



Heatwaves and Wet Bulb Temperature

For Prelims: Wet bulb temperature, Dry bulb temperature, Intergovernmental Panel on Climate Change, IPCC Report AR6, Heatwaves.

For Mains: Environmental Pollution & Degradation, Conservation, Wet bulb temperature, Impact of rising wet bulb temperature, Heatwaves.

Why in News?

The recently published [Intergovernmental Panel on Climate Change \(IPCC\) Report AR6](#) (Sixth Assessment Report) has emphasised that **humidity is very important factor** while estimating the physiological stress that extreme heat puts on the human body.

- Instead of the [“dry bulb” temperature](#) which is usually measured using a regular thermometer, an alternative metric known as the [“wet bulb temperature”](#) has been used to measure exposure to extreme heat.
- Since March 2022, the consecutive [heatwaves](#) over South Asia **have continued the disturbing tradition of breaking historical temperature records.**

What are Heatwaves?

- A heatwave is a period of **abnormally high temperatures**, more than the normal maximum temperature that occurs during the summer season in the North-Western and South Central parts of India.
- Heatwaves typically occur between March and June, and in some rare cases even **extend till July.**
- [India Meteorological Department](#) (IMD) classifies heatwaves according to regions and their temperature ranges.

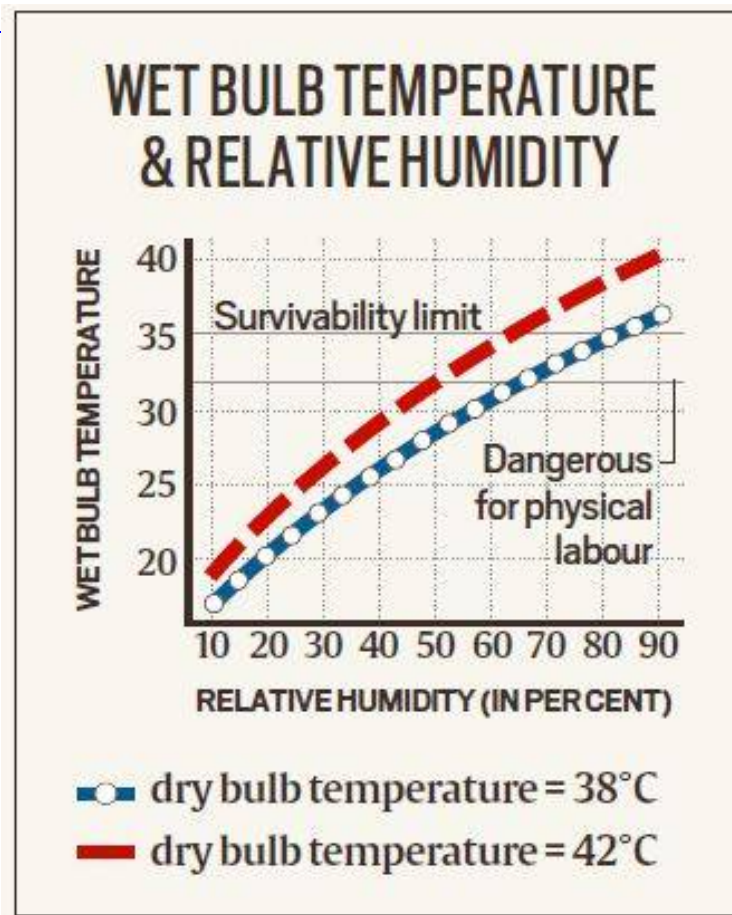
What is the Criteria for Heatwaves?

- The heatwave is considered when the maximum temperature of a station reaches **at least 40°C for Plains and at least 30°C for Hilly regions.**
- If the normal maximum temperature of a station is less than or equal to 40°C, then an increase of 5°C to 6°C from the **normal temperature is considered to be heat wave condition.**
 - Further, an increase of 7°C or more from the normal temperature is considered a **severe heat wave condition.**
- If the normal maximum temperature of a station is more than 40°C, then an increase of **4°C to 5°C from the normal temperature** is considered to be heat wave condition. Further, an increase of 6°C or more is considered a severe heat wave condition.
- Additionally, if the **actual maximum temperature remains 45°C or more** irrespective of normal maximum temperature, a heat wave is declared.

Why is Humidity such a Critical factor while Measuring Heat Exposure?

- Humans lose heat generated within their bodies **by producing sweat that evaporates on the skin.**
 - The cooling effect of this evaporation is essential in maintaining a **stable body temperature.**
- As humidity rises, sweat does not evaporate and makes it difficult to regulate body temperature. This is why humans **feel more discomfort in humid places.**
- The wet bulb temperature is usually **lower than the dry bulb temperature**, and the difference **between the two increases** dramatically as the air becomes dry.
 - The report mentions that sustained exposures to wet bulb temperatures **above 35°C are fatal**, while sustained exposures to wet bulb temperatures **above 32°C are dangerous for intense physical activity.**

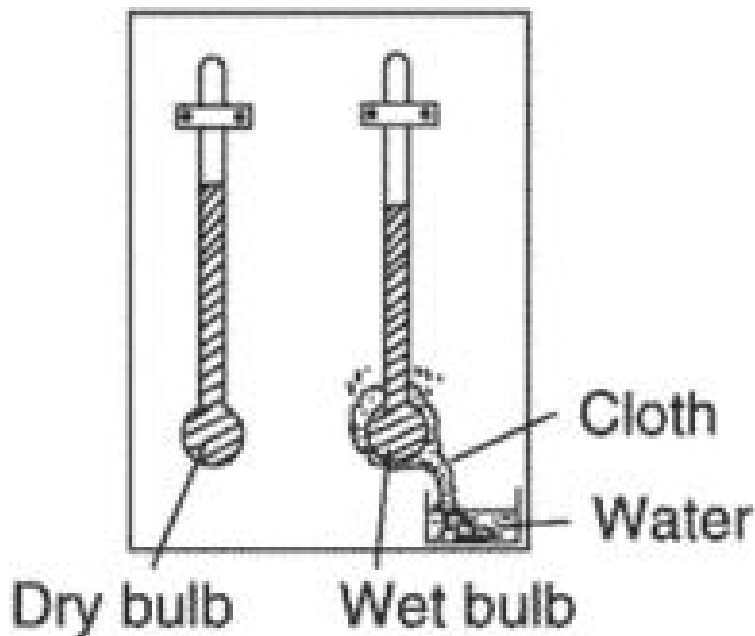
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- The humidity required to reach wet bulb temperatures in excess of 35°C over land is exceedingly **difficult to achieve.**
 - According to the report, such conditions are **rarely observed** nowadays.
- The findings also suggest that it is unlikely to experience sustained exposure to wet bulb temperatures **beyond the threshold of survivability.**
- The hype around survivability thresholds and wet bulb temperatures hides deeper issues, **both physiological and political.**
 - Firstly, the **inability of the body to stabilise its core temperature** can have multiple reasons.
 - Increased strain on the heart during periods of elevated temperature could be fatal for those with **pre-existing cardiac conditions** which is the **leading cause of deaths** during heatwaves.
 - **Pre-existing respiratory problems and diabetes** too are potential causes of death.
 - Such conditions **impair the body's ability to efficiently transfer heat to the environment.**

What is the Wet Bulb Temperature?

- Wet bulb temperature is the **lowest temperature to which air can be cooled** by the evaporation of water into the air at a constant pressure.
- WBT is a limit that **considers heat and humidity beyond which humans can not tolerate** high temperatures.
- The Wet Bulb temperature is the **temperature of adiabatic saturation**. This is the temperature indicated by a moistened thermometer bulb exposed to the air flow.
 - An adiabatic process is one in which **no heat is gained or lost by the system**.
- Wet Bulb temperature can be **measured by using a thermometer with the bulb wrapped in wet muslin**.



- The adiabatic evaporation of water from the thermometer and the cooling effect is indicated by a **"wet bulb temperature" lower than the "dry bulb temperature"** in the air.
- The rate of evaporation from the wet bandage on the bulb, and the temperature difference between the dry bulb and wet bulb, **depending on the humidity of the air**.
- The evaporation is reduced when the air contains more **water vapour**.
- The wet bulb temperature is always lower than the dry bulb temperature but will be **identical with 100% relative humidity** (the air is at the saturation line).

What is Dry Bulb Temperature?

- The Dry Bulb temperature usually referred to as **"air temperature"**, is the air property that is most commonly used. When people refer to the temperature of the air they are normally referring to the dry bulb temperature.
- The Dry Bulb Temperature refers basically to the **ambient air temperature**. It is called "Dry Bulb" because the air temperature is **indicated by a thermometer not affected by the moisture of the air**.
- Dry-bulb temperature **can be measured using a normal thermometer** freely exposed to the air but shielded from radiation and moisture.
- The dry-bulb temperature is an **indicator of heat content**.

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