Assessment of meteorological drought using satellite-derived CHIRPS precipitation product over Tamil Nadu, India

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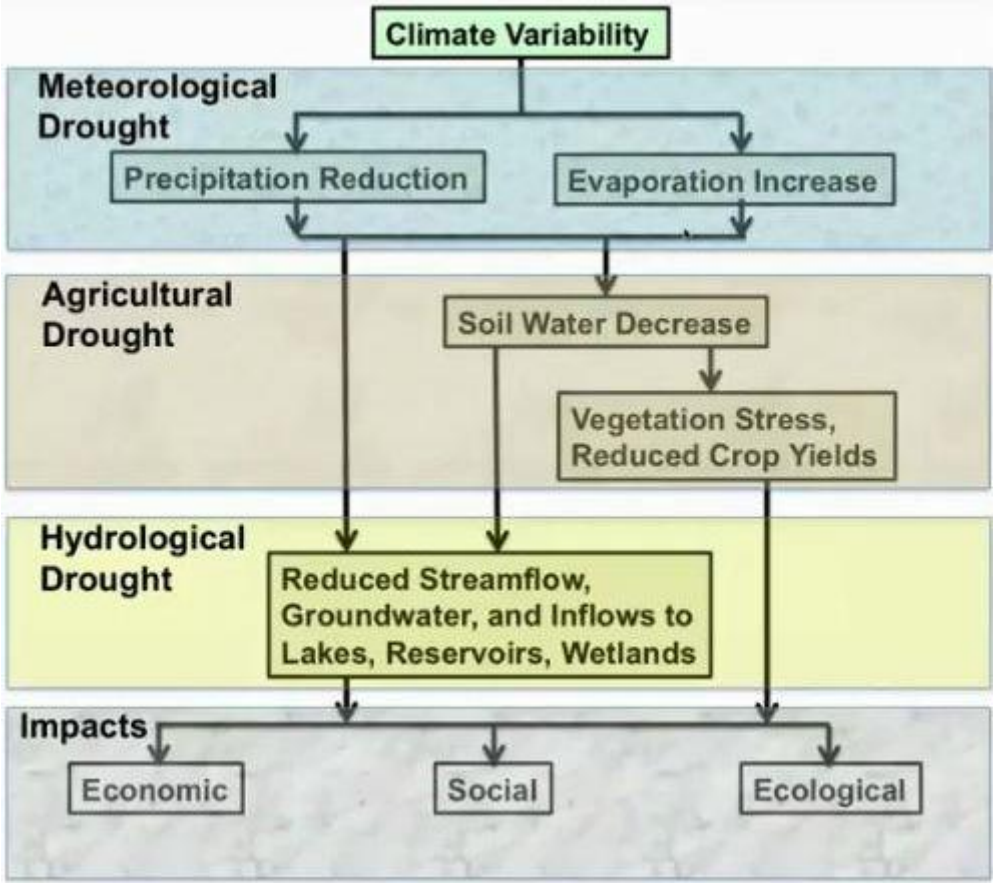
Outline of the presentation

- Introduction
- Location, Data source and Methods
- Validation of HRPPs on dominated rainfall season
- Remote sensing data for drought monitoring
- Drought monitoring with precipitation (Rainfall Deviation)
- Results and Discussions

Introduction

- Remote sensing has become crucial particularly for timely detection and monitoring of drought due to more prompt availability of spatio-temporal data over globe
- Different drought indices based on different climate variables (e.g., Precipitation, Soil moisture and remote sensing based indices)
- There have not been many studies that evaluate satellite rainfall data for complicated regions in Tamil Nadu



Objectives

- a) To validate High Resolution Precipitation Products using rain gauges across Tamil Nadu during North East monsoon.

- b) To monitor temporal rainfall deviation and resultant meteorological drought in Tamil Nadu integrating high resolution precipitation products.

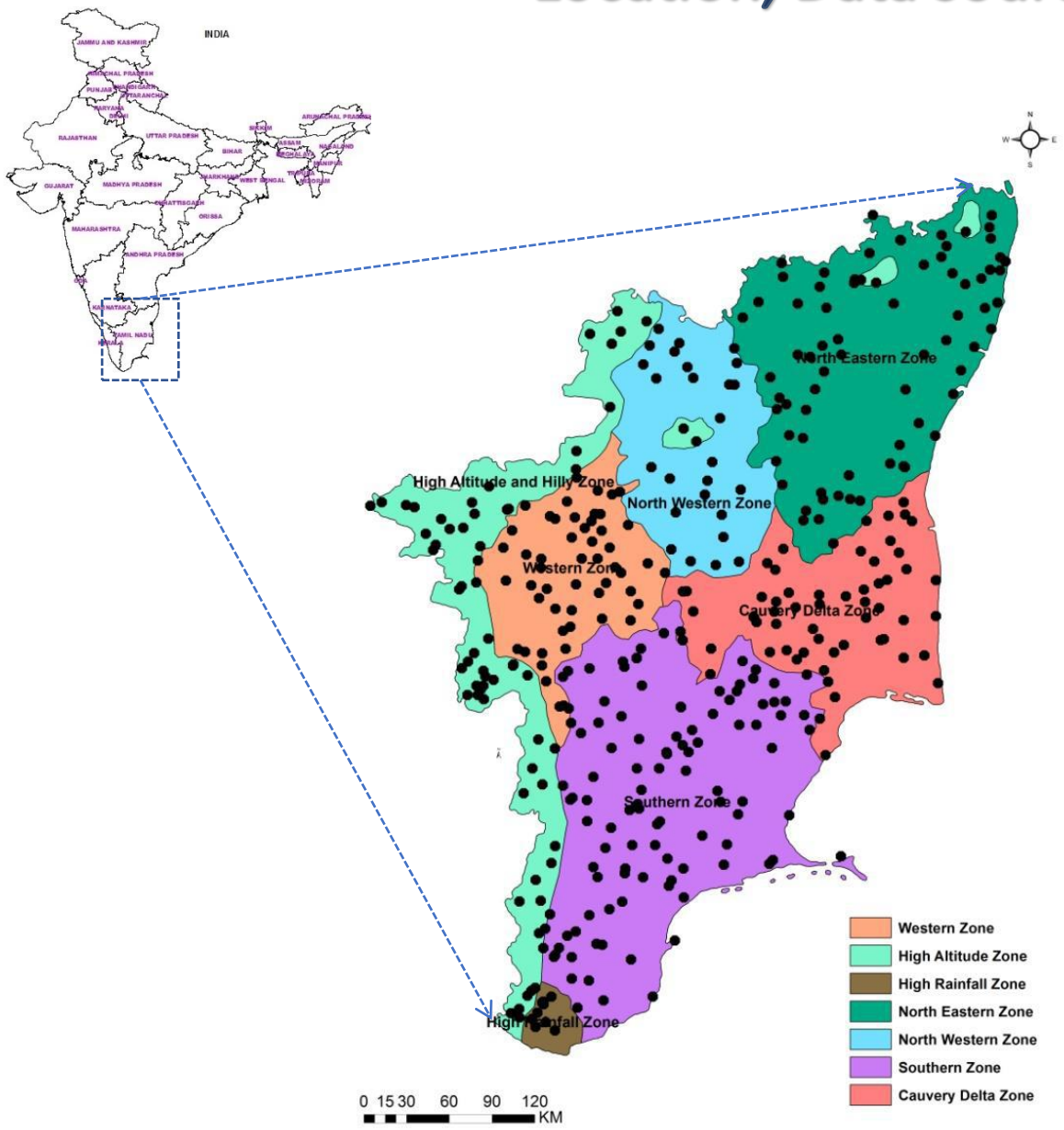
Objective I

To validate High Resolution Precipitation Products using rain gauges across Tamil Nadu during North East monsoon

HRPP validation

- CC, RMSE, NRMSE and Agreement (%)
- Monthly and Seasonally
- Agro Climatic Zone

Location, Data sources and Method



Location: Tamil Nadu
Satellite data: IMERG, TRMM, CHIRPS, PERSIANN
Obs data: Rain gauge station (391 station)
Period time: 2015-2017 (North East Monsoon)
Agro Climatic Zones: Western Zone (WZ)
High Altitude Zone (HAZ)
High Rainfall Zone (HRZ)
North Eastern Zone (NEZ)
North Western Zone (NWZ)
Southern Zone (SZ)
Cauvery Delta Zone (CDZ)

Satellite Product	Temporal Coverage	Spatial Resolution	Temporal Resolution
GPM IMERG Version 05	2014-present	0.01° (~10 km)	Daily
TMPA 3B42 Version 7.0	1998-present	0.25° (~27 km)	Daily
CHIRPS Version 2.0	1981-present	0.25° (~27 km)	Daily
PERSIANN	1983-present	0.25° (~27 km)	Daily

Data and Methods

- Periods: 2015-2017 using PWD and TNAU - North East monsoon season – (October – December)
- Spatial scales: point scale and regional scale
- Temporal scales: Seasonally
- Use statistical index: (Correlation Coefficient, RMSE, NRMSE and Percent of Agreement) to evaluate the performance of HRPPs (in different ACZ).

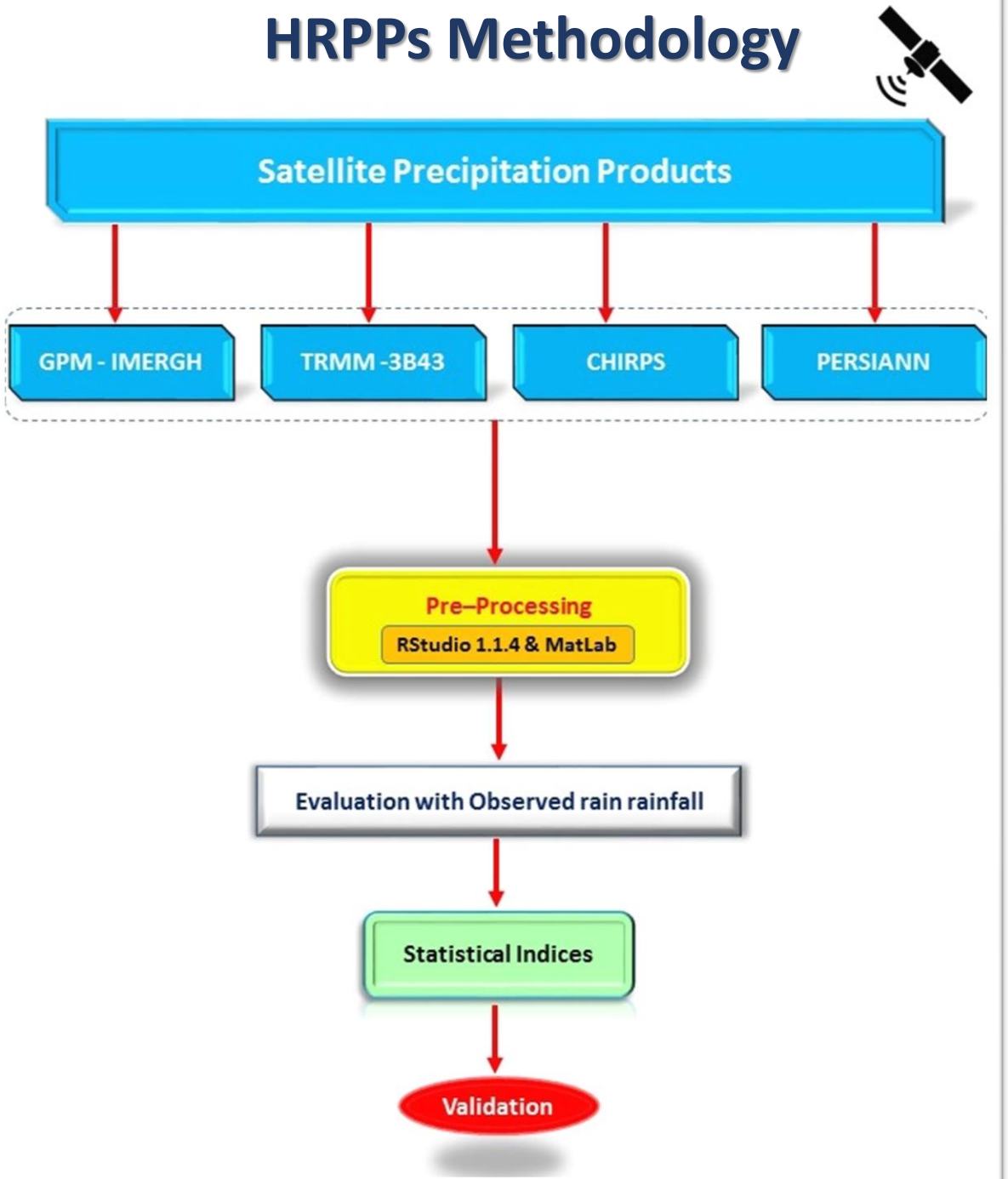
$$CC = \frac{\sum_{i=1}^{N}(HRPP_i - \overline{HRPP}).(AWS_i - \overline{AWS})}{\sqrt{\sum_{i=1}^{N}(HRPP_i - \overline{HRPP})^2.(AWS_i - \overline{AWS})^2}}$$

$$RMSE = \sqrt{\frac{1}{n}\Sigma_{i=1}^{n}\left(\frac{AWS_i - HRPP_i}{N}\right)^2}$$

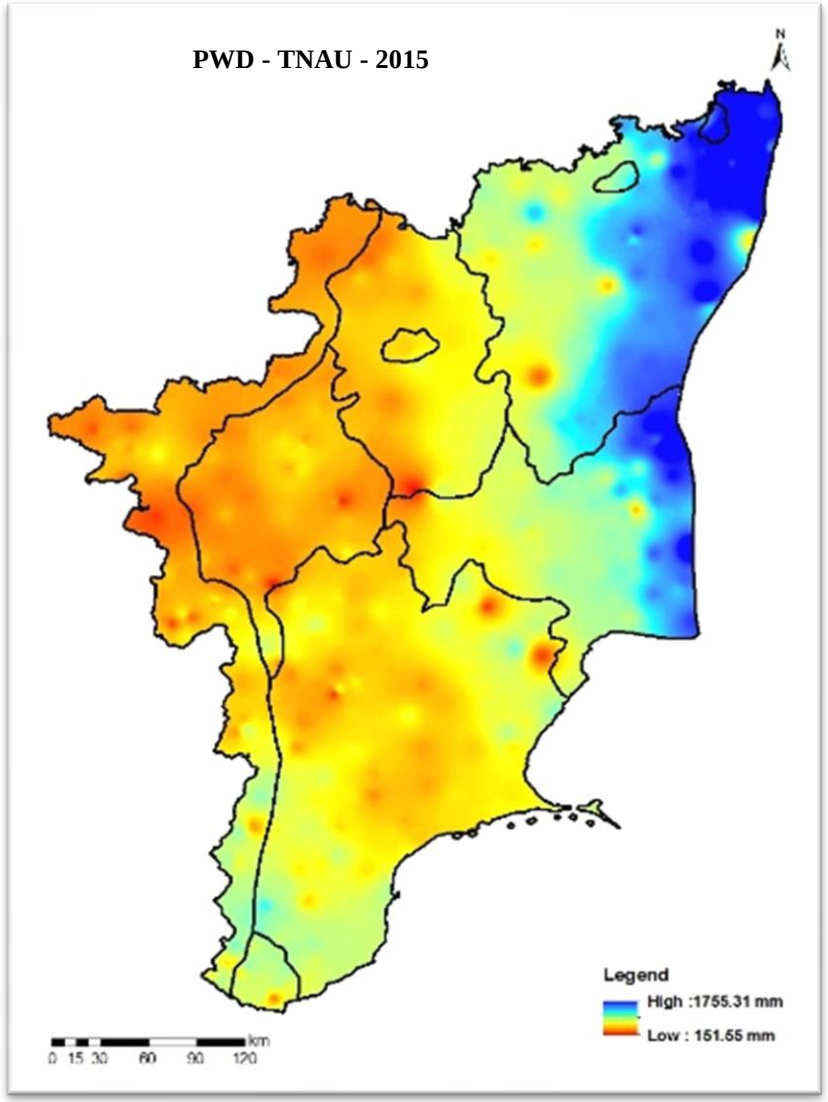
NRMSE =100 x (RMSE / O*i)*

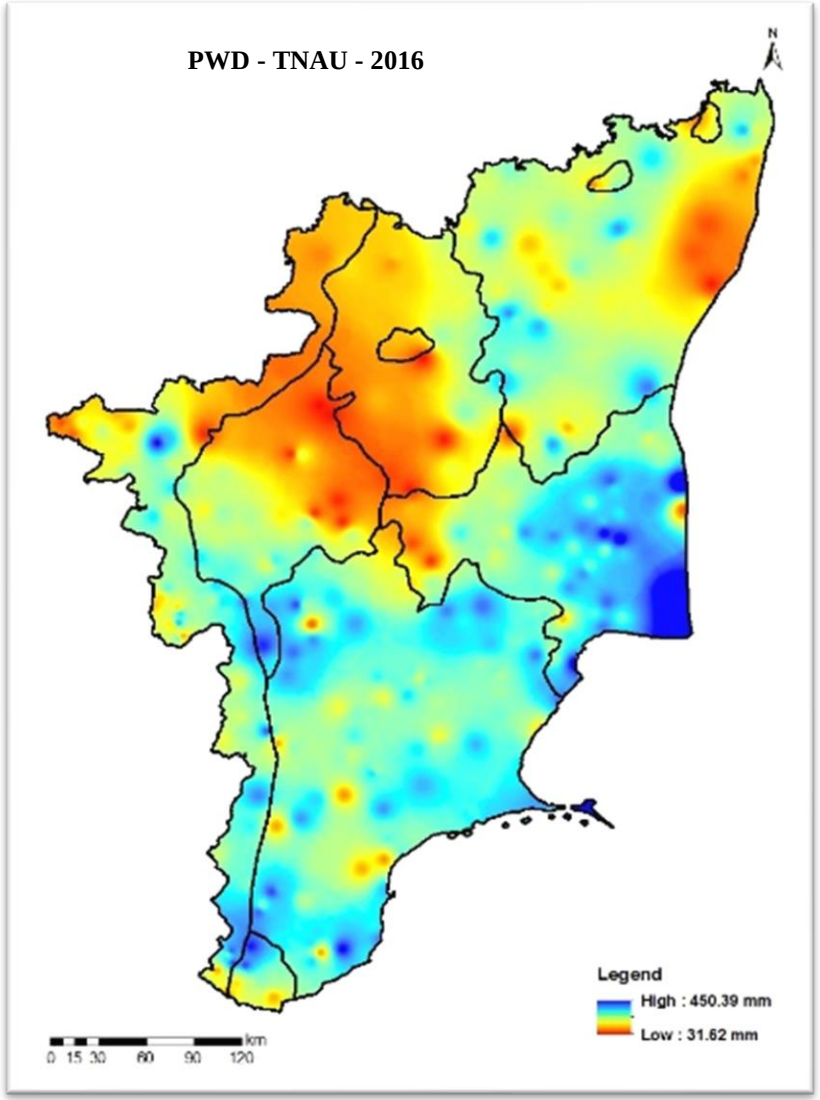
Agreement (%) =100 x (1- (RMSE / O*i))*

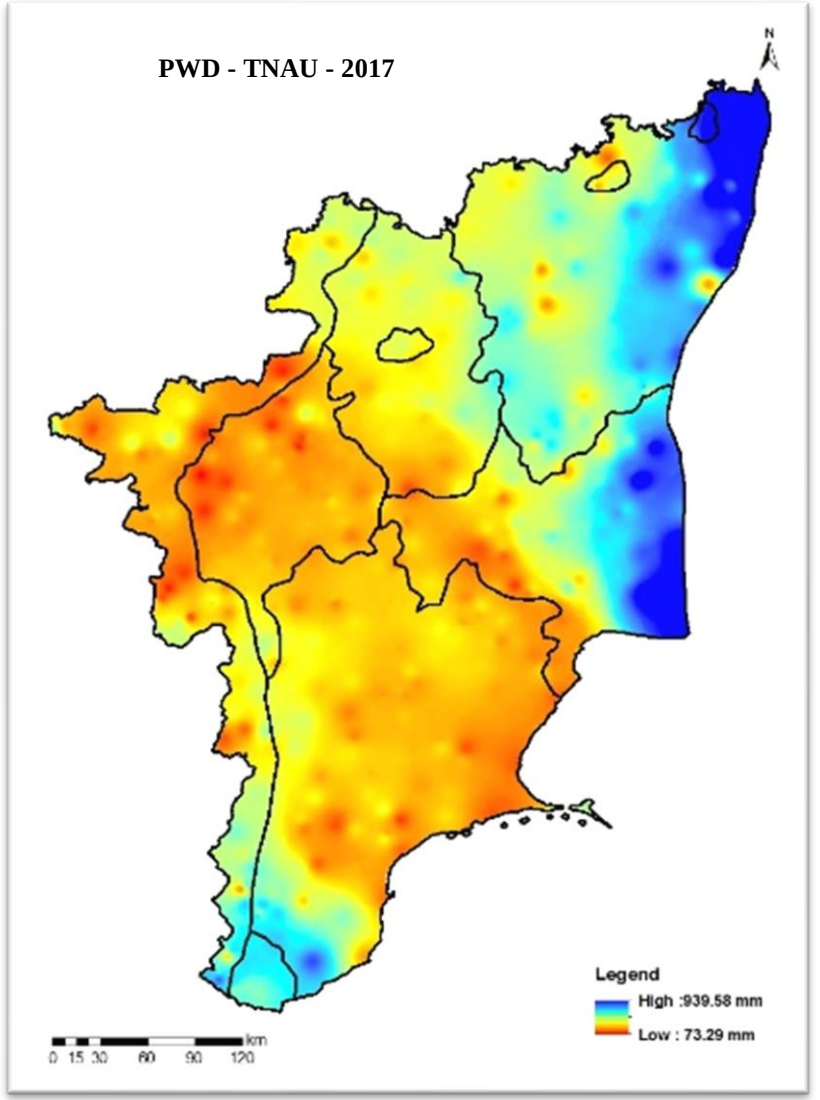
HRPPs Methodology



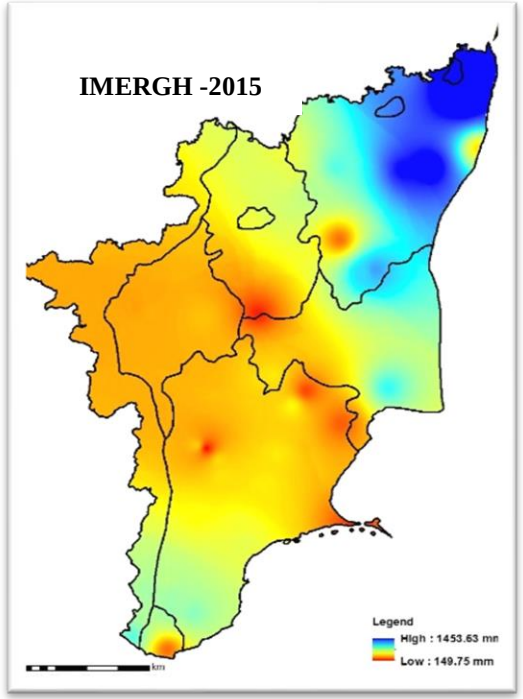
Spatial distribution of accumulated precipitation derived from HRPPs and AWS



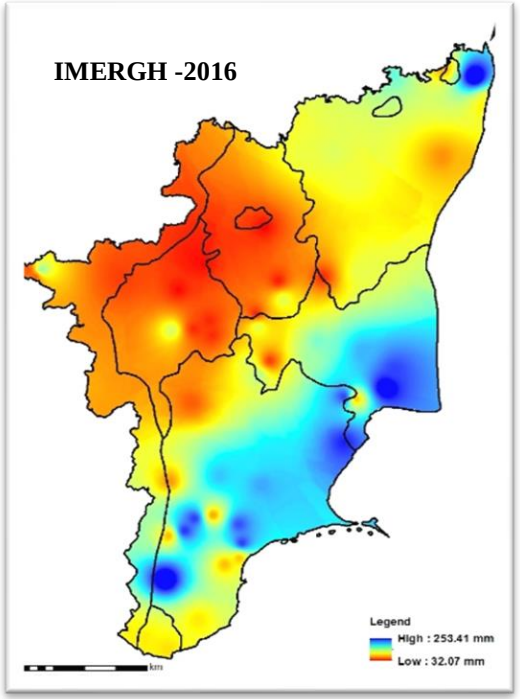




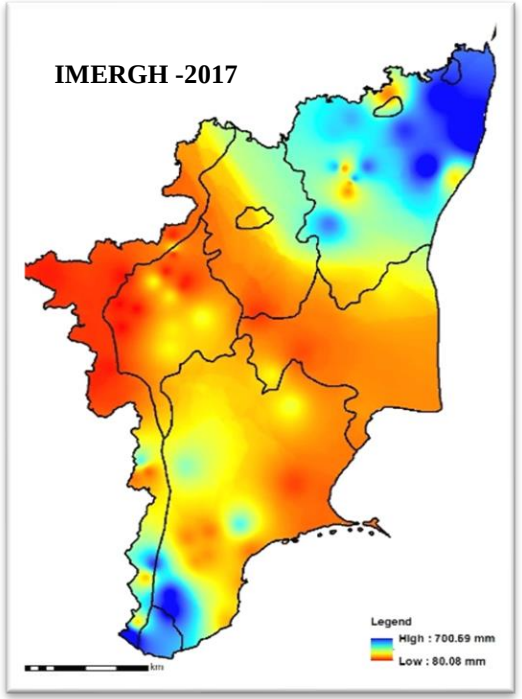
IMERGH -2015



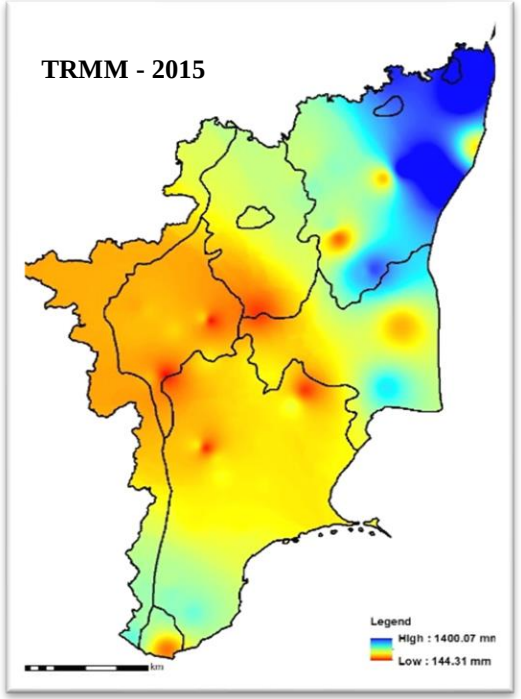
IMERGH -2016



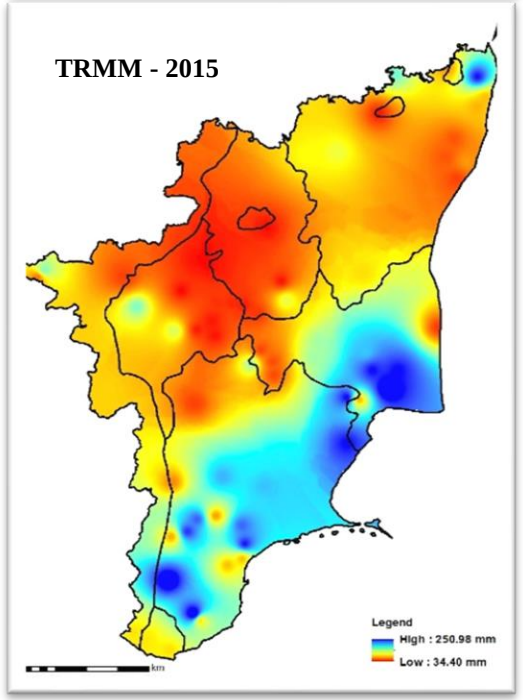
IMERGH -2017



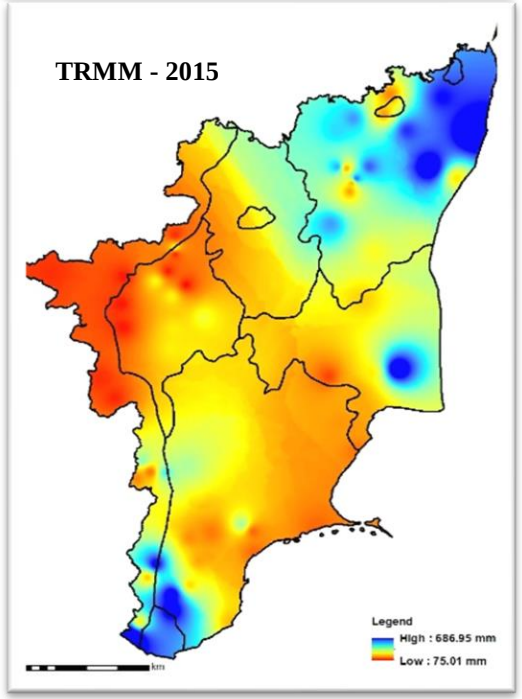
TRMM - 2015



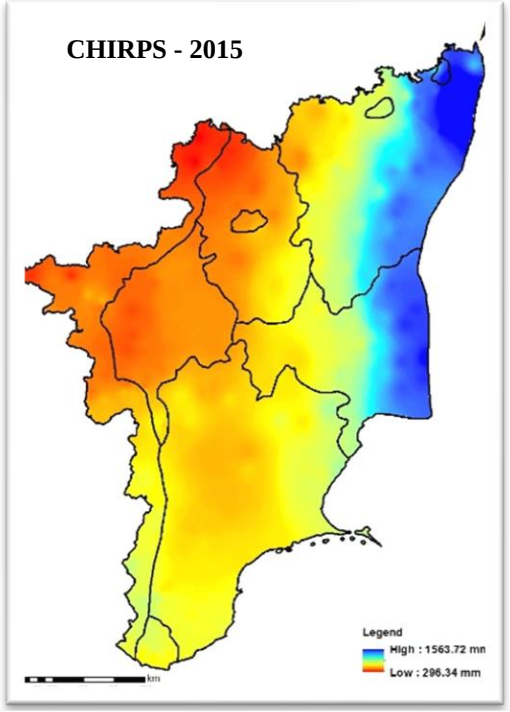
TRMM - 2015



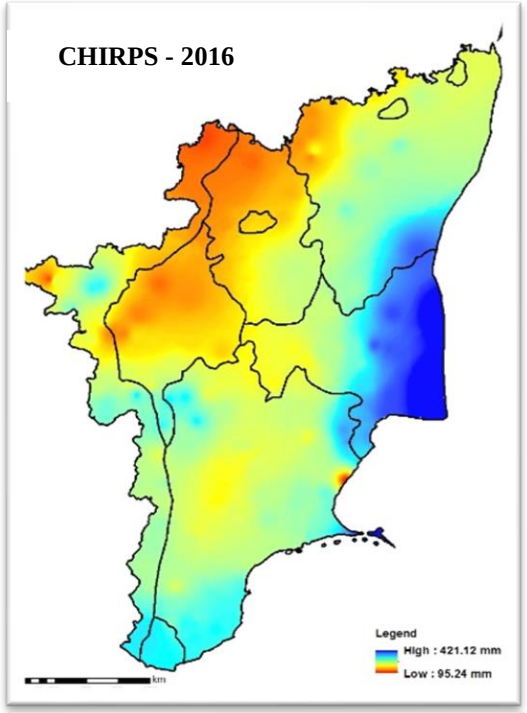
TRMM - 2015



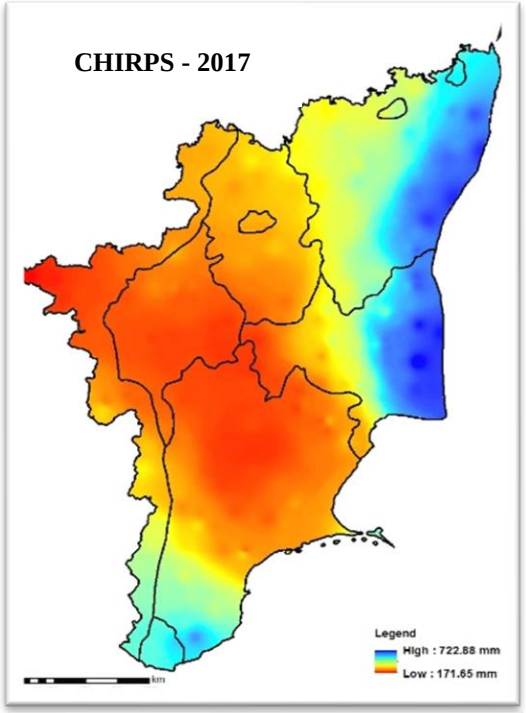
CHIRPS - 2015



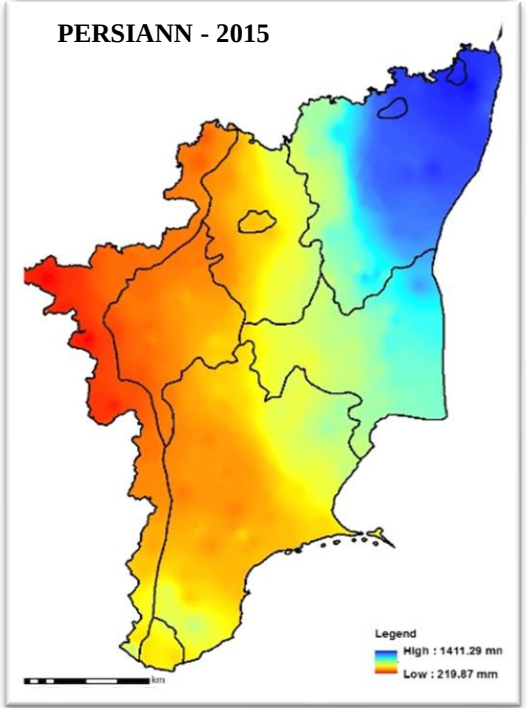
CHIRPS - 2016



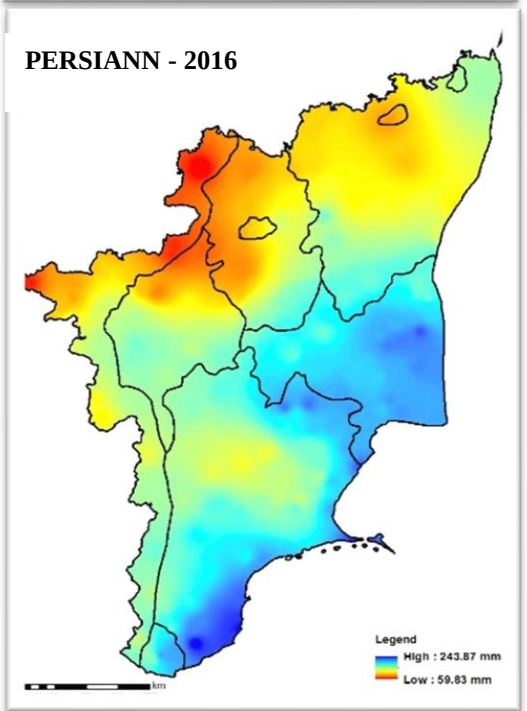
CHIRPS - 2017



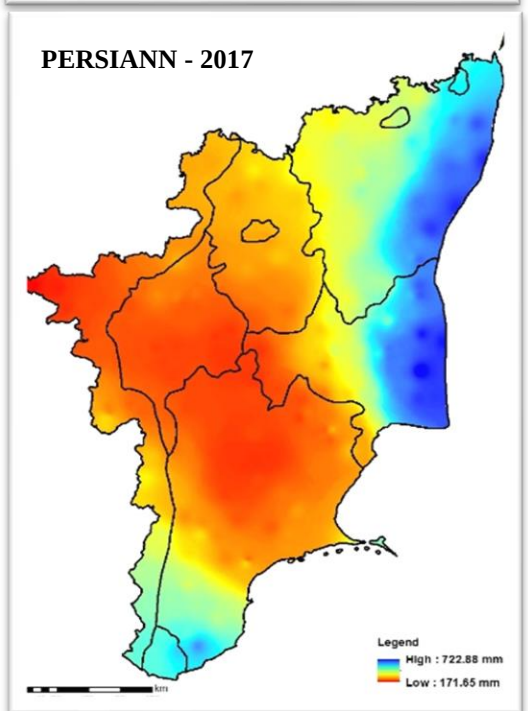
PERSIANN - 2015



PERSIANN - 2016



PERSIANN - 2017



Spatial distribution of precipitation derived from HRPPs and AWS over different Agro Climatic zones of Tamil Nadu

S.No	Agro Climatic Zones	IMERGH - 2015			IMERGH - 2016			IMERGH - 2017		
		MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN
1	Southern Zone (SZ)	124.44	756.50	474.89	47.29	279.29	135.30	130.70	700.55	378.86
2	North Eastern Zone (NEZ)	268.65	1453.31	824.47	35.70	252.98	84.33	199.46	526.98	291.44
3	High Rainfall Zone (HRZ)	263.99	726.42	526.65	84.93	251.85	118.30	93.41	668.46	262.71
4	Cauvery Delta Zone (CDZ)	165.28	901.11	495.56	36.29	238.66	118.80	80.45	254.41	163.02
5	Western Zone (WZ)	122.23	402.55	311.08	32.46	134.19	72.71	81.98	630.05	196.66
6	High Altitude and Hilly Zone (HAHZ)	109.94	1214.74	384.02	31.89	280.82	83.67	96.84	386.06	198.57
7	North Western Zone (NEZ)	133.31	689.37	409.18	30.45	104.62	46.71	102.91	610.00	209.45

S.No	Agro Climatic Zones	TRMM - 2015			TRMM - 2016			TRMM - 2017		
		MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN
1	Southern Zone (SZ)	146.62	771.65	478.34	42.33	258.57	136.98	93.09	596.13	203.71
2	North Eastern Zone (NEZ)	237.55	1399.77	841.26	28.99	214.61	69.67	126.43	686.95	381.79
3	High Rainfall Zone (HRZ)	259.82	712.16	520.99	86.11	246.43	122.48	205.86	518.27	296.08
4	Cauvery Delta Zone (CDZ)	183.31	973.37	536.39	34.21	250.93	128.72	91.58	649.52	245.98
5	Western Zone (WZ)	136.27	460.02	330.23	33.91	140.21	70.90	74.88	244.07	159.64
6	High Altitude and Hilly Zone (HAHZ)	140.51	1173.22	411.20	33.68	273.82	84.94	76.03	658.66	179.29
7	North Western Zone (NEZ)	130.08	704.08	452.64	32.46	105.53	46.35	89.42	374.72	192.30

S.No	Agro Climatic Zones	CHIRPS - 2015			CHIRPS - 2016			CHIRPS - 2017		
		MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN
1	Southern Zone (SZ)	475.15	975.57	643.65	96.75	322.73	204.96	112.99	702.60	317.52
2	North Eastern Zone (NEZ)	464.07	1563.81	982.11	128.69	296.74	221.95	314.30	1333.70	584.37
3	High Rainfall Zone (HRZ)	649.11	798.44	713.86	216.74	248.09	240.08	371.50	896.75	506.43
4	Cauvery Delta Zone (CDZ)	504.98	1447.71	954.70	159.69	421.12	265.76	231.84	1146.03	542.11
5	Western Zone (WZ)	360.48	671.68	459.47	106.86	239.91	150.49	171.94	510.65	266.84
6	High Altitude and Hilly Zone (HAHZ)	283.42	1149.41	506.81	86.58	248.33	177.01	223.38	741.06	394.18
7	North Western Zone (NEZ)	321.09	738.85	502.38	104.53	200.82	149.45	220.28	549.77	361.77

S.No	Agro Climatic Zones	PERSIANN - 2015			PERSIANN - 2016			PERSIANN - 2017		
		MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM	MEAN
1	Southern Zone (SZ)	354.59	941.72	547.95	125.61	252.23	171.73	186.55	593.66	277.02
2	North Eastern Zone (NEZ)	711.50	1409.01	1140.00	93.79	174.36	132.84	289.49	677.48	478.71
3	High Rainfall Zone (HRZ)	513.29	665.60	564.98	157.51	239.17	183.67	475.96	580.51	522.20
4	Cauvery Delta Zone (CDZ)	550.04	1233.94	867.31	163.35	218.01	186.34	185.68	722.56	450.83
5	Western Zone (WZ)	273.47	571.69	400.69	70.64	176.50	134.30	186.37	279.84	214.13
6	High Altitude and Hilly Zone (HAHZ)	219.90	1378.72	375.35	59.85	170.18	119.42	171.69	526.11	276.03
7	North Western Zone (NEZ)	348.50	822.20	571.73	71.53	172.70	119.11	201.60	366.93	280.88

Monthwise statistical evaluation of HRPP

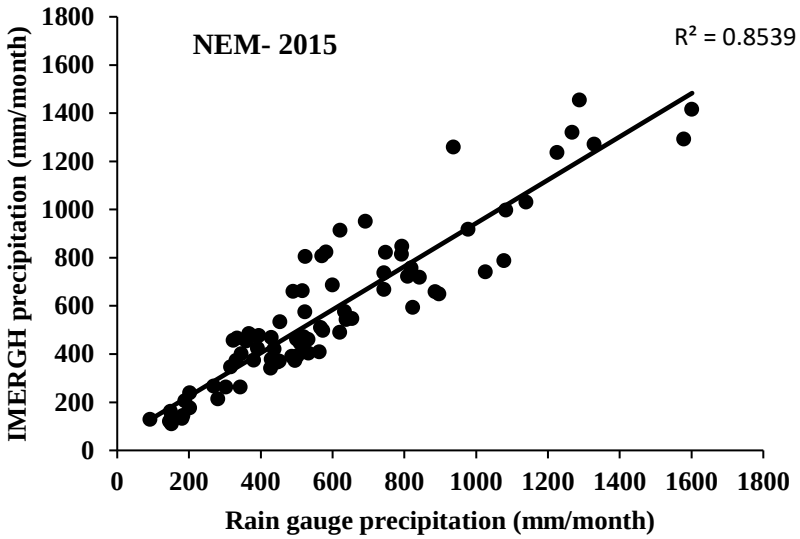
October - 2015				
Index	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**
CC	0.557	0.555	0.492	0.557
RMSE	28.51	28.45	32.20	34.67
NRMSE	19.01	19.16	19.80	19.84
Agreement	80.99	80.84	80.20	80.16
November-2015				
Index	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**
CC	0.834	0.798	0.824	0.768
RMSE	71.18	71.04	83.26	91.62
NRMSE	17.75	17.80	20.03	19.94
Agreement	82.25	82.20	79.97	80.06
December-2015				
Index	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**
CC	0.865	0.87	0.876	0.836
RMSE	30.91	33.57	28.88	30.93
NRMSE	20.40	20.44	18.87	19.51
Agreement	79.60	79.56	81.13	80.49

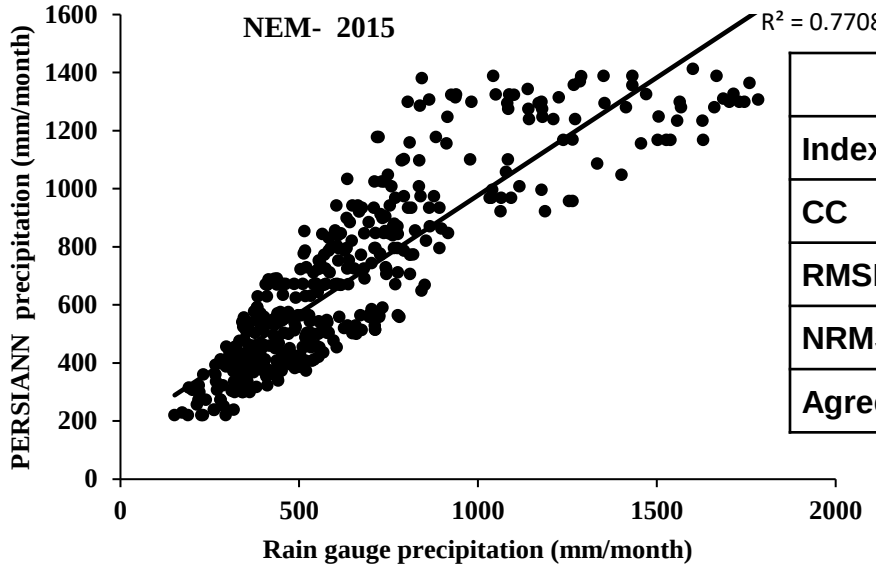
Monthwise statistical evaluation of HRPP

October - 2016			
IMERGH	TRMM	CHIRPS	PERSIANN
0.724	0.732	0.668	0.748
13.19	13.41	12.95	12.70
20.09	19.22	19.52	19.80
79.91	80.78	80.48	80.20
November-2016			
IMERGH	TRMM	CHIRPS	PERSIANN
0.875	0.875	0.874	0.896
13.18	13.53	19.83	15.22
19.19	20.70	19.51	19.38
80.81	79.30	80.49	80.62
December-2016			
IMERGH	TRMM	CHIRPS	PERSIANN
0.849	0.803	0.838	0.786
10.08	9.86	11.86	4.05
19.83	20.49	19.88	18.27
80.17	79.51	80.12	81.73

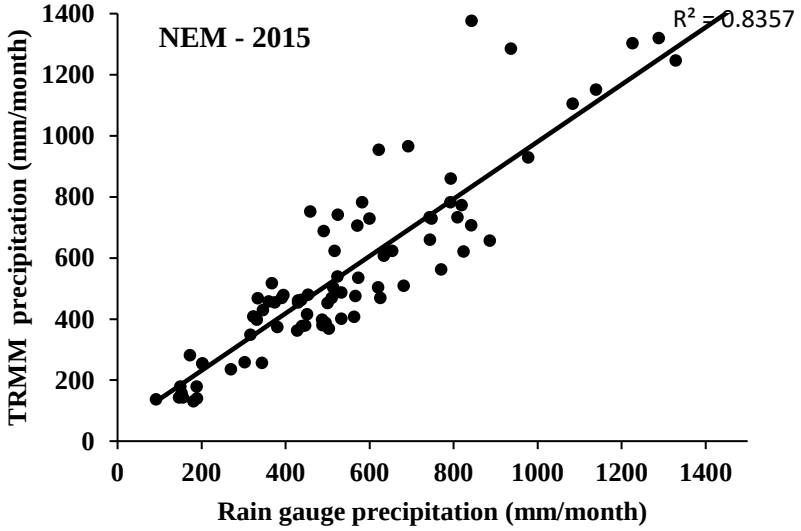
October - 2017			
IMERGH	TRMM	CHIRPS	PERSIANN
0.736	0.746	0.755	0.744
31.40	31.29	36.92	35.68
18.00	18.31	19.15	18.85
82.00	81.69	80.85	81.15
November-2017			
IMERGH	TRMM	CHIRPS	PERSIANN
0.811	0.827	0.814	0.856
51.21	49.88	54.76	37.50
20.69	21.57	22.11	21.08
79.31	78.43	77.89	78.92
December-2017			
IMERGH	TRMM	CHIRPS	PERSIANN
0.824	0.85	0.78	0.837
9.81	9.50	8.65	3.31
20.42	19.94	20.77	19.43
79.58	80.06	79.23	80.57

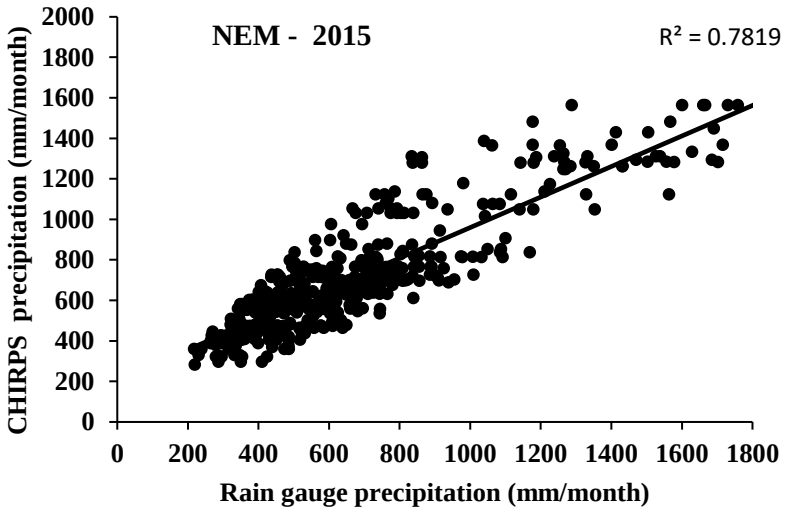
Evaluation of HRPPs on the regional scale for the state of Tamil Nadu Seasonal precipitation during North East Monsoon (NEM)





NEM 2015				
Index	IMERGH	TRMM	CHIRPS	PERSIANN
CC	0.853	0.835	0.781	0.77
RMSE	58.49	96.57	127.24	134.73
NRMSE	10.24	17.46	18.05	18.88
Agreement	89.76	82.54	81.95	81.12





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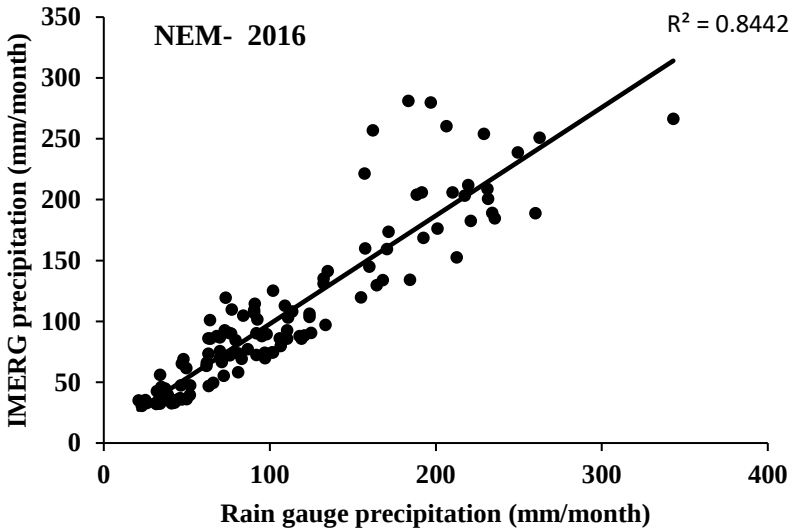
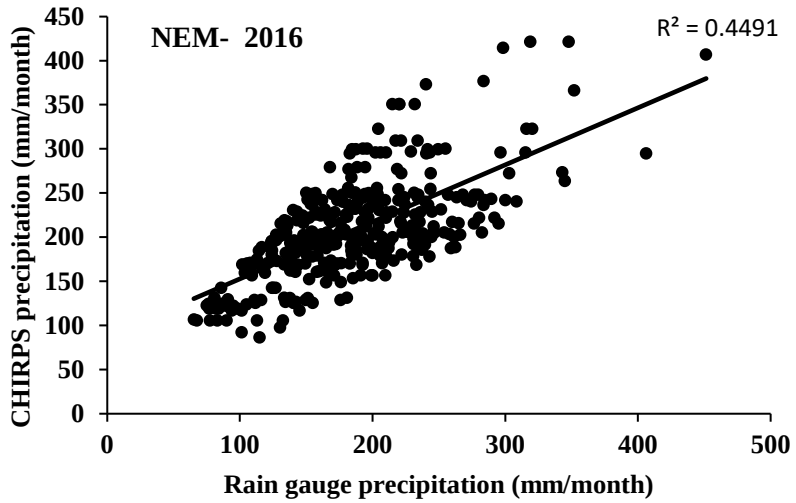
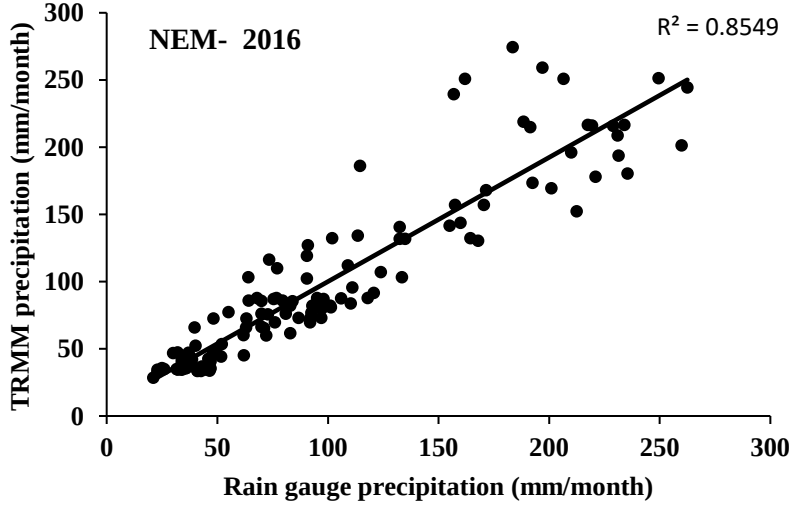
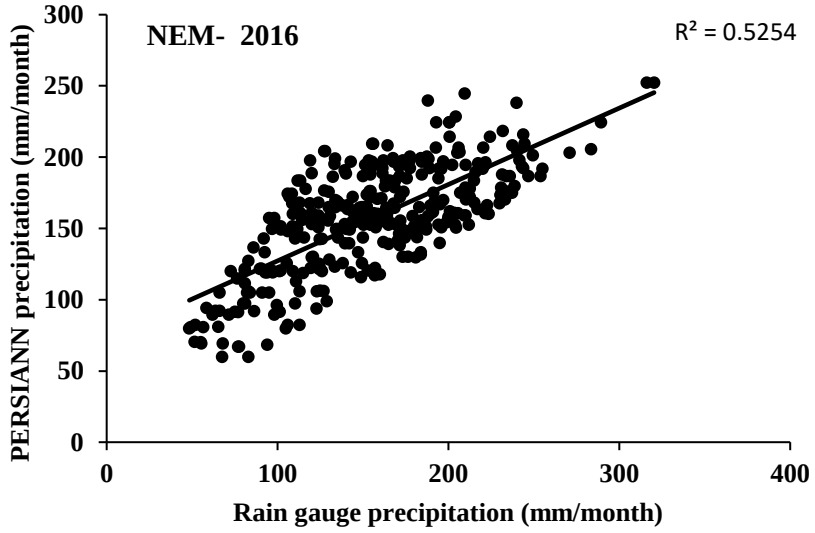


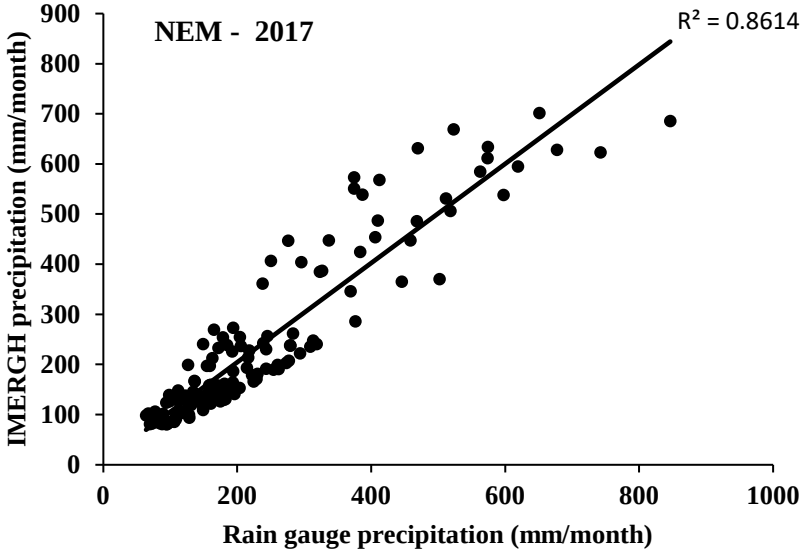


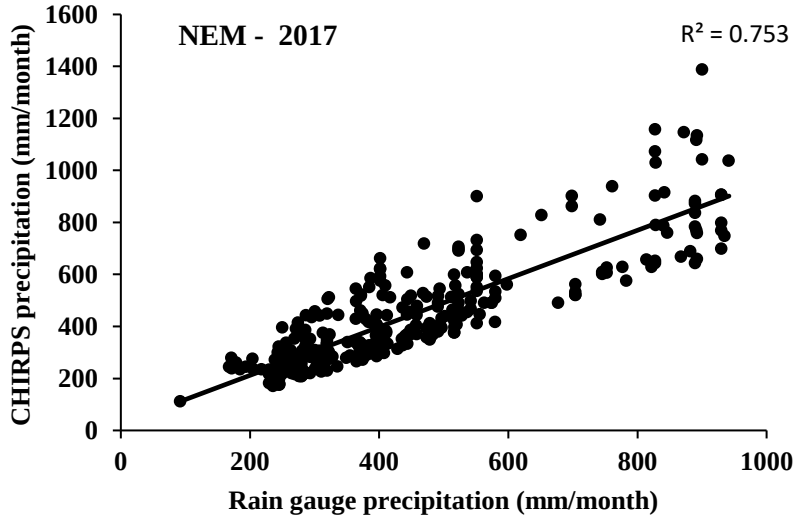
NEM 2016				
Index	IMERGH	TRMM	CHIRPS	PERSIANN
CC	0.844	0.854	0.449	0.525
RMSE	19.11	17.47	43.13	29.83
NRMSE	19.01	17.75	20.53	19.42
Agreement	80.99	82.25	79.47	80.58



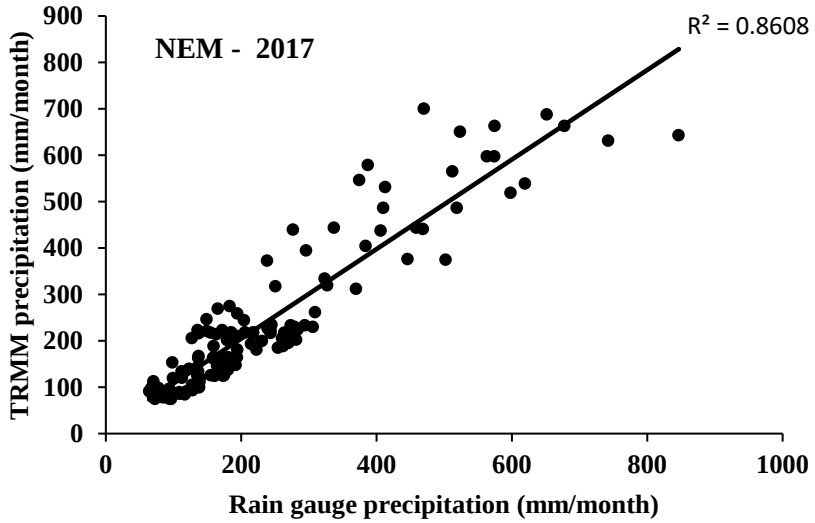


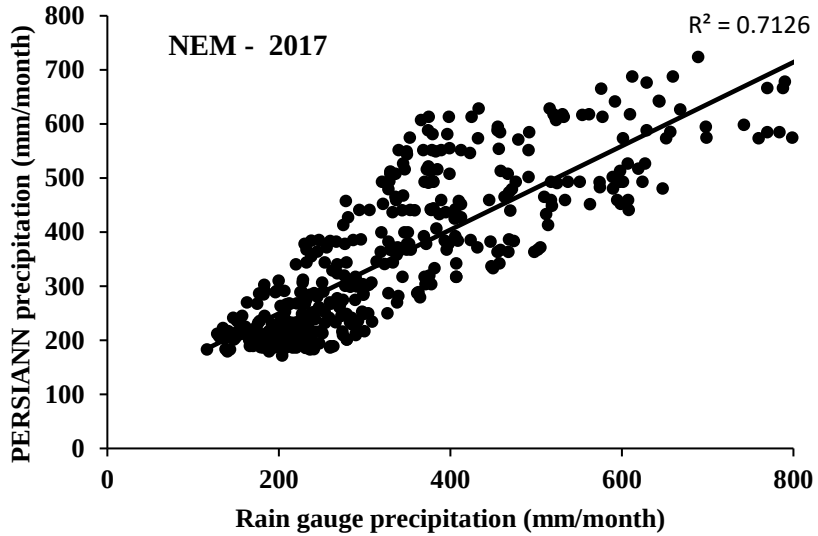
Evaluation of HRPPs on the regional scale for the state of Tamil Nadu Seasonal precipitation during North East Monsoon (NEM)





NEM 2017				
Index	IMERGH	TRMM	CHIRPS	PERSIANN
CC	0.861	0.86	0.753	0.712
RMSE	45.09	44.52	81.29	69.51
NRMSE	19.05	19.32	18.63	19.07
Agreement	80.95	80.68	81.37	80.93



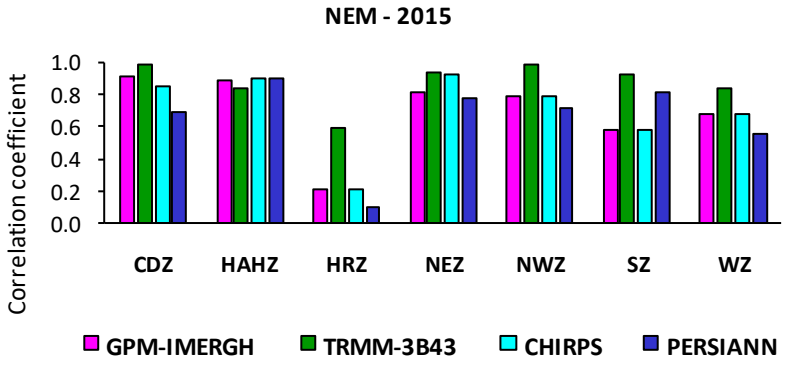


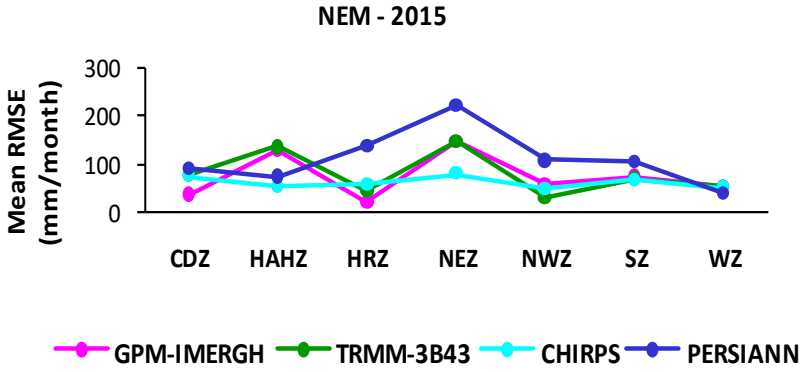
Zone wise seasonal evaluation of HRPPs

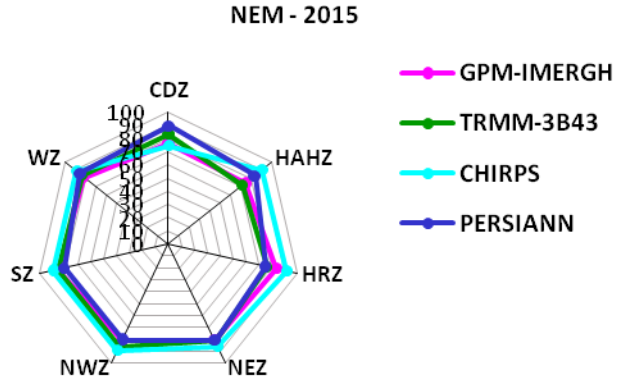
	NEM 2015				NEM 2016				NEM 2017			
Cauvery Delta Zone (CDZ)												
Index	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**	**IMERGH**	**TRMM**	**CHIRPS**	**PERSIANN**
CC	0.99	0.71	0.92	0.69	0.87	0.86	0.83	0.25	0.82	0.82	0.95	0.71
RMSE	36.85	78.59	77.05	93.33	18.04	17.19	28.05	33.38	49.18	46.02	55.04	85.04
NRMSE	23.26	16.62	25.19	10.57	17.68	14.00	10.49	18.15	19.73	21.04	10.44	18.80
Agreement	76.74	83.38	74.81	89.43	82.32	86.00	89.51	81.85	80.27	78.96	89.56	81.20
High Altitude and Hilly Zone (HAHZ)												
CC	0.68	0.67	0.89	0.79	0.72	0.73	0.75	0.56	0.92	0.92	0.89	0.70
RMSE	129.43	136.24	53.93	75.60	21.98	20.84	21.95	22.63	38.48	37.94	34.71	55.52
NRMSE	25.52	28.33	9.63	16.79	20.04	18.80	11.16	18.82	16.03	18.10	8.20	19.40
Agreement	74.48	71.67	90.37	83.21	79.96	81.20	88.84	81.18	83.97	81.90	91.80	80.60
High Rainfall Zone (HRZ)												
CC	0.98	0.96	0.22	0.10	0.60	0.70	0.81	0.45	0.34	0.34	0.71	0.59
RMSE	21.16	43.61	59.15	139.17	27.62	26.43	25.72	38.62	67.75	64.76	46.13	124.01
NRMSE	16.39	23.95	8.37	24.99	22.75	20.89	10.37	20.80	33.55	31.01	9.34	23.15
Agreement	83.61	76.05	91.63	75.01	77.25	79.11	89.63	79.20	66.45	68.99	90.66	76.85
North Eastern Zone (NEZ)												
CC	0.79	0.78	0.83	0.52	0.89	0.93	0.68	0.53	0.83	0.80	0.81	0.47
RMSE	149.40	146.96	80.78	222.17	15.07	11.44	19.63	31.18	62.79	64.59	72.79	104.69
NRMSE	19.43	18.53	8.20	19.45	18.96	17.02	10.58	22.63	18.29	17.67	11.06	21.87
Agreement	80.57	81.47	85.80	80.55	81.04	82.98	89.42	77.37	81.71	82.33	88.94	78.13

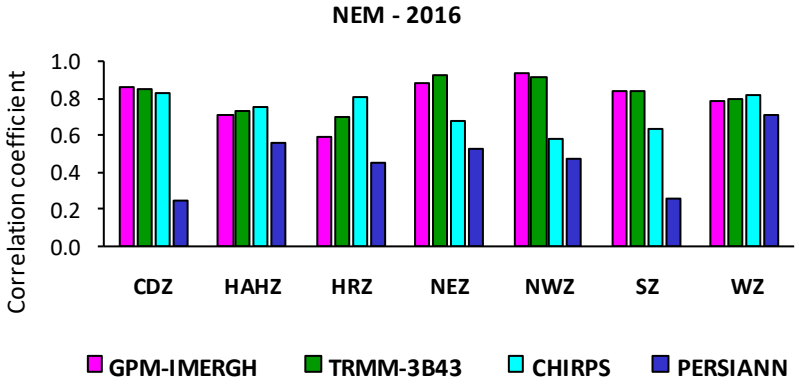
Zone wise seasonal evaluation of HRPPs

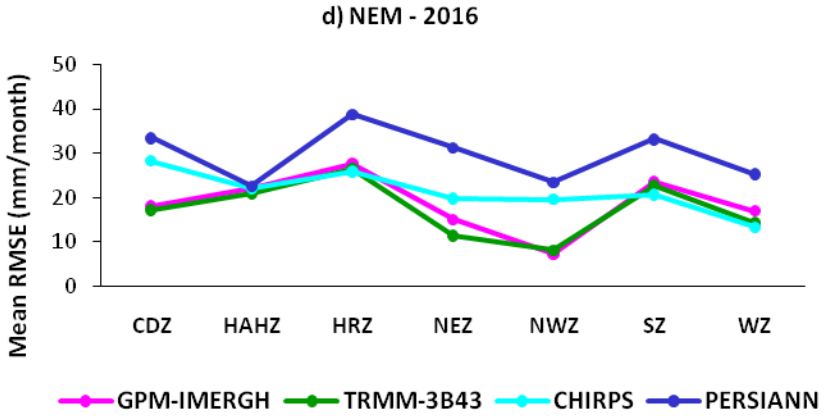
	NEM 2015				NEM 2016				NEM 2017			
North Western Zone (NWZ)												
CC	0.99	0.99	0.80	0.44	0.94	0.92	0.58	0.48	0.70	0.71	0.44	0.40
RMSE	60.25	31.17	49.13	109.30	7.33	8.18	19.44	23.41	60.66	63.27	52.57	50.55
NRMSE	19.63	13.62	10.86	19.73	18.19	20.50	13.57	21.57	31.13	31.42	14.17	17.64
Agreement	80.37	86.38	89.14	80.27	81.81	79.50	86.43	78.43	68.87	68.58	85.83	82.36
Southern Zone (SZ)												
CC	0.86	0.75	0.58	0.35	0.84	0.84	0.64	0.26	0.84	0.86	0.85	0.71
RMSE	75.22	70.15	68.17	106.34	23.49	22.71	20.52	33.07	39.74	37.62	30.88	51.90
NRMSE	14.56	14.07	10.61	18.90	17.37	16.73	9.87	18.69	19.86	19.52	9.10	18.30
Agreement	85.44	85.93	89.39	81.10	82.63	83.27	90.13	81.31	80.14	80.48	90.90	81.70
Western Zone (WZ)												
CC	0.83	0.78	0.68	0.56	0.78	0.80	0.82	0.71	0.86	0.80	0.72	0.30
RMSE	54.53	54.50	51.66	41.74	17.04	14.33	13.29	25.26	22.55	24.33	26.50	32.22
NRMSE	18.18	15.95	11.42	20.45	21.08	19.66	8.02	19.85	13.74	15.30	9.93	14.98
Agreement	81.82	84.05	88.58	85.69	78.92	80.34	89.98	80.15	86.26	84.70	90.07	85.02

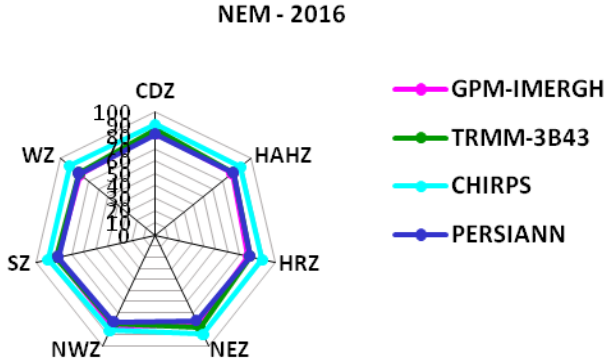

NEM - 2015
Correlation coefficient
1.0
0.8
0.6
0.4
0.2
0.0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN

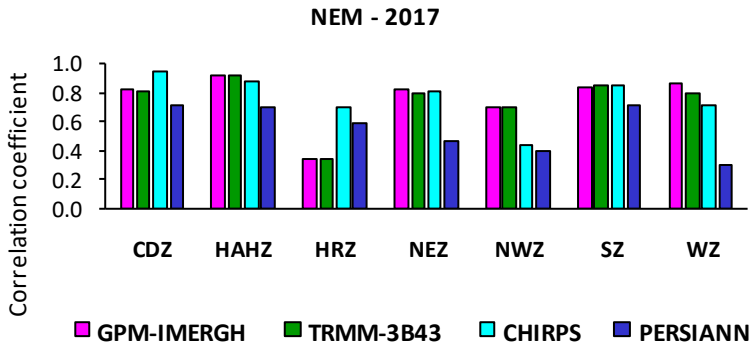

NEM - 2015
Mean RMSE (mm/month)
300
200
100
0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN

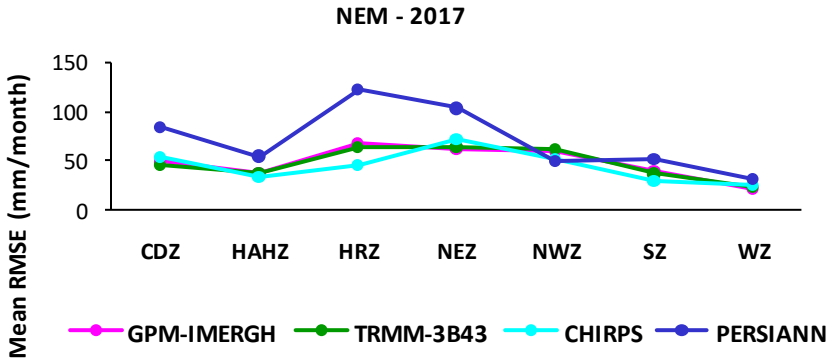

NEM - 2015
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN

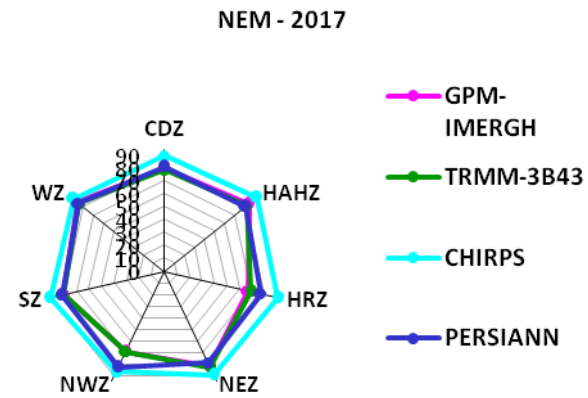

NEM - 2016
Correlation coefficient
1.0
0.8
0.6
0.4
0.2
0.0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN


d) NEM - 2016
Mean RMSE (mm/month)
50
40
30
20
10
0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN


NEM - 2016
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN


NEM - 2017
Correlation coefficient
1.0
0.8
0.6
0.4
0.2
0.0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN


NEM - 2017
Mean RMSE (mm/month)
150
100
50
0
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN


NEM - 2017
CDZ
HAHZ
HRZ
NEZ
NWZ
SZ
WZ
GPM-IMERGH
TRMM-3B43
CHIRPS
PERSIANN

Objective II

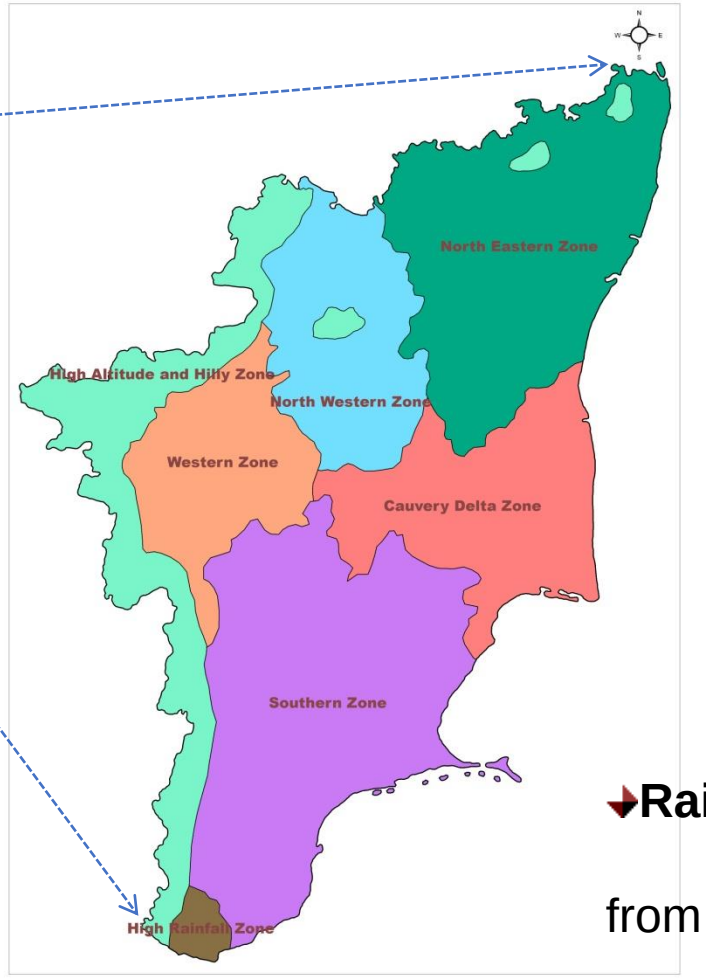
To monitor temporal rainfall deviation and resultant meteorological drought in Tamil Nadu integrating high resolution precipitation products

Meteorological drought

- Rainfall Deviation

Percentage rainfall deviation	Rainfall deviation category	Intensity of drought
60 and more	Large Excess	No drought
20 to 59	Excess	No drought
+19 to -19	Normal	Mild drought
-59 to -20	Deficient	Moderate drought
-99 to -60	Large Deficient	Severe drought
-100	No Rain	Extreme drought

Location, Data sources and Method



Location: Tamil Nadu
Obs data: Rain gauge station (391 station)
Period time: North East Monsoon
Agro Climatic Zones: Western Zone (WZ)
High Altitude Zone (HAZ)
High Rainfall Zone (HRZ)
North Eastern Zone (NEZ)
North Western Zone (NWZ)
Southern Zone (SZ)
Cauvery Delta Zone (CDZ)

- **Rainfall deviation**

Based on the percentage deviation of rainfall from its long term mean

$$Rfdev=[(Rfi-RFn)/RFn]*100$$

Meteorological drought analysis

Rainfall deviation

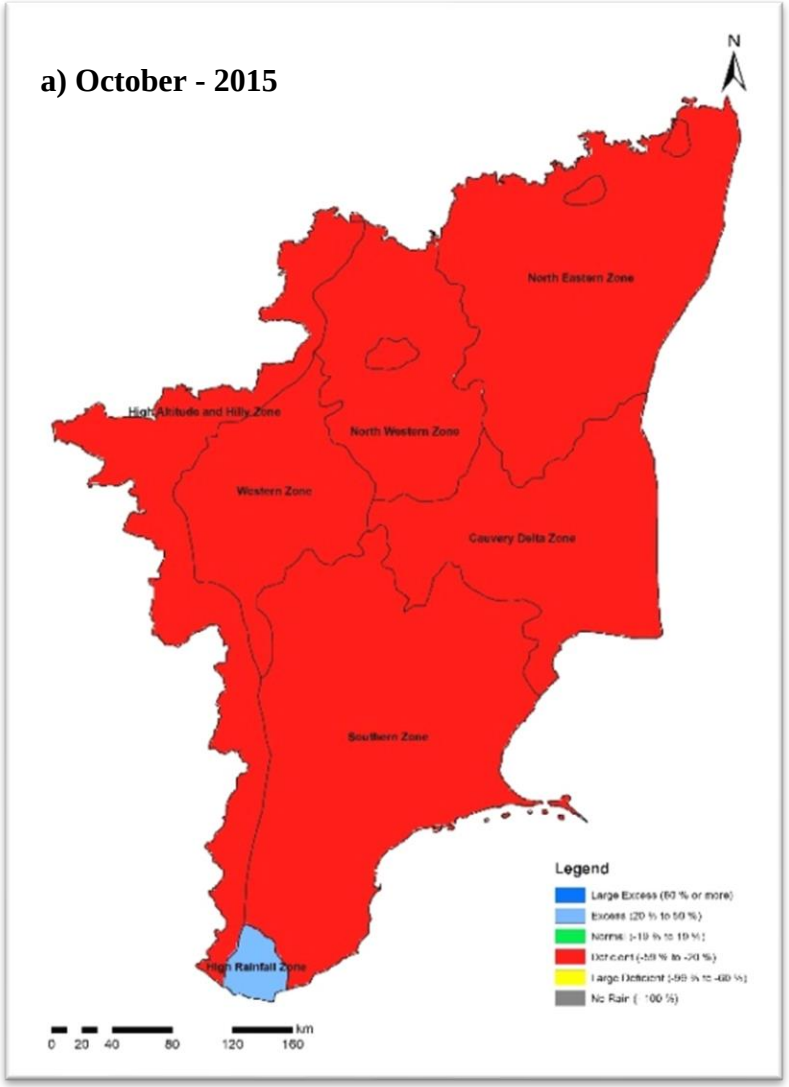
- The monthly drought condition was determined using the criteria suggested by IMD Based on rainfall deviations, four categories are used to monitor and evaluate rainfall patterns across Tamil Nadu during the North Eastern monsoon season. It is calculated using the following formula;

$$Rfdev=[(Rfi-RFn)/RFn]*100$$

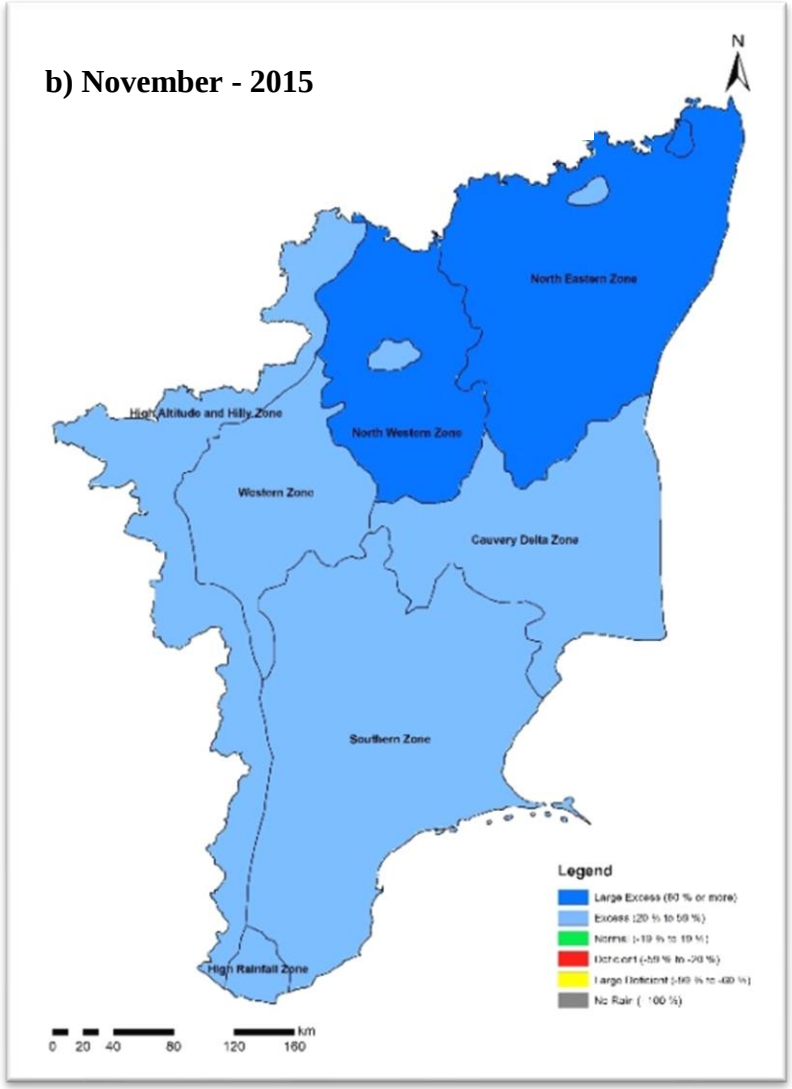
Deviation from Normal Rainfall (%)	Category	Intensity of drought
60 and more	Large Excess	No drought
20 to 59	Excess	No drought
+19 to -19	Normal	Mild drought
-59 to -20	Deficient	Moderate drought
-99 to -60	Large Deficient	Severe drought
-100	No Rain	Extreme drought

Assessing drought based on total rainfall departure

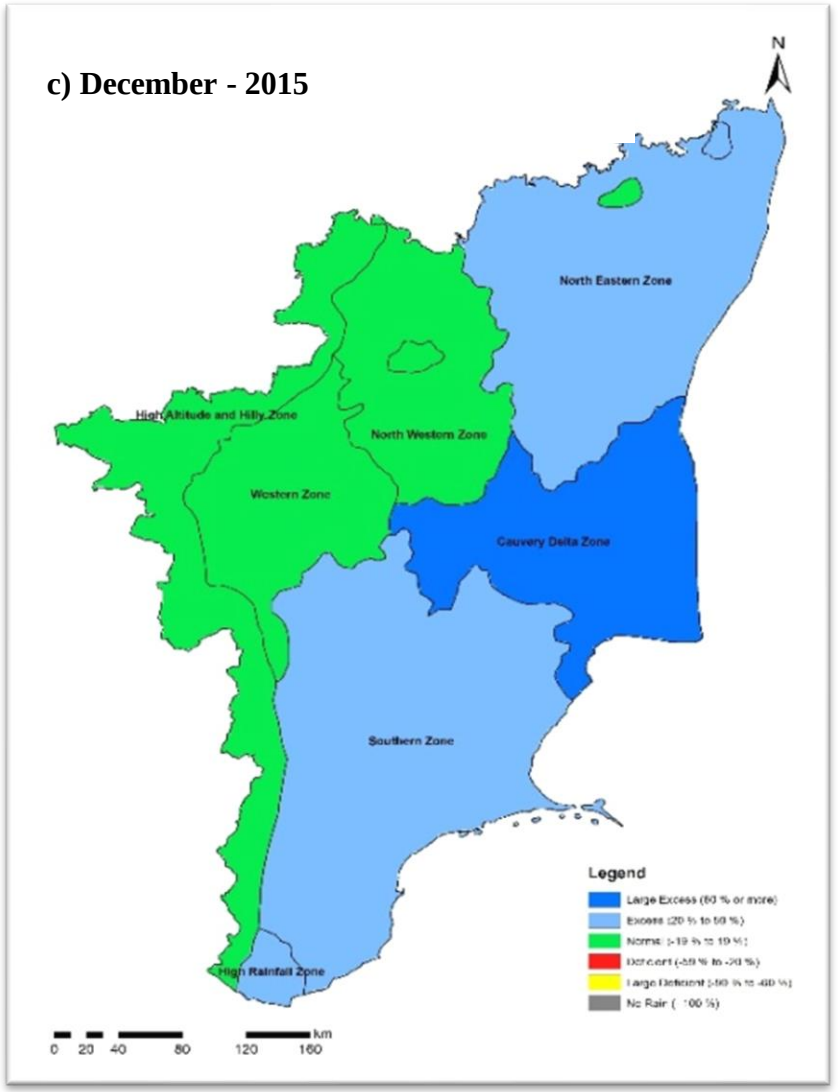
a) October - 2015



b) November - 2015

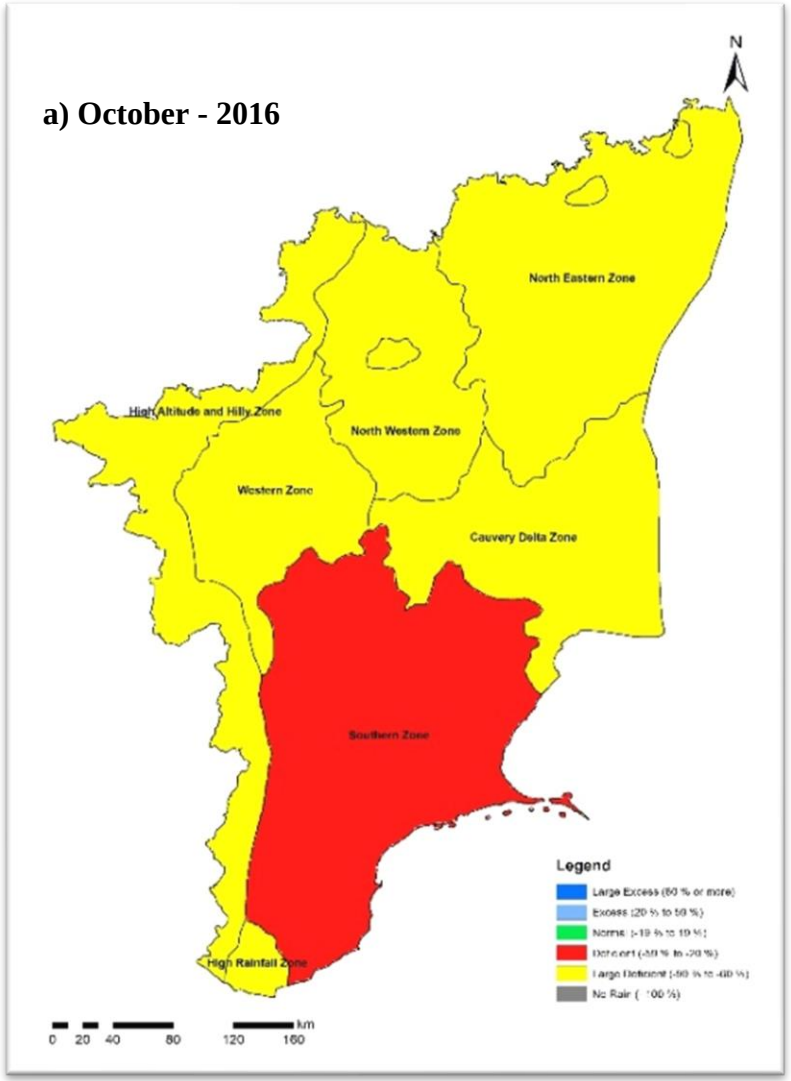


c) December - 2015

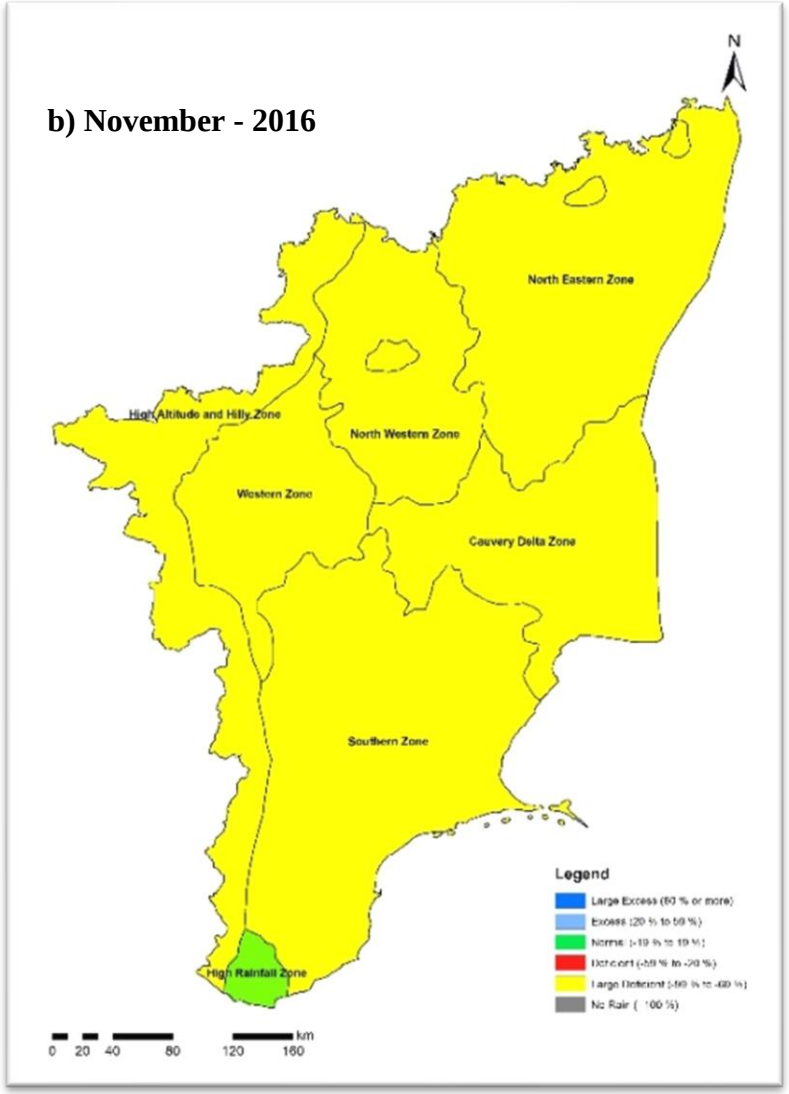


Assessing drought based on total rainfall departure

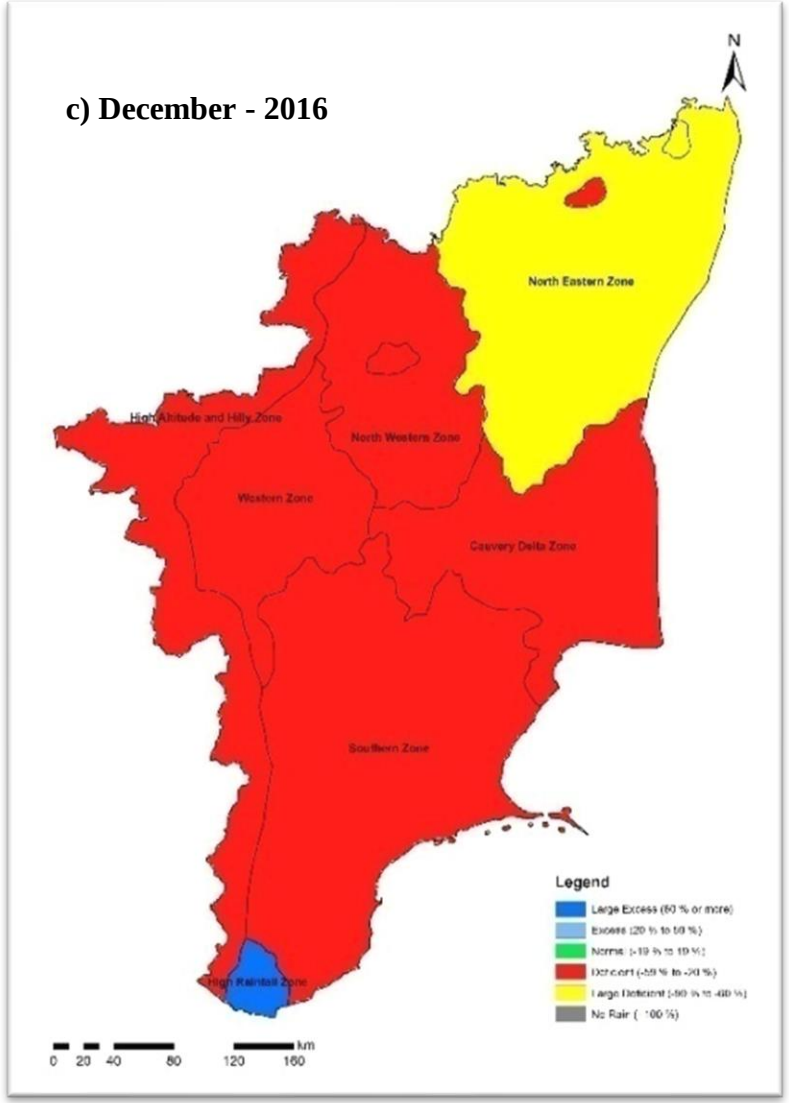
a) October - 2016



b) November - 2016

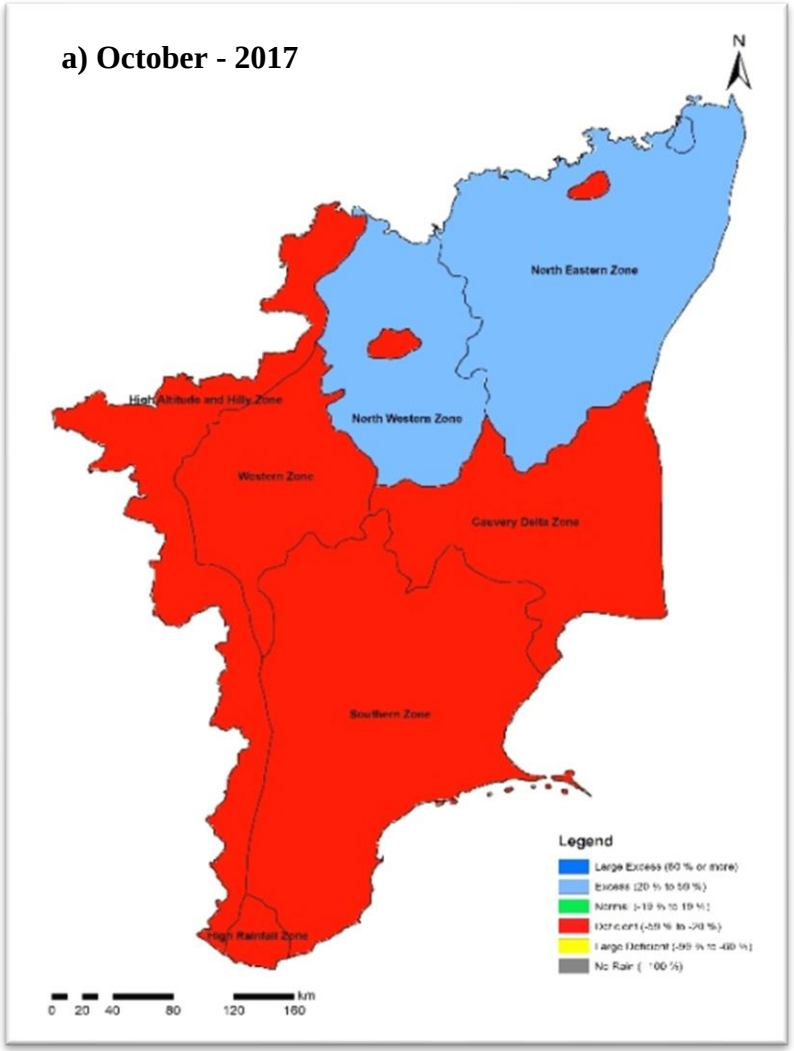


c) December - 2016

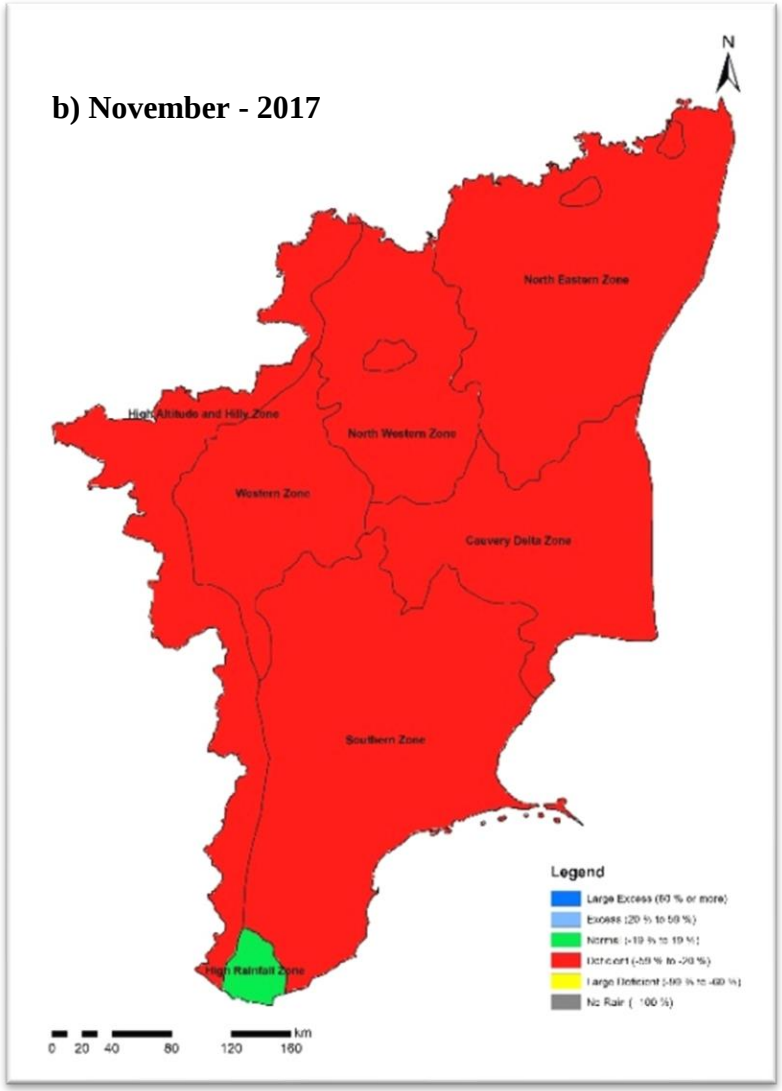


Assessing drought based on total rainfall departure

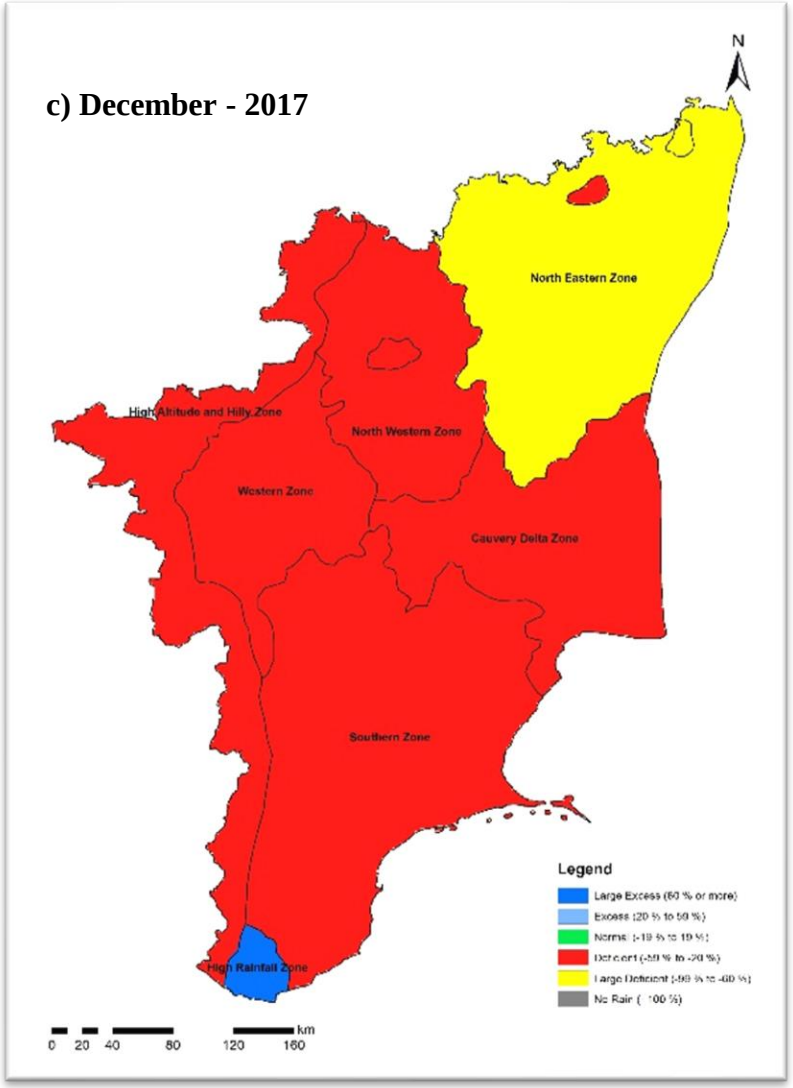
a) October - 2017

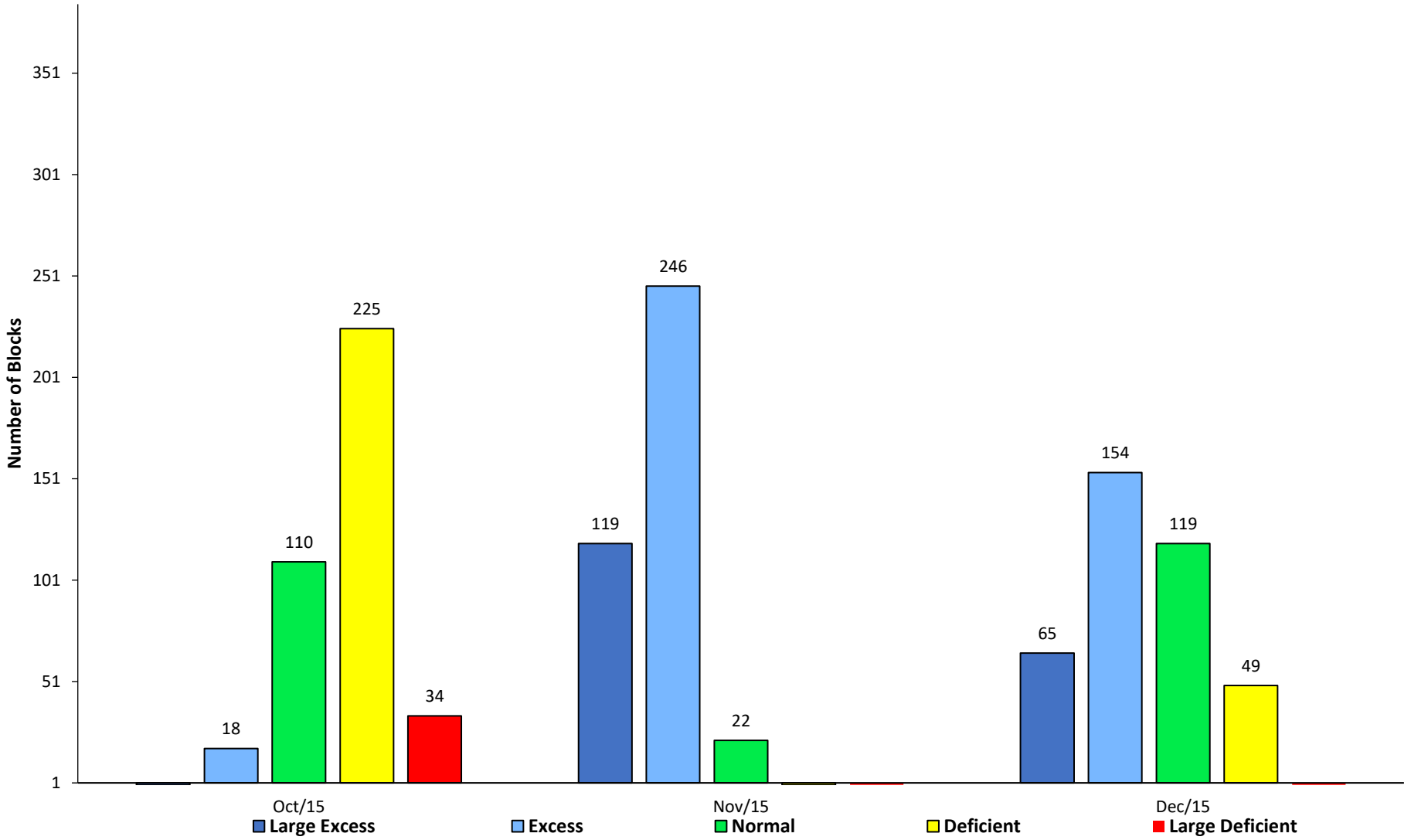


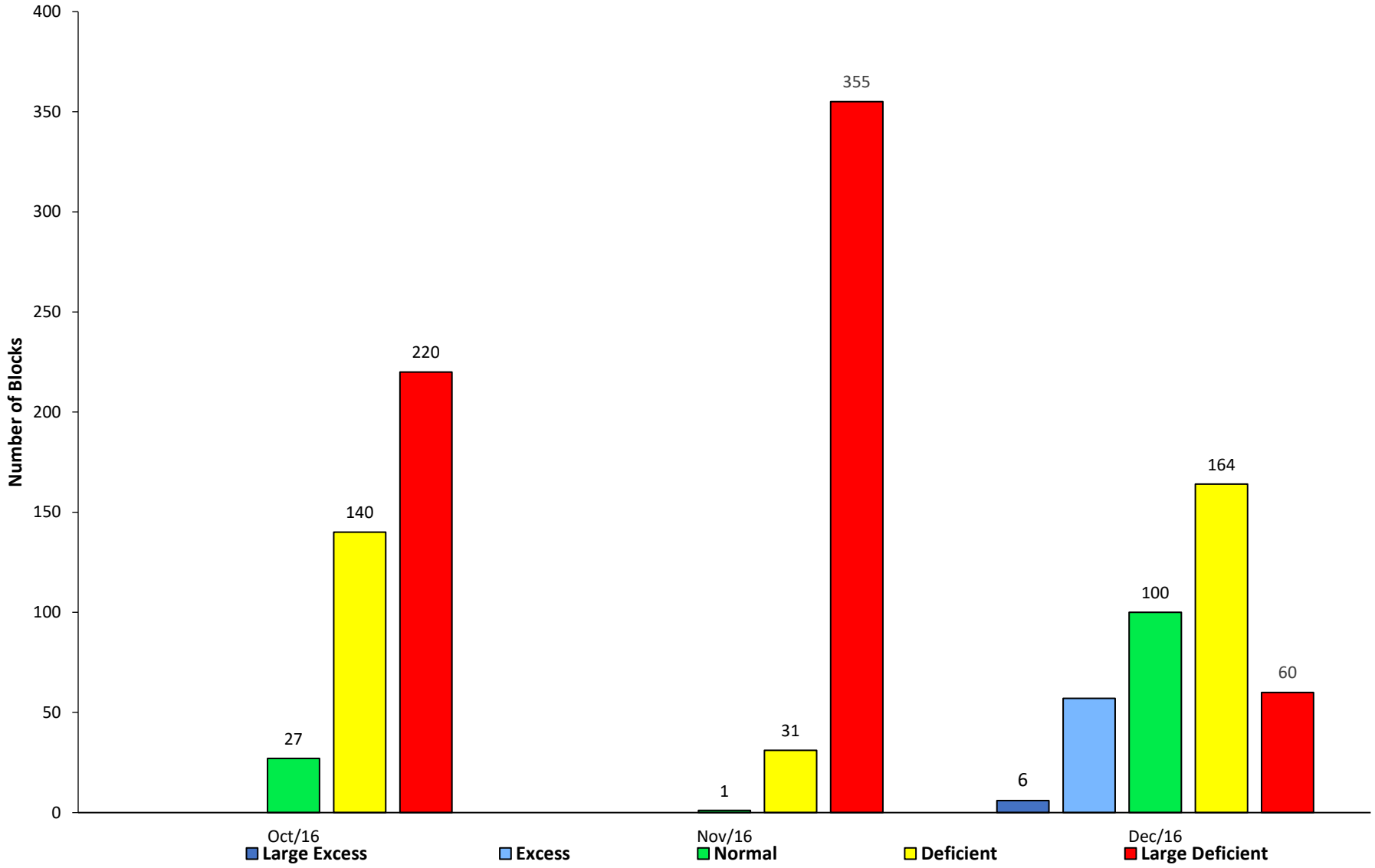
b) November - 2017

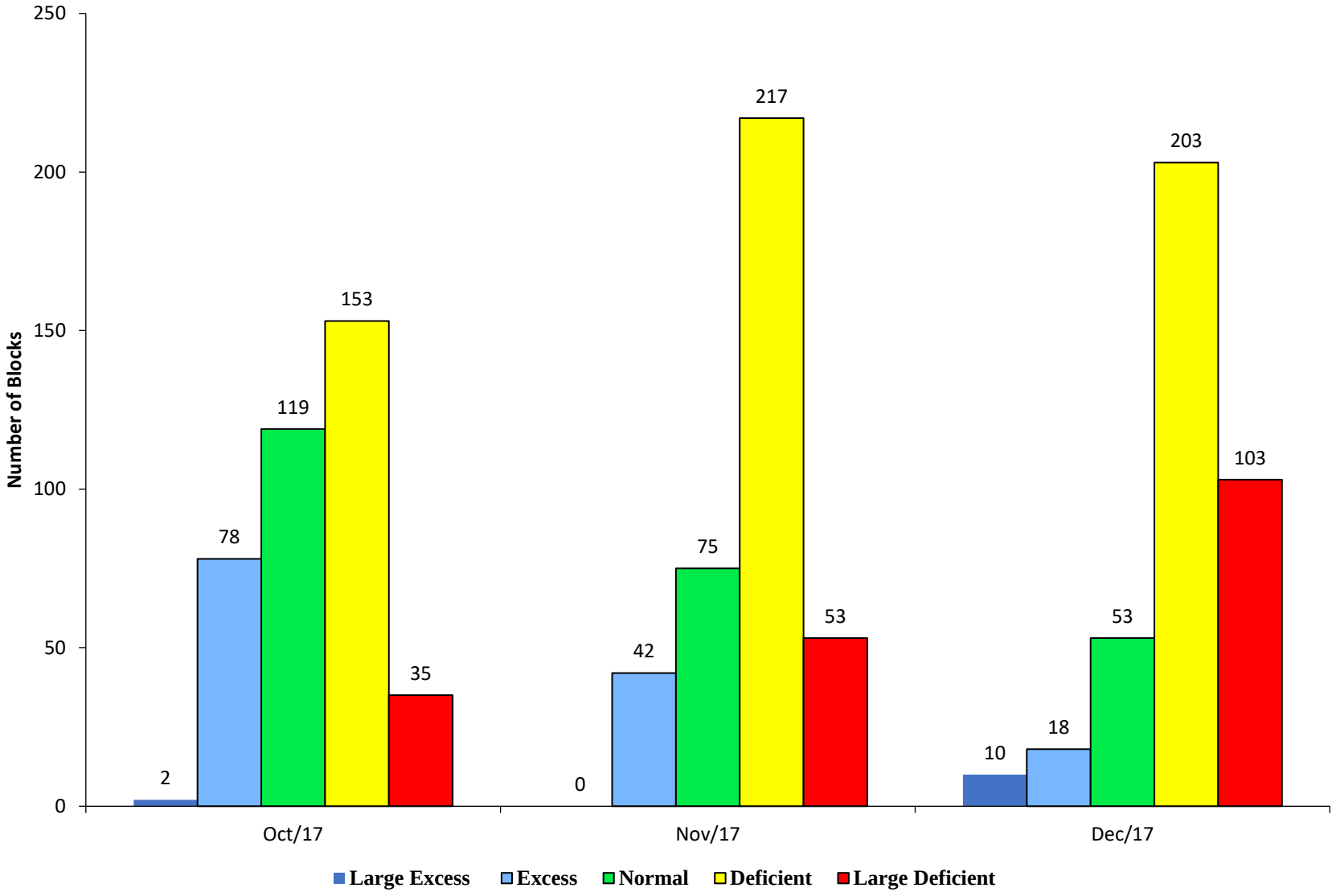


c) December - 2017

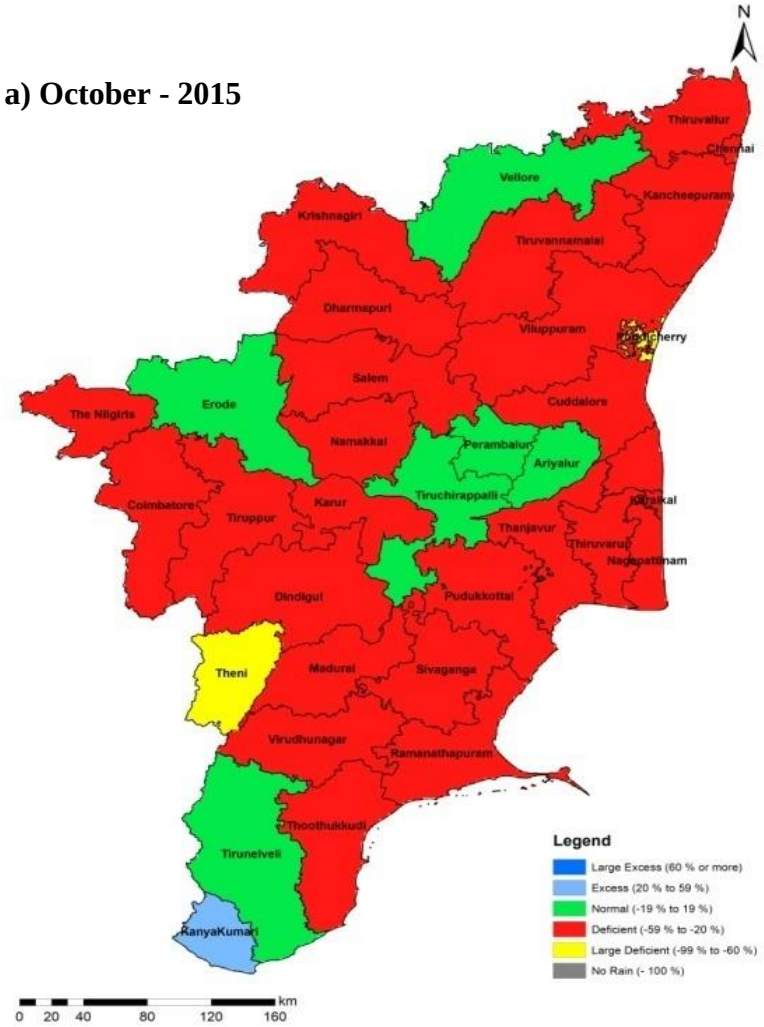



Number of Blocks
351
301
251
201
151
101
51
1
18
110
225
34
119
246
22
65
154
119
49
Oct/15
Nov/15
Dec/15
Large Excess
Excess
Normal
Deficient
Large Deficient

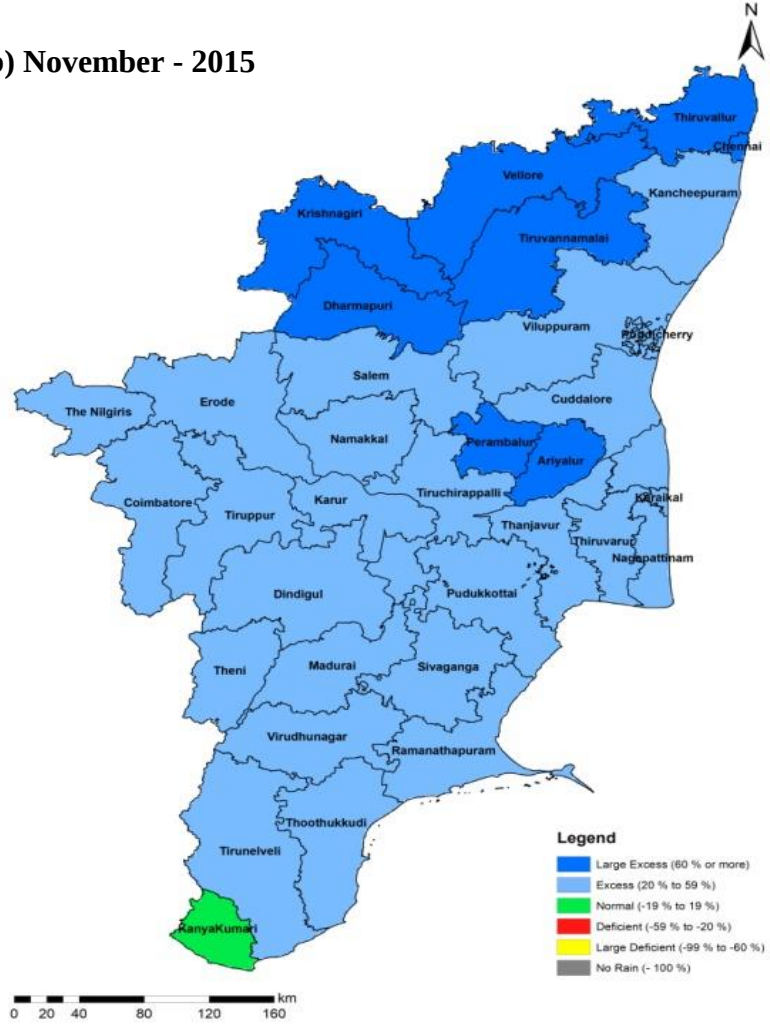

400
350
300
250
200
150
100
50
0
Number of Blocks
27
140
220
1
31
355
6
100
164
60
Oct/16
Nov/16
Dec/16
Large Excess
Excess
Normal
Deficient
Large Deficient


250
200
150
100
50
0
Number of Blocks
2
78
119
153
35
0
42
75
217
53
10
18
53
203
103
Oct/17
Nov/17
Dec/17
Large Excess
Excess
Normal
Deficient
Large Deficient

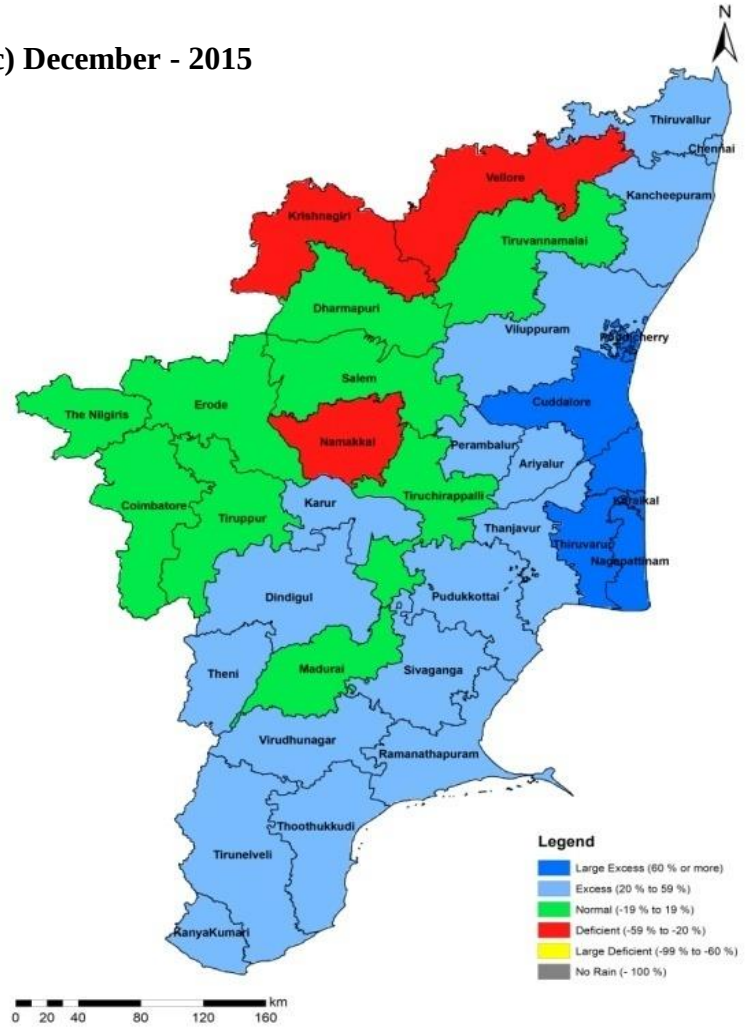
a) October - 2015



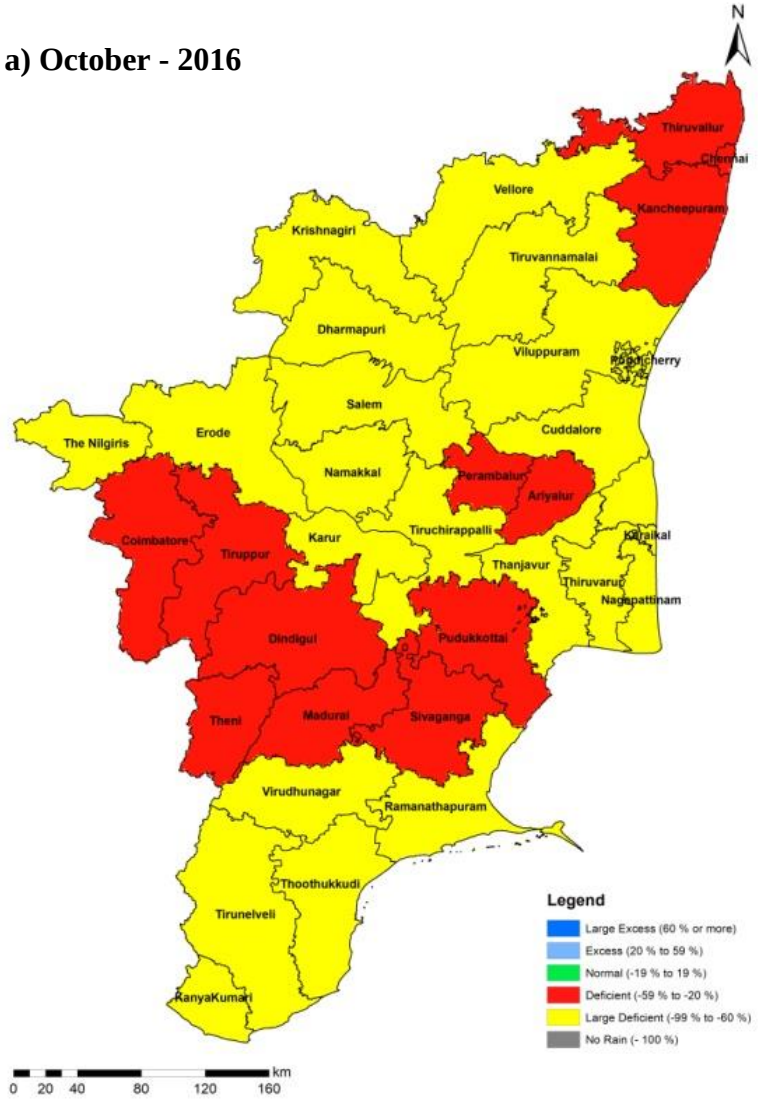
b) November - 2015



c) December - 2015

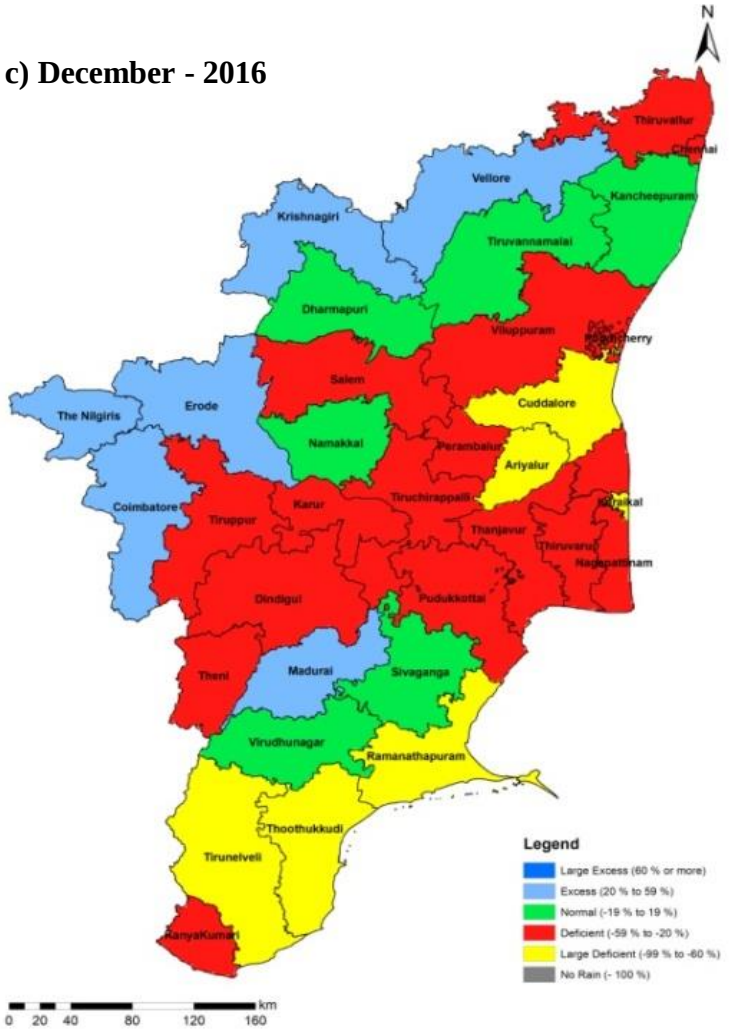


a) October - 2016

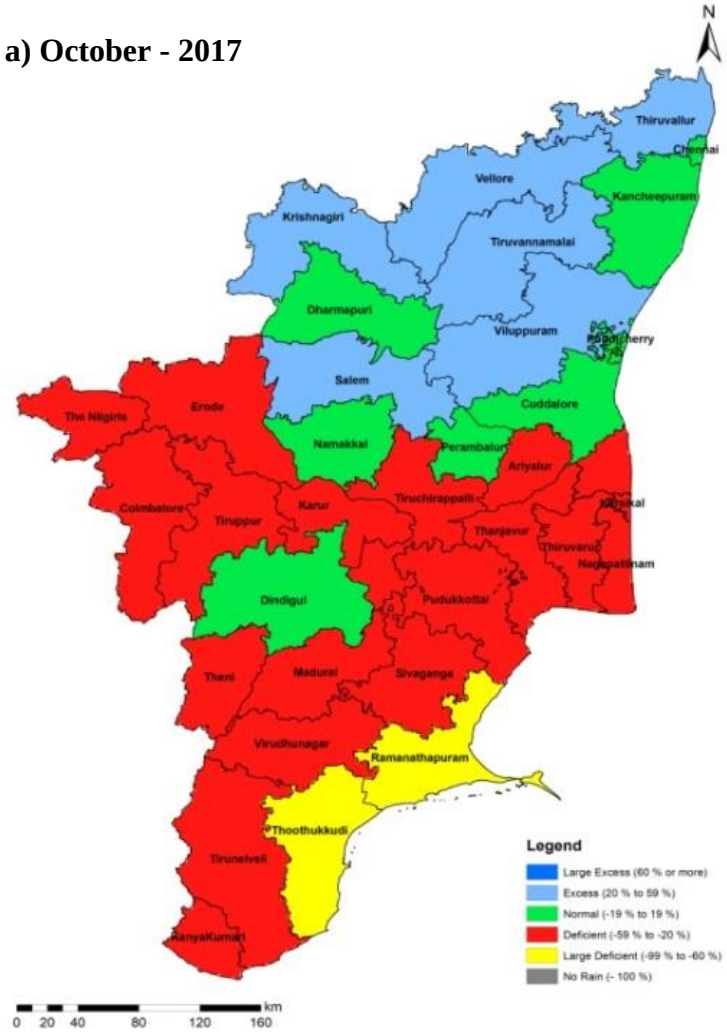


b) November - 2016

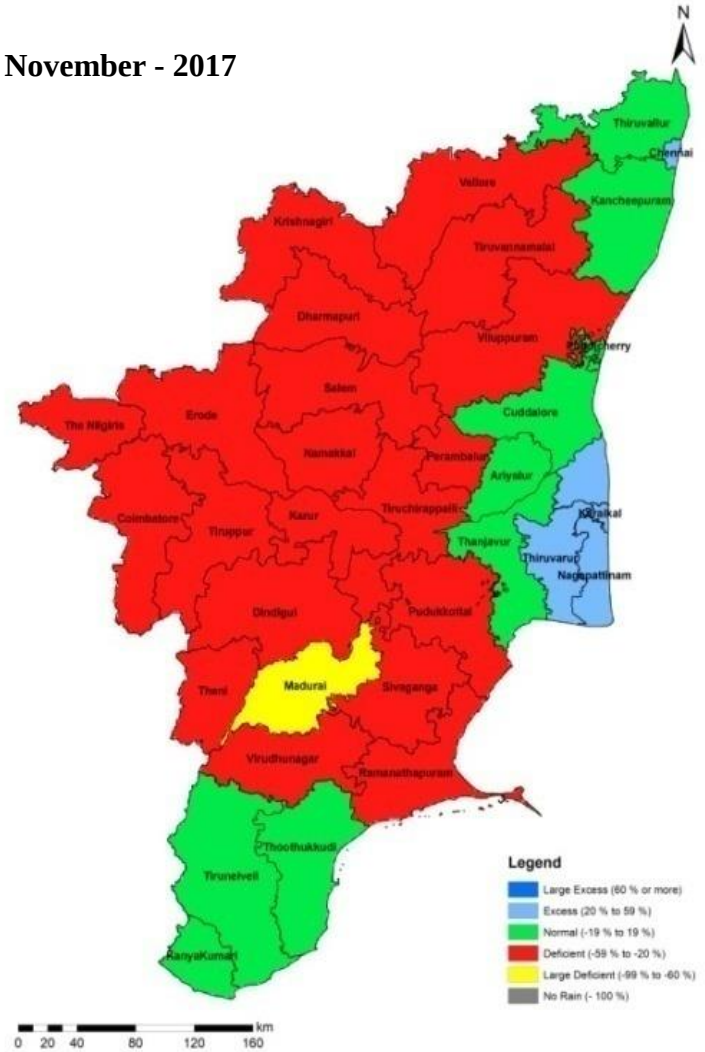
c) December - 2016



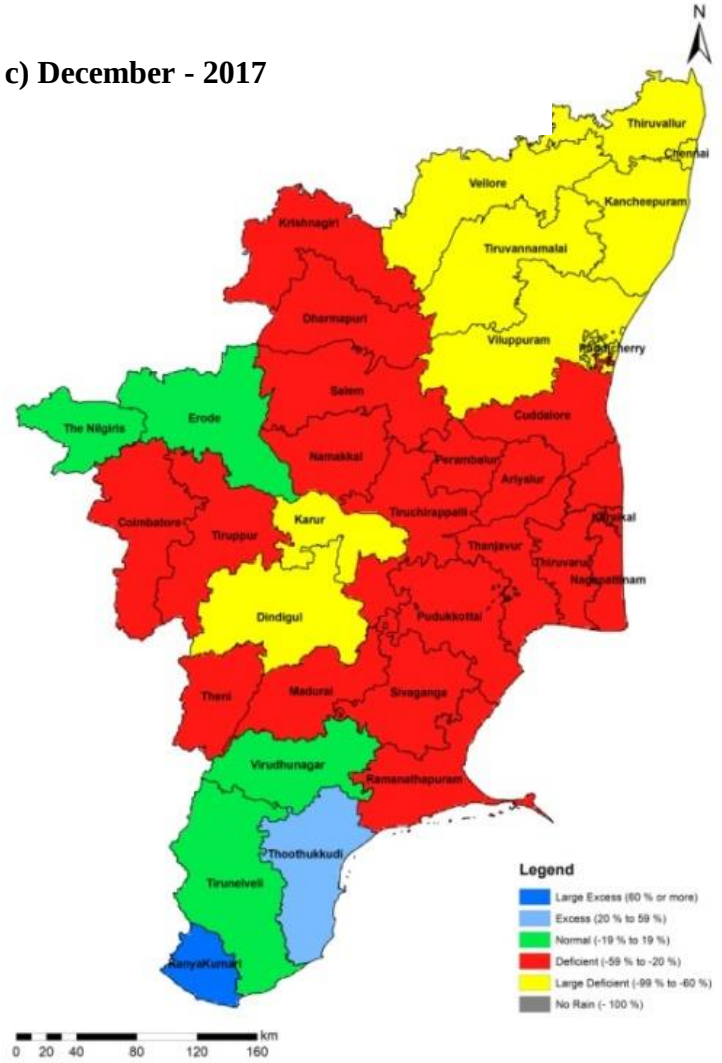
a) October - 2017



b) November - 2017

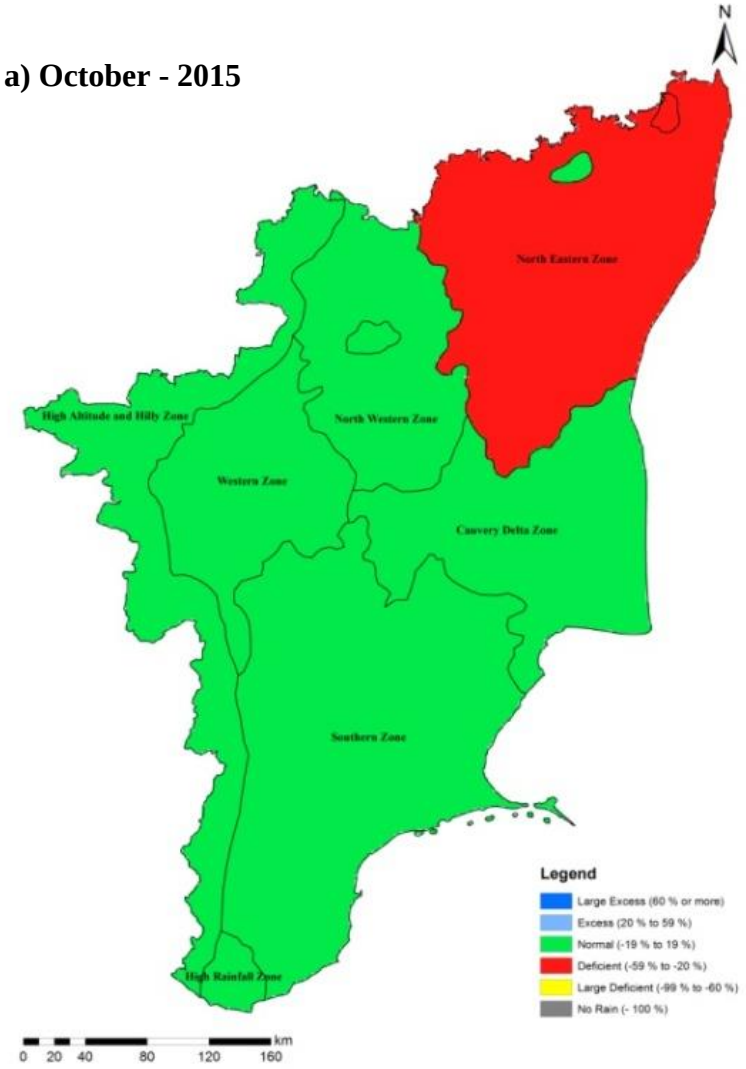


c) December - 2017

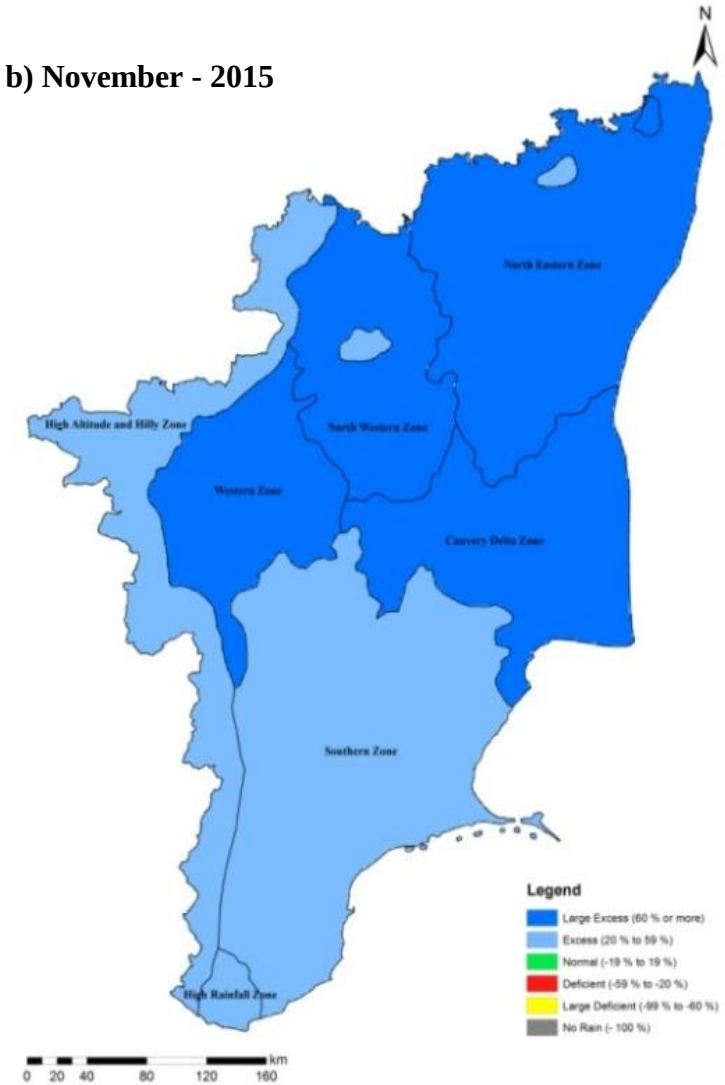


Assessing drought based on CHIRPS derived rainfall departure

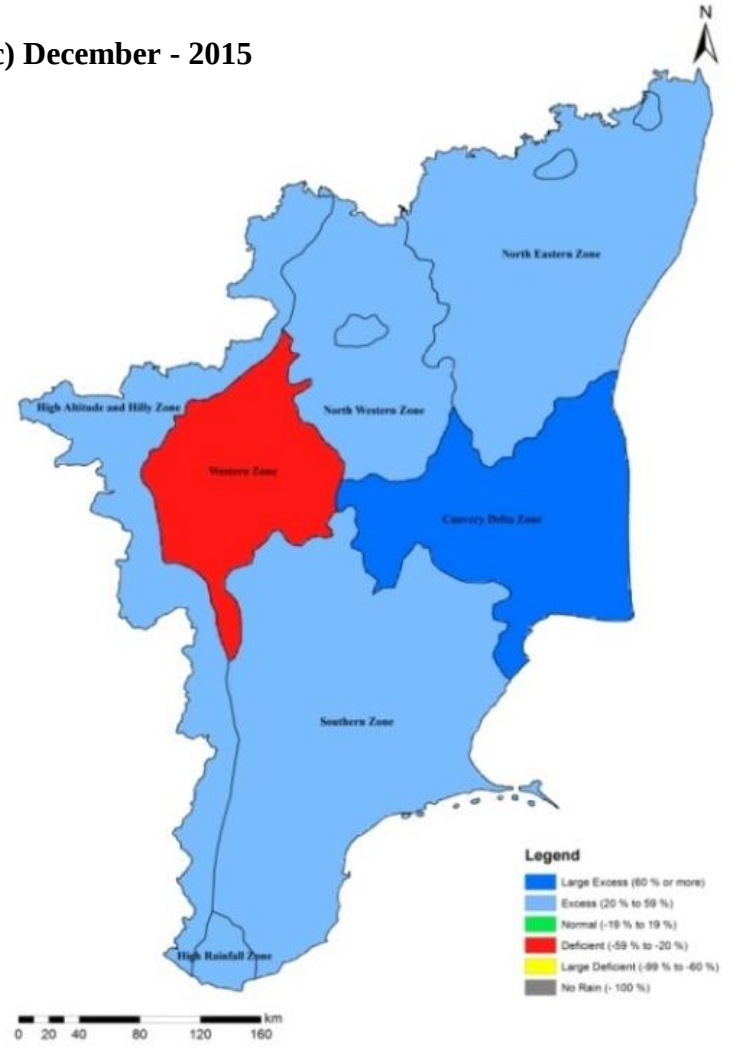
a) October - 2015



b) November - 2015

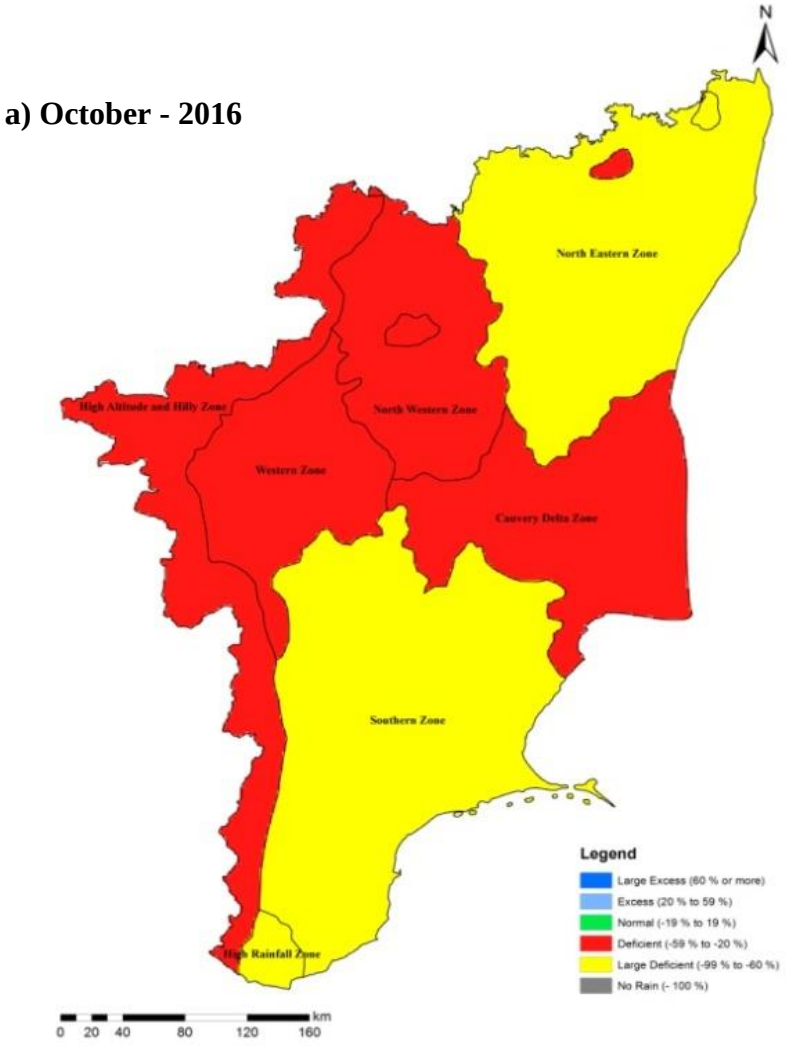


c) December - 2015

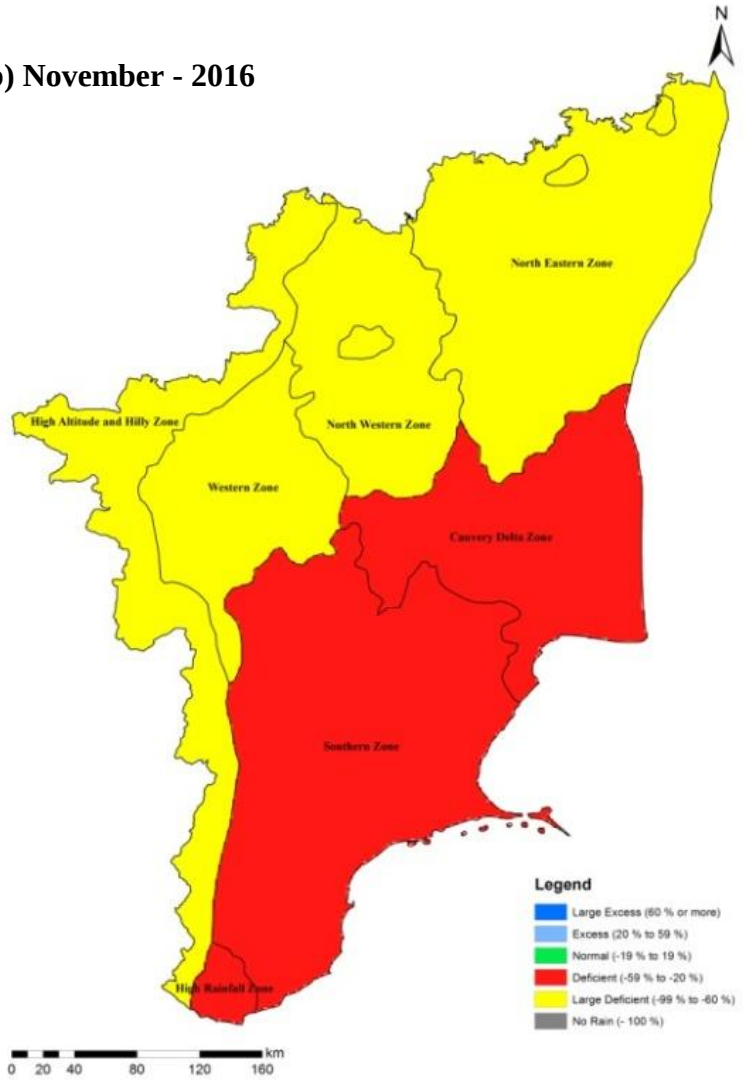


Assessing drought based on CHIRPS derived rainfall departure

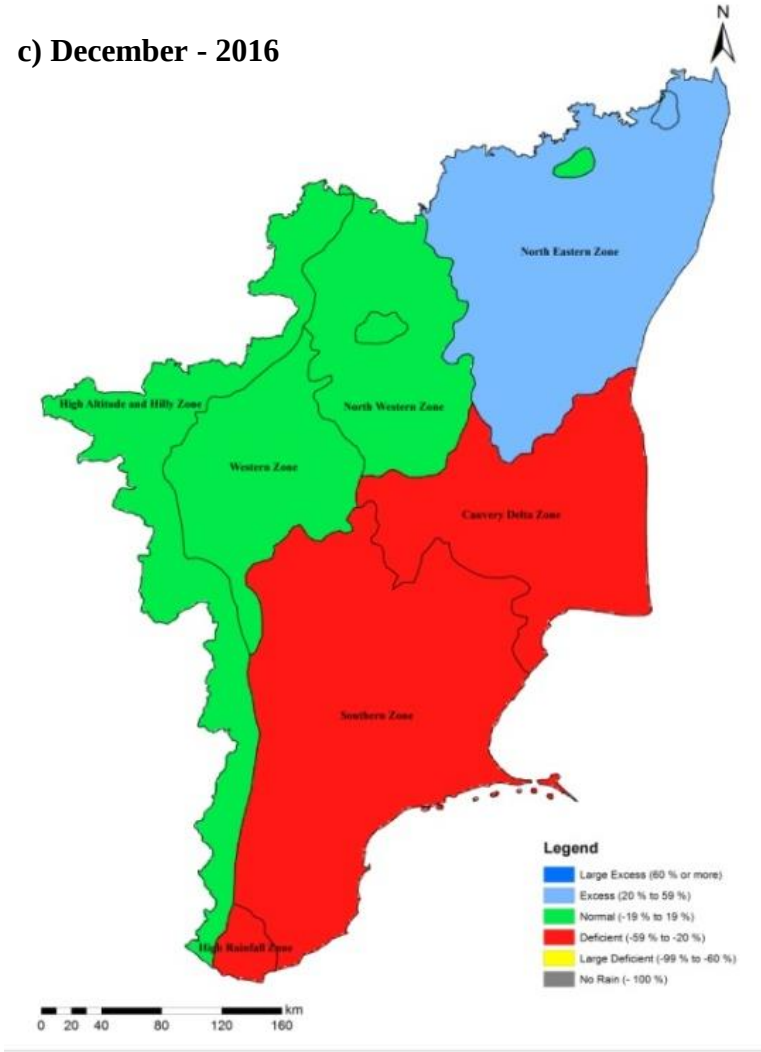
a) October - 2016



b) November - 2016

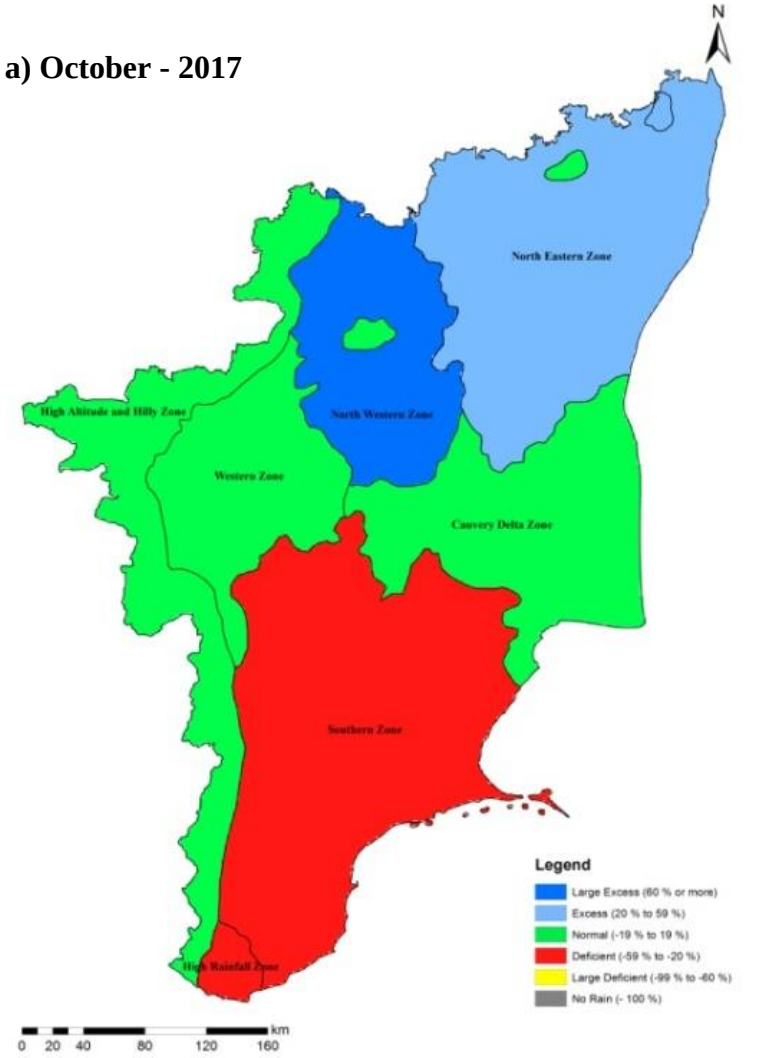


c) December - 2016

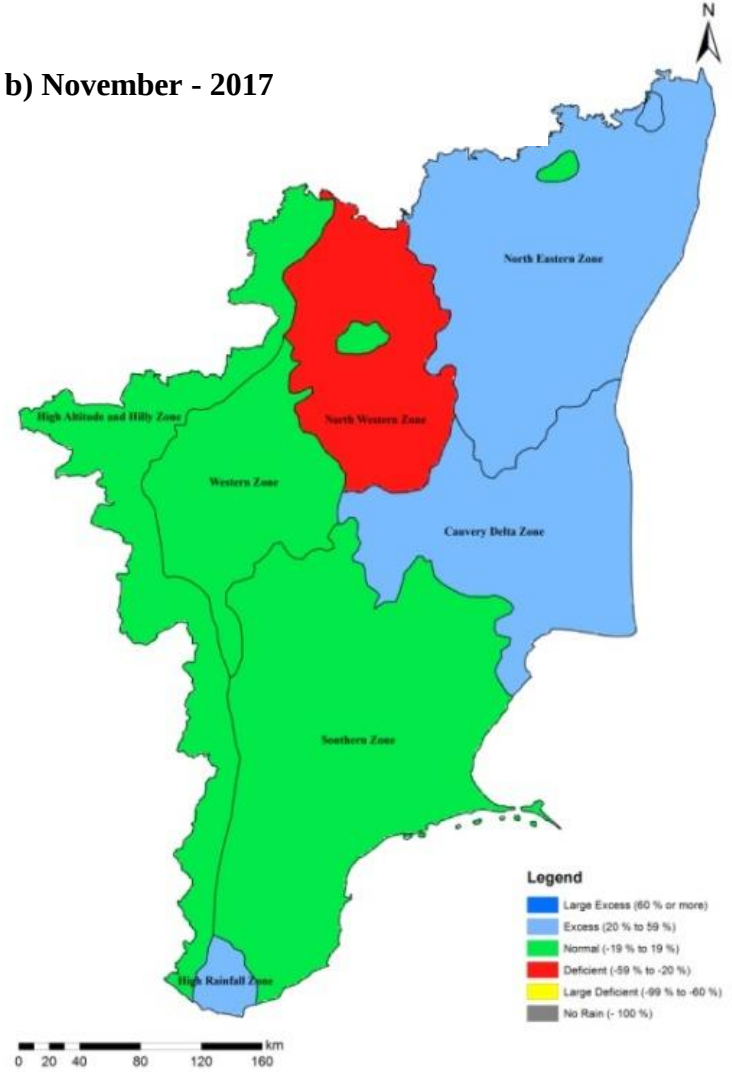


Assessing drought based on CHIRPS derived rainfall departure

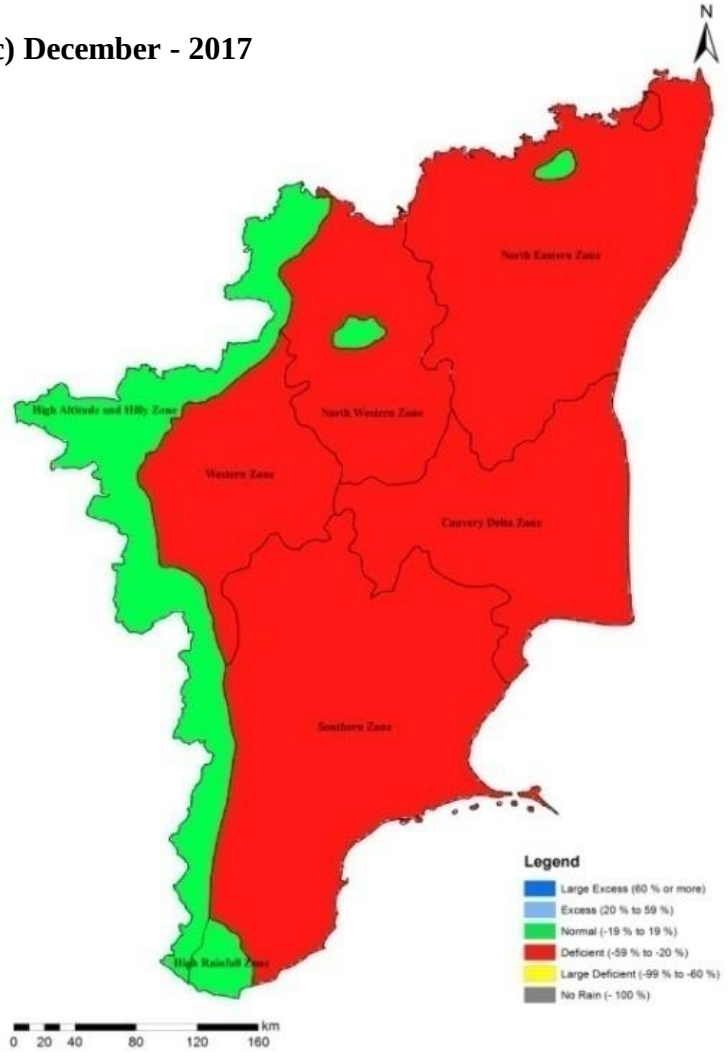
a) October - 2017

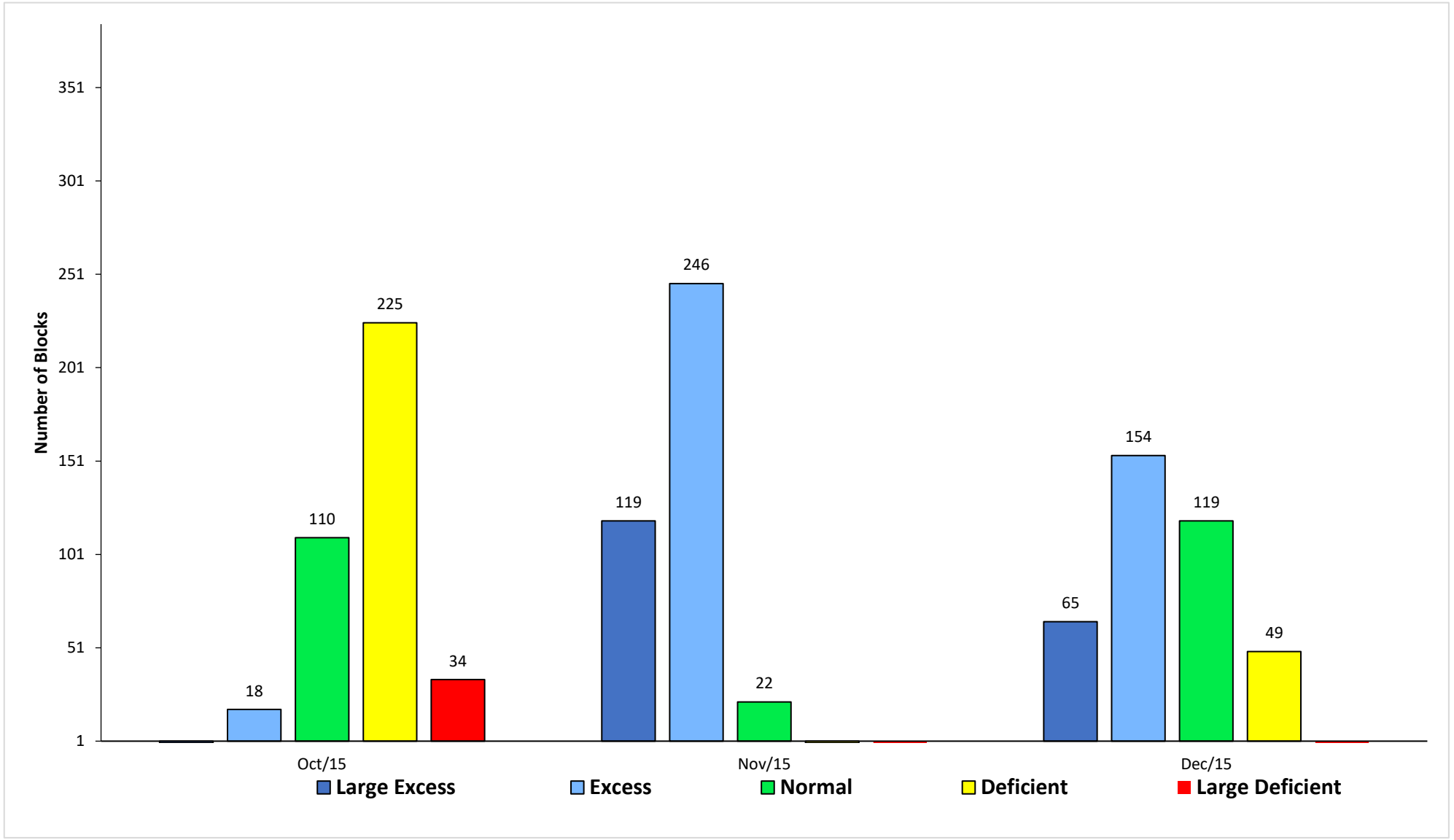


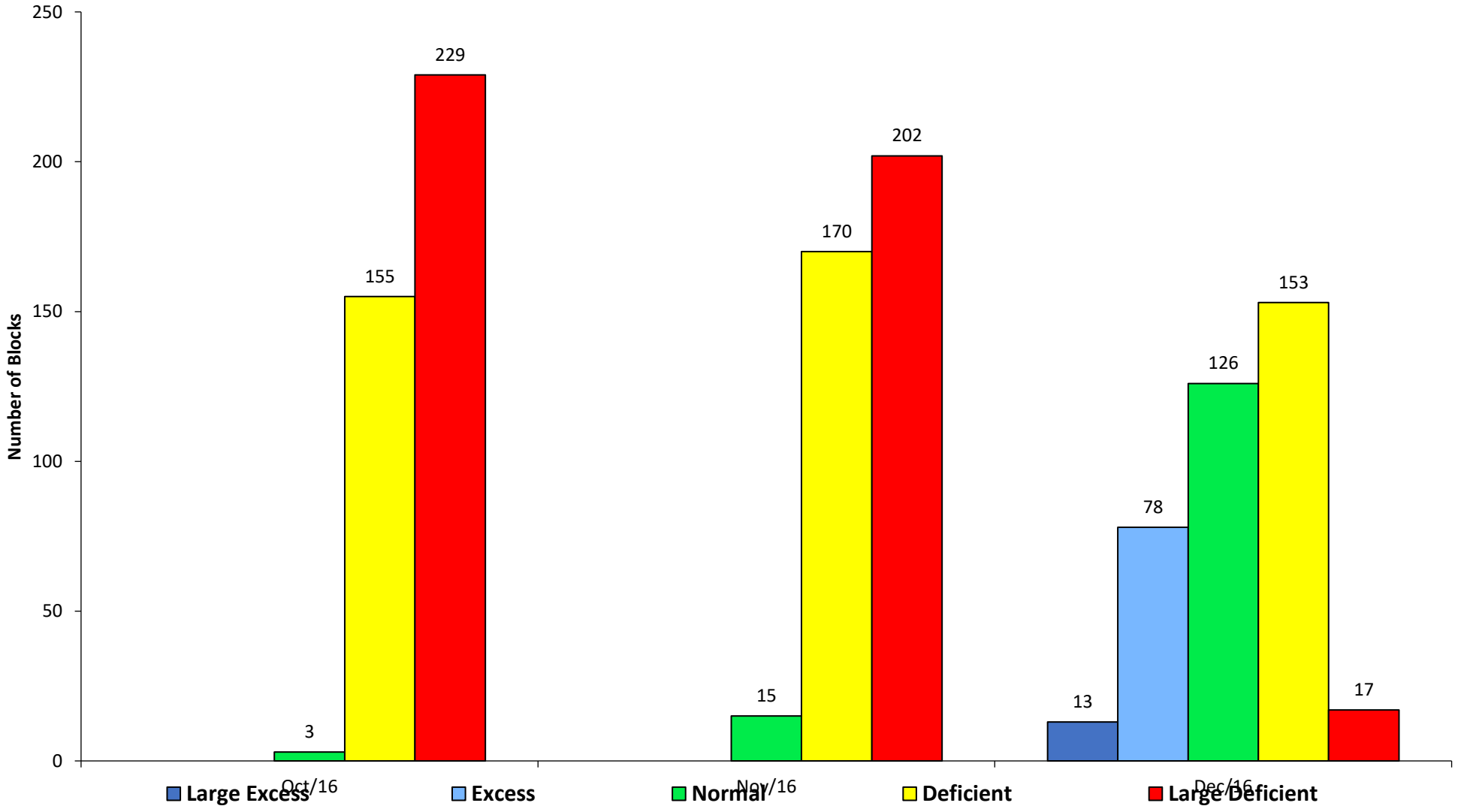
b) November - 2017

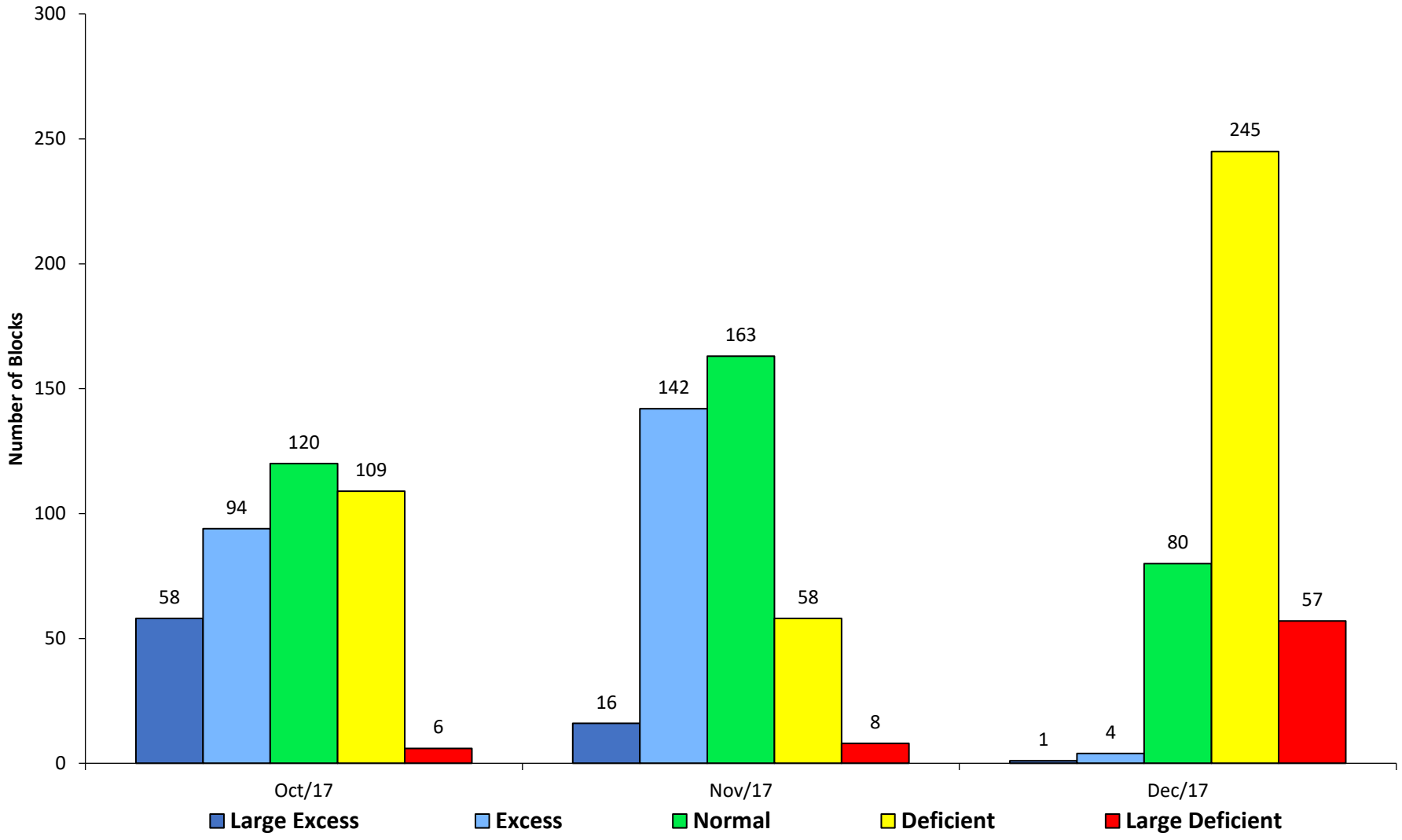


c) December - 2017

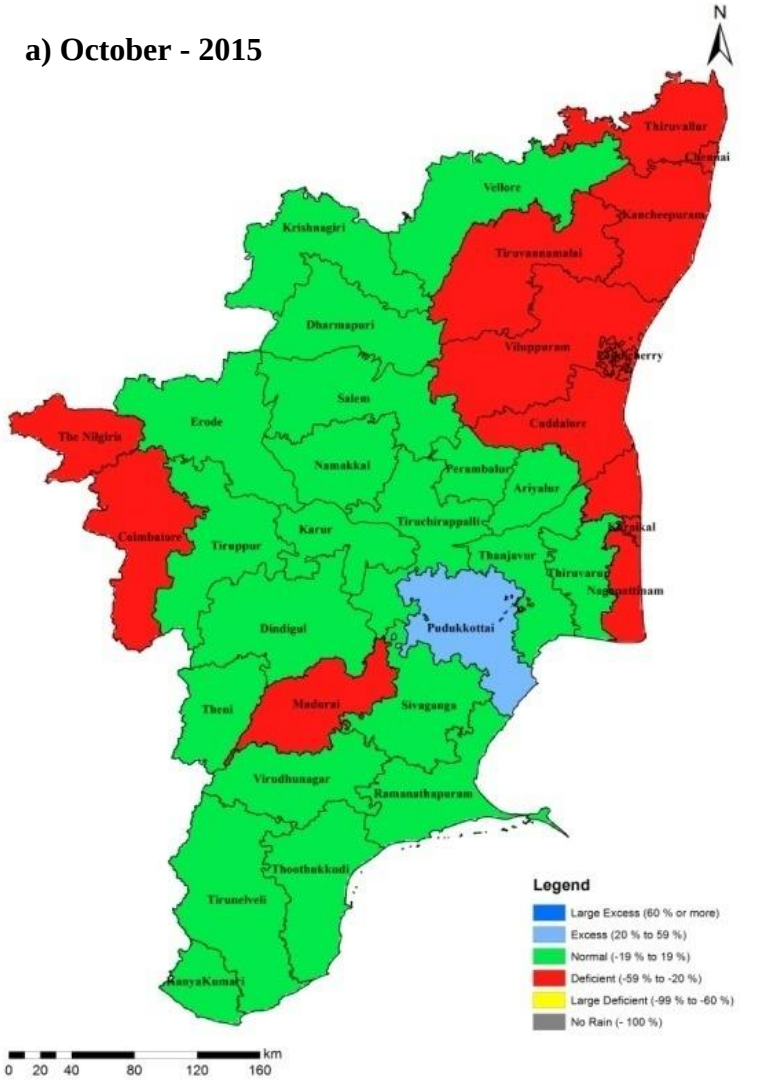



Number of Blocks
351
301
251
201
151
101
51
1
18
110
225
34
119
246
22
65
154
119
49
Oct/15
Nov/15
Dec/15
Large Excess
Excess
Normal
Deficient
Large Deficient

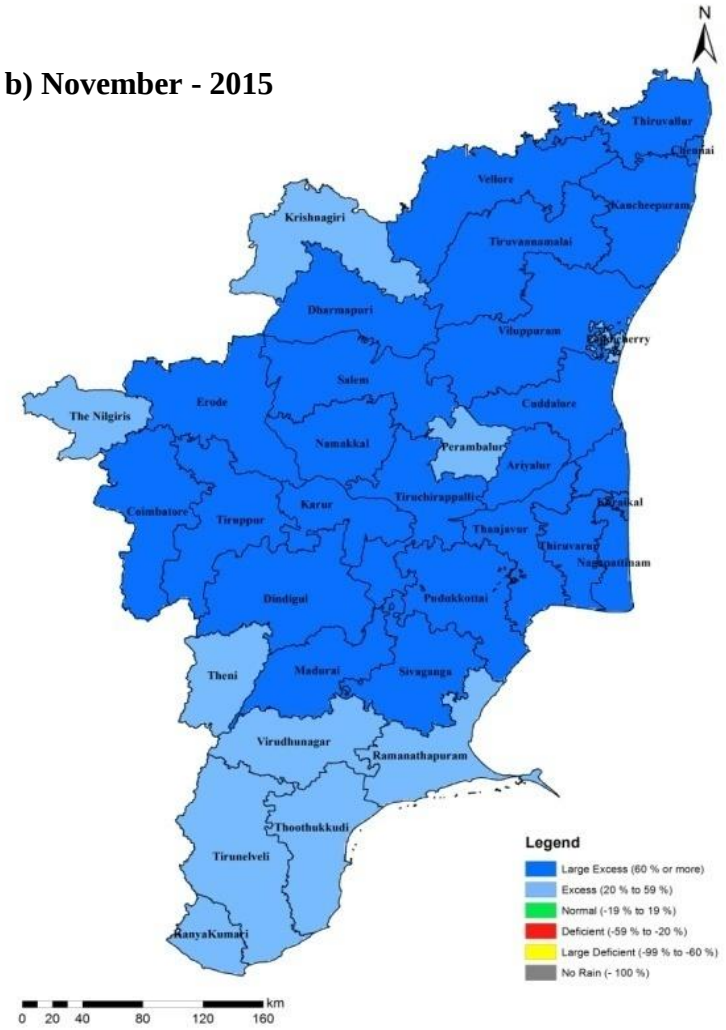

250
200
150
100
50
0
Number of Blocks
229
202
155
170
153
126
78
3
15
13
17
Oct/16
Nov/16
Dec/16
Large Excess
Excess
Normal
Deficient
Large Deficient


300
250
200
150
100
50
0
Number of Blocks
58
94
120
109
6
16
142
163
58
8
1
4
80
245
57
Oct/17
Nov/17
Dec/17
Large Excess
Excess
Normal
Deficient
Large Deficient

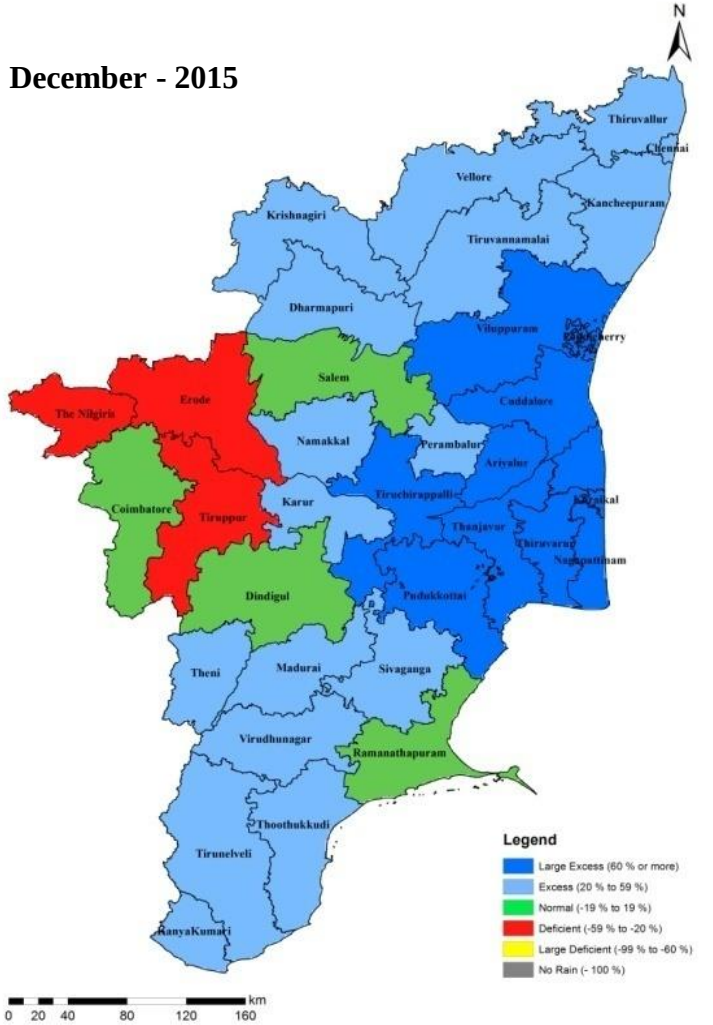
a) October - 2015



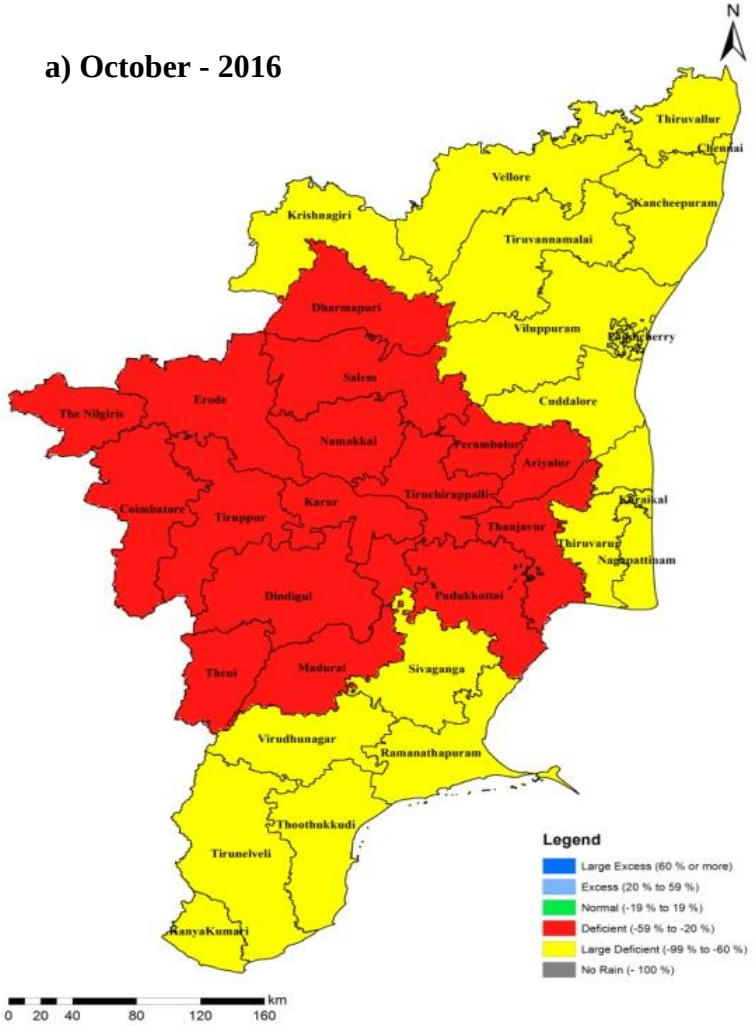
b) November - 2015



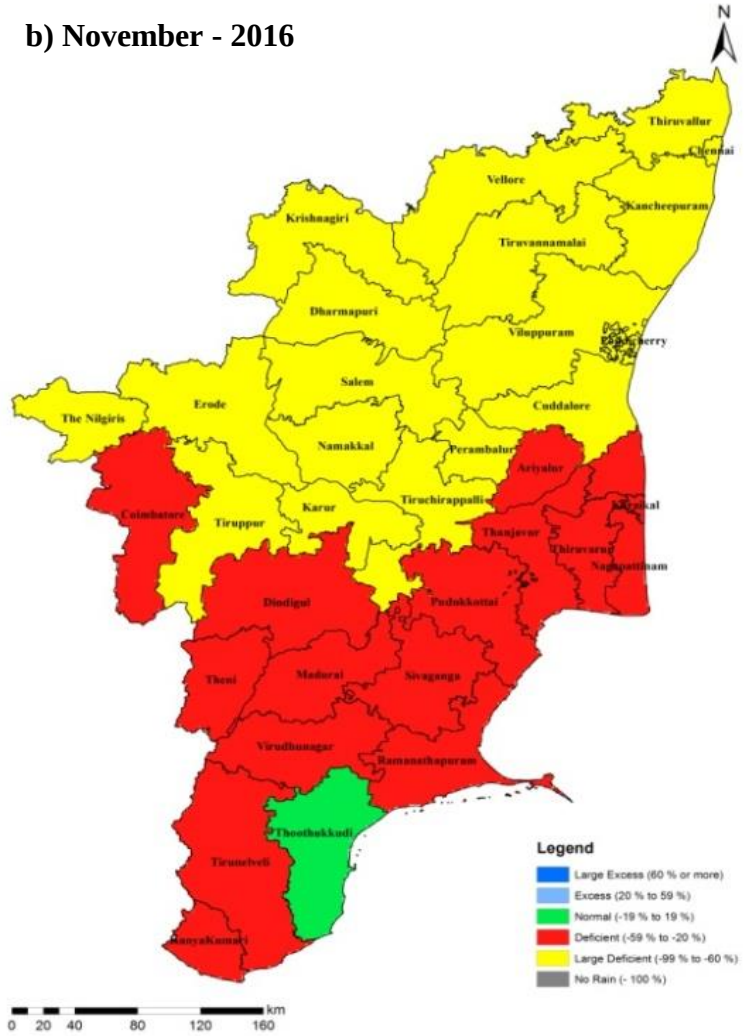
c) December - 2015



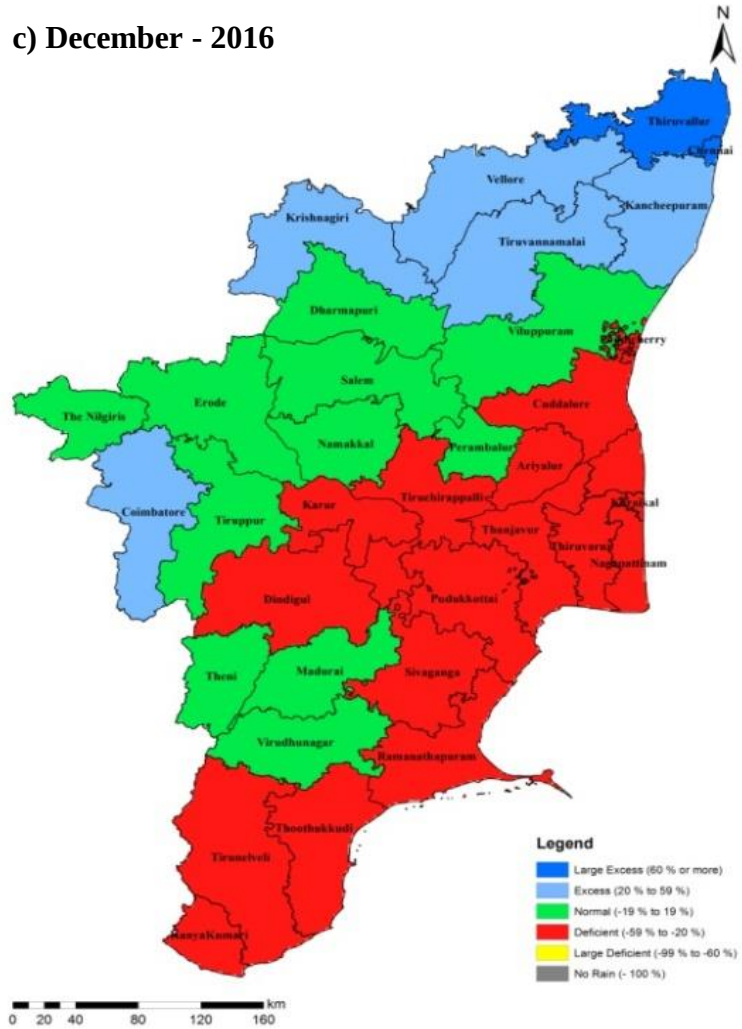
a) October - 2016



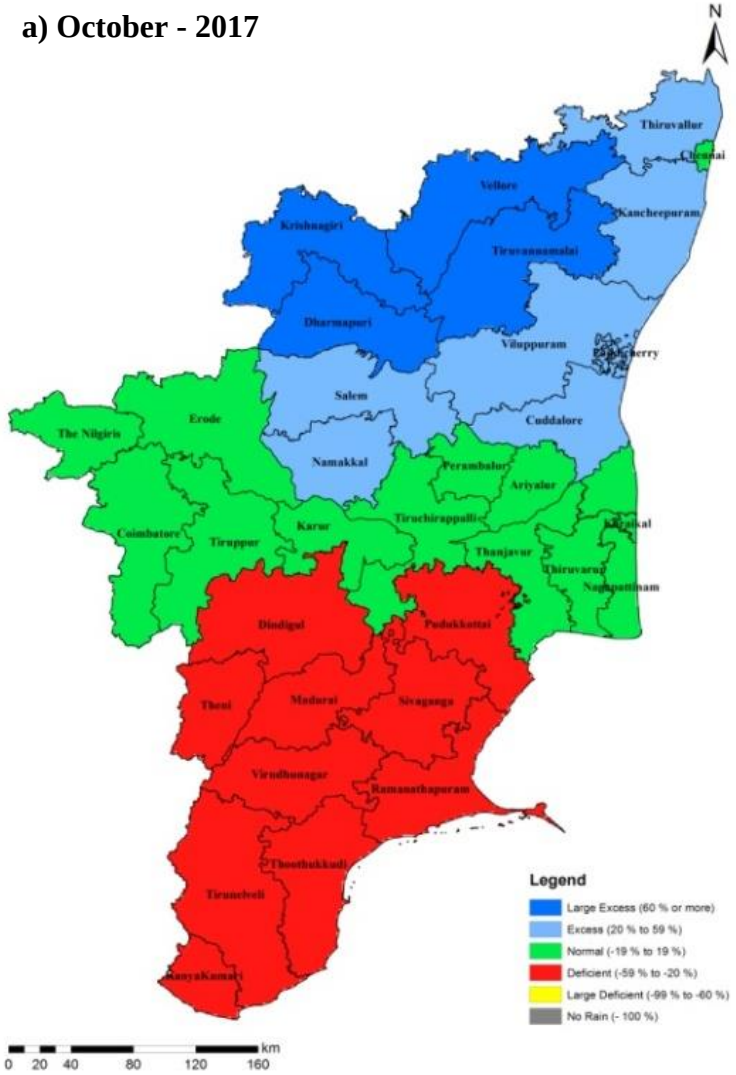
b) November - 2016



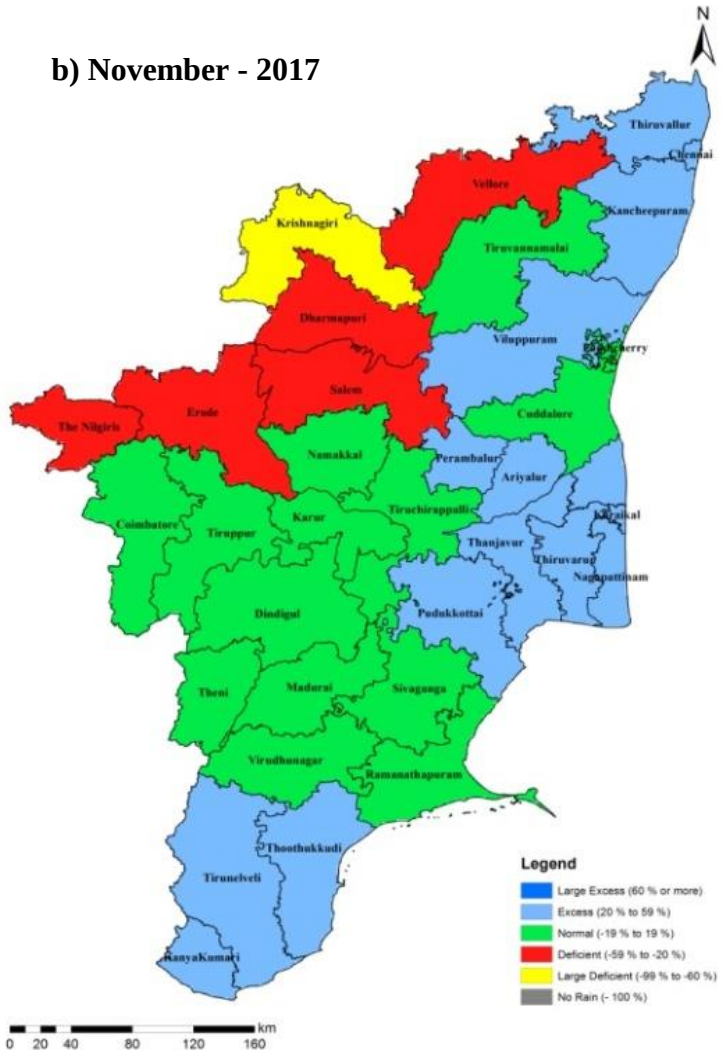
c) December - 2016



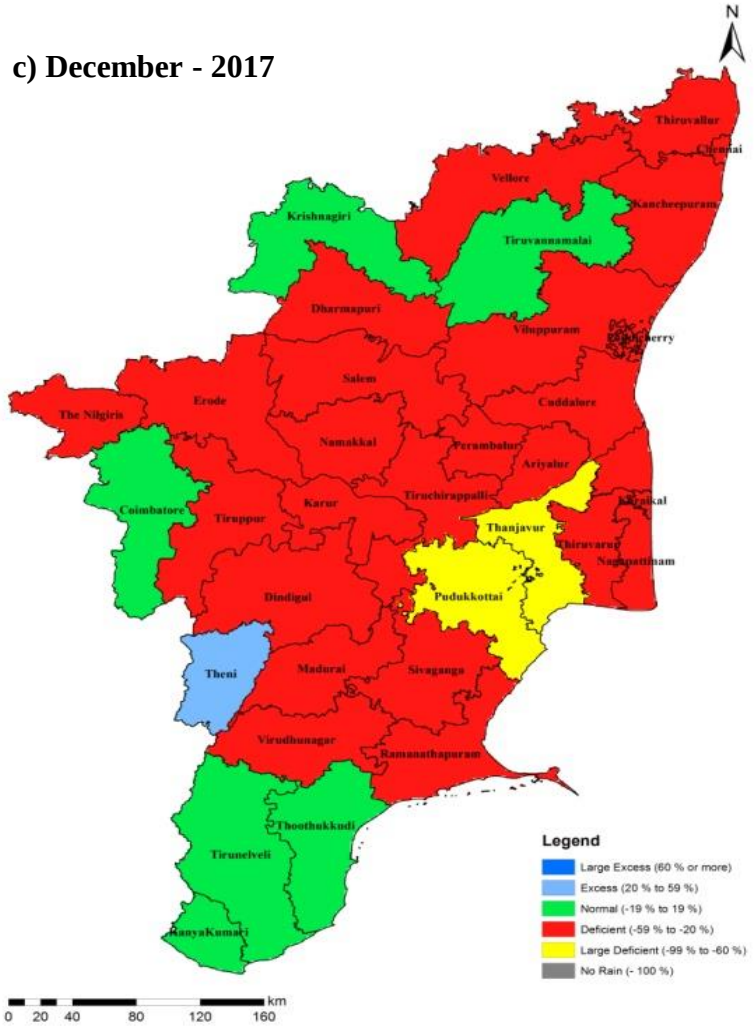
a) October - 2017



b) November - 2017



c) December - 2017



Summary and Conclusions

- IMERGH and TRMM on par with the minimum range predictions and CHIRPS on par in maximum range
- IMERGH and TRMM precipitation products used during low rainfall conditions and CHIRPS in high rainfall conditions.
- CHIRPS and PERSIANN products were inconsistent in precisely estimating rainfall with variations in R2 value over different agro climatic zones
- PERSIANN data recorded very low R2 values irrespective of the years and agro climatic zones with high RMSE.

- CHIRPS data recorded higher per cent of >85 agreement in comparison to AWS data than other precipitation products in all the agro climatic zones of Tamil Nadu.
- The rainfall deviation during the North East monsoon for the years 2016 and 2017 was mostly classified under deficient and large deficient category showing moderate to severe drought condition with 12, 3 and 15 districts were under moderate drought and 20, 29 and 5 districts were under severe drought condition during October, November and December 2016. During 2017, 17 to 20 districts were under moderate drought condition and 8 districts were under severe drought condition.
- It is concluded that the years 2016 and 2017 were drought years in the North East Monsoon and 2015 was a non-drought year.

Thank You