

## Experimental Climate Monitoring and Prediction

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Lareef Zubair and Michael Bell (FECT and IRI<sup>1</sup>)

16 June 2016

### Highlights

Previous week was dry except rainfall during 8<sup>th</sup>-9<sup>th</sup> and 12<sup>th</sup> of June mostly in the south western region. The highest rainfall up to 90 mm was seen around Balangoda on the 9<sup>th</sup>. The Temperature was highest (35- 40 °C) in the eastern coastal area and was lowest in the hill country (15- 20 °C) in the previous week. NOAA NCEP models predict up to 135mm total rainfall in south western region in the next week while other regions shall have up to 85mm rainfall. NOAA CPC GFS model predicts 35- 40 °C maximum temperature along the coastal region between Kilinochchi and Hambantota during the next week. Higher wind speed (up to 20 m/s) is expected in the southern regions and the sea. MJO shall be in the Indian Ocean and shall contribute to enhance the rainfall in the region.



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#### Monitoring

##### Rainfall

**Weekly Monitoring:** On the 8<sup>th</sup>, up to 50 mm rainfall was received in eastern region of Colombo and the sea west to Puttalam. Balangoda and surrounding regions experienced the highest rainfall of the week as 90 mm on the 9<sup>th</sup> while up to 60 mm rainfall was seen in Gampaha. No significant rainfall was received during 10<sup>th</sup>-11<sup>th</sup> June in the entire country and again up to 80 mm rainfall was seen around southern region of Puttalam and Kurunegala on the 12<sup>th</sup>. No rainfall was recorded during 13<sup>th</sup>-14<sup>th</sup> June as well. Based on the CPC Unified Precipitation Analysis, up to 75 mm total rainfall was seen in south western region of the country while surrounding regions received up to 55 mm rainfall during the week. According to the RFE 2.0 model, between 50-100 mm total rainfall was received in western and south western regions of the country within the week while the surrounding regions experienced up to 25 mm total rainfall. It recorded up to 25 mm of total rainfall anomaly in western province, Kurunegala district and nearby cities.

**Monthly Monitoring:** Entire country received more rainfall than the historical average during May 2016. The districts in western, north western and north central provinces received up to ~450mm monthly excess rainfall than the historical average. CPC Unified Precipitation Analysis recorded up to 500 mm total rainfall in south western region while 150-300 mm total rainfall in the rest of the country except Uva and eastern provinces. According to RFE 2.0 model, up to 750 mm of total monthly rainfall was received around Kegalle and Gampaha while the surrounding regions experienced up to 500 mm total rainfall during the month. Puttalam and Anuradhapura received 6 times more rainfall than the historical average and northern, central and western provinces received 4 times more rainfall. Nearly 140 mm of accumulated average monthly precipitation was recorded as above normal historical average during 17<sup>th</sup> May- 13<sup>th</sup> June while the highest daily average precipitation in the entire country was recorded as 50 mm on the 17<sup>th</sup>.

##### Temperature

The highest maximum temperature was seen along northern and eastern sea as 35- 40 °C during 5<sup>th</sup>-11<sup>th</sup> June. Kandy and Nuwara Eliya region experienced low maximum temperature as 20 °C while the maximum temperature in the rest of the country was between 30- 35 °C. Entire country has experienced 25- 30 °C of minimum temperature except Kandy, Nuwara Eliya, Ratnapura and surrounding districts. The mean temperature in South western, northern and central regions of the country was between 1°C- 3 °C during this week.

##### Wind

Entire country experienced 15 m/s total westerly wind at the 850 mb level during the previous week while northern region received up to 10 m/s wind in the same direction at the 700 mb level and 6-10 m/s in the rest of the country.

##### Ocean State

###### **Pacific seas state: June 7, 2016**

During early June 2016 the tropical Pacific SST anomaly turned weakly negative, now indicating cool-neutral ENSO conditions. Most of the atmospheric variables have also stopped supporting an El Niño pattern. This includes now near-average upper and lower level tropical Pacific winds, as well as near-normal cloudiness and rainfall patterns in the central and eastern Pacific. Most ENSO prediction models indicate neutral ENSO conditions during June, with likely development of La Niña (of unknown strength, but likely weak) by late July or August, lasting through fall and into winter. (Text Courtesy IRI)

###### **Indian Ocean State**

0.5°C above average sea surface temperature was observed around Sri Lanka.

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## Predictions

### Rainfall

**14-day prediction:** NOAA NCEP models predict more than 135mm total rainfall in south western and western regions while surrounding regions shall experience up to 115 mm total rainfall during 15<sup>th</sup>- 21<sup>st</sup> June. Total rainfall shall decrease during 22<sup>nd</sup>- 28<sup>th</sup> June. Up to 125 mm total rainfall is expected around Kegalle and Colombo districts while close by regions shall have up to 115 mm total rainfall. The rest of the country shall have up to 85 mm of total rainfall except south eastern region within the same week.

**Weekly prediction:** IMD GFS model predicts up to 40mm rainfall in south western region of the country during 16<sup>th</sup> -18<sup>th</sup> June while surrounding regions of Galle shall have up to 70 mm rainfall on the 19<sup>th</sup>. Up to 70mm rainfall is expected around Kalutara and Colombo districts while surrounding cities shall have up to 40 mm rainfall during 20<sup>th</sup>-21<sup>st</sup> June. The rainfall shall decrease in the south western region in the 22<sup>nd</sup> as up to 40 mm.

**IMD WRF & IRI Model Forecast:** According to the IMD WRF model, there shall be up to 65mm rainfall near Ratnapura and Kalutara districts while rest of western and south western regions shall receive up to 35 mm rainfall on the 17<sup>th</sup>. There shall be up to 125 mm rain around Ratnapura, Kegalle and Nuwara Eliya districts on the 18<sup>th</sup> while surrounding regions may receive up to 65 mm rainfall. According to IRI CFS model, rainfall shall increase than the previous week as up to 100 mm total rainfall in surrounding regions of Colombo and Kalutara districts while Gampaha, Kegalle, Ratnapura and Galle districts shall have up to 75 mm total rainfall during 13<sup>th</sup> -18<sup>th</sup> June.

**Seasonal Prediction:** As per IRI Multi Model Probability Forecast for July to September, the total 3-month precipitation shall be climatological. The 3-month temperature has more than 70-80% likelihood in the entire country of being in the above-normal tercile during this period.

### Temperature

NOAA CPC GFS model predicts 35- 40 °C maximum temperature along the coastal region between Kilinochchi and Hambantota and 30- 35 °C maximum temperature along north, central and south of the country. Maximum temperature in the hill country shall be between 20- 25 °C. During the same week, minimum temperature is expected around Nuwara Eliya, Ratnapura and Badulla to be 15- 20 °C while in Uva, Central, Sabaragamuwa and Western provinces it shall be 20- 25 °C.

### Wind

The wind speed shall increase up 20 m/s in Western, Southern and Sabaragamuwa provinces as well as the southern sea during 16<sup>th</sup> – 22<sup>nd</sup> June which was in the 10- 15 m/s range in the previous two weeks. The wind speed shall be 10- 15 m/s in other regions and sea areas in Sri Lanka. The wind direction shall generally be westerly.

### MJO based OLR predictions

MJO is in phase 2 on the 14<sup>th</sup>, and continue to stay in the Indian ocean region during the next 15 days. This shall enhance rainfall conditions in Sri Lanka.

## FECT BLOG

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## FECT WEBSITES

<http://www.climate.lk> and <http://www.tropicalclimate.org/>

## Weekly Hydro- Meteorological Report for Sri Lanka

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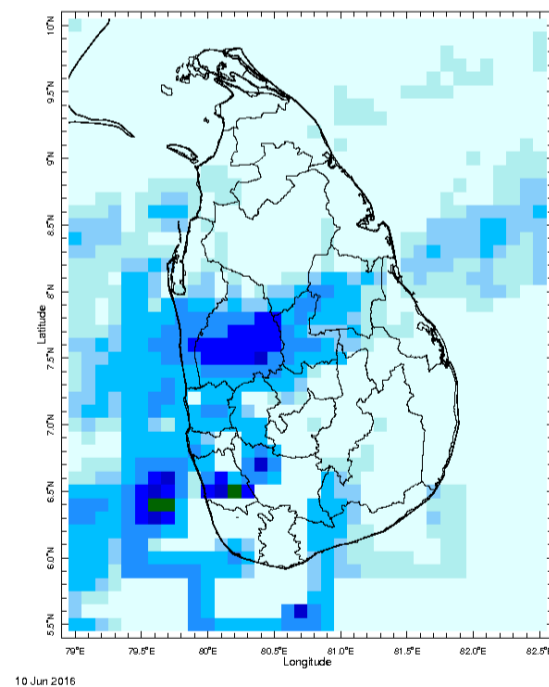
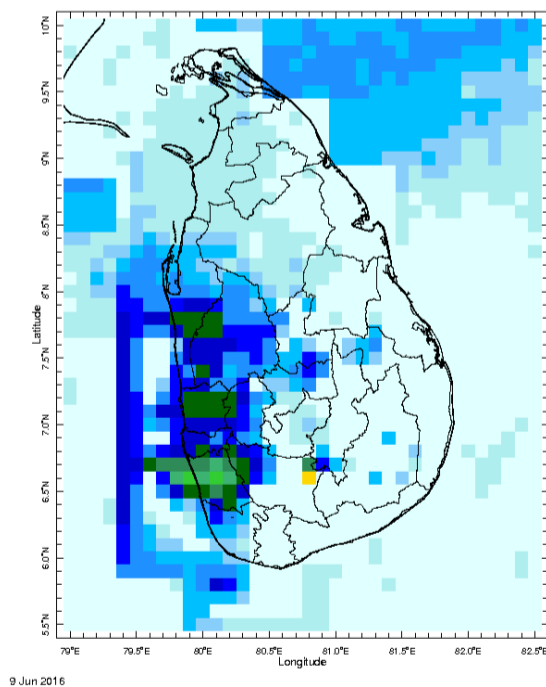
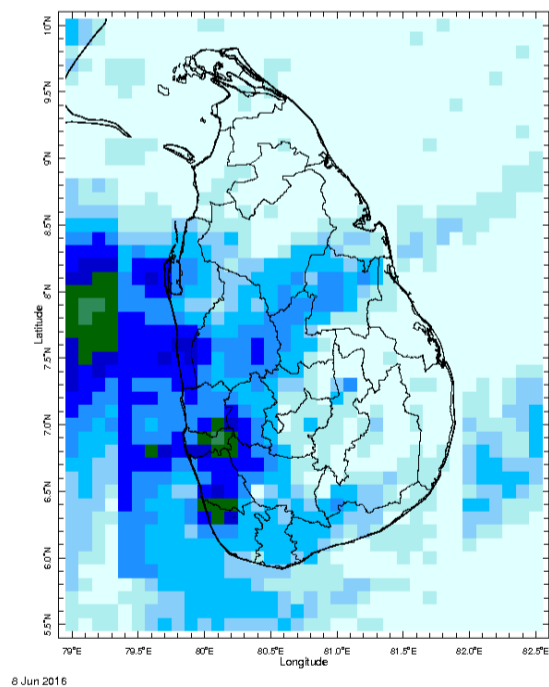
#### 2. Predictions

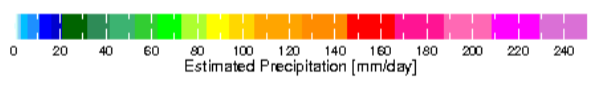
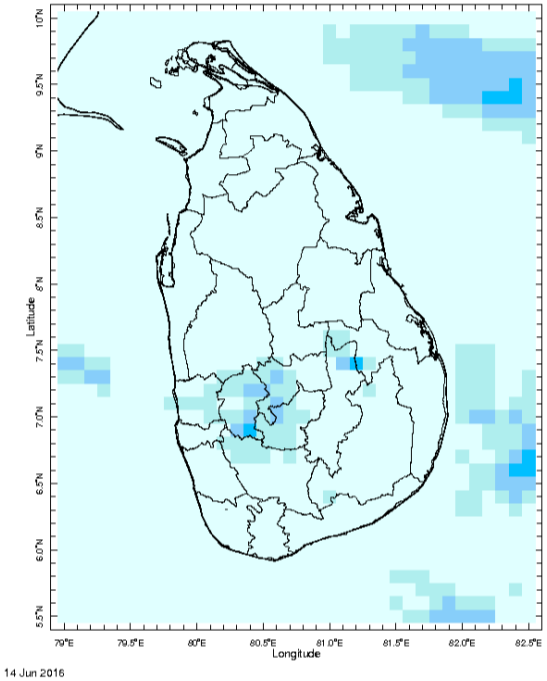
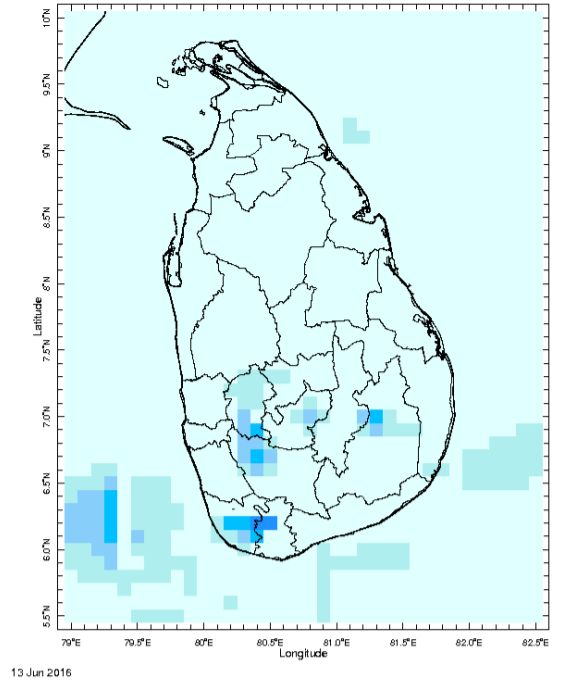
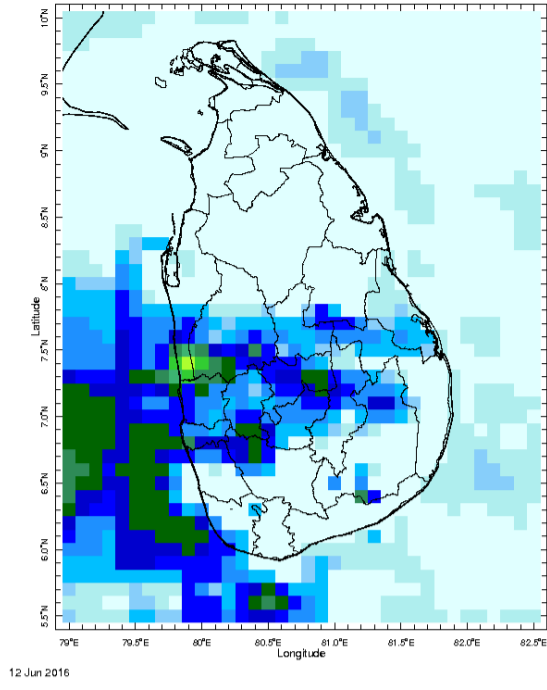
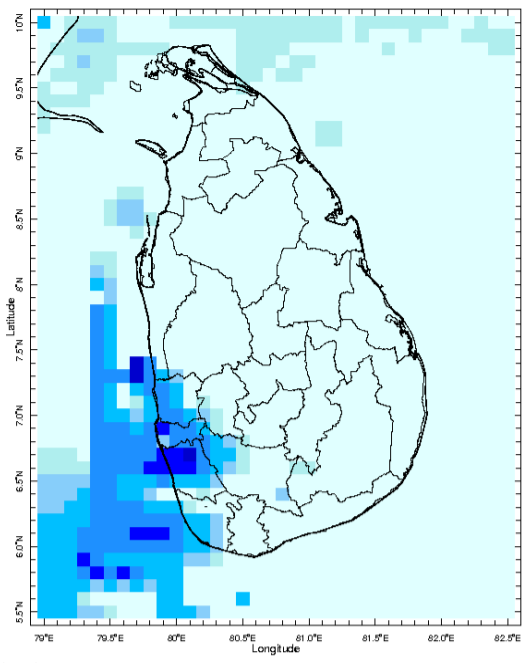
- a. NCEP GFS Ensemble 1-14 day Rainfall Predictions
- b. GFS (T574) Model Rainfall Forecast from RMSC New Delhi
- c. WRF Model Rainfall Forecast from IMD Chennai
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- g. Weekly Wind Forecast
- h. Seasonal Predictions from IRI

## MONITORING

### Daily Rainfall Monitoring

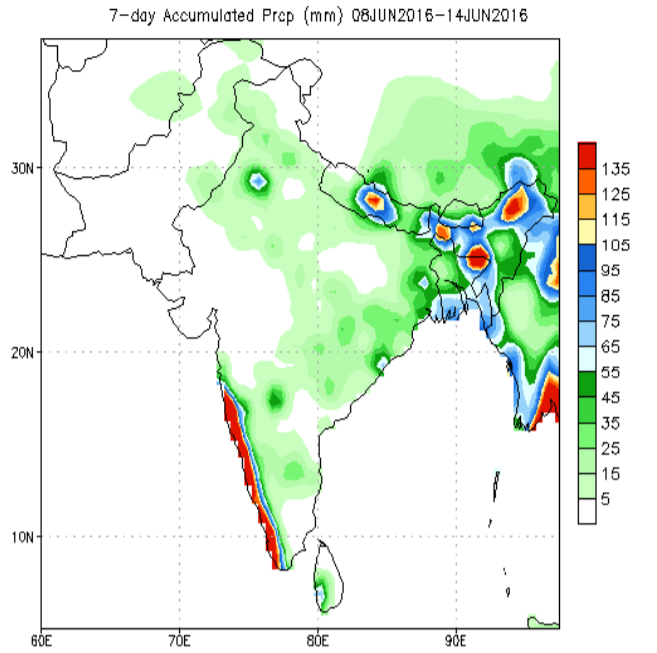
The following figures show the satellite observed rainfall in the last 7 days in Sri Lanka.



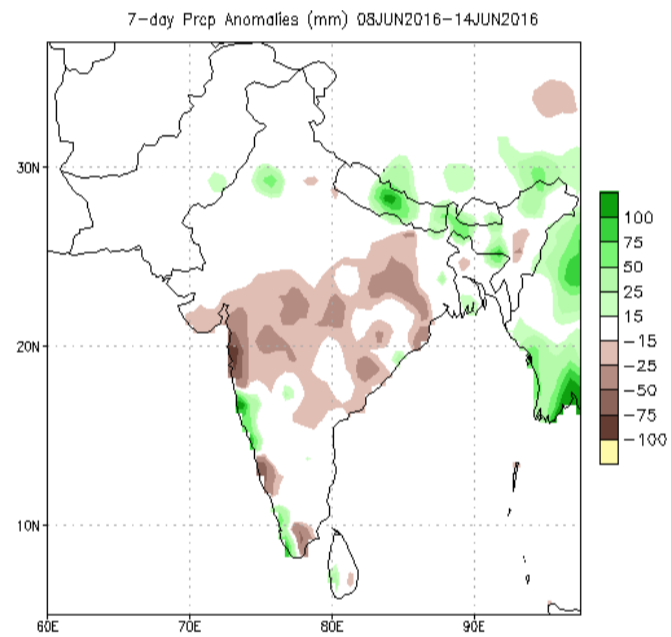
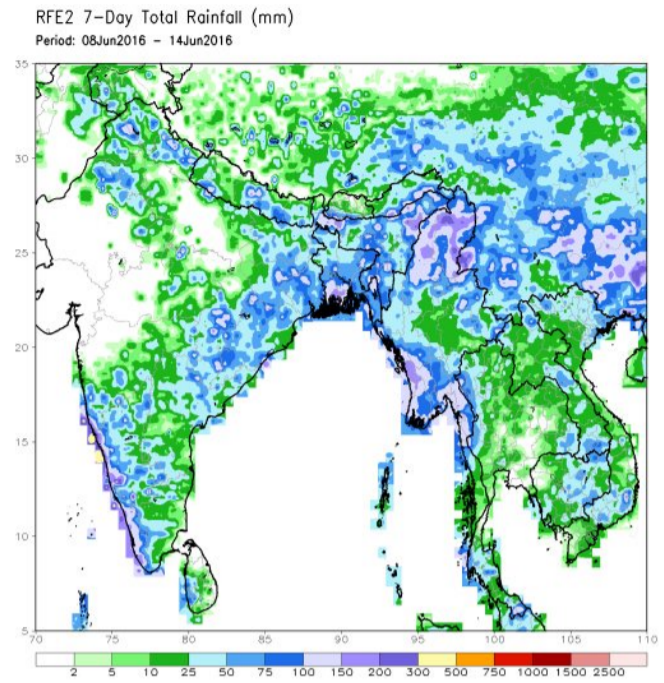


## Weekly Rainfall Monitoring

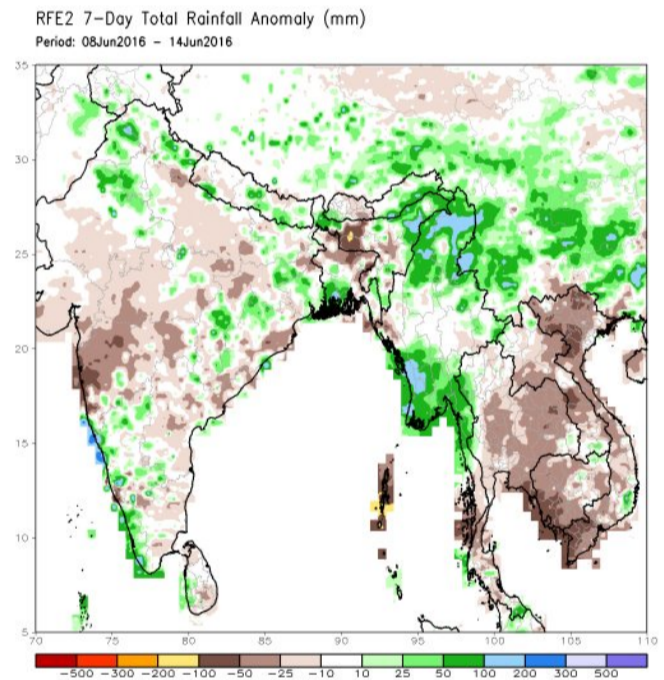
The following figures show the total satellite observed rainfall in the last week in Sri Lanka. The figure in the left is the total 7-day rainfall from NOAA Climate Prediction Center (CPC) Unified Precipitation Analysis and the figure in the right is the total 7-day rainfall from CPC RFE 2.0 Satellite Rainfall Estimates. The bottom two figures are the respective anomalies.



Data Source: CPC Unified (gauge-based & 0.5x0.5 deg resolution) Precipitation Analysis



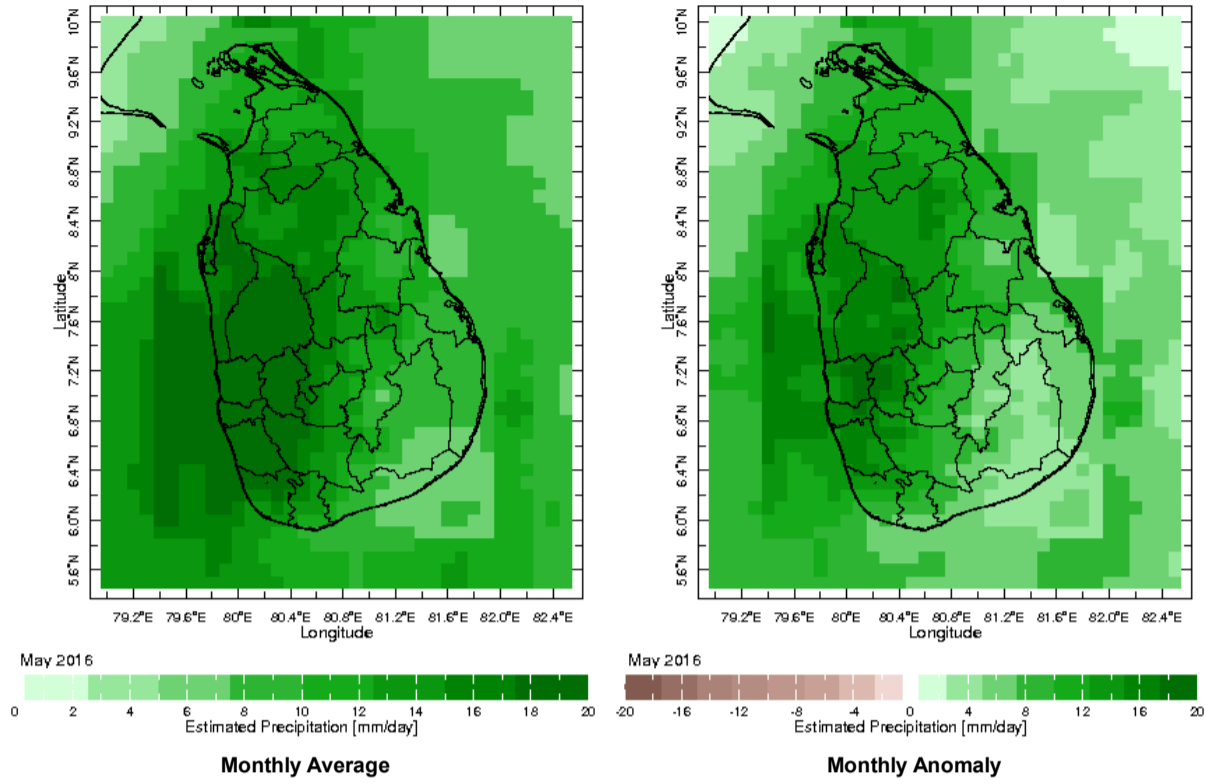
Data Source: CPC Unified (gauge-based & 0.5x0.5 deg resolution) Precipitation Analysis  
Climatology (1981-2010)



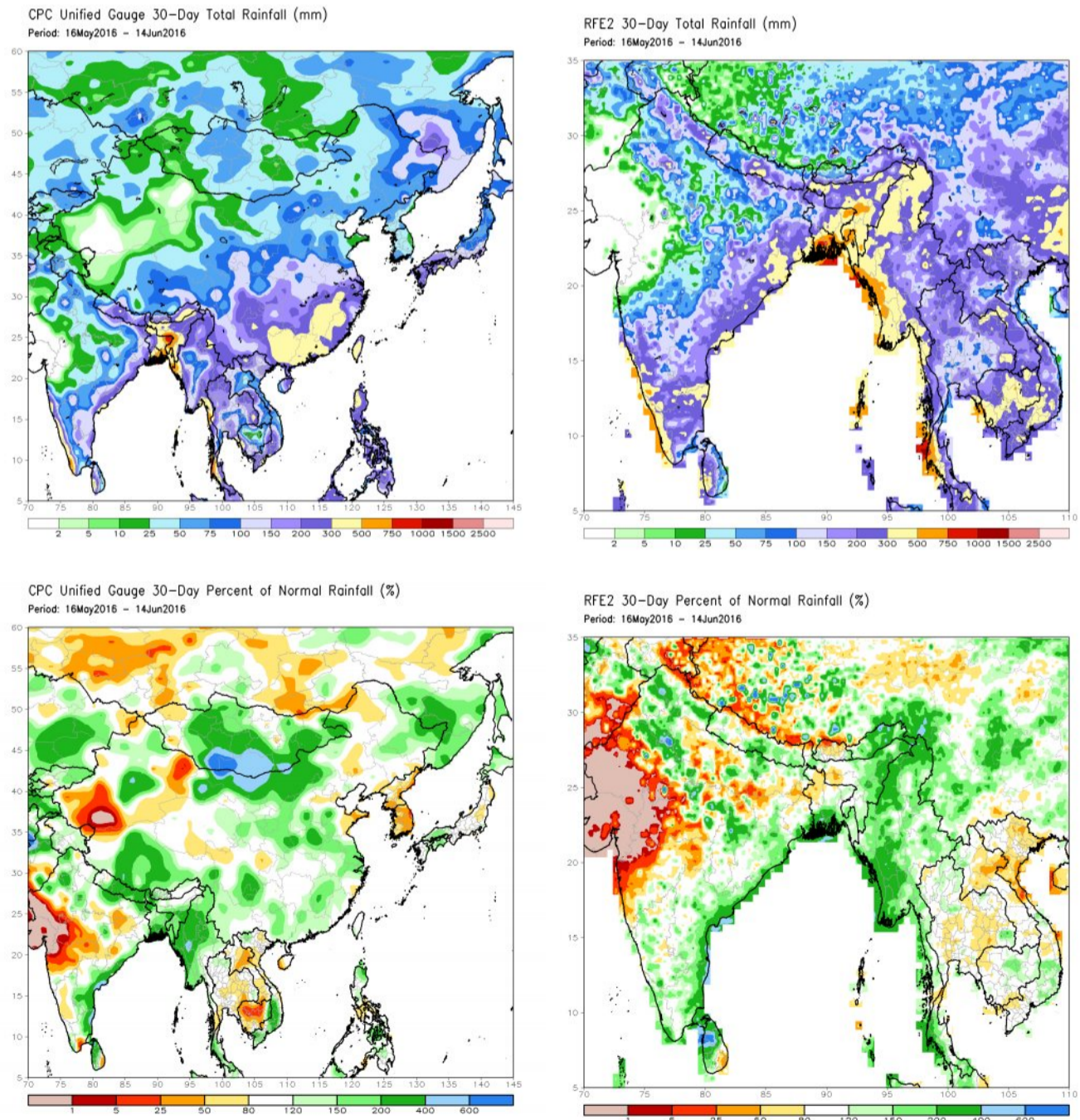


## Monthly Rainfall Monitoring

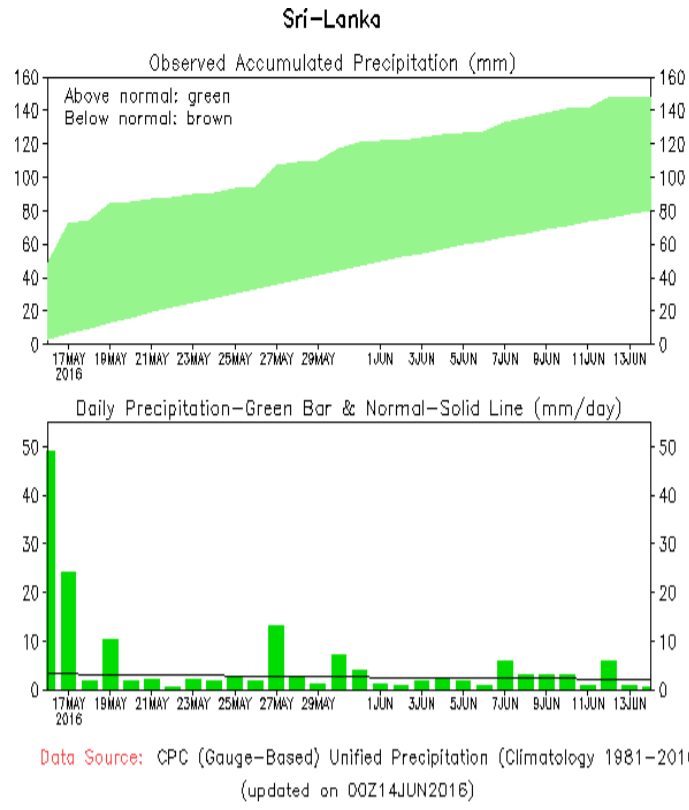
The figure in the left shows the average observed rainfall in the previous month. The rainfall anomaly in the previous month is shown in the figure to the right. The brown color in the anomaly figure shows places which received less rainfall than the historical average while the green color shows places with above average rainfall. Darker shades show higher magnitudes in rainfall



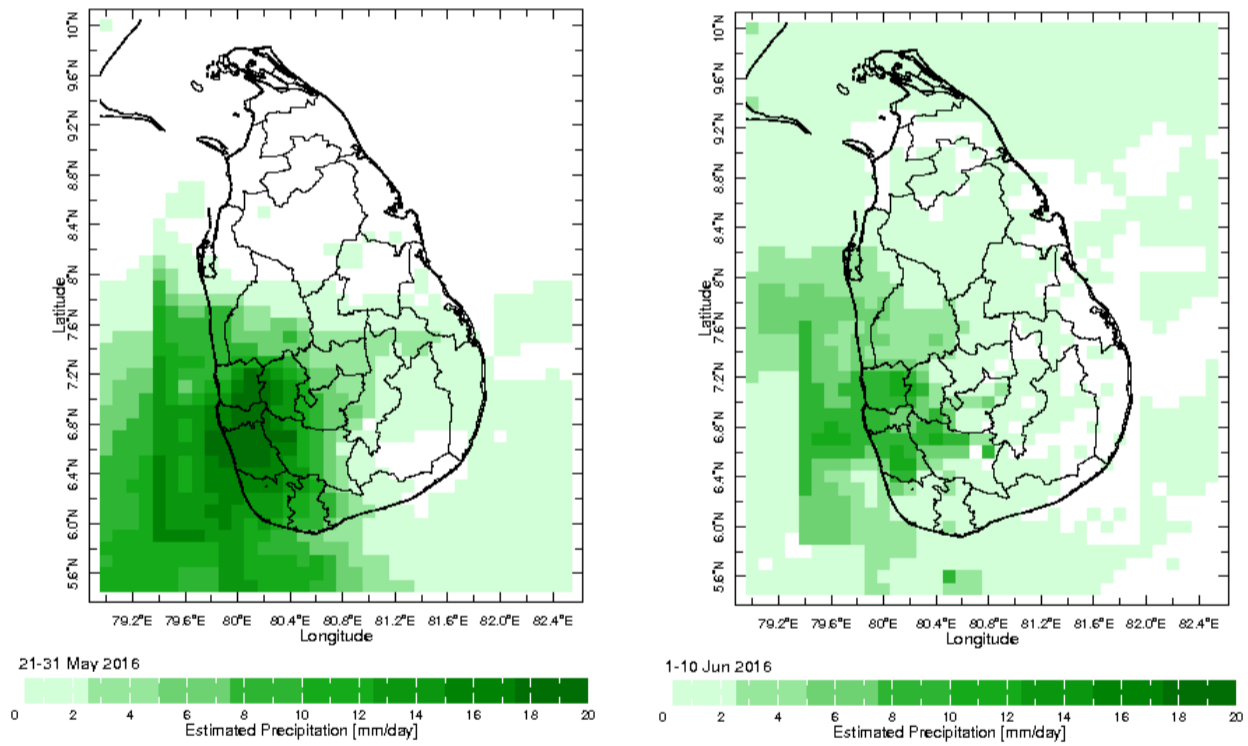
The figure in the top-left shows the total rainfall in the past 30 days from CPC Unified Precipitation Analysis while the figure in the top-right shows the total rainfall for the same period from RFE 2.0 Satellite Rainfall Estimates. The bottom two figures show the percentage of rainfall received in the past 30 days compared to normal rainfall in this period.



The following figure shows the observed accumulated rainfall (top) and daily observed rainfall (bottom) in Sri Lanka in the last 30 days.

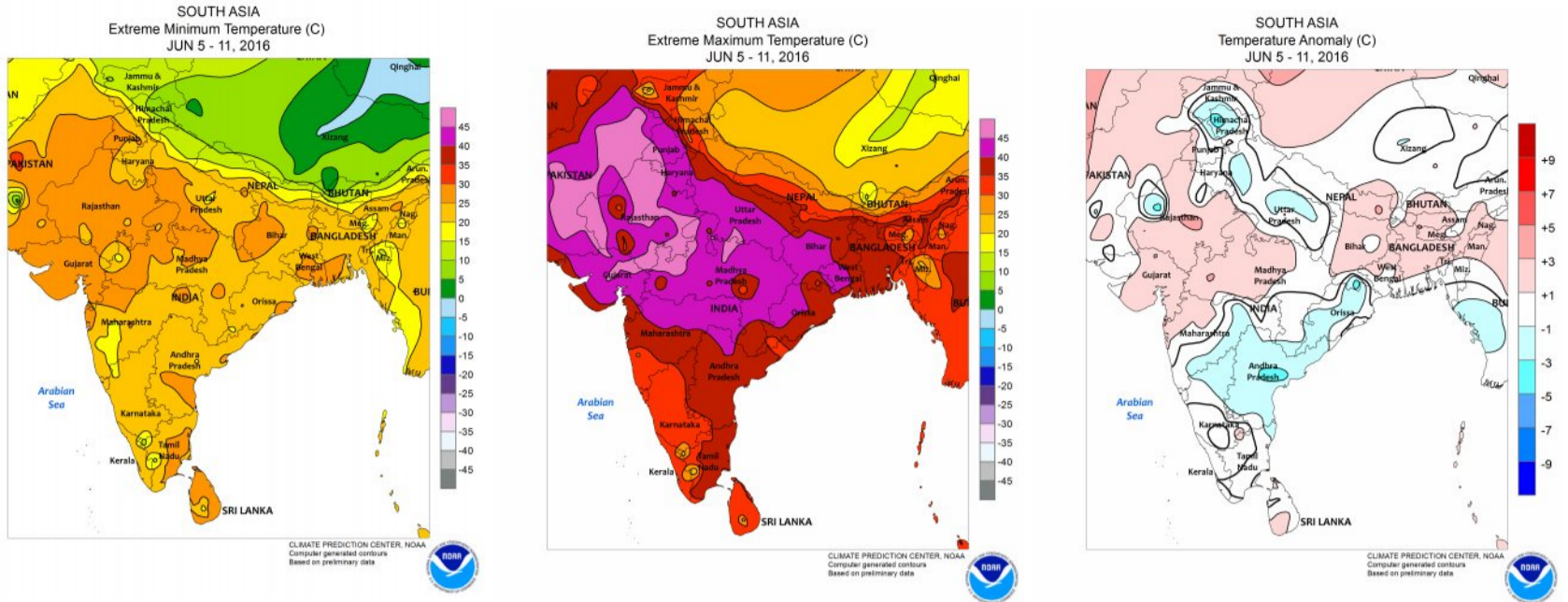


### Dekadal (10 Day) Satellite Derived Rainfall Estimates



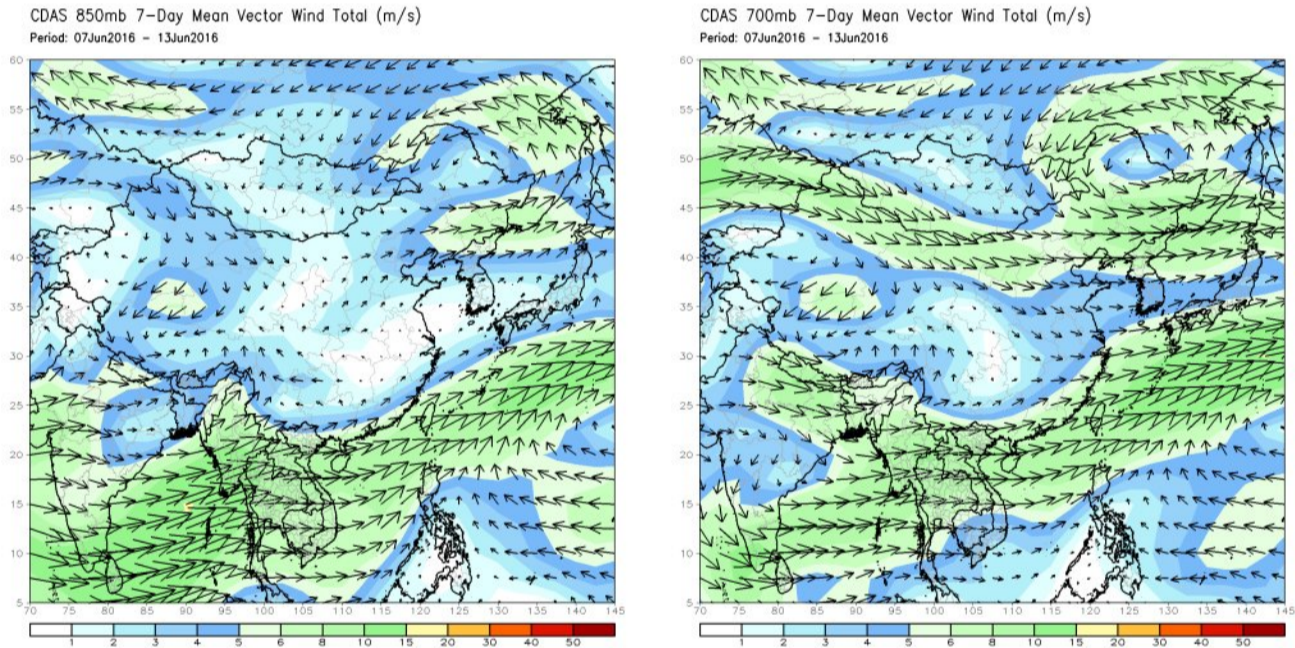


## Weekly Temperature Monitoring



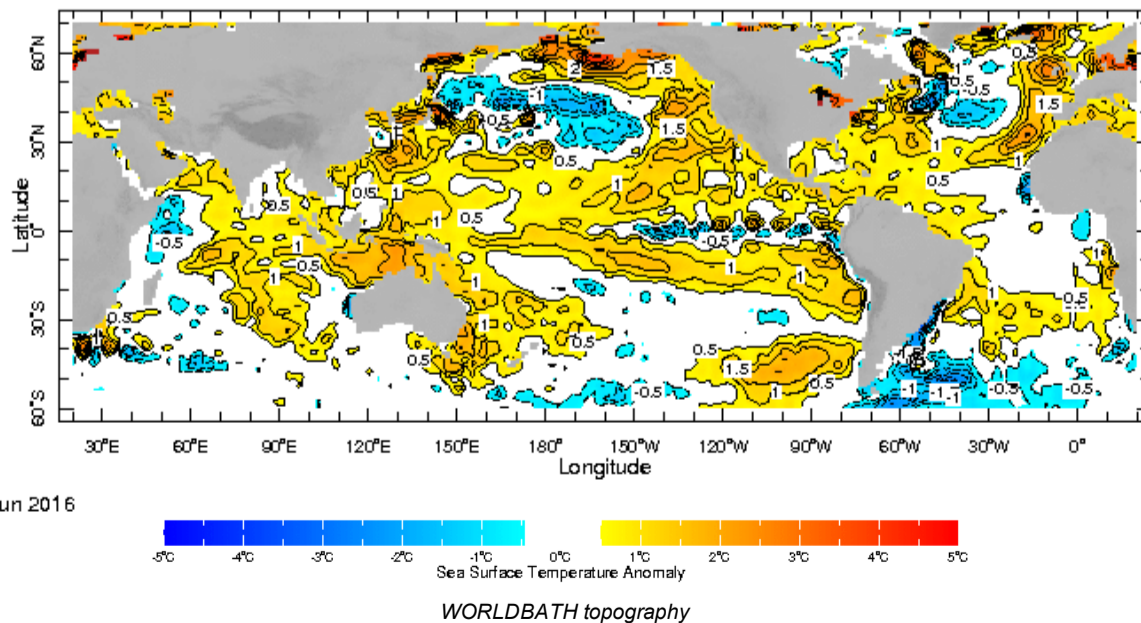
## Weekly Wind Monitoring

The following figures show the mean vector wind total of the past 7 days near Sri Lanka at two levels. The figure on the left shows 850 mb (~1500 m) level and the figure on the right shows 700 mb (~3000 m) level.

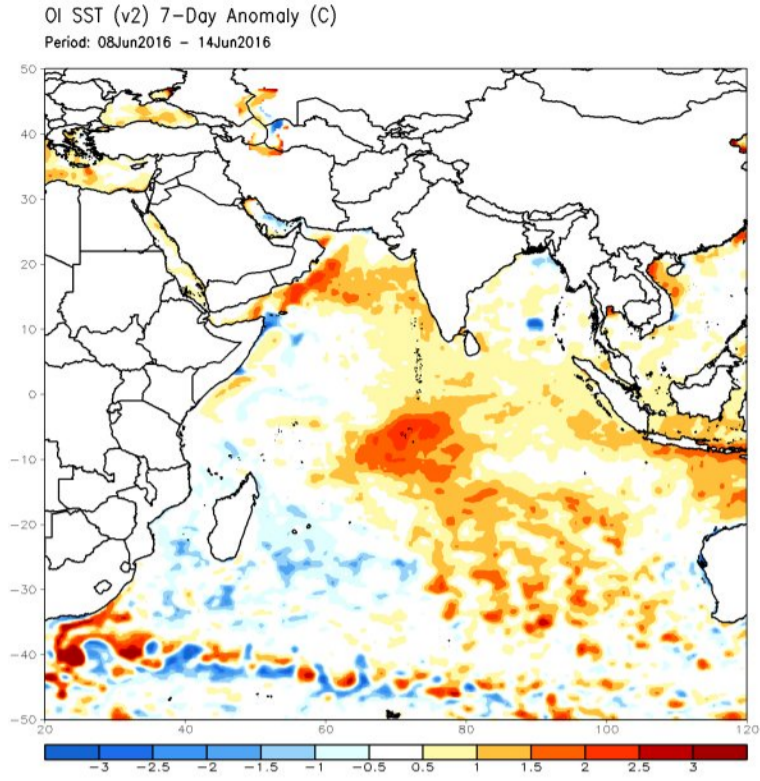


## Weekly Average SST Anomalies

Weekly average Sea Surface Temperature (SST) anomaly in the world from NOAA NCEP

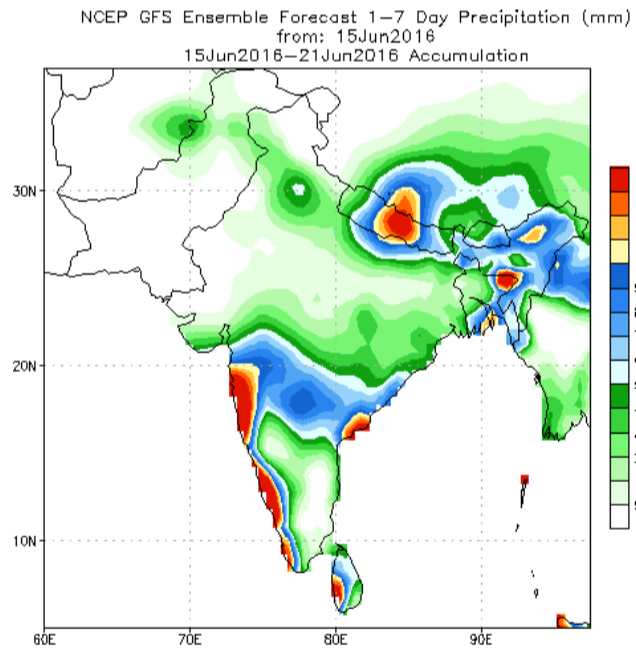




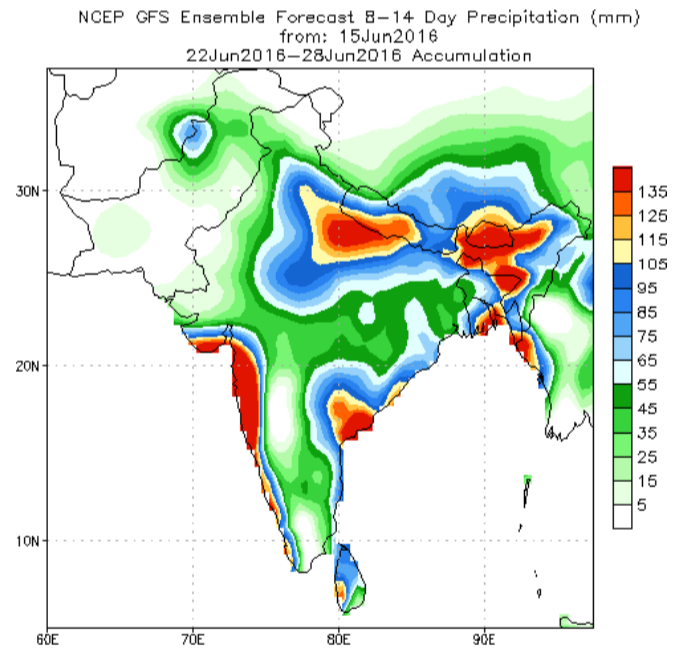


PREDICTIONS

NCEP GFS 1- 14 Day prediction

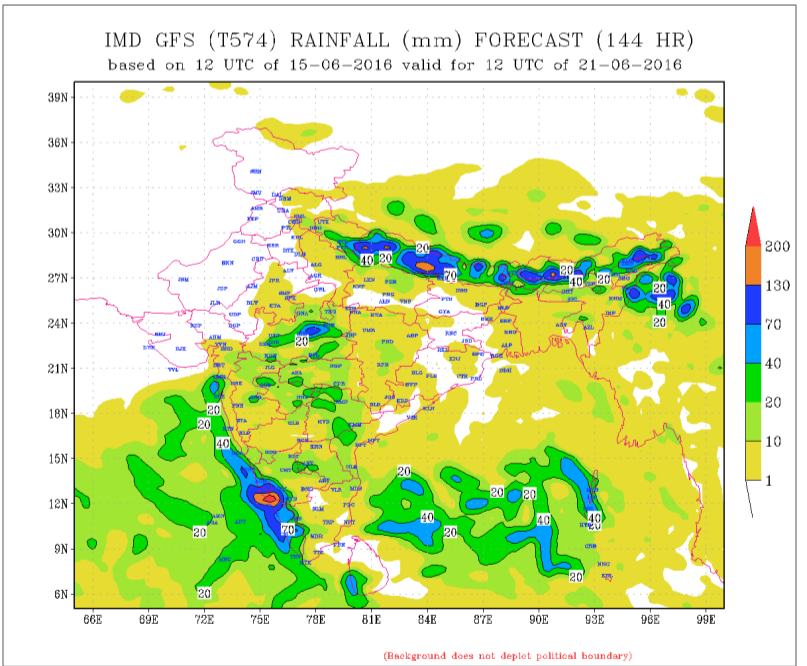
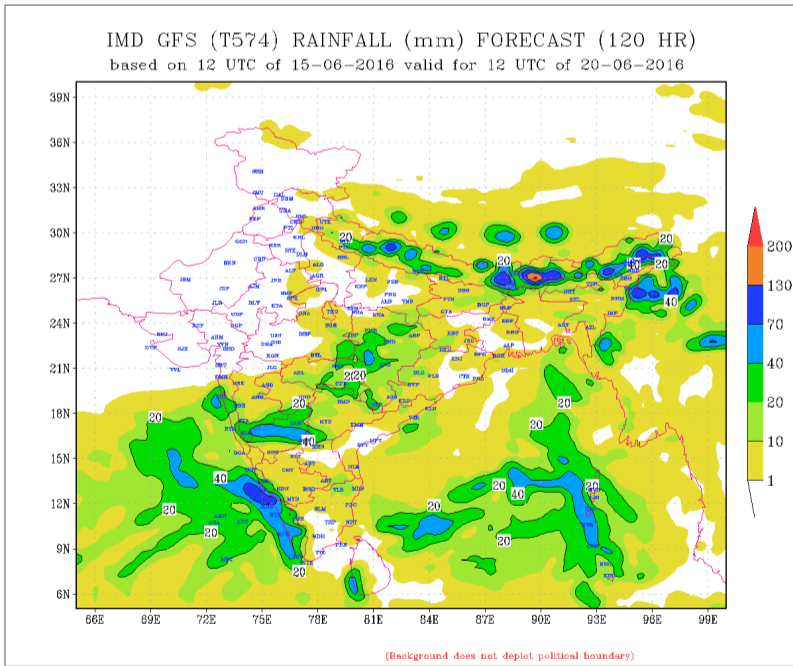
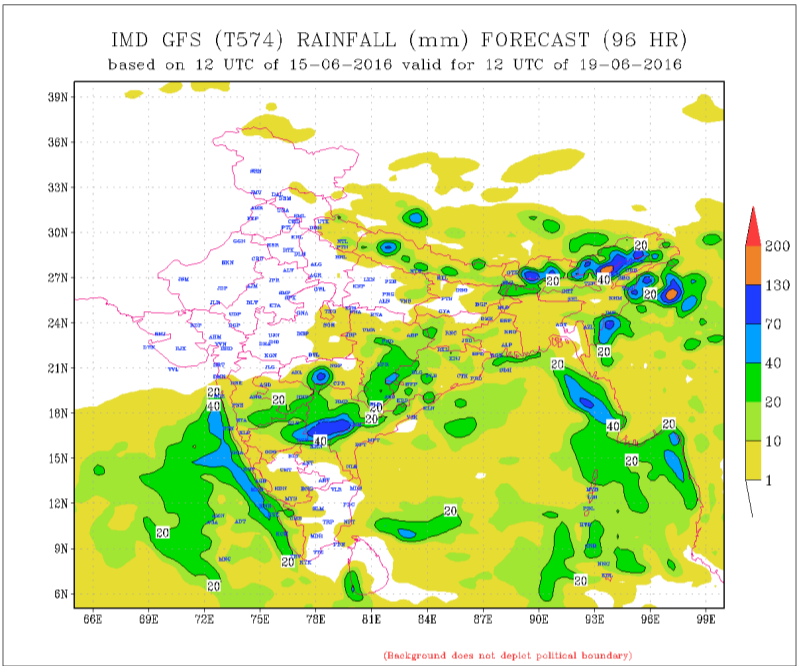
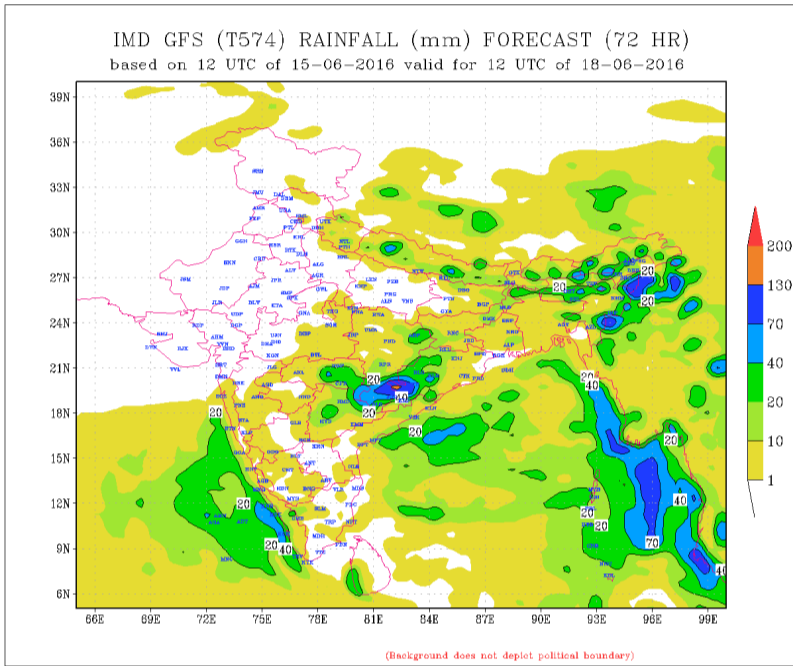
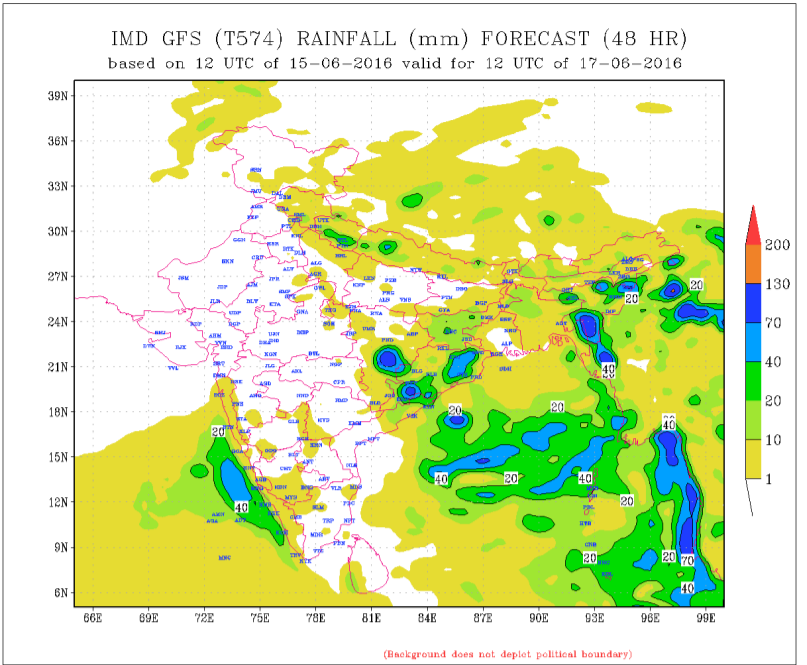
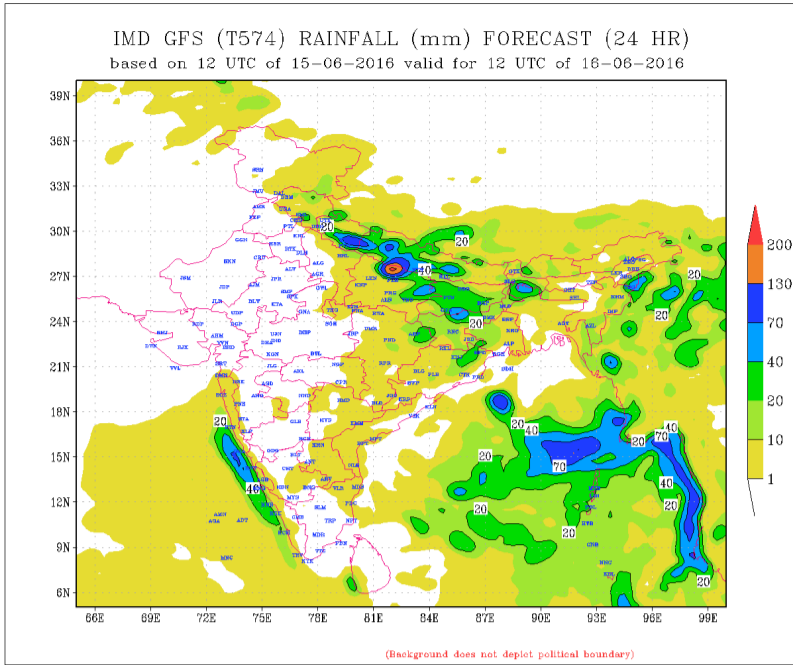


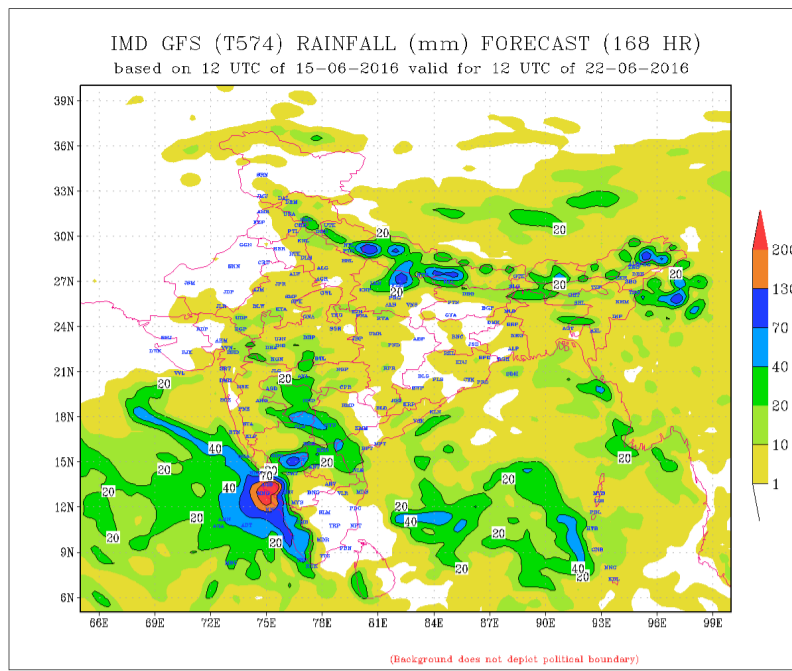
Bias correction based on last 30-day forecast error



Bias correction based on last 30-day forecast error

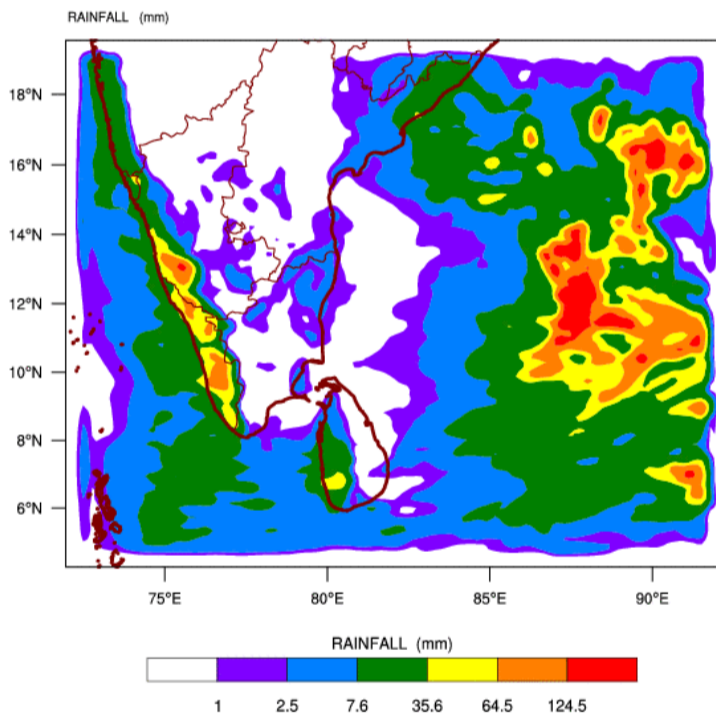
IMD GFS (T574) Model Rainfall Forecast from RMSC New Delhi, India



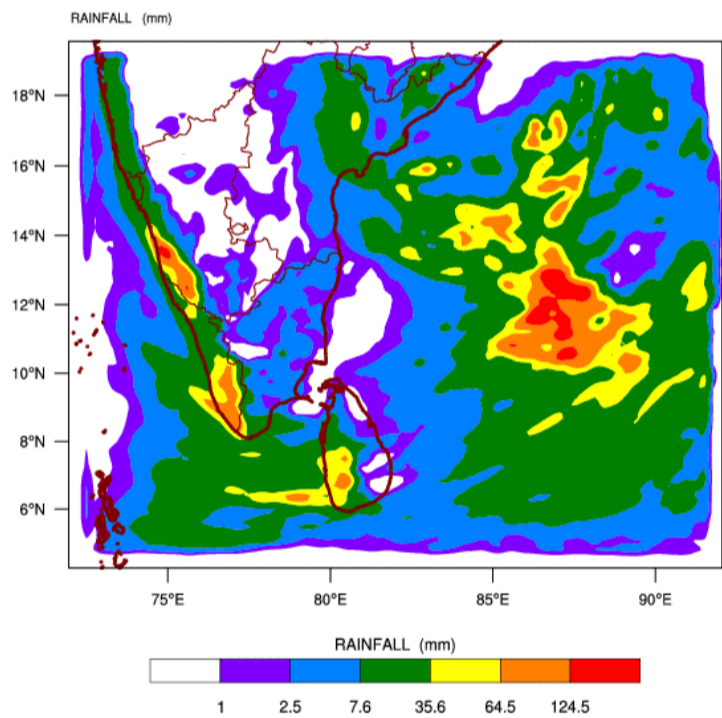


**WRF Model Forecast (from IMD Chennai)**

WRF MODEL FORECAST (48 HR.) RAINFALL(mm)\  
 based on 00 UTC of 15-06-2016 valid for 03 UTC of 17-06-2016



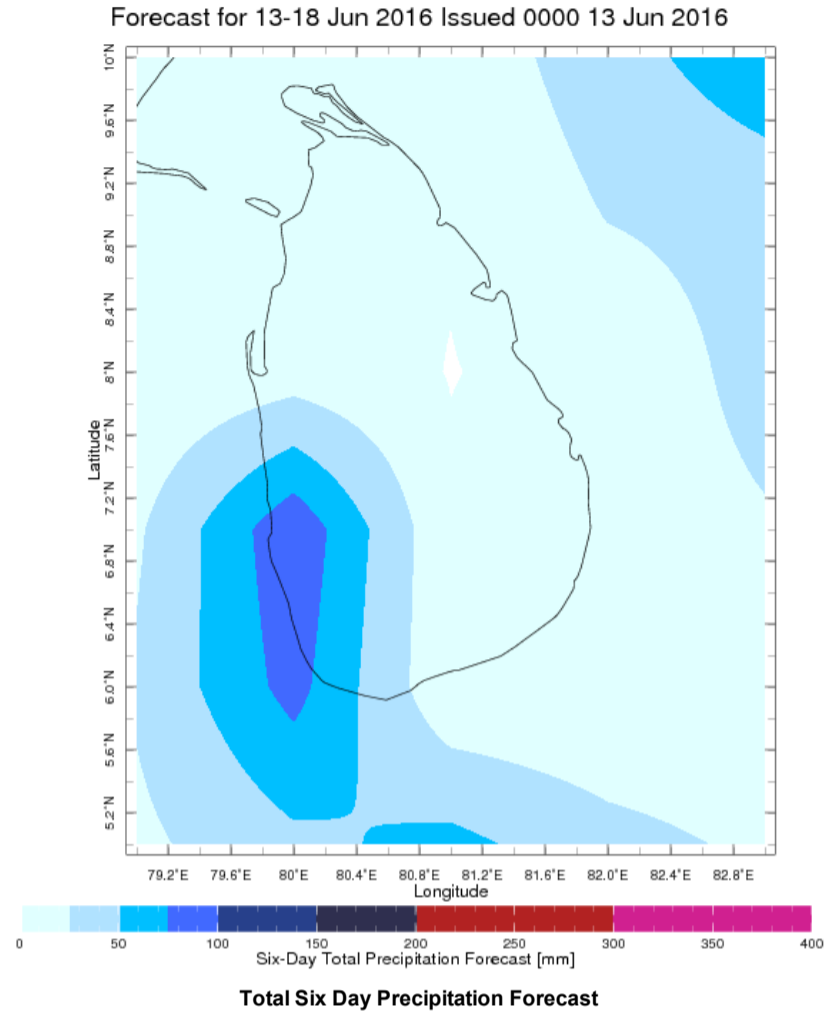
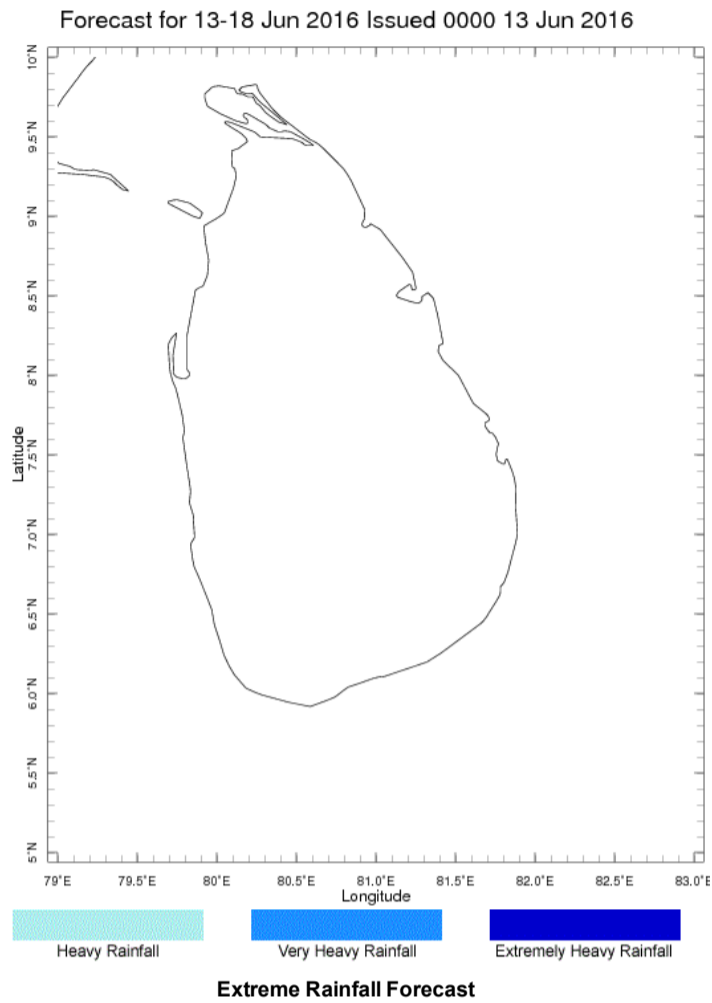
WRF MODEL FORECAST (72 HR.) RAINFALL(mm)\  
 based on 00 UTC of 15-06-2016 valid for 03 UTC of 18-06-2016





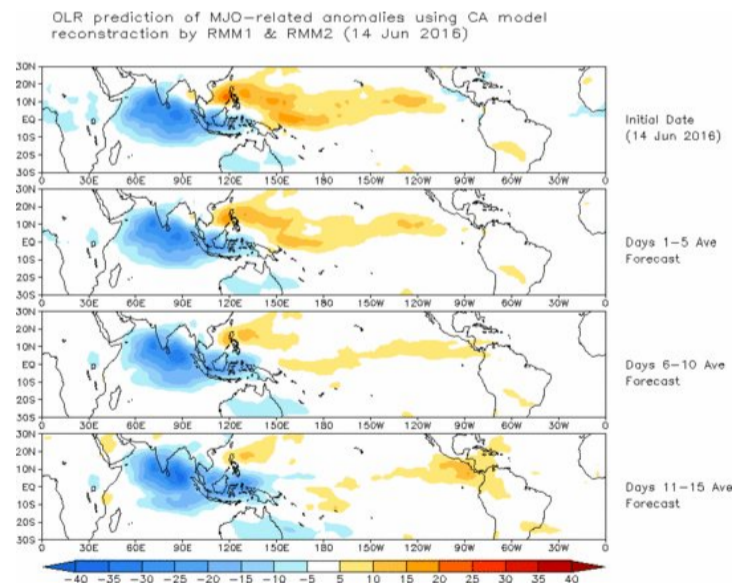
## Weekly Rainfall Forecast from IRI

Total rainfall forecast from the IRI for next six days is provided in figures below. The figure to the left shows the expectancy of heavy rainfall events during these six days while the figure to the right is the prediction of total rainfall amount during this period.



## Madden Julian Oscillation (MJO) related Outgoing Longwave Radiation (OLR) Forecast

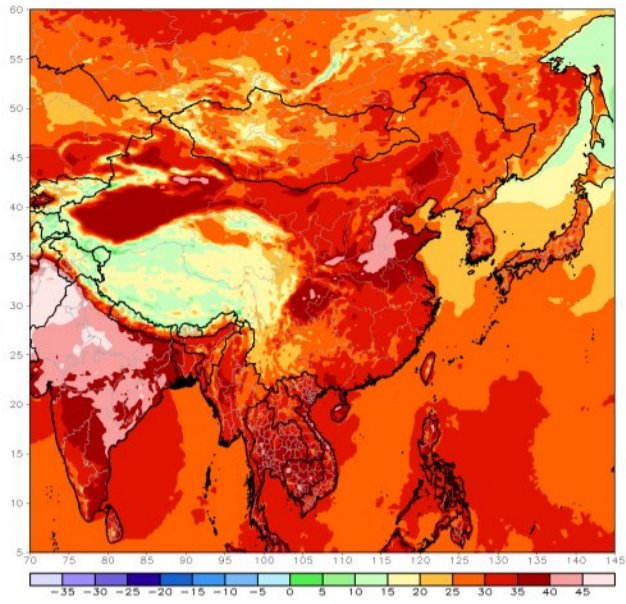
The Outgoing Longwave Radiation (OLR) is a proxy for rainfall. This can be used to identify convective rain clouds based on the MJO phase. Violet and Blue shading indicates enhanced tropical weather and Orange shading indicates suppressed conditions. The following figure shows the forecasts of MJO associated anomalous OLR for the next 15 days from the Constructed Analogue (CA) model forecasts.



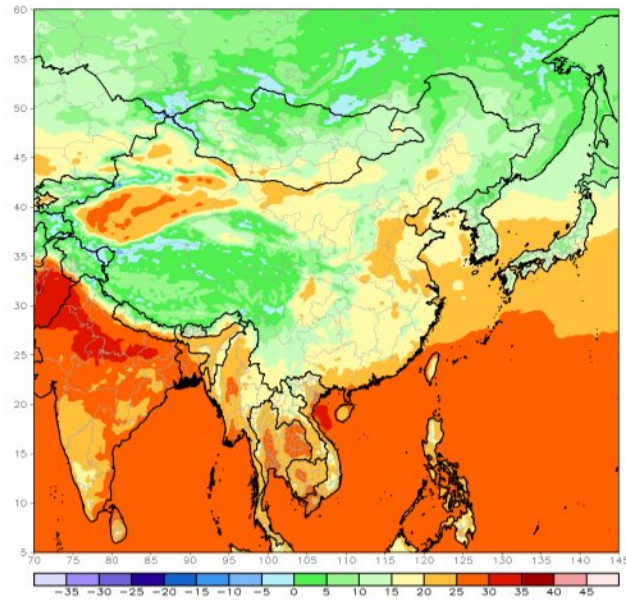
## Weekly Temperature Forecast

Weekly Minimum and Maximum Temperature prediction from the GFS model (from NOAA CPC)

GFS week1 Temperature Max (C)  
Ending: 18z22Jun2016



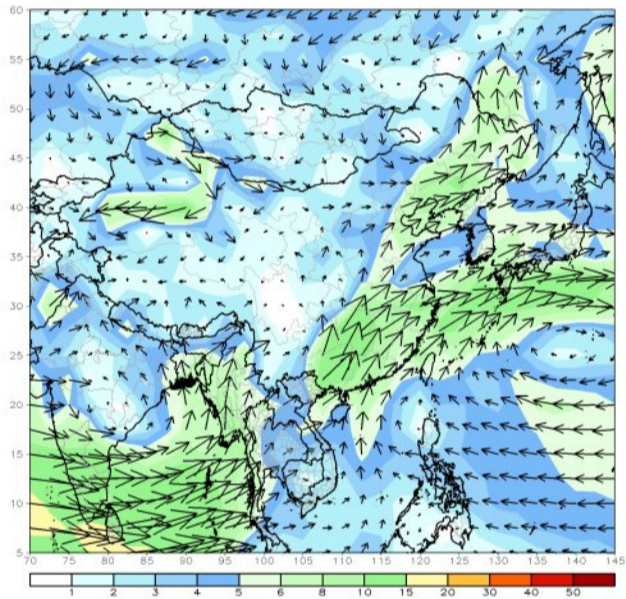
GFS week1 Temperature Min (C)  
Ending: 18z22Jun2016



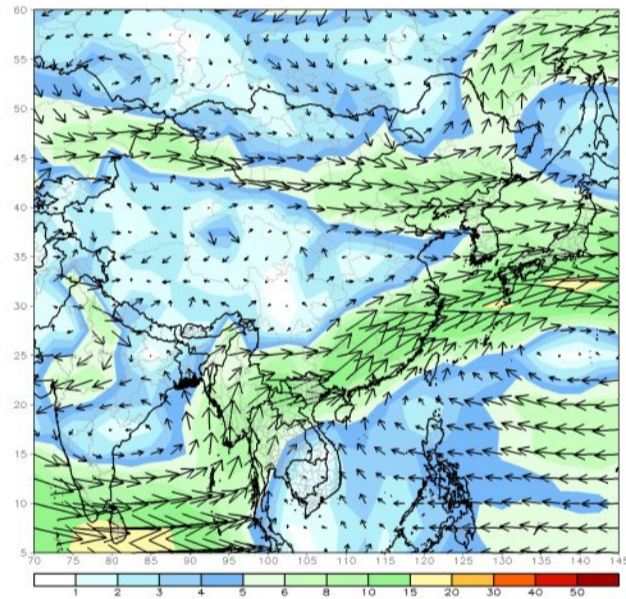
## Weekly Wind Forecast

Weekly mean vector wind total prediction from the GFS model at 850 mb (left) and 700 mb (right) levels. (from NOAA CPC)

GFS 850mb week1 Mean Vector Wind Total (m/s)  
Ending: 18z22Jun2016

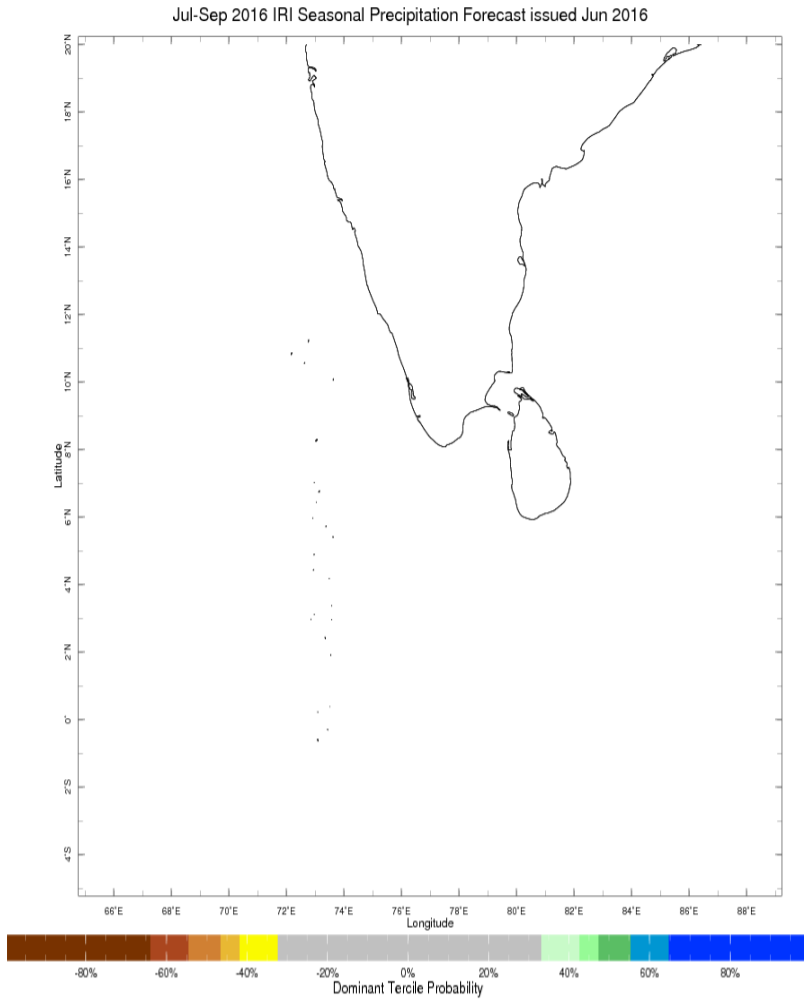


GFS 700mb week1 Mean Vector Wind Total (m/s)  
Ending: 18z22Jun2016

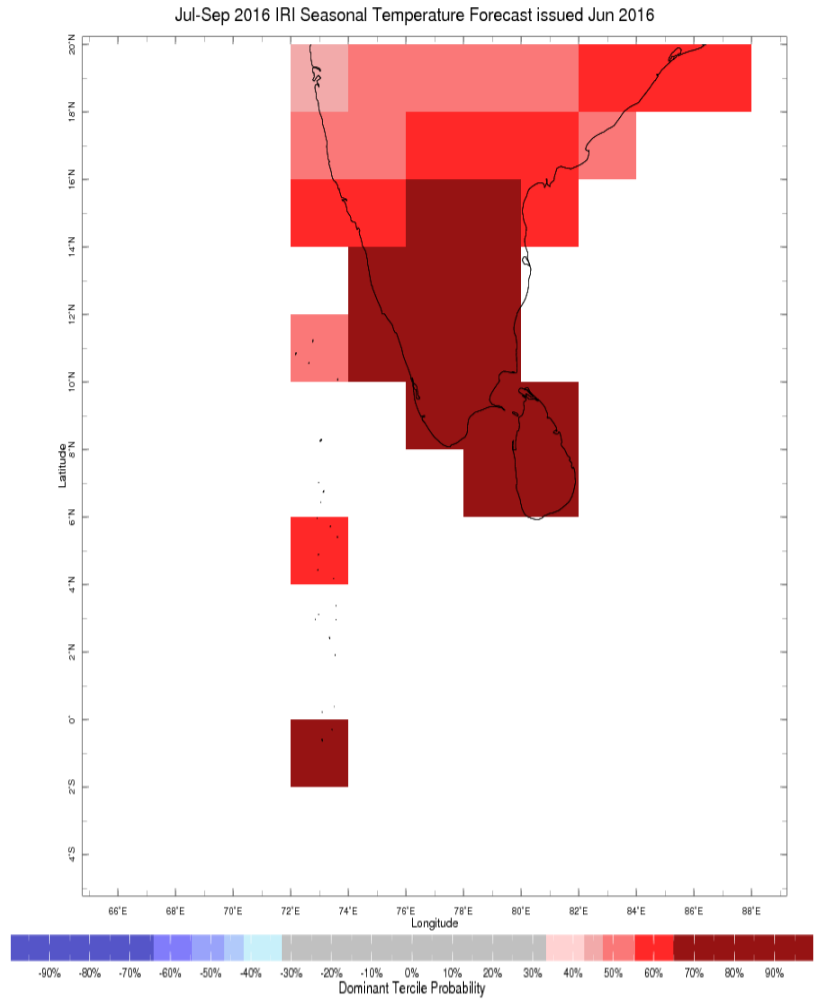


# Seasonal Rainfall and Temperature Forecast

Following is the latest seasonal precipitation and temperature prediction for the next 3 months by the IRI. The color shading indicates the probability of the most dominant tercile -- that is, the tercile having the highest forecast probability. The color bar alongside the map defines these dominant tercile probability levels. The upper side of the color bar shows the colors used for increasingly strong probabilities when the dominant tercile is the above-normal tercile, while the lower side shows likewise for the below-normal tercile. The gray color indicates an enhanced probability for the near-normal tercile (nearly always limited to 40%).



Precipitation Forecast



Temperature Forecast

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