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INDIA METEOROLOGICAL DEPARTMENT
Climate Research and Services (CRS)

Statement on Climate of India during 2020

HIGHLIGHTS

The annual mean land surface air temperature averaged over India during 2020 was above normal. During the year, annual mean land surface air temperature averaged over the country was $+0.29^{\circ}\text{C}$ above normal (based on the data of 1981-2010). The year 2020 was the eighth warmest year on record since nation-wide records commenced in 1901. However, this is substantially lower than the highest warming observed over India during 2016 ($+0.71^{\circ}\text{C}$). The monsoon and post-monsoon seasons with mean temperature anomalies (Actual temperature-Normal temperature) of $+0.43^{\circ}\text{C}$ and $+0.53^{\circ}\text{C}$ respectively mainly contributed to this warming. Mean temperature during the winter was also above normal with anomaly of $+0.14^{\circ}\text{C}$. However, during the pre-monsoon season temperature was below normal (-0.03°C).

The Global mean surface temperature anomaly during 2020 (January to October as per WMO state of the global climate) is $+1.2^{\circ}\text{C}$ (source: <https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate>).

The 2020 annual rainfall over the country as a whole was 109% of its Long Period Average (LPA) based on the data of 1961-2010. The monsoon season rainfall over the country as a whole was above normal and was 109% of its LPA.

Temperatures

The 2020 annual mean land surface air temperature for the country was $+0.29^{\circ}\text{C}$ above the 1981-2010 period average, thus making the year 2020 as the eighth warmest year on record since 1901 (Fig. 1). The five warmest years on record in order were: 2016 ($+0.71^{\circ}\text{C}$), 2009 ($+0.55^{\circ}\text{C}$), 2017 ($+0.541^{\circ}\text{C}$), 2010 ($+0.539^{\circ}\text{C}$), and 2015 ($+0.42^{\circ}\text{C}$). It may be mentioned that 12 out of 15 warmest years were during the recent fifteen years (2006-2020). Past decade (2001-2010/ 2011-2020) was also the warmest decade on record with anomalies of 0.23°C / 0.34°C . The country averaged annual mean temperature during 1901-2020 showed an increasing trend of $0.62^{\circ}\text{C}/100$ years (Fig.1) with significant increasing trend in maximum temperature ($0.99^{\circ}\text{C}/100$ years) and relatively lower increasing trend ($0.24^{\circ}\text{C}/100$ years) in minimum temperature.

The country averaged seasonal mean temperatures were also above the average during all the seasons except pre-monsoon season. The country averaged mean monthly temperatures were warmer than the normal during all the months of the year except March and June.

The mean temperatures exceeded the normal during September (by 0.72°C, warmest since 1901), August (by 0.58°C, second warmest), October (by 0.94°C, third warmest), July (by 0.56°C, fifth warmest), and December (by 0.39°C, seventh warmest).

Rainfall

The annual rainfall over the country was 109 % of long period average (LPA) of 117.7 cms. Time series of percentage departure of annual rainfall over the country as a whole since 1901 is shown in Fig. 2. Rainfall over the country as a whole during the SW monsoon season (June-September), which is the principal rainy season of the country, was above normal (109 % of LPA of 88 cms). During this season, among the four broad geographical regions of the country, Central India, South Peninsular and East & Northeast India received seasonal rainfall of 115%, 129% and 106% of its LPA respectively, while Northwest India received seasonal rainfall of 84% of its LPA.

The 2020 Northeast monsoon season (October-December) rainfall over the country as a whole was normal (101% of LPA). The seasonal rainfall during the northeast monsoon season over the core region of the south peninsula (comprising of 5 subdivisions viz. Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu & Puducherry, South Interior Karnataka and Kerala), was also normal (110% of LPA). All the five subdivisions of the core region except Kerala received excess/normal rainfall.

Tropical Storms in the Indian Seas

During 2020, 5 cyclones formed over the North Indian Ocean. These are Super cyclonic Storm **AMPHAN**, Very Severe Cyclonic Storms **NIVAR & GATI**, Severe Cyclonic Storm **NISARGA**, and Cyclonic Storm '**BUREVI**'. Of these, **NISARGA & GATI** formed over Arabian Sea, while the remaining 3 cyclones viz. **AMPHAN, NIVAR & BUREVI** formed over the Bay of Bengal. Out of these five most devastating cyclones, the Super Cyclonic Storm **AMPHAN** formed in the pre-monsoon season and crossed West Bengal coast over Sundarbans on 20th May. It claimed 90 lives & about 4,000 livestock mainly in West Bengal. The Severe Cyclonic Storm **NISARGA**, formed in the Monsoon season, crossed Maharashtra coast on 3rd June claimed 4 lives & 2000 livestock in Maharashtra. The remaining three cyclones viz. **NIVAR, BUREVI & GATI** formed during the post monsoon season. The Very Severe Cyclonic Storm **NIVAR** crossed Tamil Nadu & Puducherry coasts close to north of Puducherry and claimed 12 lives & 10836 livestock in Tamil Nadu & Andhra Pradesh. The Cyclonic Storm **BUREVI** claimed 9 lives & 200 livestock in Tamil Nadu. The VSCS "**GATI**" made landfall over Somalia coast. All these weather systems and their remnants and other low-pressure systems caused above normal rainfall over central and peninsular India. The tracks of these cyclones formed during the year are shown in figure 3.

High Impact Weather Events

The country also experienced other high impact weather events like, extremely heavy rainfall, floods, landslide, thunderstorm, lightning, cold waves, etc. (Fig.4). A few are listed below. The casualties mentioned here are based on the media and government reports.

Bihar & Uttar Pradesh were the most adversely affected states during the year which reportedly claimed more than 350 deaths from each state mainly due to thunderstorm, lightning & cold wave events.

Heavy rainfall & flood related incidents reportedly claimed over 600 lives from different parts of the country during pre-monsoon, monsoon & post-monsoon seasons. Of these, 129 lives were reportedly claimed from Assam, 72 from Kerala [Specifically, 65 persons reportedly claimed dead in a single day from Pettimudi in Munnar, Idukki district of Kerala on 7th August due to landslide.], 61 from Telangana (while, 59 lives reportedly claimed only during the period 1st to 20th October), 54 lives from Bihar, 50 from Maharashtra, 48 Uttar Pradesh, & 38 from Himachal Pradesh.

Thunderstorms and lightning reportedly claimed 815 lives from different parts of the country. Among these, 280 from Bihar, 220 from Uttar Pradesh, 122 from Jharkhand, 72 from Madhya Pradesh, 23 from Maharashtra and 20 from Andhra Pradesh were significant.

Cold wave conditions mainly prevailed over central parts the country especially in the month of January. It caused deaths of about 150 people. Of these deaths, 88 deaths were reported from Uttar Pradesh alone, 45 from Bihar only on single day on 1st January & 16 from Jharkhand.

Major Extreme Weather Events occurred during 2020 and associated casualties are shown in Fig. 4.

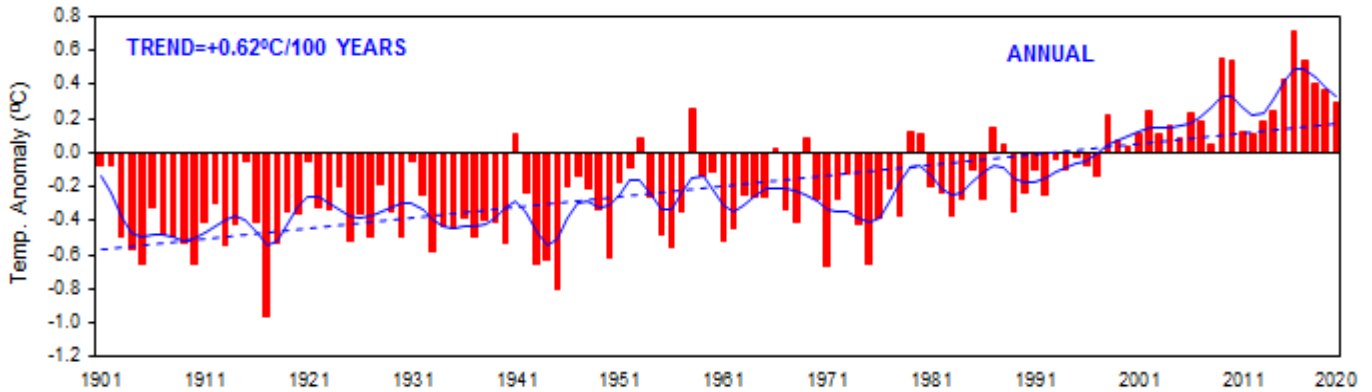


Fig.1: Annual mean land surface air temperature anomalies averaged over India for the period 1901-2020. The anomalies were computed with respect to base period of 1981-2010. The dotted line indicates the linear trend in the time series. The solid blue curve represents the sub-decadal time scale variation smoothed with a binomial filter.

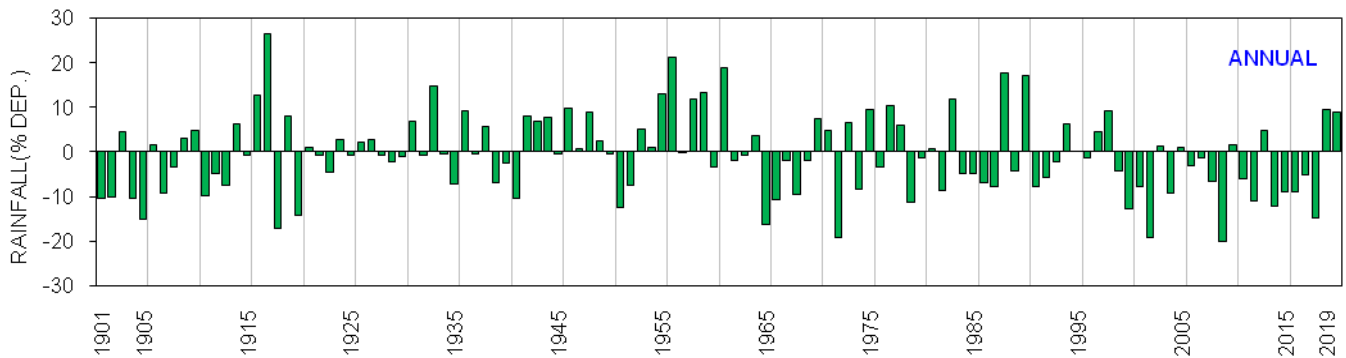


Fig. 2: Time Series of All India Annual Rainfall percentage Departure (1901-2020)

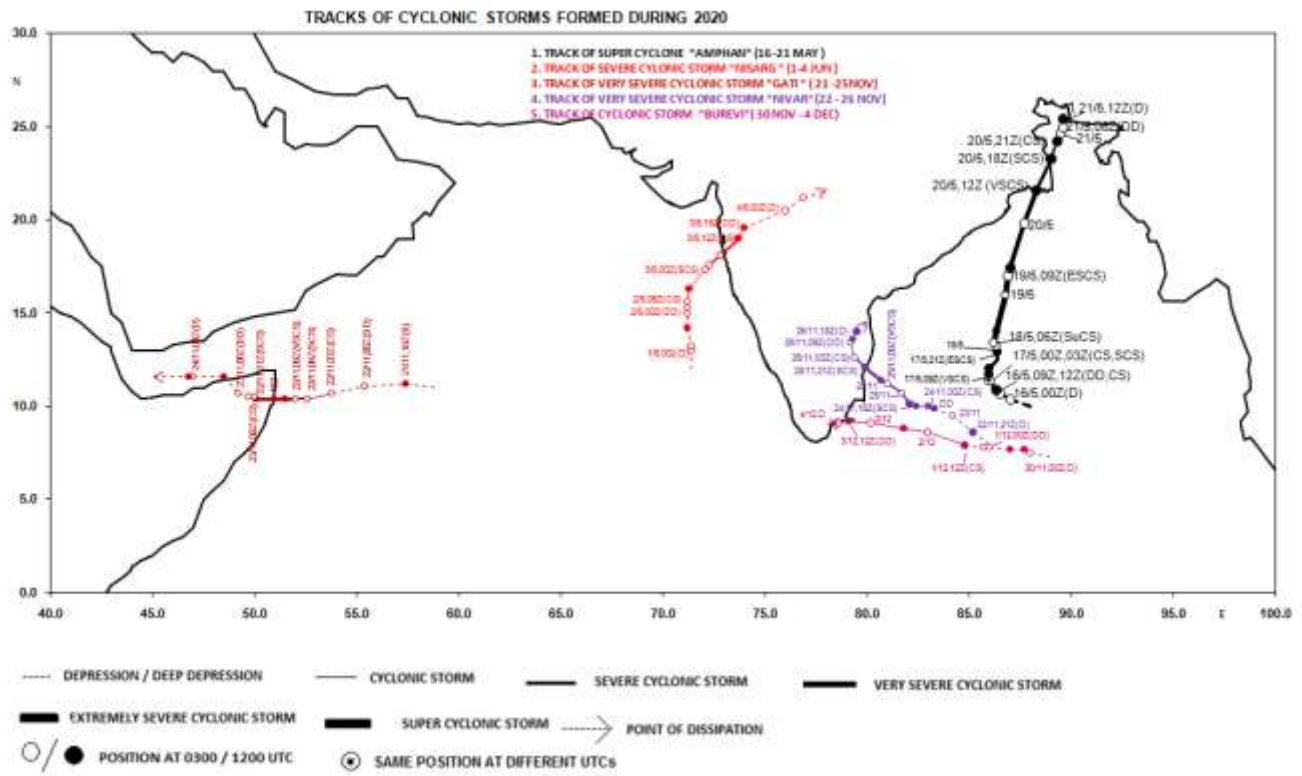


Fig. 3: Tracks of the Cyclonic storms formed during 2020

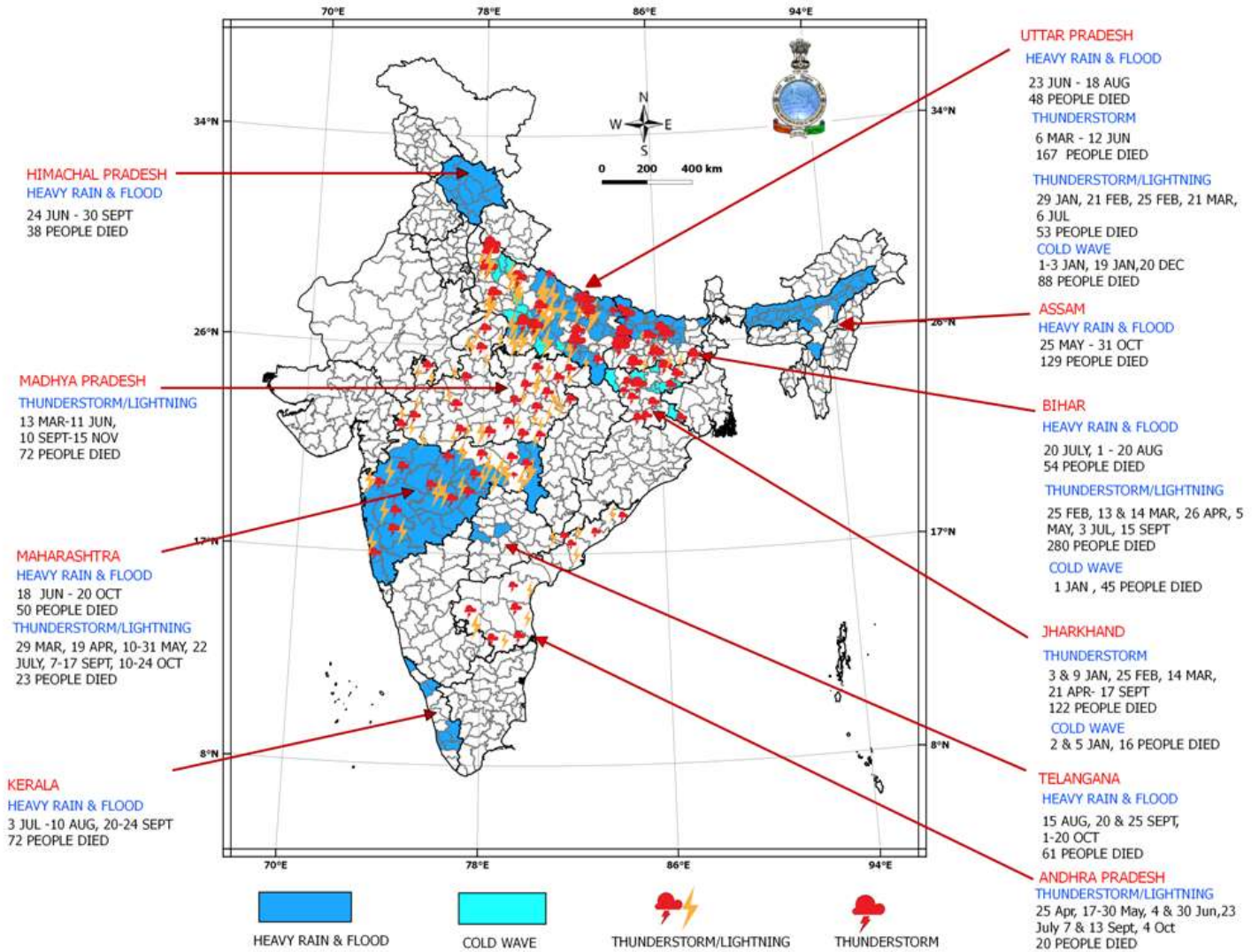


Fig. 4: Major extreme weather events occurred during 2020 and associated casualties.

(*: The casualties mentioned in the above figure are based on media reports)