

FAQ on Heat Wave

Q. What is a heat wave?

Heat Waves are a period of unusually high temperatures as compared to what is normally expected over a region. Therefore, the temperatures at which Heat waves are declared differ from place to place based on the temperature climatology (historical temperatures) of that region. The impact of heat waves gets aggravated by supportive meteorological factors such as high humidity, high wind speed, duration of heat wave events, etc.

Q. How to check Heatwave levels?

India Meteorological Department provides color-coded Heat Wave warning information through its daily bulletins as well as through a GIS-based visualization platform for the next 5 days. The same can be seen at www.mausam.imd.gov.in **Heat WaveGuidance**.

Q. Will I be affected by the Heatwave?

You may be affected if the heat wave forecast map shows a heat wave warning over your region or regions close to you. In this scenario, all precautions to mitigate the impact of heat waves should be undertaken and prompt medical service to be availed in case of any discomfort.

Q. What is criterion for declaring heat wave in India?

Heat wave is considered if maximum temperature of a station reaches at least 40⁰C or more for Plains and at least 30⁰C or more for Hilly regions.

a) Based on Departure from Normal

Heat Wave: Departure from normal is 4.5⁰C to 6.4⁰C

Severe Heat Wave: Departure from normal is >6.4⁰C

b) Based on Actual Maximum Temperature

Heat Wave: When actual maximum temperature $\geq 45^{\circ}\text{C}$

Severe Heat Wave: When actual maximum temperature $\geq 47^{\circ}\text{C}$

If above criteria met at least in 2 stations in a Meteorological sub-division for at least two consecutive days and it declared on the second day.

Q. What is a criterion for describing *Heat Wave* for coastal stations?

When maximum temperature departure is 4.5⁰C or more from normal, *Heat Wave* may be described provided actual maximum temperature is 37⁰C or more.

Q. What are the criteria used for declaring Heat Waves in different countries of the world?

Quantitatively, there are different thresholds used around the globe for declaring Heat Waves. It is usually defined based on the temperature thresholds over a region in terms of actual temperature or its departure from normal. In certain countries, it is defined in terms of the heat index based on temperature and humidity or based on the extreme percentile of the temperatures.

Q. What is a warm night?

A warm night is declared only when the maximum temperature remains 40⁰C or more. It is defined based on departures of actual minimum temperatures as follows:

Warm night: minimum temperature departure is 4.5⁰C to 6.4⁰C

Very warm night: minimum temperature departure is >6.4⁰C

Q. What is Hot and Humid Weather?

When observed maximum temperatures over any station remains 3⁰C above normal along with the above normal relative humidity, it is termed as Hot & Humid Weather over that station.

Q. What are 90,95 and 98 percentile temperatures of a month?

The maximum temperature percentile of a station refers to the ranking of the maximum temperature of any particular day with respect to all the maximum temperatures recorded for all the days of that months in record. For example, if there were 100

maximum temperature value records and these are arranged in ascending order, then the highest 90th value will be called 90th percentile, 95th value will be called 95th percentile and 98th value will be termed as 98th percentile. Statistically, the percentile values convey the information that 90th percentile temperature indicate that the 90 percent of times the maximum temperatures will be cooler than this temperature or in other words the maximum temperature above 90th /95th/98th percentile indicate the unseasonably warm day of any month.

Q. What is the impact of Relative Humidity over Heat Wave scenario on humans?

The high values of Relative Humidity aggravate the impact of Heat Waves. They compromise the body's response to heating through perspiration by reducing the evaporation rate. As high relative humidity leads to slower evaporation rate of sweat thereby reduces the efficiency of cooling mechanism of the human body.

Q. What is the impact of Winds over Heat Wave scenario on humans?

The high values of wind speed aggravate the impact of Heat Waves. During high temperature days, the surface wind gets heated up in contact with the land surface. When the hot surface wind blows and comes in contact with the human body, they tend to increase the temperature of human body thereby increasing the impact of hot temperatures.

Q. How warm nights or high minimum temperatures affect humans?

The minimum temperatures are generally seen during the night times. If the minimum temperature at night are warmer than normal then they also give a cascading effect on the next day maximum temperatures. The maximum temperatures may be attained the following day earlier and may also last for longer duration. When the high day time and night time temperatures are seen together then they tend to increase the heat stress on human as human body finds it difficult to recover from the heat of the day during night hours.

Q. What is the period of a heat wave over India?

In India, Heat Waves occur mainly from March to June and in some rare cases even in July. The peak month of the heat wave over India is May.

Q. What are the heat wave prone states over India?

Heat wave generally occurs over plains of northwest India, Central, East & north Peninsular India from March to June. It covers Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Odisha, Madhya Pradesh, Chhattisgarh, Rajasthan, Gujarat, parts of Maharashtra & Karnataka, Andhra Pradesh and Telangana. Sometimes it occurs over Tamilnadu & Kerala also. Therefore, most of the states of India are prone to heat waves in varying degrees.

Q. How India Meteorological Department (IMD) monitors the Heatwave?

IMD has a big network of surface observatories covering the entire country to measure various metrological parameters like Temperature, Relative humidity, pressure, wind speed & direction etc. Based on daily maximum temperature station data, climatology of maximum temperature is prepared for the period 1991-2020 to find out normal maximum temperature of the day for a particular station. Thereafter, IMD declared heat waves over the region as per its definition.

Q. What is the temporal range of temperature forecast issued by IMD?

IMD follows seamless forecast system since 2016. During beginning of March, maximum temperature and Heat wave forecast for season (March to June) are issued by IMD. It is followed up by the Extended Range forecast at meteorological subdivision level, which is issued every Thursday and is valid up to 4 weeks indicating possible heat wave spells. The extended range forecast is followed up by medium range forecast which is valid up to 7 days at district level and is updated 4 times a day at IMD-HQ and 2 times a day by MC/RMC's. Special bulletin is also issued during cold wave season indicating actual temperatures, cold wave and their forecasts:

- a) Short to medium range (lead time/validity of 1 to 5 days)
- b) Extended range (lead time/validity up to 4 weeks)
- c) Seasonal range (lead time/validity up to 3 months)

Q. What is the spatial range of the temperature forecast issued by IMD?

IMD issue's location, District, Meteorological Subdivision and Homogeneous regions temperature forecast to its various users and keep it on IMD Website (<https://mausam.imd.gov.in/>).

Q. How IMD predicts the Heat wave?

IMD predicts heat wave based on synoptic analysis of various meteorological parameters and from the consensus guidance from various regional & global numerical prediction models like WRF, GFS, GEFS, NCUM, UMEPS, UM Regional etc. run in Ministry of Earth Sciences (MoES) and other international models available under bilateral multi-institutional arrangement. The objective consensus is derived from the models utilising MME concepts which is further bias corrected by comparing it with initial observations. Thereafter, a subjective consensus is developed among forecasters through the exchange of knowledge, experience and expertise in video conferencing on daily basis to modulate above objective consensus forecast by taking into considerations regional and local variations and other features. By this way operational forecast is prepared by IMD.

Q. How common man may get IMD Heat wave information?

A common man may get heat wave information from, All India Weather Forecast Bulletin (https://mausam.imd.gov.in/imd_latest/contents/all_india_forecast_bulletin.php) and special heat wave guidance bulletins (http://internal.imd.gov.in/pages/heatwave_mausam.php) during 1 March to 30 June every day. The heat wave information is shared with concerned State Government Authorities, Media and other stakeholders like Indian Railway, Health departments, Power Sector etc. The general public is informed through Print & Electronics Media, through social media handles of India Meteorological Department in multi-media formats.

Q. How frequently Heat wave bulletins are issued?

5 days Heat wave warnings are updated four times in day (based on 0530-, 0830-, 1430- & 1730-hours IST) in All India Weather Forecast Bulletin (https://mausam.imd.gov.in/imd_latest/contents/all_india_forecast_bulletin.php) by National Weather Forecasting Centre (NWFC), IMD, New Delhi. In the morning and evening special heat wave bulletins are issued. The special morning heat wave bulletin (issued at 0800 hours IST) provide guidance with respect to heat wave scenarios for next 24 hours and evening bulletin (issued at 1600 hours IST) provides heat wave warning for next 5 days..The district wise heat wave warnings are issued by State level Meteorological Centre/Regional Meteorological Centre's of IMD.

Q. How does IMD co-ordinate with central & state disaster managers for Heat wave?

IMD issues special heat wave warning guidance bulletins (1600-hours IST) at meteorological sub-division & district levels to different users like, Ministry of Home Affairs, National Disaster Management Authority, State Disaster Management Authority, Deputy Commissioner/District Magistrates of different districts of states, health department, Indian Railway, Road transport, Media etc.IMD conducts the pre-season exercise at state & national level. IMD also contributes in the preparation of heat wave guidelines and heat action plan. IMD provides the required past data for heat wave advisories and development.

Q. What are Heat Action Plans (HAP)?

The Heat Action Plans help in building up the resilience of Indians, particularly those vulnerable to severe heat waves. Heat Action Plans provide the framework for planning and implementing early warning systems, preparedness strategies that address public awareness and community outreach, mechanisms for inter-agency coordination, roles and responsibilities during heatwave response, capacity building among health care professionals, mitigating heat exposure and promoting adaptive measures among the vulnerable population in the concerned region. NDMA issued Guidelines for Preparation

of Action Plan in 2016. Under HAP, IMD plays a very important role by providing the early warning and forecasting services.

(Source:<https://ndma.gov.in/sites/default/files/IEC/Booklets/HeatWave%20A5%20BOOK%20Final.pdf>)

Q. What are favorable conditions for Heat wave?

- a. **Transportation / Prevalence of hot dry air over a region** (There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region).
- b. **Absence of moisture in the upper atmosphere** (As the presence of moisture restricts the temperature rise).
- c. **The sky should be practically cloudless** (To allow maximum insulation over the region).
- d. **Large amplitude anti-cyclonic flow over the area.**

Heat waves generally develop over Northwest India and spread gradually eastwards & southwards but not westwards (since the prevailing winds during the season are westerly to northwesterly). But on some occasions, heat wave may also develop over any region in situ under the favorable conditions.

Q. How heat discomfort is determined?

It is determined by a combination of meteorological (temperature, Relative Humidity, wind, direct sunshine), social/cultural (clothing, occupation, accommodation) and physiological (health, fitness, age, level of acclimatization) factors.

Q. What is heat index?

The heat index is the combination of air temperature and relative humidity, it measures of how hot it really feels when relative humidity is factored in with the actual air temperature. This is also sometimes referred as Apparent temperature and can be understood as the temperature what the body perceive. The human body uses sweat mechanism to cool its temperature. The sweat from the body gets evaporated leading to cooling of the body surface temperature. Now, if the relative humidity, is high then the

rate of evaporation from the body decreases and thereby it compromises the body's ability to cool its temperature efficiently using perspiration mechanism.

Q. What is impact based heat wave warning issue by India Meteorological Department (IMD)?

India Meteorological Department issues following colour code impact-based heat warning jointly with National Disaster Management Authority.

Colour Code	Alert	Warning	Impact	Suggested Actions
Green (No action)	Normal Day	Maximum temperatures are near normal	Comfortable temperature. No cautionary action required.	Nil
Yellow Alert (Be updated)	Heat Alert	Heat wave conditions at isolated pockets persists on 2 days	Moderate temperature. Heat is tolerable for general public but moderate health concern for vulnerable people e.g. infants, elderly, people with chronic diseases	(a) Avoid heat exposure. (b) Wear lightweight, light-coloured, loose, cotton clothes. (c) Cover your head: Use a cloth, hat or umbrella
Orange Alert (Be prepared)	Severe Heat Alert for the day	(i) Severe heat wave conditions persists for 2 days (ii) Through not severe, but heat wave persists for 4 days or more	High temperature. Increased likelihood of heat illness symptoms in people who are either exposed to sun for a prolonged period or doing heavy work. High health concern for vulnerable people e.g. infants, elderly, people with chronic diseases.	(b) Avoid heat exposure– keep cool. Avoid dehydration. (b) Drink sufficient water- even if not thirsty. (c) Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. to keep yourself hydrated
Red Alert (Take Action)	Extreme Heat Alert for the day	(i) Severe heat wave persists for more than 2 days. (ii) Total number of heat/severe heat wave days exceeding 6 days.	Very high likelihood of developing heat illness and heat stroke in all ages.	Extreme care needed for vulnerable people.

Q. Health Impacts of Heat Waves?

The health impacts of Heat Waves typically involve dehydration, heat cramps, heat exhaustion and/or heat stroke. The signs and symptoms are as follows:

- Heat Cramps: Edema (swelling) and Syncope (Fainting) generally accompanied by fever below 39°C i.e. 102°F.
- Heat Exhaustion: Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating.
- Heat Stroke: Body temperatures of 40°C i.e. 104°F or more along with delirium, seizures or coma. This is a potentially fatal condition.

(Source: <https://ndma.gov.in/Natural-Hazards/Heat-Wave>)

Q. What are Impacts of Heat Waves on Agriculture?

Physical impacts

Water resources: - Because of the close relationship between climate and water, heat wave intensifies the water crises in several regions, especially in arid and semi-arid areas.

Wild/Forest fires: - Forest Survey of India has estimated that 21.4 per cent (1,524,21 sq.km) area under forest is vulnerable to forest fires.

Energy consumption: -

The energy sector is one of the key vulnerable industries in the wake of the projected rise in surface air temperature. Power outages are triggered by the disproportionately high electricity demand due to air-conditioning during heat waves.

Physiological impacts

Crops

High temperatures beyond certain optimum level reduce plant growth by affecting the shoot net assimilation rates, and thus the total dry weight of the plant is collectively termed as heat stress, which is one of the most important factors limiting crop.

Livestock

Under heat stress, a number of physiological and behavioral responses of livestock vary in intensity and duration in relation to the animal genetic makeup and environmental factors.

Poultry

Heat stress interferes with the broilers comfort and suppresses productive efficiency, growth rate, feed conversion and live weight gain due to changes in behavioural, physiological and immunological responses.

Fisheries

Heat Waves can affect fisheries and aquaculture via acidification, changes in sea surface temperatures and circulation patterns, frequency and severity of extreme events and sea level rise and associated ecological changes.

(Source : <http://www.icar-crida.res.in/Pubs/Heat%20wave%202022%20-%20Causes%20Impacts%20and%20way%20forward%20for%20Indian%20Agriculture.pdf>)

Q. What are Impacts of Heat Waves on Transport sector?

Heat waves can impact air operations by requiring longer take-off distances because of lower air density. This creates a similar effect to being at a higher altitude. An airplane taking off at a sea level airport at an ambient temperature of 37 degrees Celsius would operate in conditions similar to if it was at an altitude of 800 meters. Heat stress can negatively impact transport infrastructure, such as the softening of pavement, which can then be substantially damaged by vehicle circulation.

Q. What are the measures one should take to minimize the impact during the heat wave?

- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Drink sufficient water and as often as possible, even if not thirsty
- Wear lightweight, light-colored, loose, and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in sun.
- Avoid strenuous activities when the outside temperature is high. Avoid working outside between 12 noon and 3 p.m.
- While travelling, carry water with you.
- Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.

- Avoid high-protein food and do not eat stale food.
- If you work outside, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs
- Do not leave children or pets in parked vehicles
- If you feel faint or ill, see a doctor immediately.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which helps to re-hydrate the body.
- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.

(Source:<https://www.ndma.gov.in/Natural-Hazards/Heat-Wave/Dos-Donts#:~:text=Avoid%20alcohol%2C%20tea%2C%20coffee%20and,head%2C%20neck%2C%20face%20and%20limbs>)

Q. What you should do, if you think someone is suffering from the heat?

- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Drink sufficient water and as often as possible, even if not thirsty
- Wear lightweight, light-coloured, loose, and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in sun.
- Avoid strenuous activities when the outside temperature is high. Avoid working outside between 12 noon and 3 p.m.
- While travelling, carry water with you.
- Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.
- Avoid high-protein food and do not eat stale food.
- If you work outside, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs
- Do not leave children or pets in parked vehicles
- If you feel faint or ill, see a doctor immediately.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which helps to re-hydrate the body.

- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.

(Source:<https://www.ndma.gov.in/Natural-Hazards/Heat-Wave/Dos-Donts#:~:text=Avoid%20alcohol%2C%20tea%2C%20coffee%20and,head%2C%20neck%2C%20face%20and%20limbs>)

Q. What are symptoms of Sunburn and its first aid?

Symptoms: Skin redness and pain, possible swelling, blisters, fever and headaches.

First Aid: Take a shower, using soap, to remove oils that may block pores preventing the body from cooling naturally. If blisters occur, apply dry, sterile dressings and get medical attention.

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

Q. What are symptoms of Heat Cramps and its first aid?

Symptoms: Painful spasms usually in leg and abdominal muscles or extremities. Heavy sweating.

First Aid: Move to cool or shaded place. Apply firm pressure on cramping muscles or gentle massage to relieve spasm. Give sips of water. If nausea occurs, discontinue.

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

Q. What are symptoms of Heat Exhaustion and its first aid?

Symptoms: Heavy sweating, weakness, skin cold, pale, headache and clammy. Weak pulse. Normal temperature possible. Fainting, vomiting.

First Aid: Get victim to lie down in a cool place. Loosen clothing. Apply cool, wet cloth. Fan or move victim to air-conditioned place. Give sips of water slowly and If nausea occurs, discontinue. If vomiting occurs, seek immediate medical attention. Or call 108 and 102 for Ambulance.

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

Q. What are symptoms of Heat Stroke(Sun Stroke)and its first aid?

Symptoms:High body temperature(106°F). Hot, dry skin.Rapid, strong pulse.Possible unconsciousness.Victim will likely not sweat.

First Aid:Heat stroke is a severe medical emergency. Call 108 and 102 for Ambulance for emergency medical services or take the victim to a hospital immediately. Delay can be fatal. Move victim to a cooler environment. Try a cool bath or sponging to reduce body temperature. Use extreme caution.Remove clothing. Use fans and/or air conditioners.

DO NOT GIVE FLUIDS ORALLY if the person is not conscious.

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

Q. What are the measures one should do to minimize the impact during heat wave?

- Listen to Radio, watch TV, read Newspaper for local weather forecast to know if a heatwave is on the way
- Drink sufficient water and as often as possible, even if not thirsty
- Wear lightweight, light-coloured, loose, and porous cotton clothes. Use protective goggles, umbrella/hat, shoes or chappals while going out in sun.
- While travelling, carry water with you.
- If you work outside, use a hat or an umbrella and also use a damp cloth on your head, neck, face and limbs.
- Use ORS, homemade drinks like lassi, torani (rice water), lemon water, buttermilk, etc. which help to re-hydrate the body.
- Recognize the signs of heat stroke, heat rash or heat cramps such as weakness, dizziness, headache, nausea, sweating and seizures. If you feel faint or ill, see a doctor immediately.
- Keep animals in shade and give them plenty of water to drink.
- Keep your home cool, use curtains, shutters or sunshade and open windows at night.
- Use fans, damp clothing and take bath in cold water frequently.
- Provide cool drinking water near work place.
- Caution workers to avoid direct sunlight.

- Schedule strenuous jobs to cooler times of the day.
- Increasing the frequency and length of rest breaks for outdoor activities.
- Pregnant workers and workers with a medical condition should be given additional attention.

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

Q. What one should not do to minimize the impact during heat wave?

- Listen Do not leave children or pets in parked vehicles.
- Avoid going out in the sun, especially between 12.00 noon and 3.00 p.m.
- Avoid wearing dark, heavy or tight clothing.
- Avoid strenuous activities when the outside temperature is high. Avoid working outsidebetween 12 noon and 3 p.m.
- Avoid cooking during peak hours. Open doors and windows to ventilate cooking areaadequately.
- Avoid alcohol, tea, coffee and carbonated soft drinks, which dehydrates the body.
- Avoid high-protein food and do not eat stale food..

(Source:<https://ndma.gov.in/sites/default/files/PDF/Guidelines/heatwaveguidelines.pdf>)

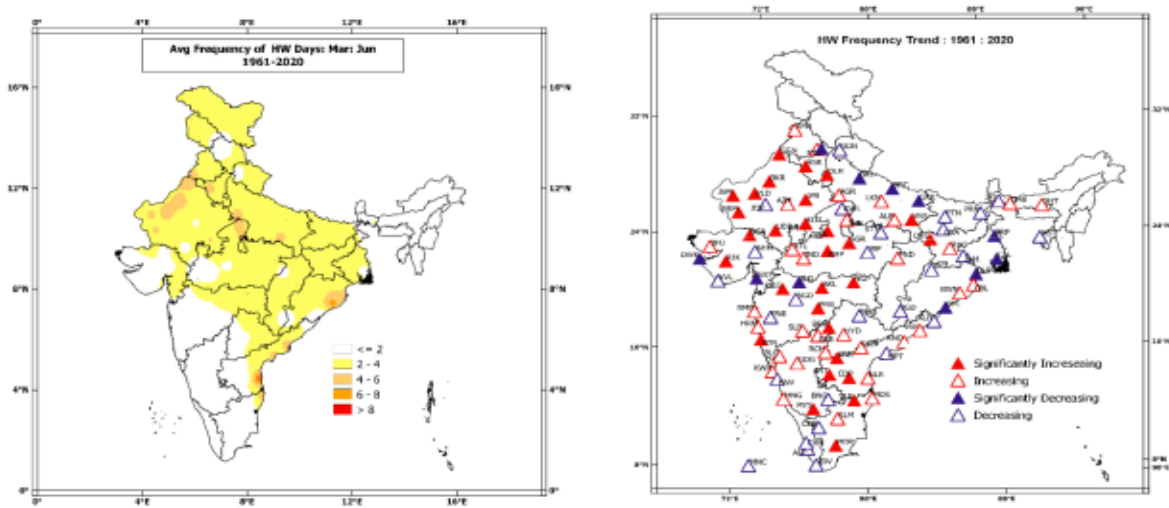
Q. Does IMD conducts any pre-season exercise for Heat waves?

The pre-season preparedness exercise is conducted by National Disaster Management Authority in which an important presentation is given by India Meteorological Department regarding the preparedness and initiatives with respect to forecasting services of heat waves.

Q. What is the trend of Heat Waves over India?

Most of IMD stations are showing increasing trends of heat wave events during the 60-year period (1961-2020). (source

file:///C:/Users/hp/Desktop/Met_Monograph_Cold_Heat_Waves.pdf)



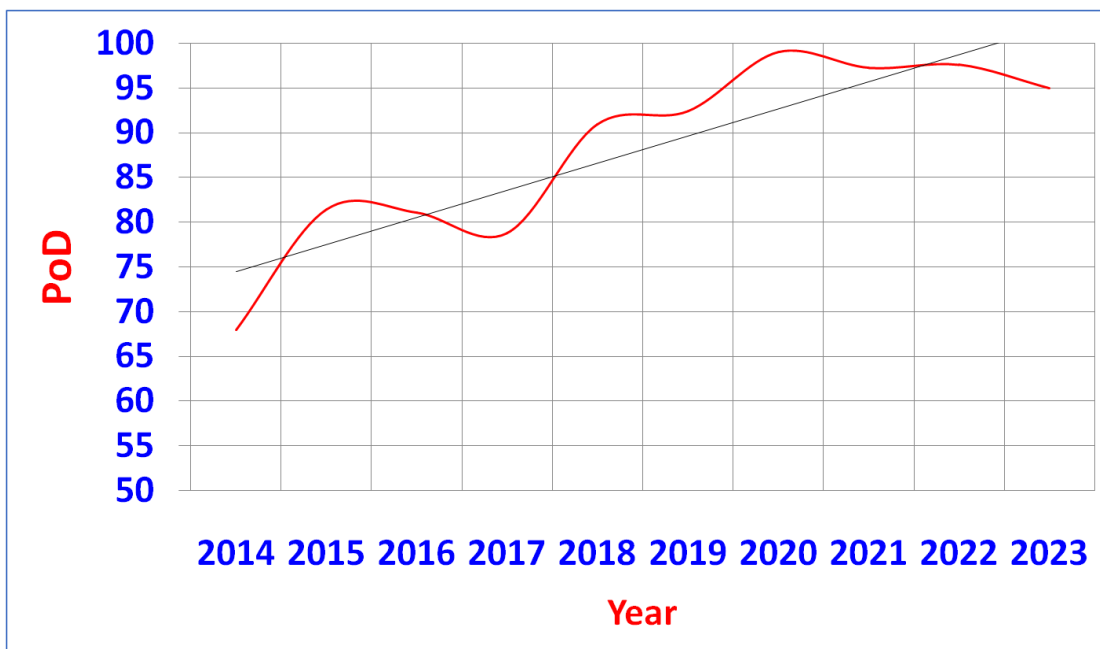
(a)

(b)

(a) Heat wave average frequency during March-June for the period 1961-2020, b) HW frequency trends, station wise during the same period.

Q. What is the accuracy of heat wave warning?

Heat wave skill (Probability of Detection (PoD) during 2014 to 2023 (April to June Months) is as follow:



There is significant improvement in POD during recent years and it was more than 95% during recent years (2020-2023).

Q. Who can be contacted for heat wave information & warning in IMD?

Round the clock duty officer is available in National Weather Forecasting Centre, IMD, New Delhi. The contact address is given below:

National Weather Forecasting Centre,
India Metrological Department,
Lodi Road, New Delhi
Phone: 011- 2434 4599

For more details visit the following website:

https://internal.imd.gov.in/pages/heatwave_mausam.php

Or

Scan the following QR code:

