Letters to the Editor

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Estimation of condensation levels over Visakhapatnam

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When moist unsaturated air ascends adiabatically its temperature decreases. As the ascent proceeds, the air in question, will reach a temperature, at which the water vapour present is just sufficient to saturate the air. The height in the atmosphere, at which this occurs is known as the condensation level. This level can be computed from the tephigram using Normands third proposition which states that the dry adiabat through the dry bulb temperature, the saturated adiabat through the wet-bulb temperature and the humidity mixing ratio line through the dew point intersect at a point. At this point of intersection condensation begins.

Hewson & Longley (1951) have obtained an equation from thermodynamical means which is given as

$$HH = 125(TT - TD) \tag{1}$$

Here HH is the height of the condensation level in metres, TT and TD are dry bulb temperature and dewpoint at the surface in degrees centrigrade/absolute, respectively. This equation involves assumptions and approximations as such its validity is doubtful.

In the present work a new equation is derived from statistical means for estimating the height of condensation level in the atmosphere.

This method involves in finding a relation, by the method of least squares, between three variables, HH (height of condensation level), TT (dry bulb temperature) and TD (dewpoint). The equation is given as,

$$HH = P + QTT + RTD \tag{2}$$

Here P, Q and R are constants and their values are obtained by solving the normal equations.

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The surface pressure, surface dry bulb temperature and surface dewpoint are noted for both the synoptic hours of each day for the months of June, July and August for five years at Visakhapatnam.

The dry bulb temperature and dewpoint are marked on the corresponding pressure line on the tephigram. The dry adiabat through the dry bulb temperature and the humidity mixing ration line through the dewpoint intersect at a point and the height of the point of intersection is easily computed. For each set of observations the corresponding heights are obtained. Thus a number (N) of sets of heights and the corresponding surface temperatures are used to solve the three normal equations for the three constants.

The values of the constants as obtained are,

$$P = 335, \quad Q = 119 \quad \text{and} \quad R = -132.$$

Substituting these values in eq. (3)

$$HH = 335 + 119TT - 132TD \qquad \ldots \quad (3)$$

Here HH is the height of condensation level in metres TT and TD are surface dry bulb temperature and surface dewpoint respectively in degrees centigrade/absolute.

Eq. (3) as obtained by the authors by the method of least squares, gives results comparable to those obtained from the tephigram quickly and easily.

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