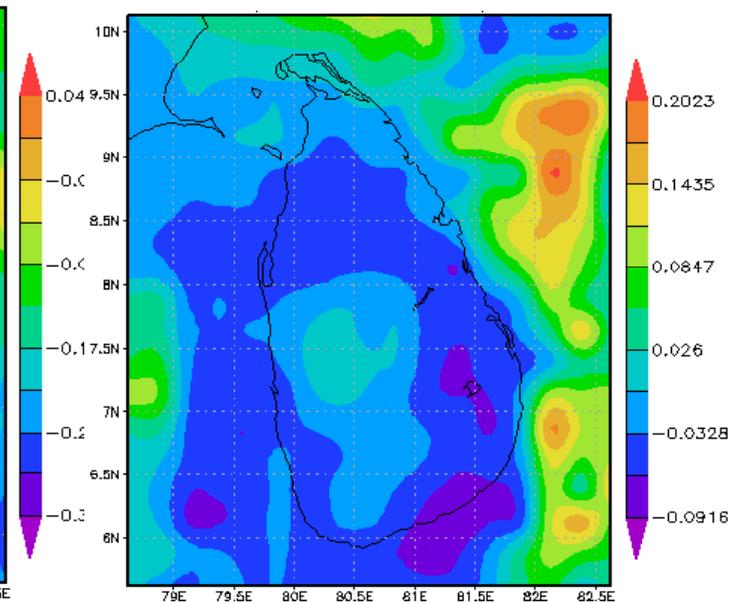


TRMM 3B43 Anomaly of Rain Rate

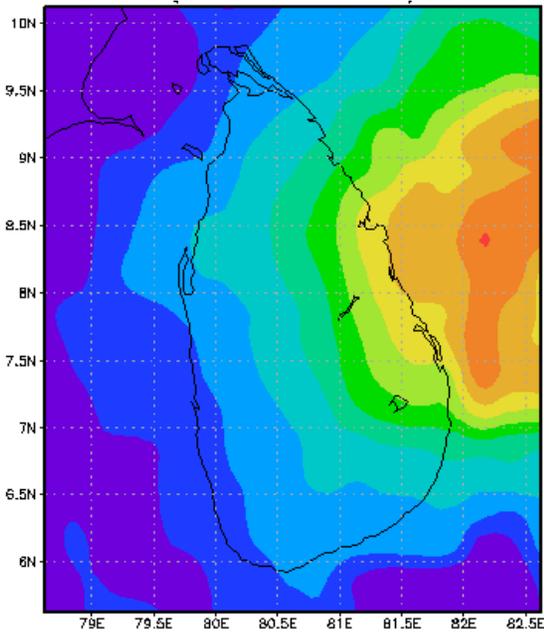
Dec2008 – Feb2009 (mm/hr)



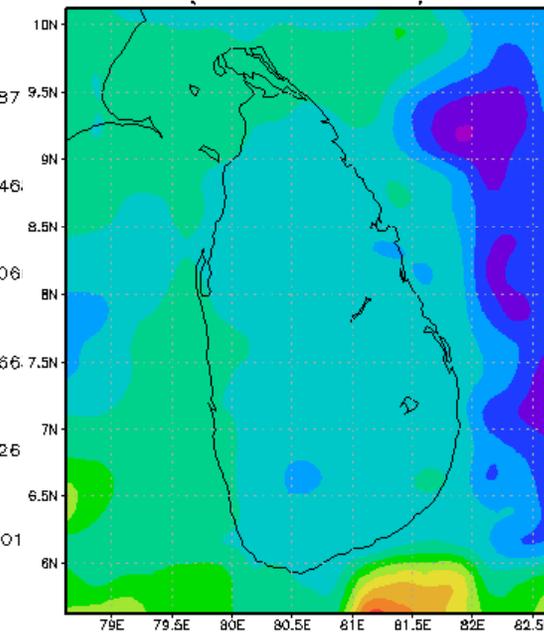
Dec2009 – Feb2010 (mm/hr)



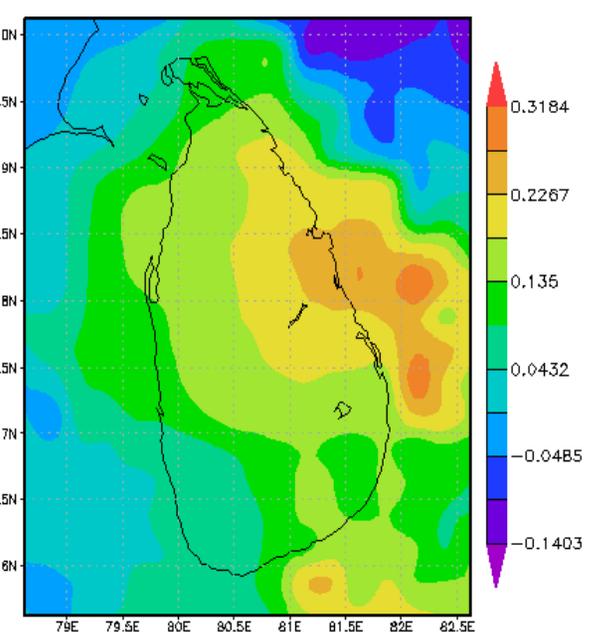
Dec2010 – Feb2011 (mm/hr)



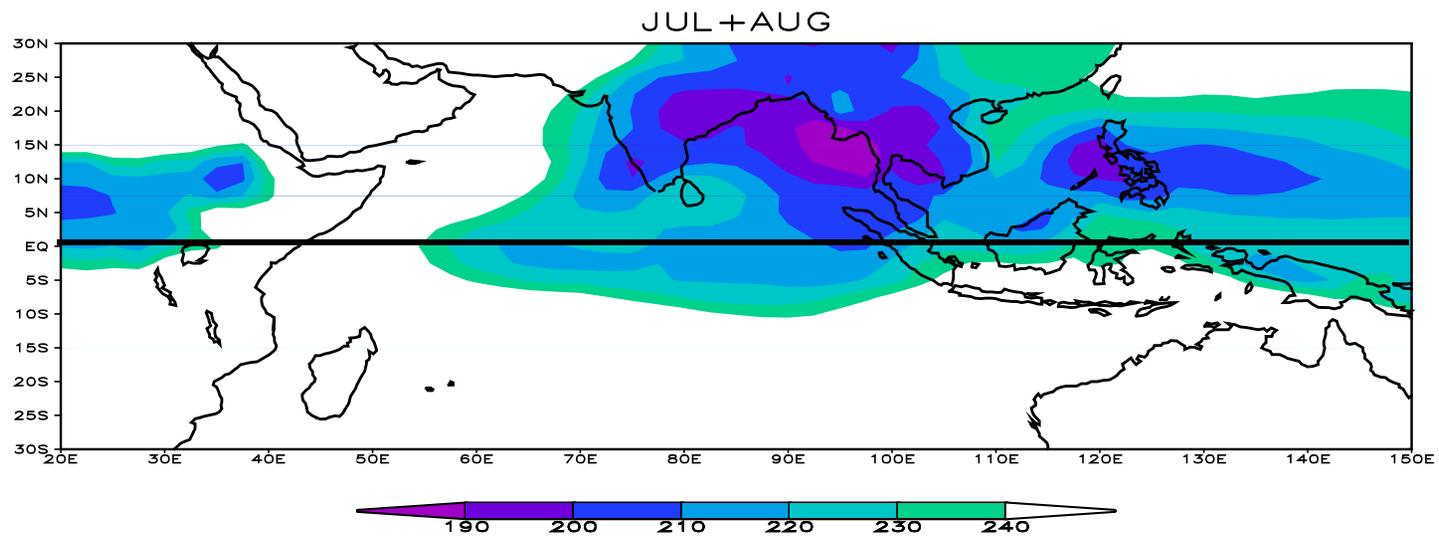
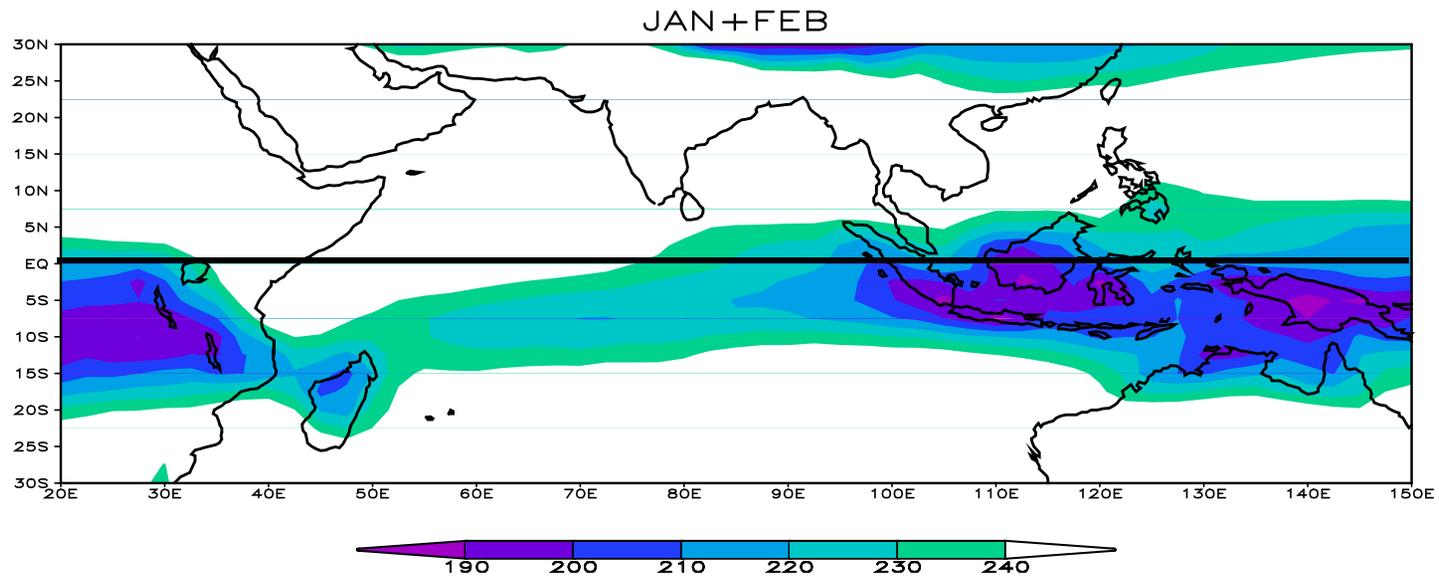
Dec2011 – Feb2012 (mm/hr)

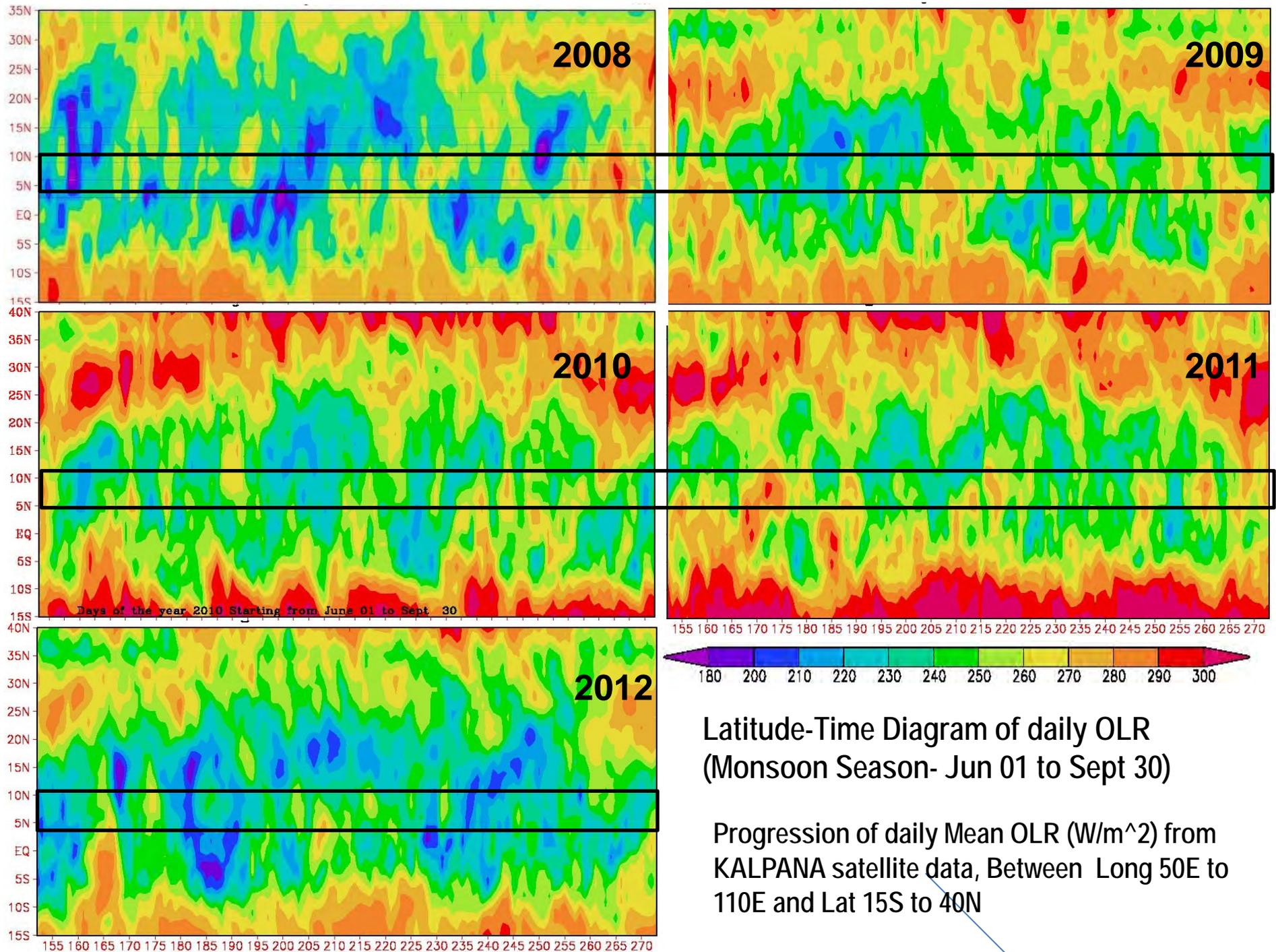


Dec2012 – Feb2013 (mm/hr)



Inter Tropical Convergence Zone (ITCZ)





**Latitude-Time Diagram of daily OLR
(Monsoon Season- Jun 01 to Sept 30)**

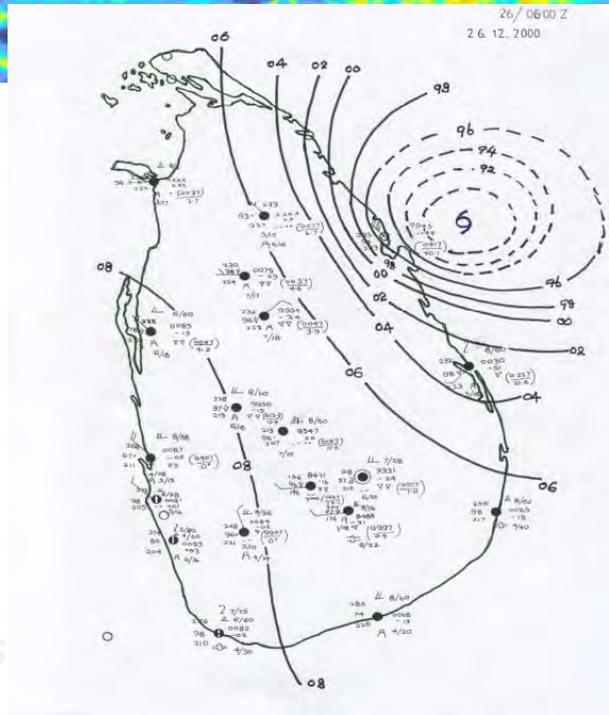
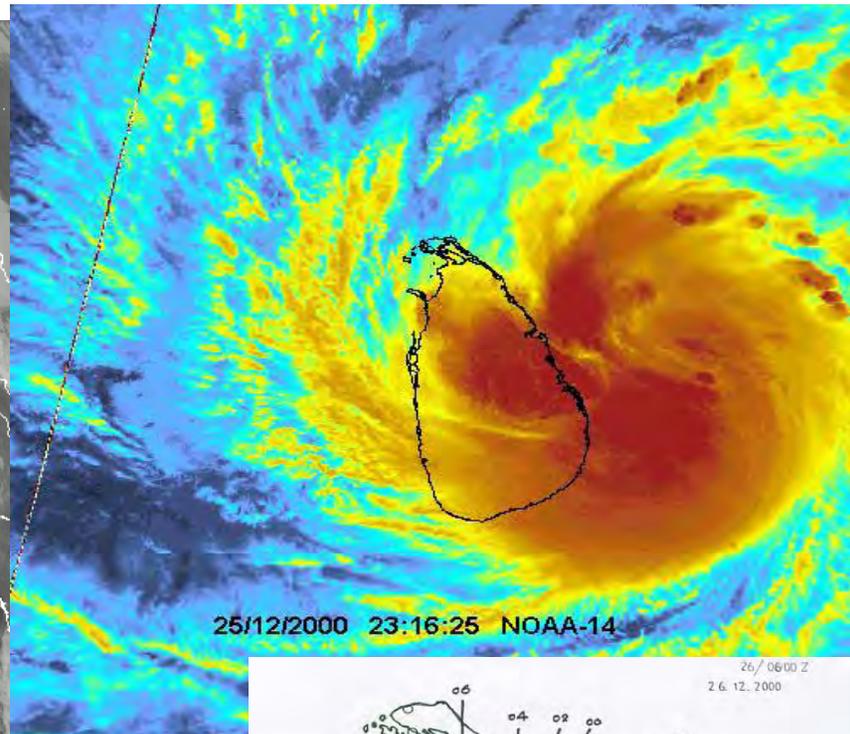
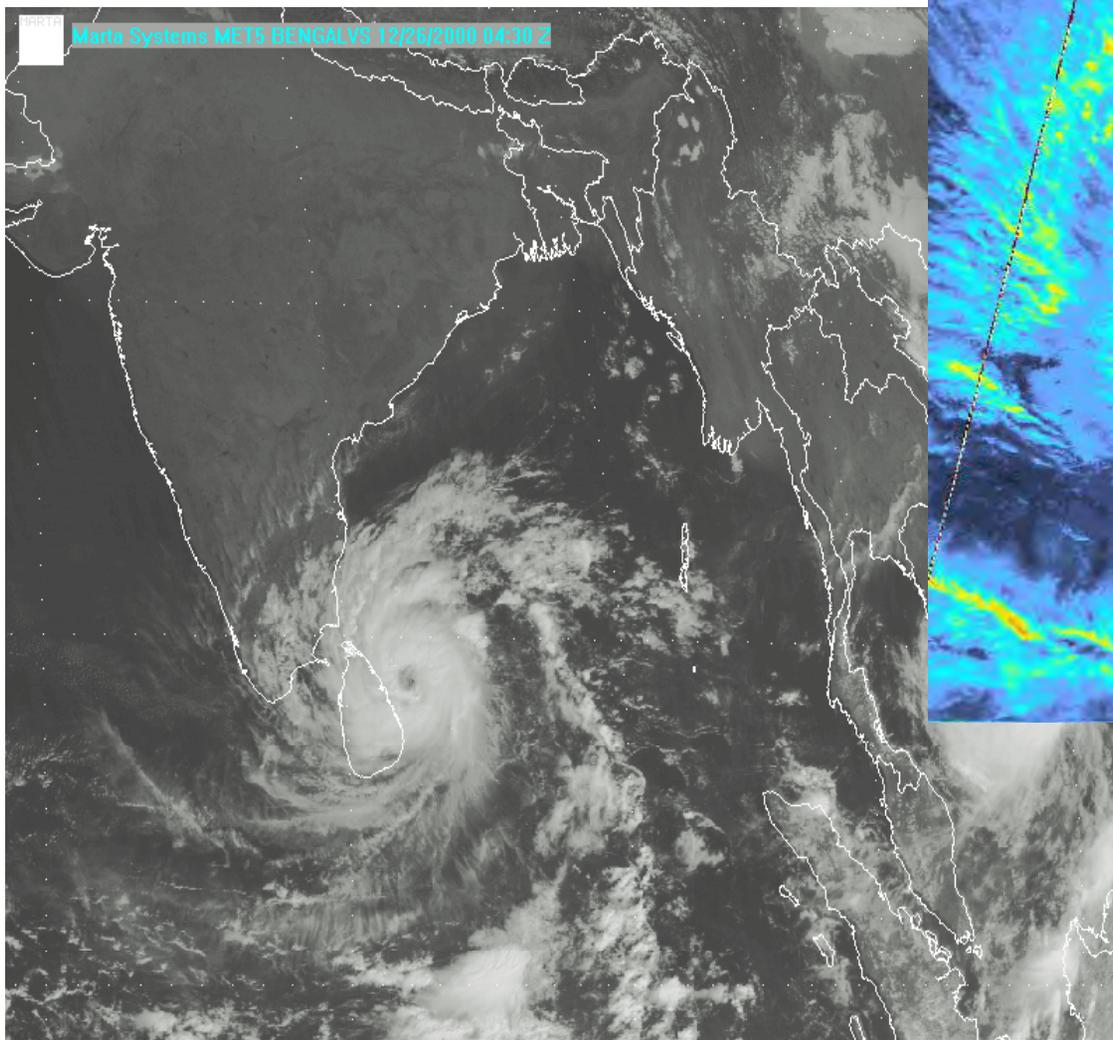
Progression of daily Mean OLR (W/m^2) from KALPANA satellite data, Between Long 50E to 110E and Lat 15S to 40N

Closing Remarks

- ❖ As a small Island, Sri Lanka can be obtain unique benefit of the used of space base information combined with ground data to address changes in the weather and climate.
- ❖ The capacity of receiving of earth observation data should be developed.
- ❖ Reliable more ocean observations (Remote sensing/ in situ) should be increased.
- ❖ Remote sensing data should be available free of charge or amounts of low cost.



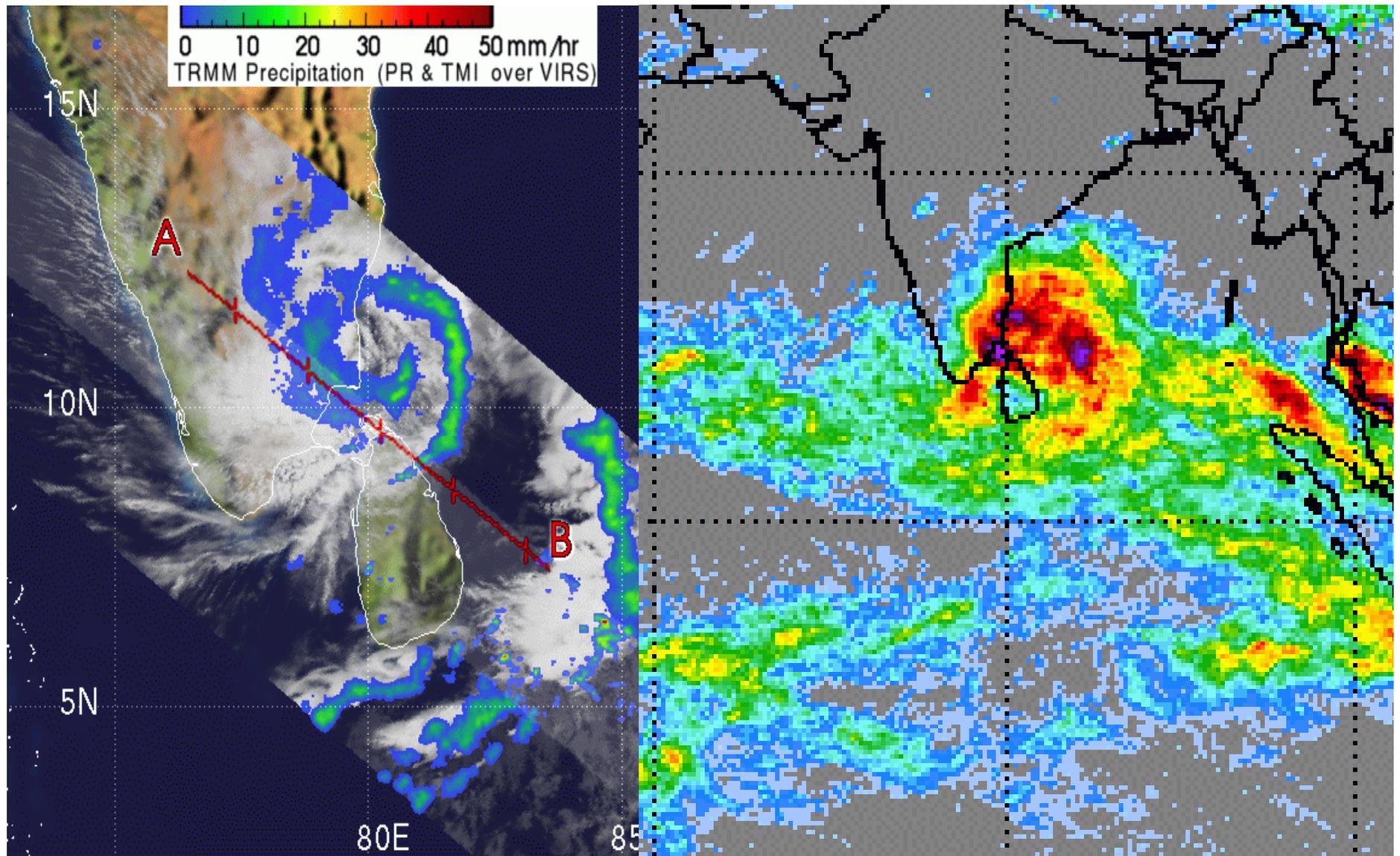
Thank You



Trincomalee Cyclone 25 December 2000

Cyclone 'NISHA'

2008.11.28



Tropical Cyclone "NILAM"

