

**Anjusha Sanjay Gawai**

Dept. of Climate Change and Agril.  
Meteorology  
Punjab Agricultural University  
Ludhiana  
India - 141 004

**Mangshatabam Annie**

Dept. of Climate Change and Agril.  
Meteorology  
Punjab Agricultural University  
Ludhiana  
India - 141 004

**Raj Kumar Pal**

Dept. of Climate Change and Agril.  
Meteorology  
Punjab Agricultural University  
Ludhiana  
India - 141 004

**Corresponding Author**

Anjusha Sanjay Gawai  
[anjushagawai11599@gmail.com](mailto:anjushagawai11599@gmail.com)

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## ***Cold Wave and Fog - Criteria, Causes, Impact and Warning***

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**Northwest India has been hit by a deadly cold wave. Red and yellow alerts have been issued by the India Meteorological Department (IMD) in a number of locations, including Uttar Pradesh, Punjab, Haryana, Chandigarh, Rajasthan, and Uttarakhand. Severity and average number of cold waves are increasing day by day due to climate change. Disastrous Weather Event of 2018 issued by India Meteorological Department IMD reported loss of about 280 human lives due to cold wave out of that 135 were from Uttar Pradesh and 121 from Bihar. Additionally, it also caused death or injured to the livestock. During the Rabi cropping season, cold waves cause sudden freeze and frost, which has an impact on crops, horticulture plantations/orchards, and other agricultural support services. Hence Central as well as State Government needs to take necessary action regarding early warnings, alert and in making policies in favor of farmers in case of crop failure due to cold wave.**

### **INTRODUCTION**

Cold wave instances are related to the decrease minimum temperatures particularly in winter time within 24 hours. It is observed that cold wave causes more deaths than hot wave. In 2012, the government designated the cold wave as a natural disaster due to its severity. Cold wave typically last 3 to 7 days, however they can occasionally persist up to 2 weeks. According to scientist from IMD, one of the main causes of the low minimum temperatures than normal over north India is the widespread fog cover. Fog persisting for longer durations and preventing sunlight from reaching the surface and altering the radiation balance, along with westerly and north-westerly winds of about 5 to 10 km/hr. Major reason for colder night is due to there is no heating during the day time. Fog is a term used to describe an obscurity in the upper earth's atmosphere caused by a suspension of water droplets (when humidity more than 75%), with or

without smoke particles containing different kinds of pollutants, and associated with less than 1000 metres visibility. Other than contributing in cold wave, dense fog is also seriously impairing the operation of the aviation, railway, highway, and other transport sectors due to the absence of sufficient visibility.

**Criteria for a cold wave and cold day proclamation**

Cold wave	When minimum temperature of plain regions is $\leq 10.0^{\circ}\text{C}$ and $\leq 0^{\circ}\text{C}$ of hilly regions
	On the basis of withdrawal Cold wave: Negative withdrawal from normal by $4.5^{\circ}\text{C}$ to $6.4^{\circ}\text{C}$ Severe cold wave: Negative withdrawal from normal by $> 6.4^{\circ}\text{C}$
Cold day	On the basis of minimum temperature A. For plain regions only Cold wave: The minimum temperature is $\leq 04^{\circ}\text{C}$ Severe cold wave: The minimum temperature is $\leq 02^{\circ}\text{C}$ B. For coastal regions only "Cold Wave" may be used to describe conditions where the minimum temperature deviation is equal to or less than $-4.5^{\circ}\text{C}$ over a station and the minimum temperature is $15^{\circ}\text{C}$ or less.
	When minimum temperature of plain regions is $\leq 10.0^{\circ}\text{C}$ and $\leq 0^{\circ}\text{C}$ of hilly regions Based on withdrawal Cold day: $-4.5^{\circ}\text{C}$ to $-6.4^{\circ}\text{C}$ is the maximum temperature departure. Severe cold wave: $< -6.4^{\circ}\text{C}$ is the maximum temperature departure.

**Different types of fog are classified based on how much visibility is lost in general**

Fog type	General visibility range (meters)
Shallow	Drop up to 500
Moderate	Drop up to 200
Dense	Drop up to 50
Very dense	Less than 50

**Causes of cold wave over the Indo-Gangetic Plains (IGPs)**

- Over the IGP, northwesterly winds from Central Asia's and the Hindukush region dominate, bringing cooler temperatures.
- Clouds are form on the Indo-Gangetic Plains, maximum temperatures decrease, thereby minimum temperatures increase due to the Western Disturbance (WD).
- Another factor that causes cold waves is the development of an anticyclone in the lower and middle troposphere. Such an anticyclone causes sinking motion above the IGP, which lowers the minimum temperature.
- At the same time, cloud cover reduces the amount of solar radiation that reaches the earth, resulting in a drop in maximum temperatures.

**Causes of Fogover the Indo-Gangetic Plains (IGPs)**

- Night-time radiative cooling in low-wind circumstances.
- Moreover, major factors in the fog life cycle include the nature as well as concentration of aerosols in the surface layer. Additionally, recognised that when turbulent mixing is strong then plays a crucial role lead to fog formation and development.

**Impacts of cold wave and fog**

- Fog majorly affect transportation by rail, road, and river/coal ferry services as well as aviation

- Fog not only cause pollution, decrease in oxygen and increase in humidity but also cause road accidents happen when fog safety regulations are not followed during dense fog
- Cold waves cause angina pectoris, heart disease, asthma, myocardial infarction, and other health issues.
- Pipes frequently freeze during the extremely cold winter months. Even some inadequately secured interior plumbing bursts when the water inside them expands.
- Cold waves also bring freezes and frosts which cause damage to the early and most vulnerable stages of plant growth during the growing season, leading to crop loss as plants are killed before they can be harvested profitably.

**Cold wave colour-coded alert and warning given by IMD**

Colour code	Alert	Warnings
Green (No action)	Normal day	Minimum temperatures are near normal
Yellow alert (Be updated)	Cold Wave Alert	Isolated areas suffer a cold wave for at two days or more.
Orange alert (Be prepared)	Severe Cold Wave Alert	Severe CW conditions remain for two days and though maybe not severe, last for at least four days
Red alert (Take action)	Extreme Cold Wave Alert	Severe CW conditions remain for two days and total CW day cross six days

**Fog colour-coded alert and warning given by IMD**

Colour code	Alert	Warnings
Green (No action)	No fog/Shallow fog	No warning
Yellow alert (Be updated)	Between moderate to Dense fog	Forecasted to last at least one day or longer, with moderate fog in scattered locations and dense fog conditions at isolated pockets
Orange alert (Be prepared)	Between dense fog to very dense fog	Already Dense to very dense fog has begun or expected rainfall regions and will likely last at least one day or more
Red alert (Take action)	Dense to Very dense fog at most or many locations in the MET Sub-Divisions	Wide spread/ FWS dense fog with SCTD and FWS Very dense fog reported in the met-Sub-div or forecasted to prevail in Day

**Surviving cold wave and fog (Be smart, be prepared)**

- Have winter clothing adequately and stay indoor as much as possible.
- For weather updates, listen to the radio, watch TV, or read the newspaper
- Drink warm drinks frequently and store enough water because pipes may freeze.
- Take care of the young one and the old one.
- Be cautions when driving during foggy day and use fog lights.
- In case of travelling, be in touch with airlines, railways and state transport Dept.
- Acquire emergency supplies

(Source: [https://ndma.gov.in/Resources/awareness/Cold\\_Wave](https://ndma.gov.in/Resources/awareness/Cold_Wave))

**Dissemination of cold wave warnings by IMD**

1) All India Weather Forecast- For the next five days, there will be cold wave bulletins that are updated four times per day and are color-coded and impact-based (According to IST on 0530, 0830, 1430 & 1730 hours)

([https://mausam.imd.gov.in/imd\\_latest/contents/all\\_india\\_forecast\\_bulletin.php](https://mausam.imd.gov.in/imd_latest/contents/all_india_forecast_bulletin.php))

2) In addition to the aforementioned methods, warnings are also distributed via all digital channels, such as SMS, WhatsApp, Facebook, Twitter, e-mail, Instagram, and uploaded to YouTube each week in the audio-video weather model form

3) For easy access there are some mobile application app are also available like-

- "Mausam App" : Location wise forecast
- "Meghdoot App" : To give Agromet advisory
- "Damini App" : For giving lightning warning

### **Conclusion**

Cold wave/severe cold waves particularly in northern part of the country largely affect to human being, livestock, agriculture and other sectors. But with proper planning and by adopting preventive measures the impact of cold wave can be reduced considerably. Early warning and alerts issued from IMD help people in survival. Keeping on track on warnings became very easy with mobile application app like Mausam, Meghdoot and Damini.