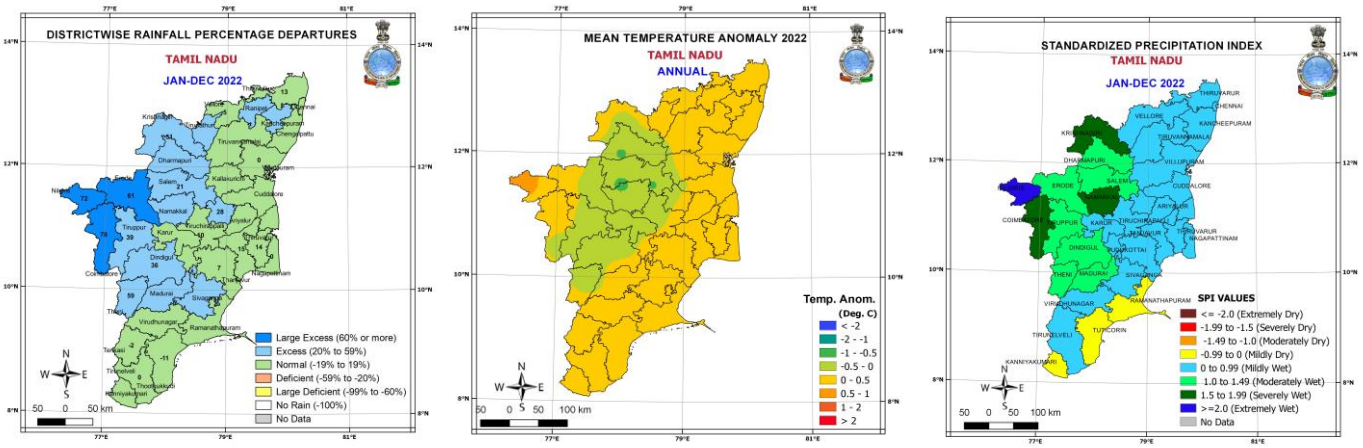
भारत सरकार
Government of India
पृथ्वी विज्ञान मंत्रालय (एम. ओ. ई. एस.)
Ministry of Earth Sciences (MoES)
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT
जलवायु अनुसंधान एवं सेवाएँ
CLIMATE RESEARCH AND SERVICES



तमिलनाडु राज्य के लिए जलवायु पर वक्तव्य: २०२२

STATEMENT ON CLIMATE FOR THE STATE OF TAMIL NADU: 2022

द्वारा जारी / ISSUED BY
जलवायु निगरानी और प्रागुक्ति समूह / Climate Monitoring and Prediction Group
जलवायु अनुसंधान एवं सेवाएँ का कार्यालय / Office of Climate Research and Services
भारत मौसम विज्ञान विभाग / India Meteorological Department
पुणे 411005 / Pune 411005

तमिलनाडु राज्य के लिए जलवायु पर वक्तव्य: २०२२

Statement on Climate for the state of Tamil Nadu: 2022

जलवायु अनुसंधान एवं सेवाएँ का कार्यालय
O/o Climate Research and Services, IMD
Pune 411 005

Preamble:

It gives me immense pleasure to share this scientific document titled, "Statement on Climate for the state of Tamil Nadu for 2022" prepared by office of Climate Research and Services, India Meteorological Department, Pune (Ministry of Earth sciences). The statement of climate is attempting to capture the regional climate variability of the state especially with reference to weather parameters like; temperature and rainfall which has huge impact on various sectors like agriculture, health, power, water management and many other critical domains. The information on severe weather analysis is also presented in this along with the statistics which could be, one of the important inputs for state for its planning purpose, disaster managements issues and over all the economic sustainability and growth. With the continuous projections of climate globally, indicating the possibility of increase in the severe weather events along with its severity, both at global and regional level, this annual update will be very useful to all concerned. The data used in this analysis is from 1901 to 2022 (122 years). I am sure this yearly update with climatological perspectives, will create more awareness among all the stakeholders, users in the state about the climate of the state and would enable to move parallelly with relevant global and regional scientific directives or advisories in the coming time.

This statement of 2022 which my office is conveying to your good office, would suggest here to have active participation from the state with required inputs in areas like economic losses, infrastructural losses, agricultural and other relevant inputs due to severe weather and other weather-related factors. The future Climate statements could be a joint publication of state government authorities of Tamil Nadu and India Meteorological Department, with your kind cooperation and support. I am sure, that will have more improved contents and added value too. I wish that such joint ventures and integrated approach will yield more benefits to the society, state and in turn to our Nation. Any suggestion to improve the contents of this document will be highly appreciated.

Looking forward for your feedback and will work together.

K. S. Hosalikar
Head, Climate Research and Services,
India Meteorological Department,
Pune.

February 2023

HIGHLIGHTS

The Tamil Nadu State averaged annual mean land surface air temperature (27.02^{0}C) during 2022 was same as its Long Period Average (LPA) for the period 1981-2010. It was 24th warmest year on record for the state since 1901.

The annual maximum temperature averaged over the state during the year 2022 was 0.1^{0}C below its LPA, while annual minimum temperature was above normal by +0.2^{0}C.

Out of 38 districts of the state, 3 received large excess rainfall (60% or more of its 1971-2020 period LPA), 13 received excess rainfall (20% to 59% of its LPA) and 22 districts received normal rainfall (-19% to +19% of its LPA).

Objective

The objective of this brief report is to provide the analysis of state's temperature, rainfall and extreme weather events that occurred during 2022. This report will be useful for various stakeholders and general public who are interested on the latest weather and climate conditions and its impact in 2022.

Introduction

India Meteorological Department (IMD) is the official agency responsible for providing operational weather and climate services required for the country in various sectors. IMD provides climate services through its office of the Climate Research and Services (CRS) situated in Pune. As part of its climate monitoring activities, CRS office in coordination with IMD's state Meteorological Centers and state governments have decided to issue the statement of annual climate 2022 for each individual state in line with the annual statement of climate issued for the country. The present statement contains, important information about the monthly, seasonal and annual State averaged temperature, rainfall and Standardized Precipitation Index (SPI) for the year 2022 and as well as long term trend for some of the parameters. This statement also includes State specific information related to various extreme weather and climate events experienced during 2022.

Temperature

The monthly, seasonal and annual maximum, minimum and mean temperature anomalies averaged over the State of Tamil Nadu for the year 2022 is given in the **Fig. 1**. The anomalies were computed based on the LPA for the period 1981-2010. Top 10 warmest/coolest months/seasons are marked on the graph. It may be mentioned that the January and December months and the winter season (Jan-Feb) as a whole were relatively warmer for the state. The annual maximum temperature averaged over the state during the year 2022 was slightly cooler than average with anomaly -0.1^{0}C, while annual minimum temperature was slightly warmer than average by 0.2^{0}C. The mean temperature for the state was normal (24th warmest year on record since 1901).

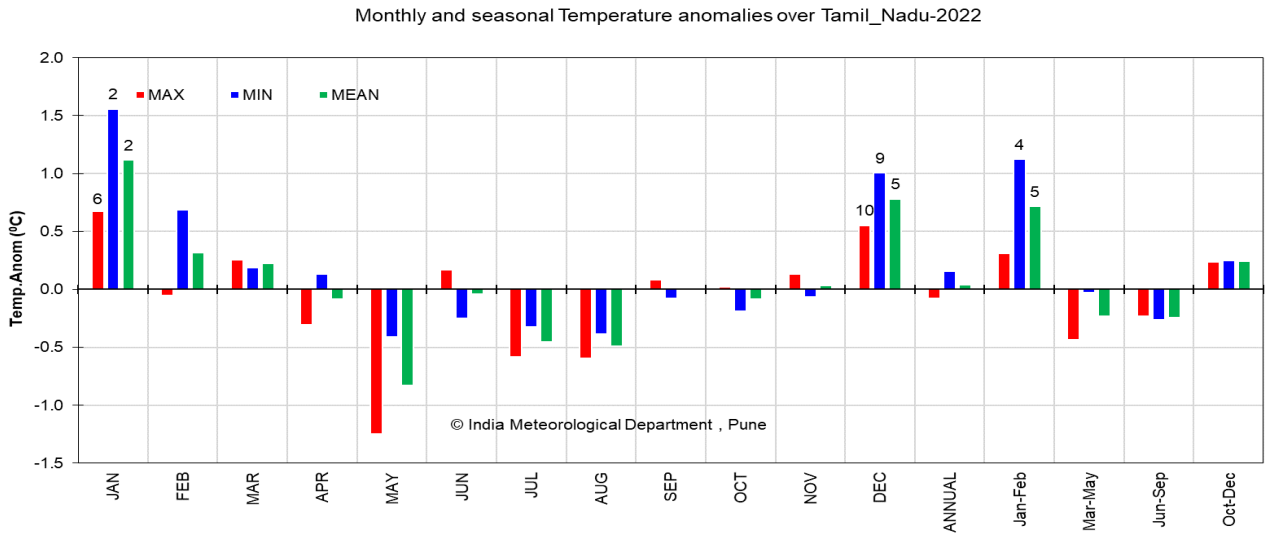


Fig. 1: Monthly and Seasonal Maximum, Minimum and Mean Temperature anomalies averaged over Tamil Nadu during 2022.The anomalies were computed from the LPA base period of 1981-2010.
The numbers above/below the bar indicate top 10 warmest/coolest ranking since 1901.

The Spatial pattern of Annual Maximum, Minimum and Mean Temperature anomalies over Tamil Nadu during 2022 given in **Fig 2**. The temperature anomalies were within $\pm 0.5^0$C over most parts of the state. However, over some northern districts of the state, the minimum temperature was above normal by 1 to 2^0C.

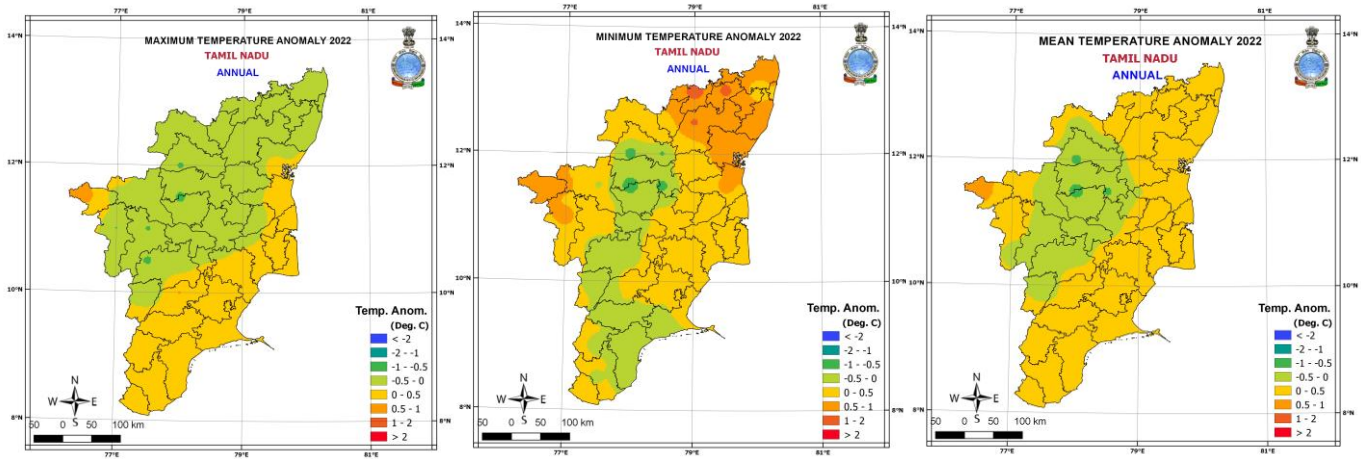


Fig. 2: Spatial pattern of Annual Maximum, Minimum, and Mean Temperature anomalies over Tamil Nadu during 2022. The anomalies were computed from LPA for the base period of 1981-2010.

The time series of variation of annual maximum, minimum and mean land surface air temperature anomalies averaged over the State for the period 1901-2022 is given in **Fig 3**. A significant increasing trend of 0.67^0C/100 years is observed in the State averaged annual mean temperature during 1901-2022. It was more significant in respect of maximum temperature ($+0.82^0$C/100 years) and relatively less significant ($+0.51^0$C/100 years) in respect of minimum temperature. The five warmest years on record in order for Tamil Nadu are 2019 (anomaly$+0.848^0$C), 2016($+0.837^0$C), 2017($+0.624^0$C), 2020($+0.493^0$C) and 2012($+0.427^0$C).

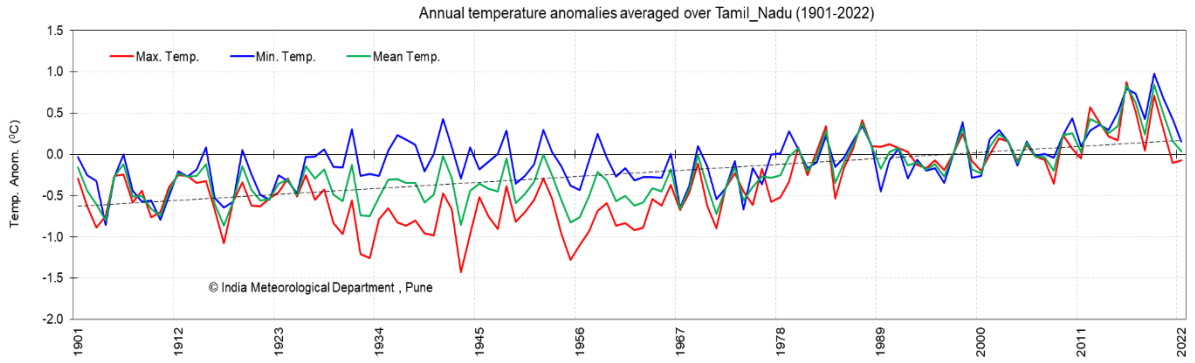


Fig. 3: Annual maximum, minimum and mean land surface air temperature anomalies averaged over the State of Tamil Nadu for the period 1901-2022. The anomalies were computed with respect to the base period of 1981-2010. The dotted black line indicates the linear trend in the annual mean temperature time series.

Fig.4 (a and b) shows daily variation of minimum and maximum temperature anomaly during the year respectively. The anomalies were computed with respect to the base period of 1981-2010. State was warmer in respect of both maximum and minimum temperature during January and December months and relatively cooler during May, July and August months.

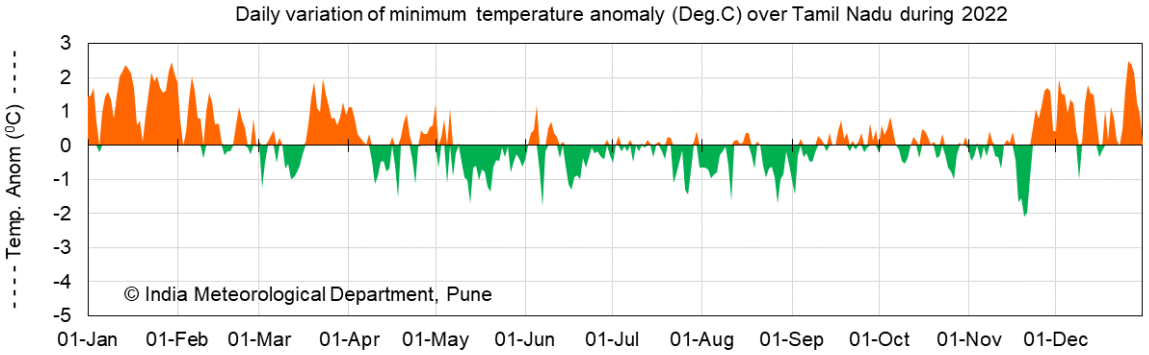


Fig. 4(a): Daily variation of minimum temperature anomaly (^{0}C) over Tamil Nadu during 2022

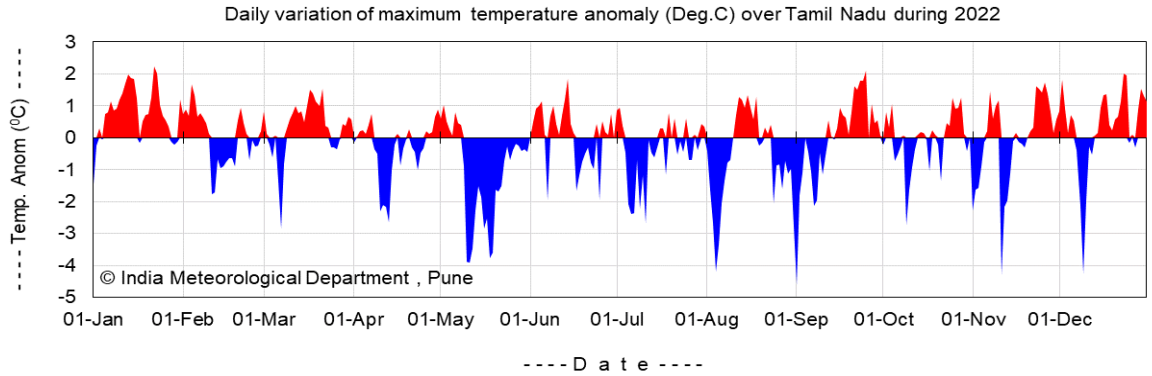


Fig. 4(b): Daily variation of maximum temperature anomaly (^{0}C) over Tamil Nadu during 2022

Rainfall

Based on 1971-2020 climatology, Tamil Nadu state as a whole receives 2.7 % of its annual rainfall during the winter season (Jan-Feb), 13.6% during the Pre-Monsoon season (Mar-May), 35.7 % during the southwest monsoon season (Jun-Sept) and 48 % during the Post-Monsoon season (Oct-Dec). Thus, though the Post monsoon season is the principal rainy season for the state, the state receives

considerable amount of rainfall during the monsoon and pre-monsoon seasons also. **Fig. 5** shows the annual departure of rainfall over different districts of Tamil Nadu during 2022. The anomalies were computed based on the 50 year LPA for period of 1971-2020. Out of 38 districts of the state, 3 received large excess rainfall (60% or more of its 1971-2020 period LPA), 13 received excess rainfall (20% to 59% of its LPA) and 22 districts received normal rainfall (-19% to +19% of its LPA).

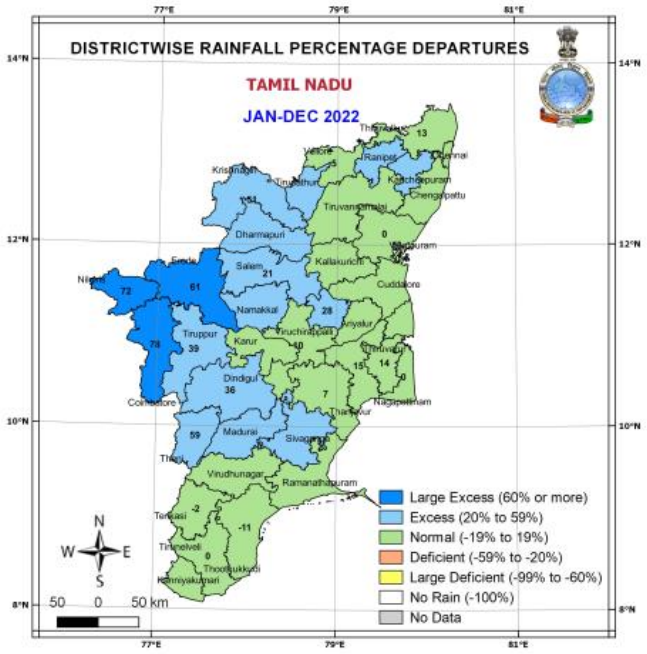


Fig. 5: District-wise annual rainfall percentage departures

The daily variation of rainfall (mm) during the year for the state is shown in **Fig. 6(a)**. The state received below normal rainfall on many days at a stretch from mid-September to mid-October month and above normal rainfall on some occasions in July, August, October and November months.

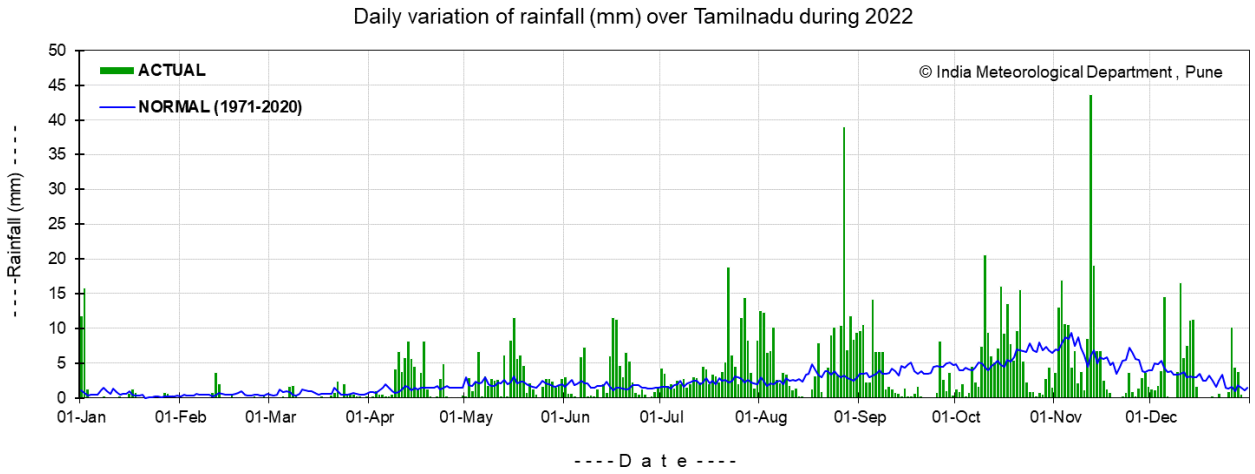


Fig. 6(a): Daily variation of rainfall (mm) averaged over Tamil Nadu during the year.

The time series of variation of % departure of Southwest Monsoon seasonal, Northeast Monsoon seasonal and annual rainfall for the state for the period 1901-2022 are shown in **Fig. 6(b), 6(c) and 6(d)** respectively. The departures are calculated with respect to the LPA base period of 1961-2010. For the Southwest Monsoon season, Northeast Monsoon season and the year 2022, the state received 145 %, 101% and 123 % of its LPA rainfall respectively.

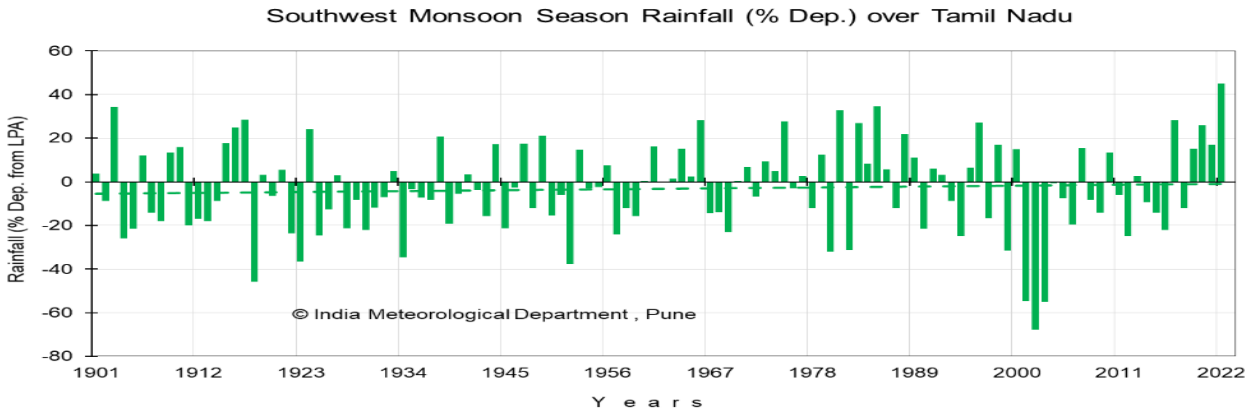


Fig. 6(b): Time series of % departure of southwest monsoon rainfall averaged over Tamil Nadu (1901-2022)

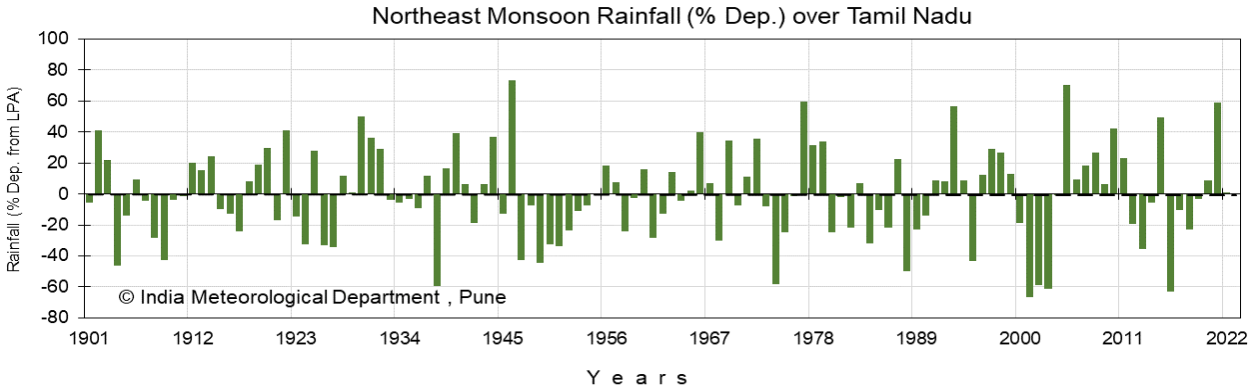


Fig. 6(c): Time series of % departure of Northeast monsoon rainfall averaged over Tamil Nadu (1901-2022)

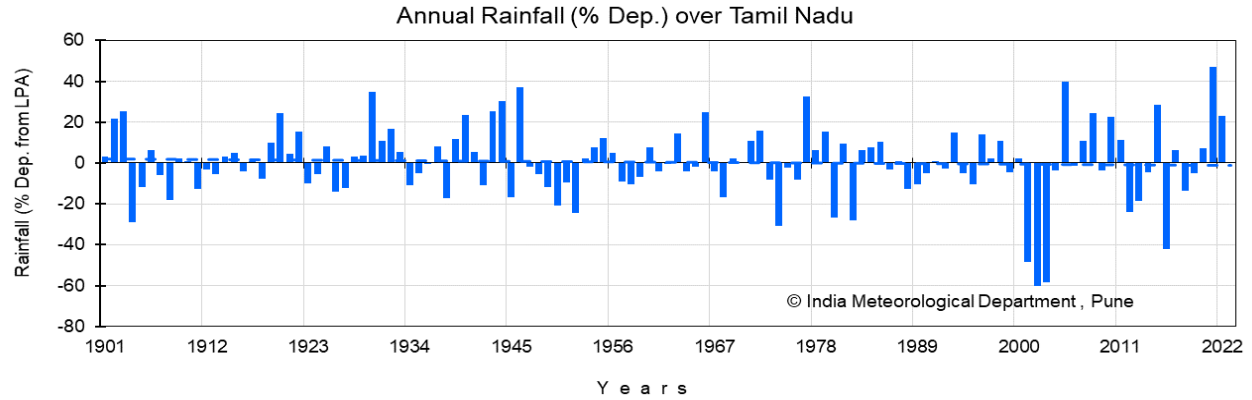


Fig. 6(d): Time series of % departure of annual rainfall averaged over Tamil Nadu (1901-2022)

Table 1 below shows the monthly, seasonal and annual rainfall statistics for the state for the year 2022. The state as a whole received large excess rainfall during the winter season, excess rainfall during pre-monsoon, monsoon and year as a whole. During the post monsoon season, it received normal rainfall.

TABLE 1

MONTH / SEASON	ACTUAL (mm)	NORMAL (mm)	% DEP.	CATEGORY
JANUARY	34.7	12.2	184.2	LE
FEBRUARY	7.7	12.5	-38.2	D
WINTER SEASON	42.4	24.7	71.6	LE
MARCH	12.1	19.9	-39.1	D
APRIL	65.2	38.8	68.1	LE
MAY	89.2	66.3	34.5	E
PRE-MONSOON SEASON	166.5	125.0	33.2	E
JUNE	79.2	50.7	56.1	E
JULY	138.1	69.0	100.1	LE
AUGUST	174.0	90.0	93.3	LE
SEPTEMBER	85.6	118.7	-27.9	D
MONSOON SEASON	476.8	328.4	45.2	E
OCTOBER	165.8	171.6	-3.4	N
NOVEMBER	178.0	181.2	-1.8	N
DECEMBER	101.0	88.9	13.6	N
POST-MONSOON SEASON	444.8	441.7	0.7	N
ANNUAL	1130.6	919.8	22.9	E

CATEGORY		
	LARGE EXCESS [LE]	+60 % OR MORE
	EXCESS [E]	+20 % TO +59 %
	NORMAL [N]	-19 % TO +19 %
	DEFICIENT [D]	-59 % TO -20%
	LARGE DEFICIENT [LD]	-99 % TO -60 %
	NO RAIN [NR]	-100%

The district-wise rainfall trends in annual rainfall for the period 1901-2021 is given in **Fig 7**. Most of the districts of the state are showing non-significant increasing or decreasing trend. However, Madurai district is showing significantly decreasing trend while Perambalur district is showing significantly increasing trend.

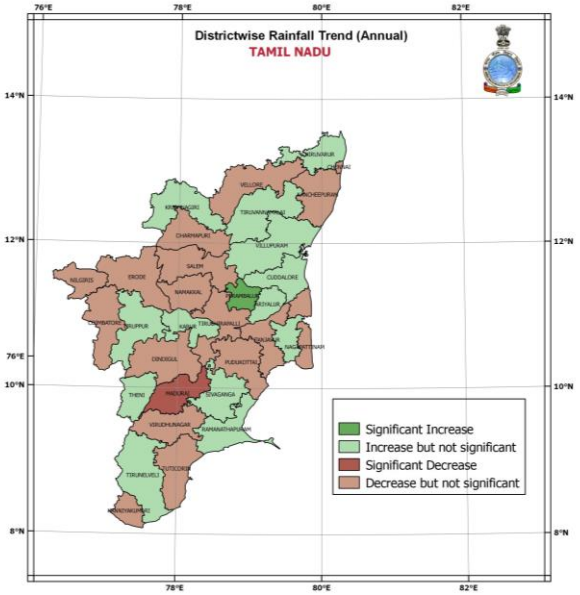


Fig. 7: District-wise annual rainfall Trend for Tamil Nadu (period of study 1901-2021)

Standardized Precipitation Index (SPI)

The district wise Annual SPI Map for the state for the year 2022 is shown in **Fig. 8**. The SPI is based on precipitation and is used for measuring drought. This index is negative for drought and positive for wet conditions. As the wet and dry conditions become more severe, the index becomes more positive or negative. Mildly wet to Moderately wet conditions were observed over many districts of the state. Extremely wet conditions were observed over parts of Nilgiris district, while severely wet conditions were observed over parts of Coimbatore, Namakkal and Krishnagiri districts. Mildly dry conditions were observed over some southern coastal districts of the state viz. Kanyakumari, Tuticorin and Ramanathapuram.

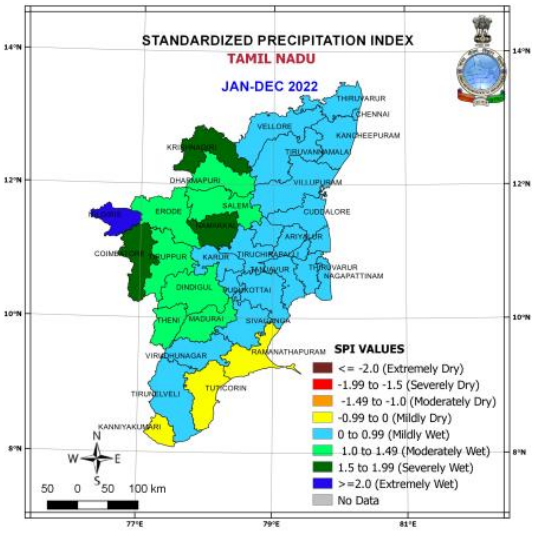


Fig. 8: District wise Annual SPI Map for Tamil Nadu for the year 2022

Heavy Rainfall Events

Heavy (64.5-115.5mm), Very heavy (115.6-204.4 mm) and Extremely heavy (more than 204.4 mm) rainfall events were recorded over some stations of Tamil Nadu and Puducherry during 2022. **Fig. 9** shows the location and frequency of occurrence of such events during the year. **Table 2** below shows the extremely heavy rainfall values with the date of its occurrence and the location.

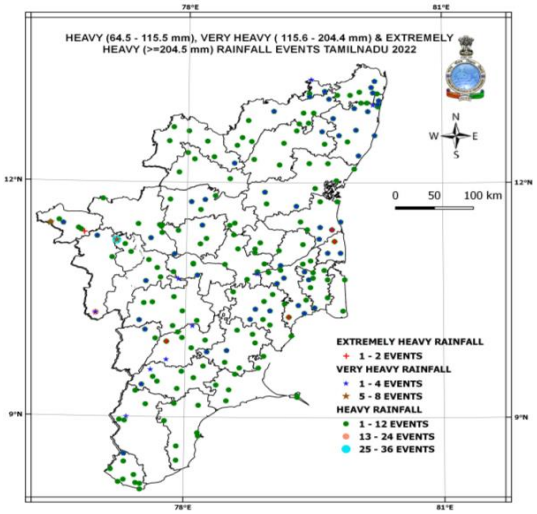


Fig. 9: Location and frequency of Heavy Rainfall, Very Heavy Rainfall and Extremely Heavy Rainfall events reported over stations of Tamil Nadu during the period January to December 2022.

Table 2

Very heavy (115.6-204.4 mm) or extremely heavy rainfall # (> 204.4 mm) recorded over some stations of Tamil Nadu during January – December 2022

DATE	STATION NAME	RAINFALL (mm)
02-Jan	ALANGUDI	130.0
	PUDUKOTTAI	117.0
	TIRUMAYAM	132.0
	ADIRAMPATNAM	159.6
	PATTUKOTTAI	183.0
	PERAVURANI	222.6
	MUTHUPET	184.0
10-Apr	WATRAP	120.0
13-Apr	AYIKUDI	116.0
	DHARAPURAM	150.0
15-Apr	YERCAUD	120.0
02-May	PERUNDURAI	125.0
18-May	SANKARIDURG	133.0
	VIRINJIPURAM AWS	144.5
17-Jun	UTHANGARAI	122.0
06-Jul	CHINNAKALAR	117.0
11-Jul	CHINNAKALAR	142.0
12-Jul	DEVALA	117.0
13-Jul	DEVALA	149.0
14-Jul	VALPARAI PTO	131.4
	DEVALA	163.0
	NADUVATTAM	147.0
22-Jul	RASIPURAM	129.0
	OMALUR	122.0
26-Jul	K.M.KOIL	123.0
	TIRUPUVANAM	140.4
27-Jul	VALANGAIMAN	116.2
	ULUNDURPET	120.0
30-Jul	PERIYAKULAM	145.0
01-Aug	USILAMPATTI	230.0
	TIRUPUVANAM	120.4
02-Aug	CHINNAKALAR	131.0
	VALPARAI PTO	127.6
04-Aug	CHINNAKALAR	142.0
	VALPARAI PTO	118.8
05-Aug	CHINNAKALAR	194.0
	VALPARAI PTO	124.4
	DEVALA	181.0
	NADUVATTAM	152.0
08-Aug	DEVALA	188.0
11-Aug	NADUVATTAM	128.0
12-Aug	NADUVATTAM	135.0
27-Aug	PERAIYUR	172.4
	SHOLINGUR	142.0
29-Aug	RASIPURAM	200.0
31-Aug	KODAIKANAL	168.8
11-Sep	DEVALA	125.0
13-Sep	DEVALA	117.0
26-Sep	GRAND ANAICUT	155.0
	THANJAVUR	122.0
	VALLAM	117.0

DATE	STATION NAME	RAINFALL (mm)
10-Oct	SIVAGANGA	123.0
11-Oct	PANCHAPATTI	120.0
	METTUPATTI	168.0
15-Oct	TIRUPUVANAM	117.0
16-Oct	LOWER KOTHAIYAR ARG	130.5
18-Oct	PERIYAKULAM	125.0
01-Nov	RED HILLS	127.0
02-Nov	ANNA UNIVERSITY	121.2
	CHENNAI(N)	129.0
	CHEYYUR	134.2
	PONNERI	157.0
	RED HILLS	142.0
03-Nov	CHIDAMBARAM	153.8
	PARANGIPETTAI	115.8
	SETHIATHOPE	128.6
	SIRKALI	220.0
	THANJAVUR	177.5
04-Nov	METTUPALAYAM	120.5
12-Nov	CHIDAMBARAM	307.9
	K.M.KOIL	185.4
	PARANGIPETTAI	181.2
	SETHIATHOPE	159.4
	ARAVAKURICHI	118.0
	MAYILADUTHURAI	161.6
	SIRKALI	436.2
	TRANGAMBADI(OR)TRANQUEB	184.0
	KANGEYAM	154.0
13-Nov	KODUMUDI	117.6
	UTHIRAMERUR	169.0
	TIRUTTANI	130.0
16-Nov	RAJAPALAYAM	121.0
05-Dec	THANJAVUR	159.0
	NEEDAMANGALAM	140.6
10-Dec	CHENGALPATTU	121.0
	CHENNAI AP	115.7
	KANCHEEPURAM	184.9
	MAHABALIPURAM	132.0
	SRIPERUMBUDUR	133.0
	TAMBARAM	133.5
	UTHIRAMERUR	138.0
	CHOLAVARAM	129.0
	PALLIPATTU	127.0
	RED HILLS	121.0
	TIRUTTANI	162.0
	CHEYYAR	181.0
	ARAKONAM	141.5
14-Dec	THIRUMANUR	155.0
	COONOOR	303.0
	NEEDAMANGALAM	159.0

(#: Rainfall figures are for past 24 Hrs. ending on 8:30 Hrs. IST of the date)

Extreme Weather Events

The state experienced lightning, flood/heavy rains and cyclonic storm during the year 2022. The location of these events is given in **Fig. 10**. **Table 3** shows the associated loss of Human Lives due to these events with date and location.

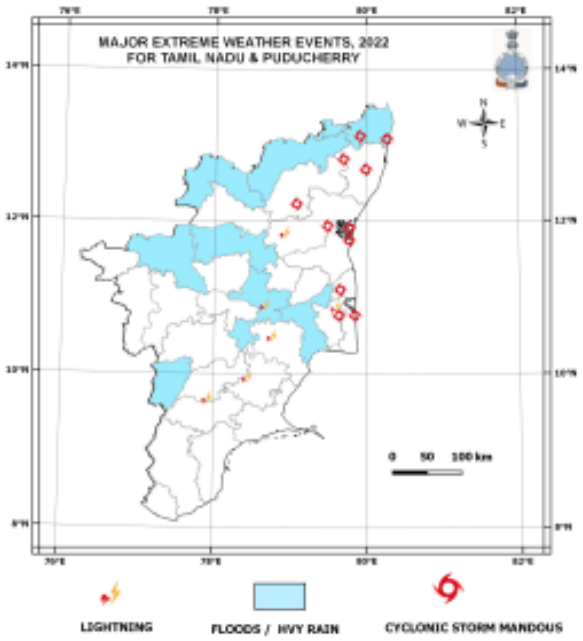


Fig.10: Locations of impact occurred associated with Major Extreme Weather Events occurred during 2022 (details provided in the Table 3 below).

Table 3

Major extreme weather events during 2022 which caused loss of human lives* occurred in Tamil Nadu and Puducherry

Event	Number of causalities and Date	Season	Affected districts
Lightning	**21** (11 to 13 Apr.; 24 May; 12 Jun.; 18, 26 Sep.; 20 Oct.; 14 Nov.; 13 Dec.)	Pre-Monsoon (March to May), Monsoon (June to September), Post-Monsoon (October to December)	Kallakurichi, Pudukkottai, Sivaganga, Thiruvarur, Tiruchirappalli, Virudhunagar
Floods and Heavy Rain	**3** (21 Oct.; 1 Nov.)	Post-Monsoon (October to December)	Chennai, Erode
Severe Cyclonic Storm MANDOUS	**5** (6 to 10 Dec.)	Post-Monsoon (October to December)	Chennai, Chinglepet, Cuddalore, Kanchipuram, Mayiladhurai, Nagapattinam. Thanjavur, Thiruvarur, Tiruvannamalai, Viluppuram, north coastal districts of T'Nadu and Parts of Puducherry

(: Based on the media reports and the reports from disaster Management Authorities of the government)*

A Severe Cyclonic Storm MANDOUS (6 - 10 December) which formed during the post-monsoon season over the Bay of Bengal, crossed north Tamil Nadu-Puducherry and adjoining south Andhra Pradesh coasts between Puducherry and Sriharikota, close to Mamallapuram (Mahabalipuram) on 9th December. It claimed 5 lives from Tamil Nadu and Puducherry. The tracks of the cyclonic storms formed over the Bay of Bengal during the year is shown in **Fig. 11**.

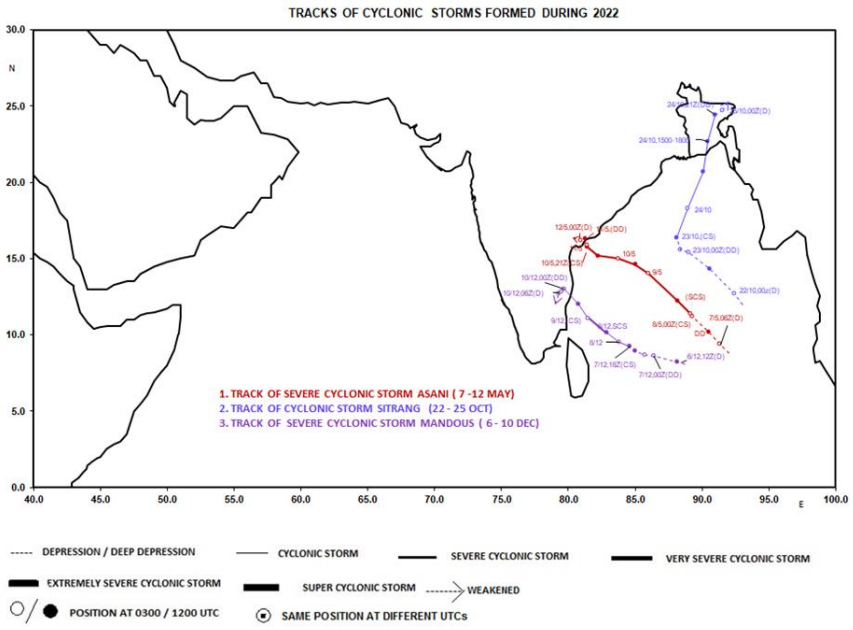


Fig.11: Tracks of cyclonic storms formed over the Bay of Bengal during the year 2022

Summary

The Statement on Climate for the state of Tamil Nadu for 2022 is prepared based on the real-time meteorological observation across the state at the district/block level in different seasons and taking reference of more than 100 years of past climate data for the state. So, the observation made in this report are very important for different sectors like agriculture, health, power, disaster management, and water, etc. This report which is prepared by the India Meteorological Department is suggesting for crucial inputs from the state government in future. It is suggested that with the demanding need at global and regional level related to the climate change for sustainable development, the future joint reports/ventures would be a path breaking for the society. By saying so, following are the submitted:

(i) The report may please be circulated to all the concerned ministries/departments of the state government and other relevant stakeholders in the state.

(ii) Based on the feedback, further course of actions in different climate sectors can be planned, like holding workshops, pilot studies, and any other joint ventures.

Apart from this annual climate statement, India Meteorological Department, Pune comes out regularly with climate updates which are shared on the public domain for the users' benefit. It is suggested to check for these updates regularly on the India Meteorological Department (IMD), Pune website: https://www.imdpune.gov.in/.

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