Vapor pressure deficit

Definition

The vapor pressure deficit Δe is the difference between saturation e_s and actual vapor pressure e_a

Formula

The vapor pressure deficit Δe [kPa] can be calculated using temperature and relative humidity as follows (cf. Allen et al. 1998):

$$\Delta e = e_s - e_a$$

with

$$e_s = 0.6108 \cdot e^{\frac{17.27 \cdot T}{T+237.3}}$$

and

$$e_a = e_s \cdot \frac{H}{100}$$

where T is temperature [°C] and H [%] relative humidity.

However, using mean air temperature as above results in a lower estimate of e_s, thus in a lower vapor pressure deficit. It would therefore be more appropriate to use, if available, maximal and minimum temperature for calculating e_s, as follows (Allen et al. 1998):

$$e_s = \frac{1}{2}\left(0.6108 \cdot e^{\frac{17.27 \cdot T_{max}}{T_{max}+237.3}} + 0.6108 \cdot e^{\frac{17.27 \cdot T_{min}}{T_{min}+237.3}}\right)$$

where T_{max} is maximal temperature [°C] and T_{min} minimal temperature [°C].

NB: The conversion between kiloPascals and millimeters of mercury is as follows: 1 [kPa] = 7.500616827042 [mmHg]

Reference

Allen et al. (1998)