The Penman-Monteith Equation for ET

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$$B = \frac{H}{E} = \frac{K_H (T_s - T_a)}{\rho_w \lambda_v K_E (e_s - e_a)}$$

The Penman-Monteith Equation for ET

- Skipping a few steps, we get

$$E = \frac{K + L + (K_H V / \Delta)(e_s - e_a)}{\rho_w \lambda_v + (K_H / K_E)\Delta}$$

The Penman-Monteith Equation for ET

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- Factoring out e_s and assuming $e_s \approx e_a^*$ (sat. VP of atmos.)

$$E = \frac{\Delta\left(K + L\right) + K_H V e_a^* \left(1 - {e_a}/{e_a^*}\right)}{\rho_w \lambda_v (\Delta + \gamma)}$$

The Penman-Monteith Equation for ET

- Penman simplified further:

$$E = \frac{\Delta\left(K+L\right) + K_H V e_a^*\left(1 - \frac{e_a}{e_a^*}\right)}{\rho_w \lambda_v (\Delta + \gamma)}$$

- Noting that $K_H V$ is conductivity of the atmosphere to sensible heat flux from the surface.

$$K_H V = \rho_a c_a C_{at} V = \frac{\rho_a c_a k^2 V}{\left[\ln\left(\frac{z_m - z_d}{z_0}\right)\right]^2}$$

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- The relative humidity of the atmosphere, W_a.
  - e_a* is calculated from temperature .
  - W_a is usually measured.

$$W_a = \frac{e_a}{e_a^*}$$

The Penman-Monteith Equation for ET

- Gives us the final form of the Penman Equation:

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- English scientist Monteith rewrote the denominator, the energy released by ET, to account for canopy conductance.

The full Penman-Monteith Equation

$$E = \frac{\Delta\left(K + L\right) + \rho_a c_a C_{at} e_a^* (1 - W_a)}{\rho_w \lambda_v \left[\Delta + \gamma\left(C_{can} + C_{at}\right)\right]}$$