

MAXIMUM PERSISTING DEW POINTS DURING THE SOUTHWEST MONSOON SEASON OVER INDIA

1. The moisture maximization procedure used in the derivation of Probable Maximum Precipitation (PMP) for specific areas consists of moisture adjustment of observed areal rainfall values associated with the severe rainstorms both those occurring within the specific areas and those transposed over the areas. For moisture adjustment the observed areal rainfall values are multiplied by the ratio of the highest amount of moisture recorded in the specific area to that recorded during the rainstorm period. USWB (1960) and Reitan (1963) showed that the moisture in an air mass, from which large precipitation occurs, can be estimated from the surface dew points decreasing with height at the saturated pseudoadiabatic lapse rate.

In maximization procedure it has, therefore, been customary to use the highest 12-hr or 24-hr persisting 1000 mb dew points ever recorded in the study area for estimating the highest value of atmospheric precipitable water. The precipitable water for the storm is estimated from the highest 12-hr or 24-hr persisting dew points of the air which fed the storm. As such the information on the highest 12-hr or 24-hr persisting dew points, based on long periods of data in different months of the year at representative stations in the country, has a potential value in PMP studies.

In view of the importance of the subject, an attempt has been made in this paper to construct generalized maps of the highest 24-hr persisting dew points for the individual months of June to September for the Indian region. These dew points can then be used to calculate the maximum moisture content of the atmosphere for any location. These maps will not only provide a ready convenient source of maximum persisting dew points but will also aid in maintaining consistency between estimates in various parts of the country.

2. For the Indian region Pramanik and Hariharan (1951) reported the highest dew points recorded during 5 years period for 24 stations. Shenoy *et al.* (1970), while giving the range of moisture adjustment factors for some severe rainstorms of Madhya Pradesh, have also reported maximum dew point temperatures of stations in and near Madhya Pradesh. The single observation dew point maximums are intended to be an index of maximum moisture but these have certain synoptic limitations and are also susceptible to observational error. Obviously the moisture must be that, which persists for several hours. Thus, the maximum value of atmospheric moisture used for storm maximization is usually estimated from the 12-hr or 24-hr maximum persisting dew point rather than a single reading. It was, therefore, considered that information on the 24-hr maximum persisting dew point temperatures at representative stations in the country will provide valuable data for PMP studies. Dhar and Mhaisker (1968) worked out the maximum 24-hr persisting dew points for 10 years for stations in the southern-half of the Indian Peninsula. Based

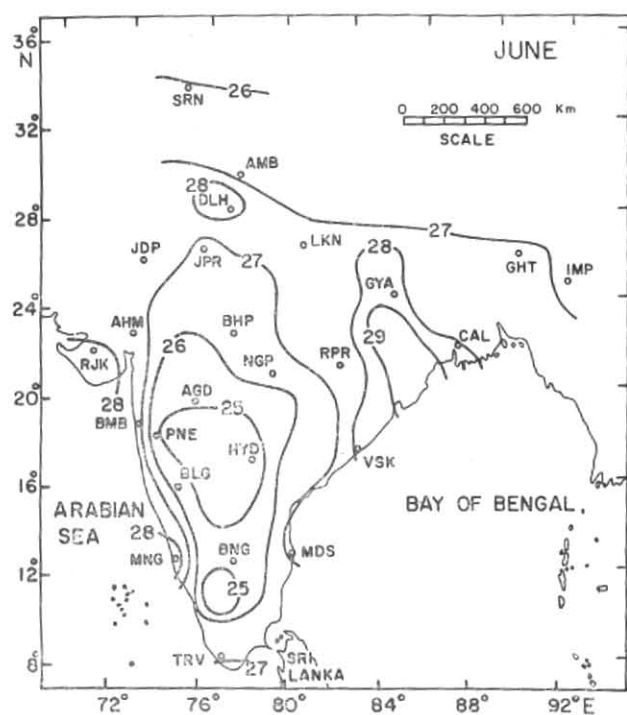


Fig. 1. Maximum persisting 24-hr, 1000 mb dew point temperature ($^{\circ}$ C) — June

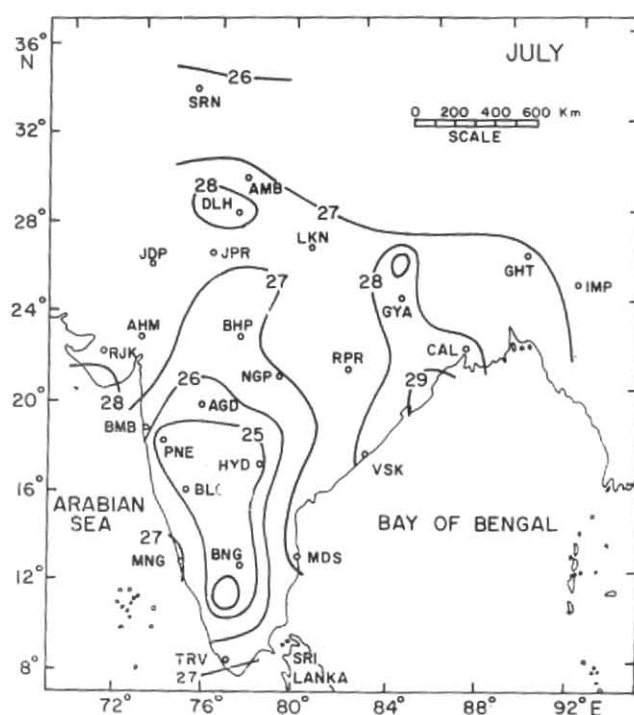


Fig. 2. Maximum persisting 24-hr, 1000 mb dew point temperature ($^{\circ}$ C) — July

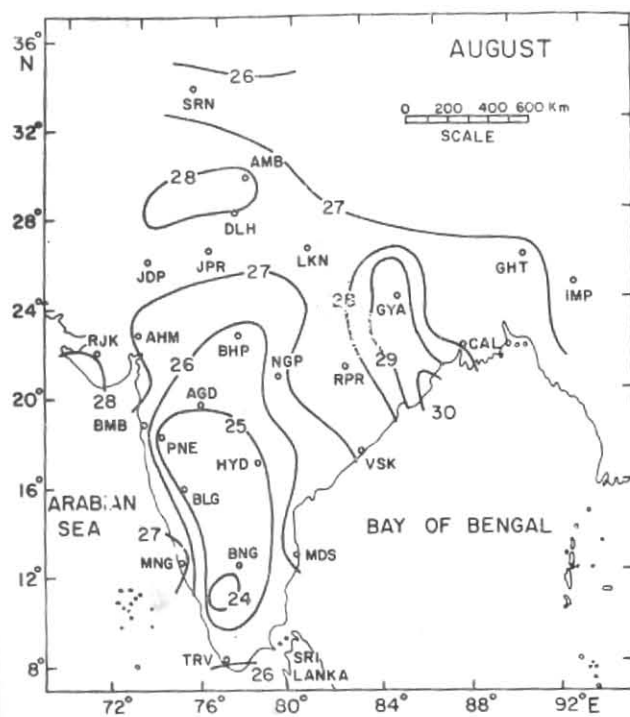


Fig. 3. Maximum persisting 24-hr, 1000 mb dew point temperature ($^{\circ}$ C) — August

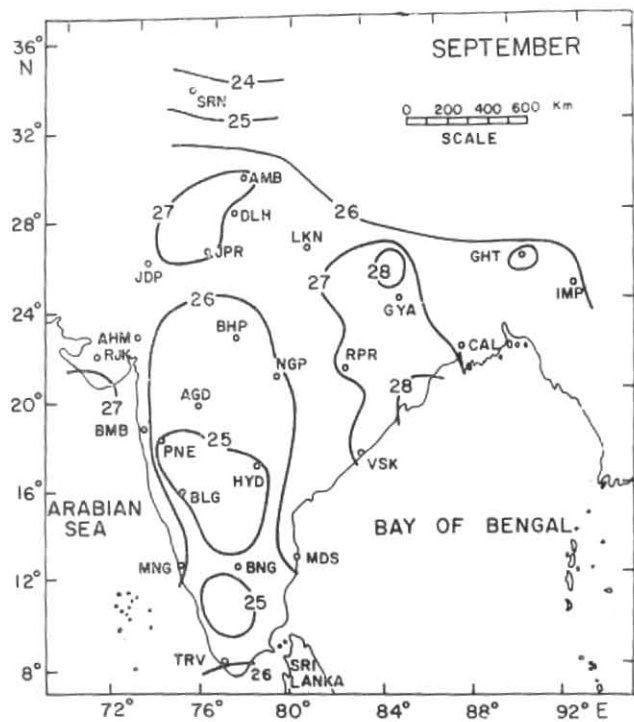


Fig. 4. Maximum persisting 24-hr, 1000 mb dew point temperature ($^{\circ}$ C) — September

on observations of a few stations, Rakhecha and Kennedy (1985) prepared a generalized map of annual maximum persisting dew points for the Indian region.

3. The daily dew point temperatures for meteorological stations are published in the *Indian Daily Weather Reports* (IDWR) by the India Meteorological Department (IMD), Pune. The daily dew points recorded at 0830 and 1730 IST for 9 years (1961-1969) during June to September months were collected for 48 stations well distributed throughout India from IDWR and for 11-year (1970-1980) data was obtained from magnetic tapes at the National Data Centre, IMD, Pune. In determining the persisting dew point the consecutive dew point values at 0830 and 1730 IST during the 24-hr period were examined for reliability and the lowest of these readings was selected. Daily minimum temperatures were also used to check that the minimum temperature has not fallen below the dew point temperature.

In this way, a series of 24-hr persisting dew points for the individual months of June to September for each year were constructed for each station. The maximum value of the individual months was then taken as the maximum persisting dew point for that month. Like this, the maximum persisting dew points for each month of June to September for all years were determined and the highest, out of these, was taken as the highest persisting 24-hr dew point for that month. The monthly highest persisting dew point values for each station were picked out and then reduced pseudo-adiabatically to the 1000 mb level so that the highest dew points observed for stations at different elevations are comparable.

4. The highest persisting dew point values are plotted on a large scale base map of India and generalized maps of the highest 24-hr persisting dew point; have been prepared. The isotherms of 24-hr maximum persisting dew point temperatures over the Indian region for each month of June to September are shown in Figs. 1-4. The spatial pattern of maximum persisting dew points, which is a measure of maximum moisture over an area, depends upon the direction of moisture flow, topographic barriers and other geographic factors. It is seen that the maximum persisting dew points range from 24°C to 30°C. The persisting dew point values decrease both northward and southward. The lowest values are observed in the northern parts of the country, above 30°N. Another tongue of the lowest values ranging from 25°C to 26°C is located in the leeward

side of the Western Ghats, running in north-south direction. The low values in the lee of Western Ghats are due to the shielding effect of the topographic barrier in the path of the inflowing moist currents from the Arabian Sea. During the monsoon season, depressions and cyclonic storms form at the Head of the Bay of Bengal and move in a northwest direction. The higher values of dew points close to the Bay of Bengal coast can be attributed to prevailing moisture conditions associated with these systems.

It is also of interest to see that comparatively higher values of dew points are also prevailing over Rajasthan, the driest part of India. This shows that though sufficient moisture is available in this region, it does not yield higher rainfall due to lack of an efficient storm mechanism.

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