भारत सरकार

Government of India

पृथ्वी विज्ञान मंत्रालय (एम. ओ. ई. एस.)

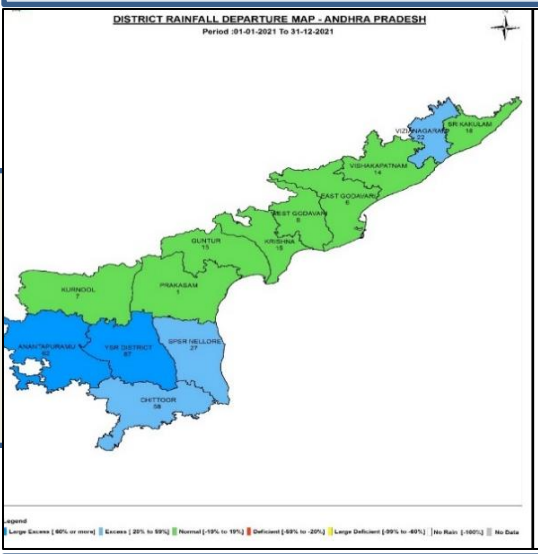
Ministry of Earth Sciences (MoES)

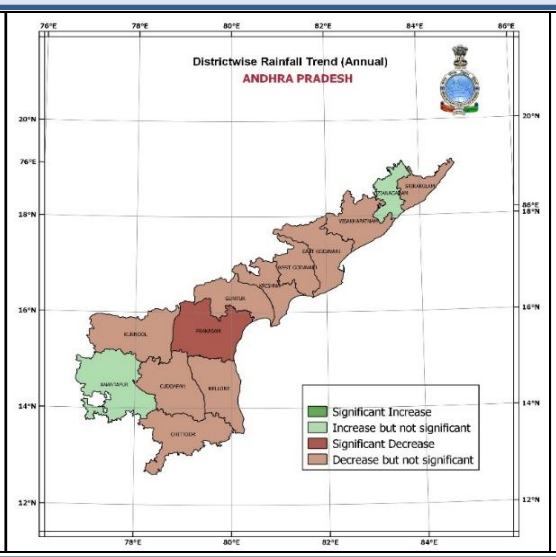
भारत मौसम विज्ञान विभाग

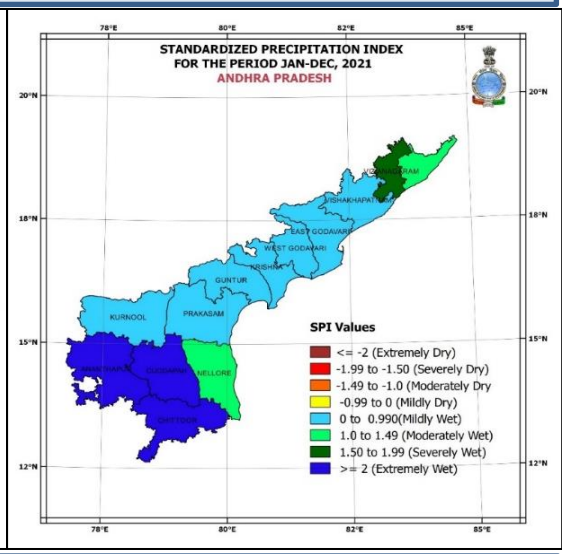
INDIA METEOROLOGICAL DEPARTMENT

जलवायु अनुसंधान एवं सेवाएँ

CLIMATE RESEARCH AND SERVICES







आंध्र प्रदेश राज्य के लिए जलवायु पर वक्तव्य: 2021

STATEMENT ON CLIMATE FOR THE STATE OF ANDHRA PRADESH: 2021

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

आंध्र प्रदेश राज्य के लिए जलवायु पर वक्तव्य: 2021
Statement on Climate for the state of Andhra Pradesh: 2021

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

Preamble:

It gives me immense pleasure to share this scientific document titled, "Statement on Climate for the state of Andhra Pradesh for 2021" prepared by office of Climate Research & 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 projected in this along with 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 scientists 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 2021 (121 years). I am sure this yearly update with climatological perspectives, will create more awareness among all the stake holders, 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 2021 which my office is conveying to your good office is with some delay, but next Climate statement 2022, this office is planning to send in the beginning of the year and 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 Climate statement 2022 could be a joint publication of state government authorities of Andhra Pradesh 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 approached 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 & Services,
India Meteorological Department,
Pune.

July 2022

HIGHLIGHTS

The Andhra Pradesh State averaged annual mean land surface air temperature during 2021 was +0.10^{0}C warmer than its Long Period Average (LPA) for the period 1981-2010.

The annual maximum temperature averaged over the state during the year 2021 was slightly cooler than average with anomaly of -0.2^{0}C while annual minimum temperature averaged over the state was warmer than average by 0.3^{0}C.

Out of 13 districts of the state, 8 districts received normal rainfall (-19% to +19% of its 1961-2010 period LPA), 2 received excess rainfall (20% to 59% of its LPA) and 3 received large excess (60% or more of its LPA) rainfall.

Objective

The objective of this brief report is to provide the analysis of state's temperature, rainfall and extreme weather events that occurred during 2021. 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 2021.

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 have decided to issue the statement of annual climate 2021 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 2021 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 2021.

Temperatures

The monthly and seasonal maximum, minimum and mean temperature anomalies averaged over the State of Andhra Pradesh is given in the **Fig.1**. The anomalies were computed based on the Long Period Average (LPA) for the period 1981-2010. The State averaged monthly maximum temperature was colder than average during the months of February, April, May, June, July, September and November 2021 and warmer during rest of the months with October recording highest monthly maximum temperature

anomaly (1.0^{o}C).The State averaged monthly minimum temperature was warmer than the average during all months except in February, March, May, June and July with highest anomaly recorded in November (1.8^{o}C).The State averaged mean monthly temperature was warmer than average during all the months of the year except from February to July. Among the months, the highest State averaged monthly mean temperature anomaly was recorded in October (1.0^{0}C, second warmest since 1901), followed by January (0.9^{0}C, fifth warmest since 1901). Season wise, the post monsoon season (October-December) recorded the highest season averaged maximum temperature anomaly (0.1^{o}C), minimum temperature anomaly (1.3 ^{o}C, second warmest since 1901) and mean temperature anomaly (0.7^{o}C, sixth warmest since 1901).

Fig. 2 shows the Spatial pattern of Annual Maximum, Minimum and Mean Temperature anomalies over Andhra Pradesh during 2021. The temperature anomalies were within $\pm$ 1^{0} C over all the districts of the state. During the year 2021, the annual mean land surface air temperature of Andhra Pradesh was +0.1^{0}C warmer than the average (1981-2010) (**Fig. 3**). A significant increasing trend of 0.64 ^{0}C/100 years is observed in the State averaged annual mean temperature during 1901-2021 (Fig.3). 2019, 2016 are the warmest year since 1901 followed by 2017,2015 ,2018 and1998. The annual maximum temperature averaged over the state during the year 2021 was cooler than average with anomaly of -0.2^{0}C while annual minimum temperature averaged over the state was warmer than average by 0.3^{0}C (10th warmest) (**Fig. 1**). During the period 1901-2021, the State averaged maximum temperature showed a significant increasing trend (0.8^{0}C/100 years) while the State averaged minimum temperature showed a relatively lower increasing trend (0.4^{0}C/100 years) (**Fig. 3**).

Rainfall

Andhra Pradesh experiences rainfall mainly during two seasons of the year; Southwest monsoon season (June to September) and Northeast monsoon season (October to December). **Fig. 4** shows the annual departure of rainfall in different districts of Andhra Pradesh for the year 2021. The anomalies were computed based on the LPA period of 1961-2010. Out of 13 districts of the state, 8 districts received normal rainfall (within -19% to +19% of its LPA), 2 received excess rainfall (20% to 59% of its LPA) and the remaining 3 received large excess (60% or more) rainfall.

Fig. 5(a), 5(b) and 5(c) show the time series of variation of % departure of southwest Monsoon, northeast Monsoon and annual rainfall for the state for the period 1901-2021 respectively. The departures are calculated with respect to the LPA base period of 1961-2010. For the SW monsoon season, NW Monsoon season & the year 2021, the state received 119 % ,140% & 126 % of its LPA rainfall respectively.

Fig. 6 depicts the district-wise rainfall trends for annual rainfall. It is seen that among all the district, Prakasam shows significantly decreasing trend while rest of the districts shows non-significant trend.

Standardized Precipitation Index (SPI)

The SPI is based on precipitation and 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. Extremely wet/severely wet conditions were observed over parts of Ananthapur, Chittor, Cuddpah and Vizianagaram districts while mildly /moderately wet conditions were observed over other districts of the state (**Fig. 7**).

Extreme Weather Events

Extremely heavy rainfall (> 204.4 mm) events were recorded over some stations of Andhra Pradesh (**Fig. 8**). Table1 shows the extremely heavy rainfall values with the date of its occurrence and the location. Major Extreme Weather Events & associated loss of life occurred during 2021 over Andhra Pradesh state is given in **Fig. 9**. Table 2 shows the extreme weather events and loss of Human Lives occurred during 2021 in Andhra Pradesh. The tracks of the cyclonic storms formed during the year are shown in **Fig. 10**. The Cyclonic Storm GULAB (24 September to 28 September), formed during the southwest monsoon season & crossed north Andhra Pradesh – south Odisha coasts on 26th September.

Summary

As a first attempt, the CRS office in coordination with its state Meteorological Centre data, prepared this annual climate statement 2021 for each state of the country with all the available climate related information in this office. Continuous improvement of climate services requires to develop communication and linkages with decision-makers and users. Starting from next year, attempt will be made to further develop the state-level climate statement in collaboration with state governments as well as IMD's State Meteorological Centre.

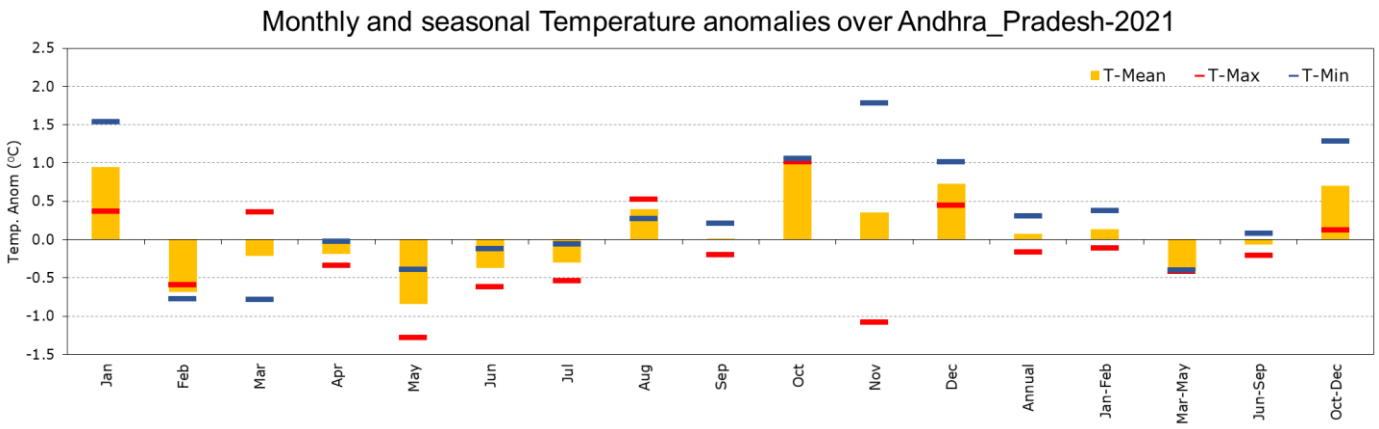


Fig. 1: Monthly and Seasonal Maximum, Minimum and Mean Temperature anomalies averaged over Andhra Pradesh during 2021.The anomalies were computed from long period average for the base period of 1981-2010.

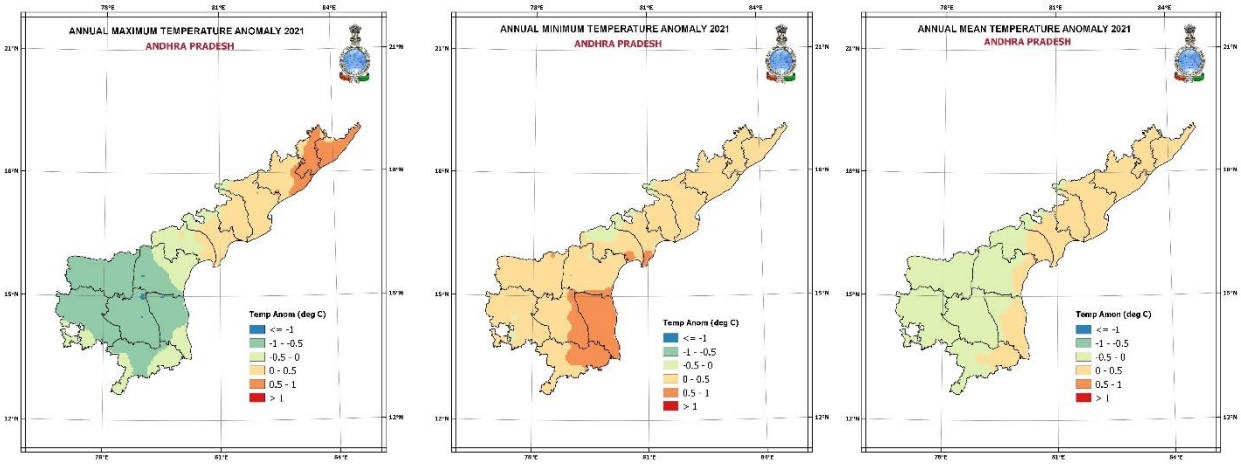


Fig. 2: Spatial pattern of Annual Maximum, Minimum and Mean Temperature anomalies over Andhra Pradesh during 2021.The anomalies were computed from long period average for the base period of 1981-2010.

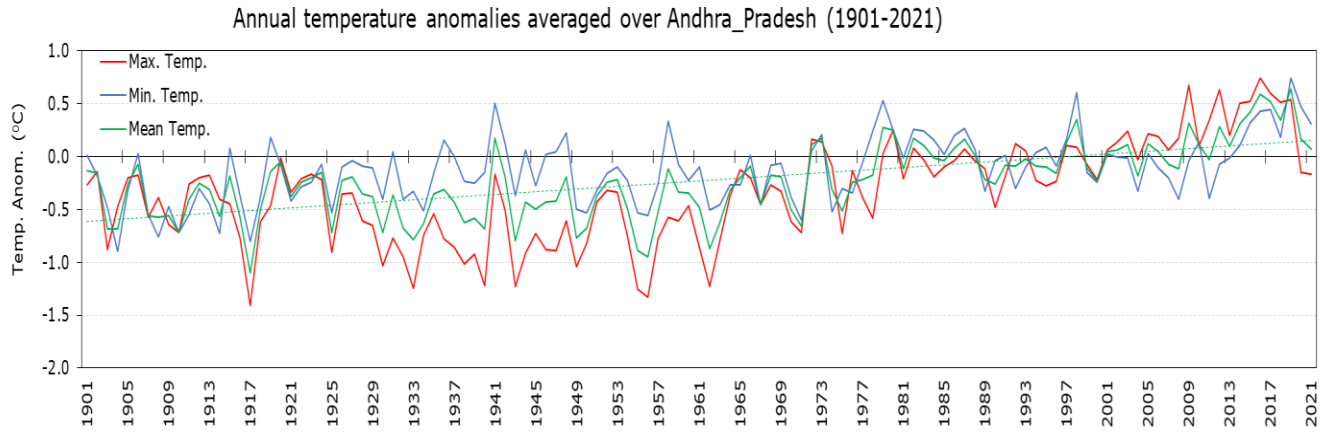


Fig. 3: Annual maximum, minimum and mean land surface air temperature anomalies averaged over the State of Andhra Pradesh for the period 1901-2021.The anomalies were computed with respect to the base period of 1981-2010. The dotted line indicates the linear trend in the annual mean temperature time series.

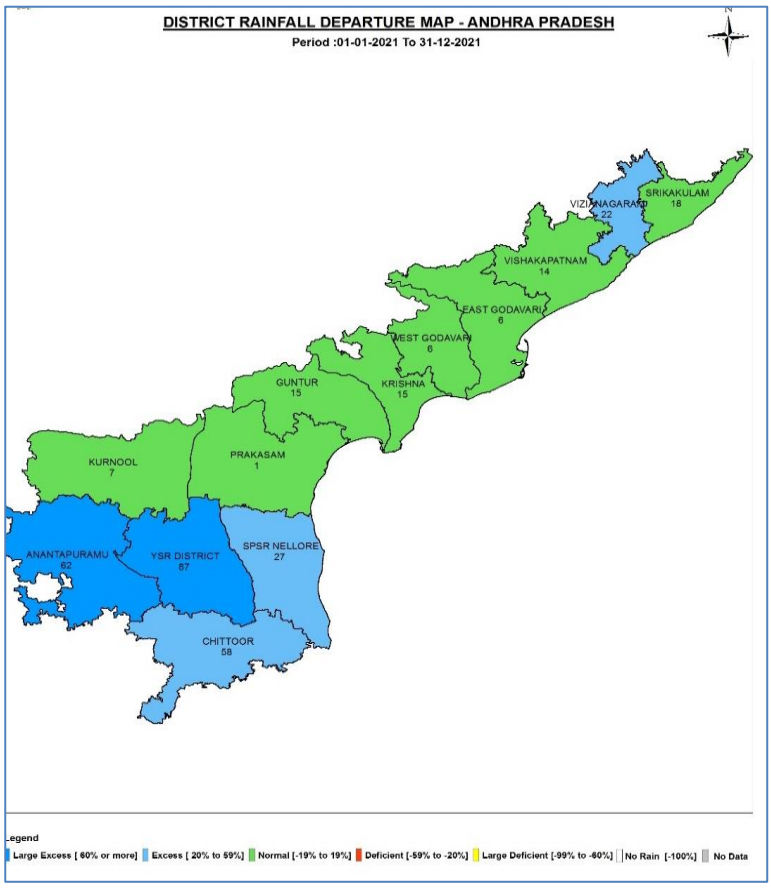


Fig. 4: District Annual rainfall departure Map for Andhra Pradesh

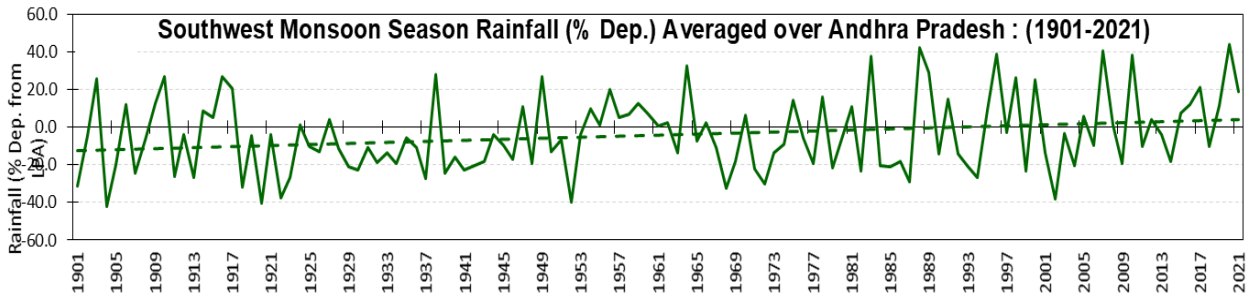


Fig. 5(a): Percentage departure of southwest monsoon rainfall averaged over Andhra Pradesh (1901-2021)

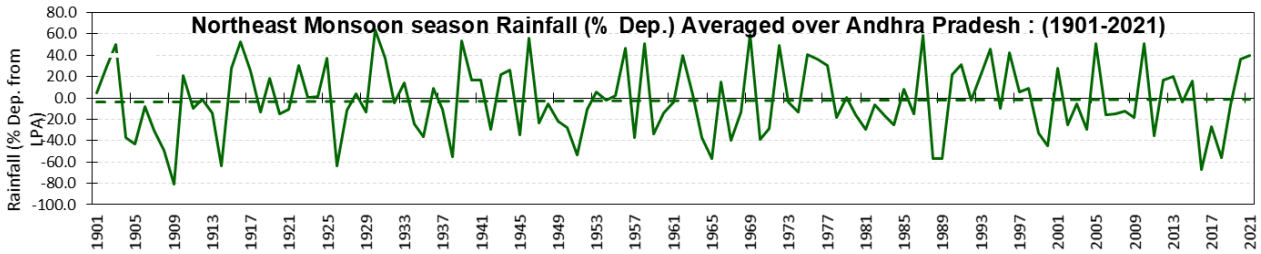


Fig. 5(b): Percentage departure of northeast monsoon rainfall averaged over Andhra Pradesh (1901-2021)

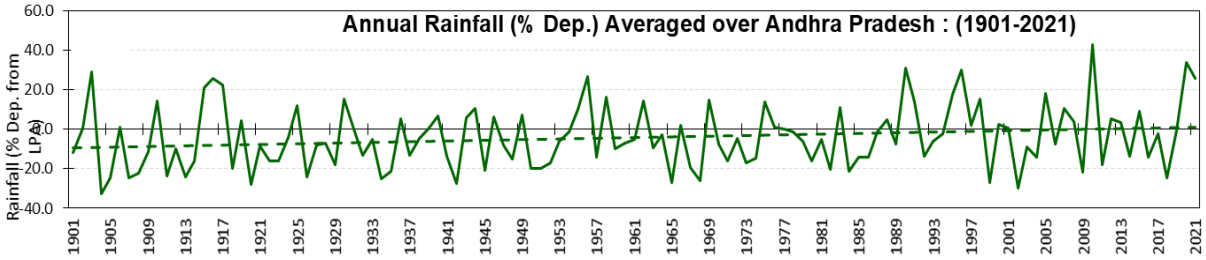


Fig. 5(c): Percentage departure of annual rainfall averaged over Andhra Pradesh (1901-2021).

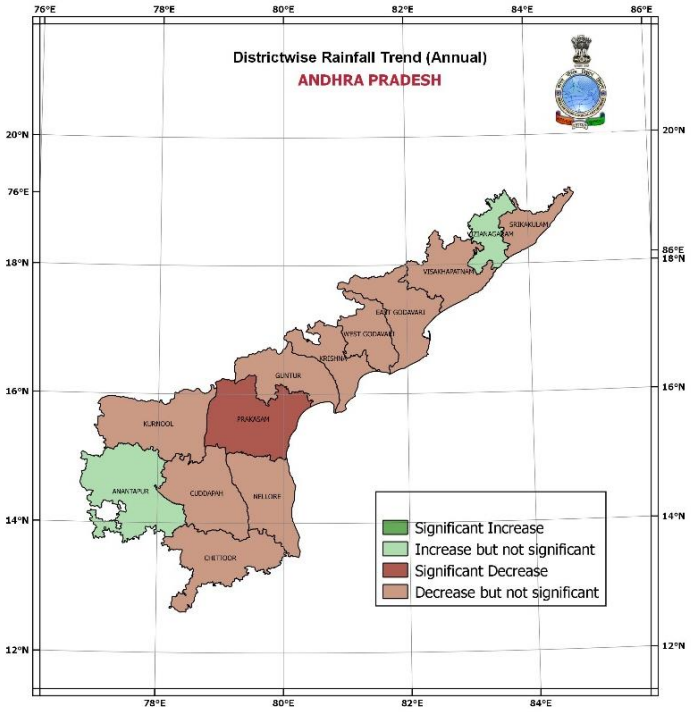


Fig. 6: District-wise annual rainfall Trend

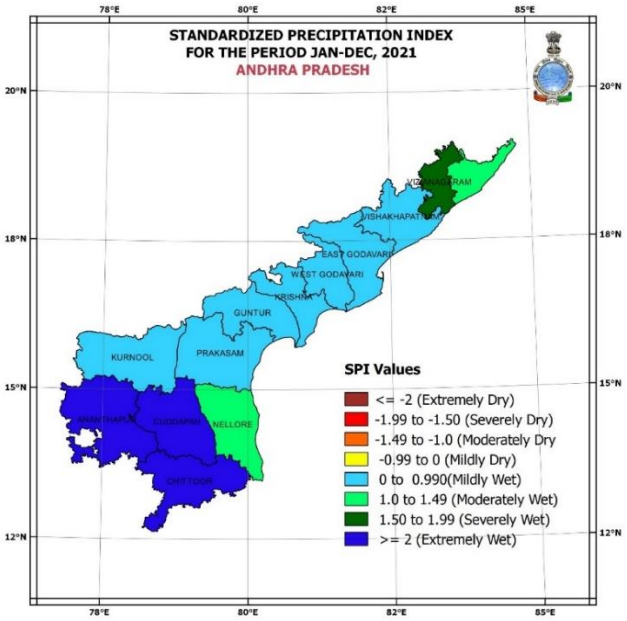


Fig. 7: District wise Annual SPI Map for Andhra Pradesh

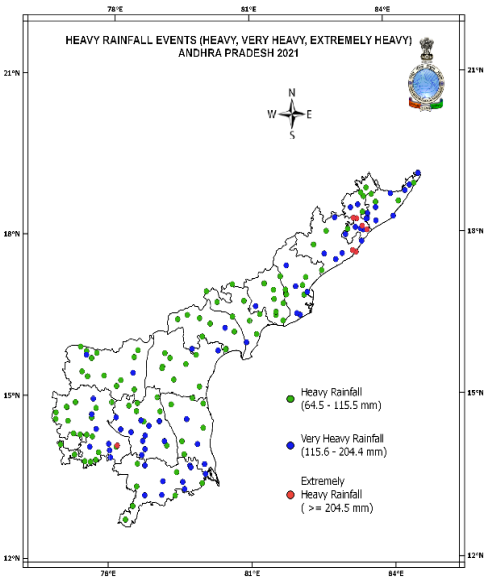


Fig. 8: Location of Heavy Rainfall (64.5-115.5mm), Very Heavy Rainfall (115.6-204.4 mm) and Extremely Heavy Rainfall (more than 204.5 mm) reported stations over Andhra Pradesh during the period January to December 2021.

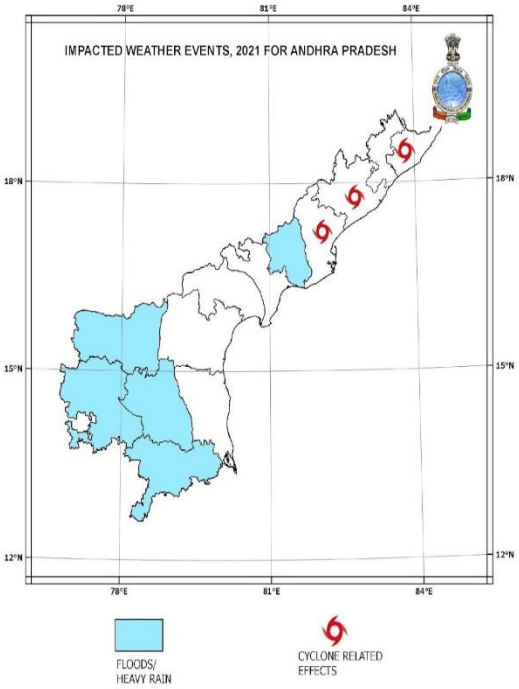


Fig. 9: Locations of impact occurred associated with Major Extreme Weather Events occurred during 2021 causing loss of life (details provided in the Table 2).

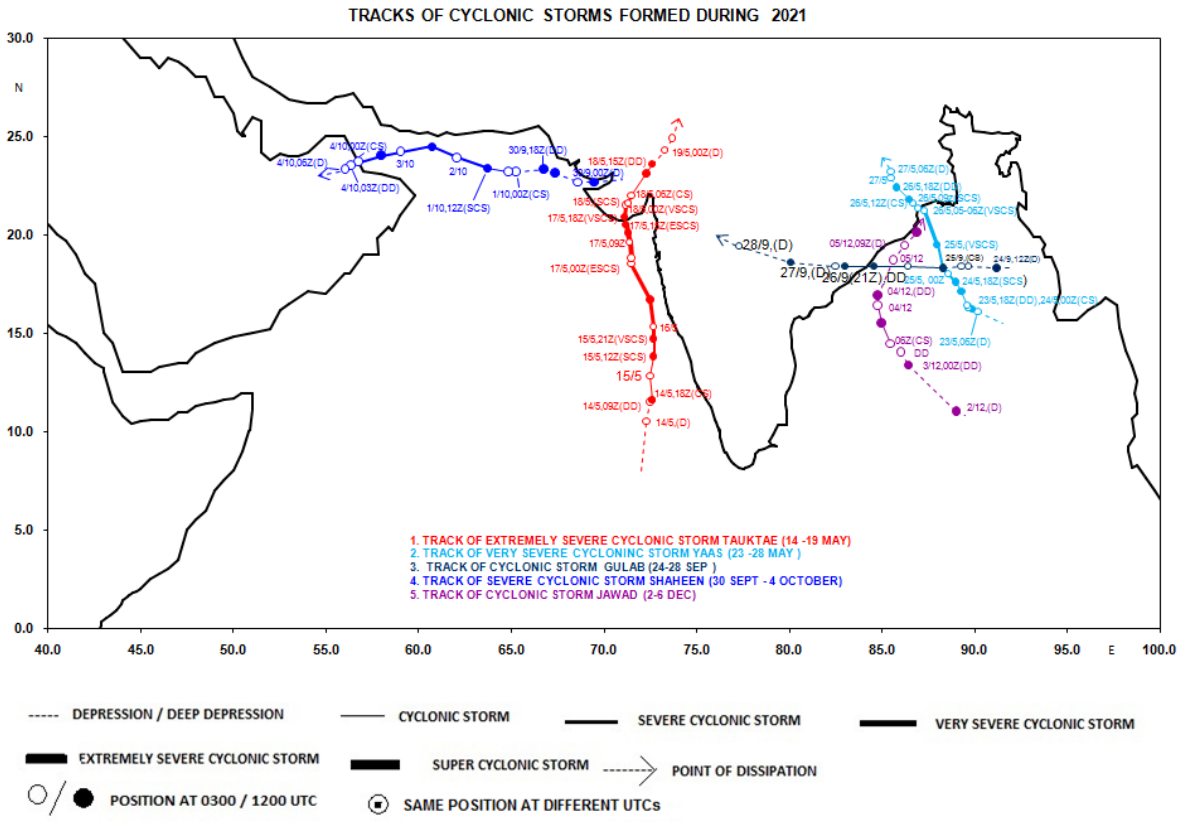


Fig. 10: Tracks of the Cyclones formed over north Indian Ocean during 2021

Table 1

Extremely heavy rainfall recorded over some stations of Andhra Pradesh during June – December 2021

STATION NAME	Rainfall (mm)	DATE
KADIRI	215.4	18 JUL 2021
VISAKHAPATNAM	282.4	27 SEP 2021
VISAKHAPATNAM AP	267.0	27 SEP 2021
GAJAPATHINAGARAM	280.8	27 SEP 2021
MENTADA	246.8	27 SEP 2021
NELLIMARLA	278.0	27 SEP 2021
PUSAPATIREGA	239.2	27 SEP 2021

Table 2

Extreme weather events during 2021 and associated loss of human lives* occurred in Andhra Pradesh Impacted Weather Events, 2021 Andhra Pradesh

Event	Number of casualties & Date	Season	Affected districts
Floods and Heavy Rain	46 (6 Sep.; 8 to 21 Nov.)	Monsoon (June to September), Post-Monsoon (October to December)	Anantpur, Chittoor, Cuddapah, Kurnool, West Godavari & Parts of Andhra Pradesh
Heavy rainfall and strong winds associated with the Cyclonic Storm GULAB (pronounced as Gul-Aab)	4 (24 to 28 Sep.)	Monsoon (June to September)	Srikakulam, Visakhapatnam
Heavy rainfall and strong winds associated with the Cyclonic Storm JAWAD (pronounced as Jowad)	2 (2 to 5 Dec.)	Post-Monsoon (October to December)	6 Districts including Srikakulam

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

Contact

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