



Heatwave Monitoring Using Excess Heat Factor Index (Background Information)

Heatwaves are a significant cause of environmental and health hazards. This bulletin has two major components:

- (a) Heatwave Index Monitoring over the Indian region
- (b) Prediction of Heatwave index for the next two days (48hrs) using an LSTM-based framework.

Heatwave Indices: We choose the **Excess Heat Factor (EHF)** index based on previous studies (Nairn & Fawcett (2015); Rohini et al. (2016) along with the maximum temperature (Tmax). These indices are defined in the panel below:

Panel-1: The panel defines the heatwave

(i) Excess heat signature index:

$$EHI_{sig}(i) = \frac{T_i + T_{i-1} + T_{i-2}}{3} - T_{95}$$

T_{95} is the 95th percentiles of mean Temperature for the day “ i .”

(ii) Heat Stress index:

$$EHI_{accl,i} = \left[\frac{T_i + T_{i-1} + T_{i-2}}{3} \right] - \left[\frac{T_{i-3} + \dots + T_{i-32}}{30} \right]$$

where the nomenclature is the same as earlier.

(iii) Excess heat Factor index:

$$EHF_i = \max(1, EHI_{accl,i}) \times EHI_{sig,i}$$

A positive value of the EHF (>0) indicates the extreme heatwave-like condition.

indices used in this study. It is based on Temperature (T) for the day “ i ”

Data: This bulletin is prepared based on IMD Daily gridded maximum and minimum temperature data.

References

Nairn JR, Fawcett RJB. The Excess Heat Factor: A Metric for Heatwave Intensity and Its Use in Classifying Heatwave Severity. *International Journal of Environmental Research and Public Health*. 2015; 12(1):227-253. <https://doi.org/10.3390/ijerph120100227>

Narkhede, N., Chattopadhyay, R., Lekshmi, S., Guhathakurta, P., Kumar, N., and Mohapatra, M.: An empirical model-based framework for operational monitoring and prediction of heatwaves based on temperature data, *Model. Earth Syst. Environ.*, <https://doi.org/10.1007/s40808-022-01450-2>, 2022.

Rohini, P., Rajeevan, M., and Srivastava, A. K.: On the Variability and Increasing Trends of Heat Waves over India, *Sci. Rep.*, 6, 26153, <https://doi.org/10.1038/srep26153>, 2016.

(a) Heatwave Monitoring over Indian Region

Excess Heat Factor (EHF) index provides an estimate of excess temperature based on last 30 days excess and last three days extreme.

Interpretation of EHF: Regions with EHF > 0.0 are to be monitored for heatwave type of situations (See **Figure 1**).

(b) EHF Tendency over Indian Region

The tendency of EHF for any day ‘ i ’ over each grid point is calculated as:

$$EHF\ Tendency(i) = \frac{EHF(i) - EHF(i - 2)}{2}$$

Interpretation of EHF Tendency: The regions with an increasing tendency of EHF and the Tmax ≥ 40.0 °C (if exist) should be monitored for heatwave type of conditions (See **Figure 2**).

(c) Diurnal variation in temperature over the Indian region.

Figure.3 shows the diurnal variation in temperature for the day in °C with countour line of 15°C(+5).

(d) 12 days Cumulative EHF for the day.

EHF computed for the last 12 days, summed as cumulative EHF for 12 days to show how people in the orange to red zone of the map are experiencing Heat stress in the last 12 days. (See **Figure 4**).