

Heat wave in India in late May

2 June 2015

Tokyo Climate Center, Japan Meteorological Agency

- A heat wave¹ is reported to have caused more than 2,200 fatalities in central and other parts of India in late May 2015.
- A strong descending air current over the country is thought to have contributed to the extremely high temperatures observed.
- These extreme conditions are expected to gradually ease this weekend.

1. Climate characteristics and influence

Figure 1 shows that daily maximum temperatures averaged for the period from 21 to 31 May 2015 exceeded 42°C across much of India and reached 45°C or more in northern and central parts. In Hyderabad (Telangana State) and the capital, New Delhi, average daily maximum temperatures for this period were around 4°C higher than the respective 39.0 and 39.8°C normals² for May.

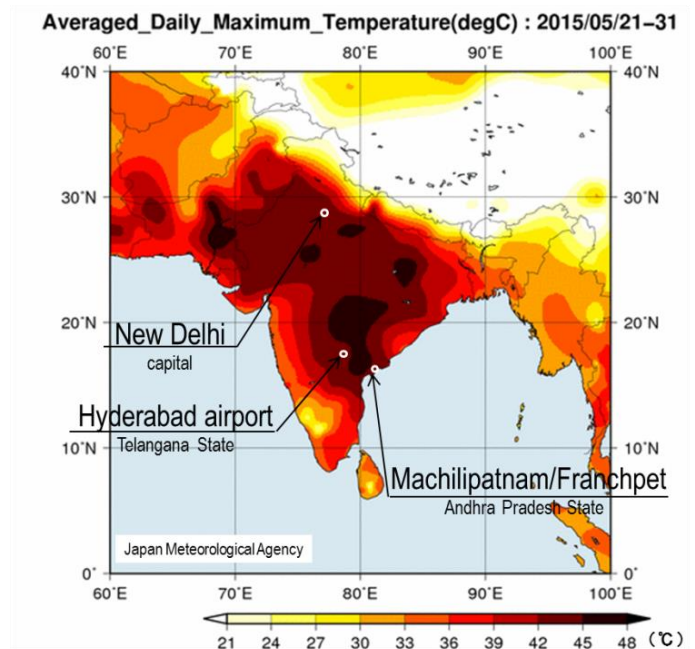


Figure 1 Daily maximum temperatures averaged for the period from 21 to 31 May 2015

¹ The Indian Meteorological Department defines a heat wave based on the following criteria (http://www.imd.gov.in/section/nhac/dynamic/Met_Glossary.htm):

- When the normal maximum temperature of a station is less than or equal to 40°C:
Heat wave: Departure from the normal is 5 to 6°C.
Severe heat wave: Departure from the normal is 7°C or more.
- When the normal maximum temperature of a station is more than 40°C:
Heat wave: Departure from the normal is 4 to 5°C.
Severe heat wave: Departure from the normal is 6°C or more.
- When the actual maximum temperature remains at 45°C or more irrespective of the normal maximum temperature, a heat wave should be declared.

² Based on information provided by the Indian Meteorological Department. These values are averages for the period from 1951 to 2000 for Hyderabad and from 1901 to 2000 for New Delhi.

Figure 2 shows time-series representations of daily maximum and minimum temperatures at cities in seriously affected areas, namely (a) Hyderabad and (b) Machilipatnam (Andhra Pradesh State). Since 19 May, daily maximum and minimum temperatures for both cities stayed higher by 3 to 9°C and around 2°C, respectively, than those for early May. The daily maximum temperature in Machilipatnam exceeded 45°C for six consecutive days from 22 to 27 May.

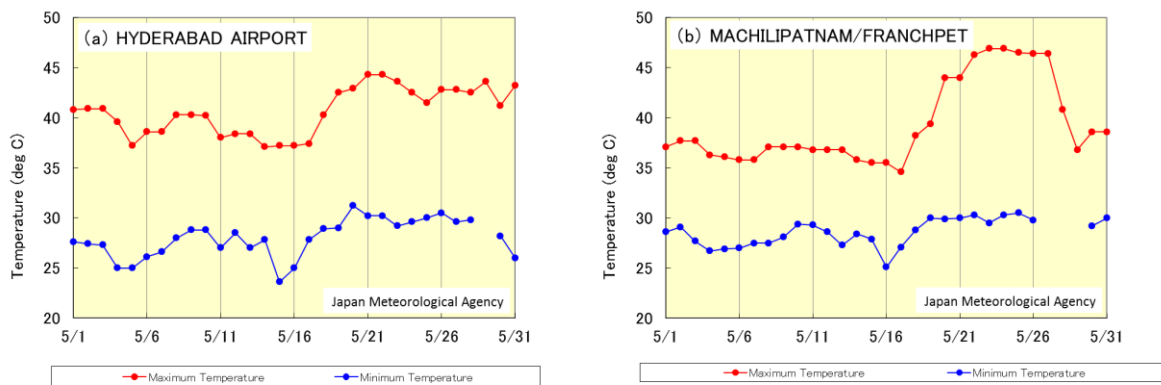


Figure 2 Time-series representations of daily maximum and minimum temperatures (a) Hyderabad (Telangana State) and (b) Machilipatnam (Andhra Pradesh State). The red and blue lines show daily maximum and minimum temperatures, respectively.

The late-May heat wave is reported to have caused adverse effects from 23 May onward. The number of fatalities has increased due to persisting extreme temperatures, and is thought to have exceeded 2,200 in Andhra Pradesh State, Telangana State and elsewhere by 31 May (source: National Institute of Disaster Management, Government of India).

2. Characteristics of atmospheric circulation (Figure 3)

Convective activity over the Bay of Bengal was enhanced in late May, and associated vertical circulation caused a descending air current over India to intensify. Consequently, cloud formation was suppressed over the area and continual strong solar radiation led to increased near-surface air temperatures. Adiabatic heating associated with the strong descending air current also appears to have contributed to the air temperature increase.

The hottest month in India is usually May, just before the onset of the southwestern monsoon. The atmospheric circulation anomalies mentioned above caused air to warm and led to the extremely high temperatures observed in India.

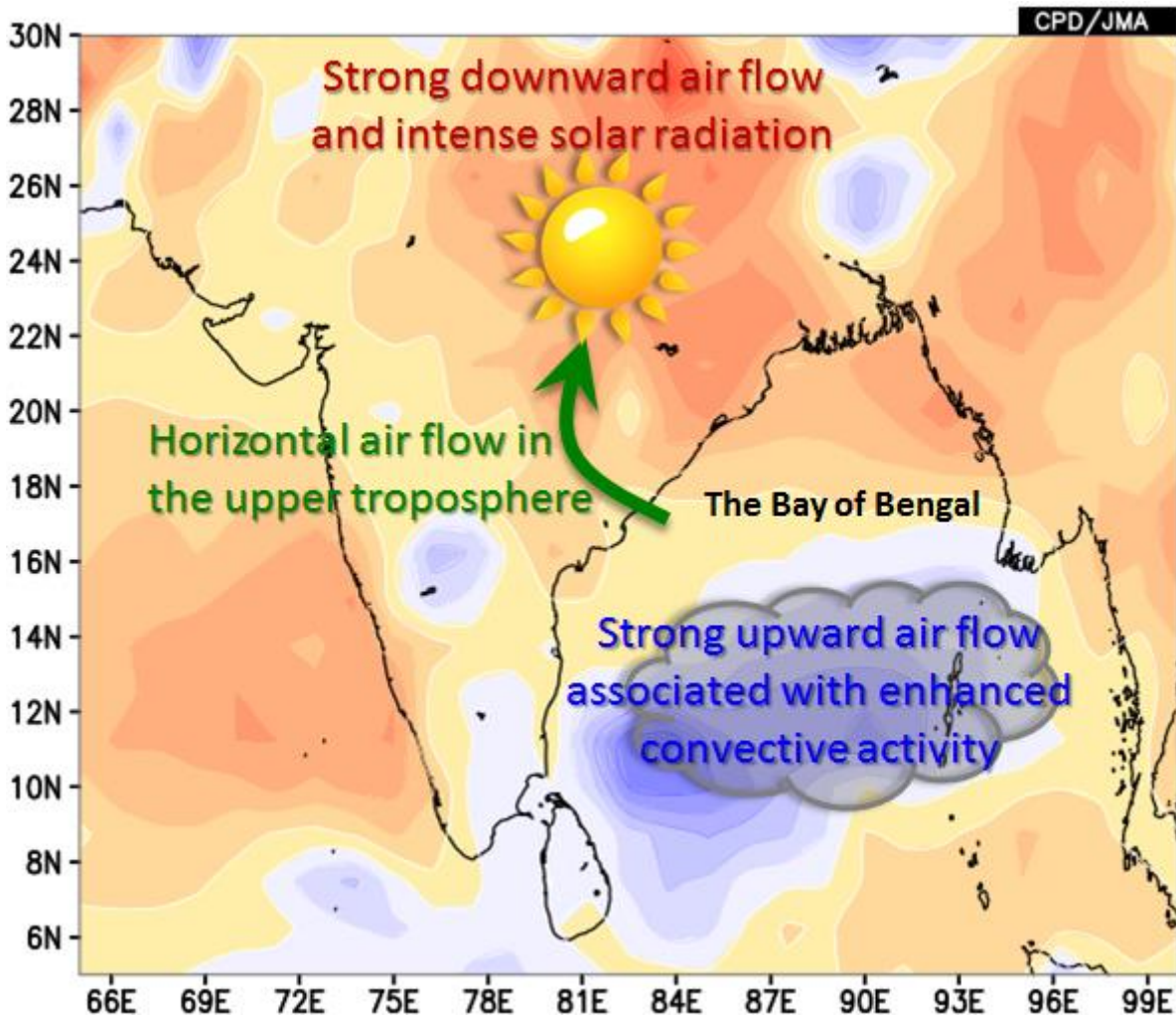


Figure 3 Schematic diagram of atmospheric circulation over India in late May

Shading indicates average anomalies of vertical air flow at an altitude of around 5,800 m from 21 to 31 May. Warm and cool colors show stronger descending air currents (or weaker ascending air current) and stronger ascending air currents (or weaker descending air current), respectively. The green arrow indicates the atmospheric current at an altitude of around 12,000 m.

3. Outlook

The convective activity over the Bay of Bengal that has contributed to the heatwave is likely to be suppressed this weekend, and the Indian Meteorological Department forecasts that the extremely high temperatures will also gradually ease this weekend. Rainy and cooler conditions are observed after the onset of the summer monsoon in India, which usually takes place from late May to early June in southeastern parts, in mid-June in central and northeastern parts, and from late June to early July in northwestern parts.