Bretherton Lect. 11

$$H_L = \rho L C_H V_1 (q_0 - q_1)$$

$$q_0 = q^*(T_1) + \left(\frac{dq^*}{dT}\right)_R (T_0 - T_1)$$

Subst. into H_L:

$$H_L = \rho L C_H V_1 (q^*(T_1) - q_1)$$

$$+ \rho L C_H V_1 \left(\left(\frac{dq^*}{dT}\right)_R (T_0 - T_1)\right) = A + B$$

$$B = \rho c_p C_H V_1 \underbrace{\left[\frac{L}{c_p}\left(\frac{dq^*}{dT}\right)_R\right]}_{s^*} (T_0 - T_1)$$

$$= s^* H_s$$

Bowen ratio:

$$\frac{H_s}{H_L} = \frac{H_s}{\rho L C_H V_1 (q^*(T_1) - q_1) + s^* H_s}$$

max. value occurs when $q^*(T_1) = q_1$:

$$\frac{H_s}{H_L} = \frac{H_s}{s^* H_s} = \frac{1}{s^*}$$

s^* increases with T.

Energy balance : $R_N - H_G = H_S + H_L$.

so $H_S = R_N - H_G - H_L$.

subst. into (1) :

$$H_L = \rho L C_H V_1 (q^*(T_1) - q_1) + s^*(R_N - H_G) - s^* H_L$$

Solve for H_L :

$$H_L (1+s^*) = \rho L C_H V_1 (q^*(T_1) - q_1) + s^*(R_N - H_G)$$

$$H_L = \frac{s^*}{1+s^*}(R_N - H_G) + \frac{\rho L C_H V_1 (q^*(T_1) - q_1)}{1+s^*}$$

$$= \Gamma (R_N - H_G) + (1-\Gamma) \rho L C_H V_1 (q^*(T_1) - q_1)$$

$$\Gamma \equiv \frac{s^*}{1+s^*}$$

Evap. from dry vegetation

$$E = \frac{1}{r_{st}} \rho (q^*(T_0) - q_0)$$

so $\frac{1}{r_{st}}$ is like $C_H V_1$.