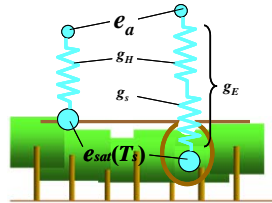
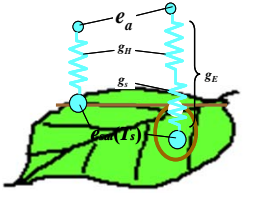


g_H について

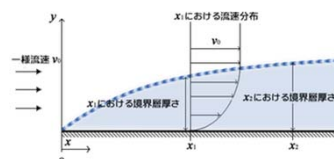

群落: $g_H = \frac{\kappa^2 u}{\left(\ln \frac{z-d}{z_0}\right)^2}$



個葉: $g_H = m \sqrt{\frac{u}{d}}$

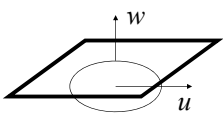


個葉

$$g_H = m \sqrt{\frac{u}{d}}$$



群落

まずは運動量フラックス



$$\frac{\rho l^2 w}{l^2} u = \rho u w \quad (\text{kg m/s})/\text{m}^2 \text{s}$$

kg/m²s m/s

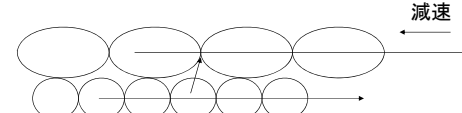
$$\overline{\rho u w} = \rho \overline{(u + u')(w + w')} = \rho \overline{u' w'}$$

(kg m/s)/m²s = Ns/m²s = N/m²

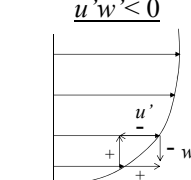
運動量フラックスはせん断応力

運動量フラックスはせん断応力

減速



$$\tau = -\rho \overline{u' w'} \quad (\text{kg m/s})/\text{m}^2 \text{s} = \text{N/m}^2$$

$$\overline{u' w'} < 0$$


フラックスは拡散係数で表現できる

$$F = -K \frac{dC}{dz}$$

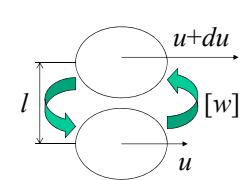
$\frac{\text{m}^2/\text{s} \cdot \text{kg}/\text{m}^3}{\text{m}} = \text{kg}/\text{m}^2 \text{s}$
 $\frac{\text{m}^2/\text{s} \cdot \text{mol}/\text{m}^3}{\text{m}} = \text{mol}/\text{m}^2 \text{s}$
 $\frac{\text{m}^2/\text{s} \cdot (\text{kg m/s})/\text{m}^3}{\text{m}} = (\text{kg m/s})/\text{m}^2 \text{s}$

運動量濃度

$$\tau = -\rho \overline{u' w'} = K_M \frac{d(\rho u)}{dz}$$

$$= \rho K_M \frac{du}{dz}$$

運動量フラックスで考える



$$[w] = l \left| \frac{du}{dz} \right| \quad \frac{[w]}{l} = \left| \frac{du}{dz} \right| \quad (\text{s})$$

単位時間当たり交換運動量

$$\rho l^3 du \left| \frac{du}{dz} \right| = \rho l^4 \left| \frac{du}{dz} \right| \frac{du}{dz}$$

$$-\rho \overline{u' w'} = \frac{1}{l^2} \rho l^4 \left| \frac{du}{dz} \right| \frac{du}{dz} = \rho l^2 \left| \frac{du}{dz} \right| \frac{du}{dz} = \tau$$

K_M

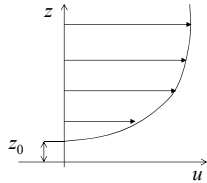
- $l = \kappa z$ κ : カルマン定数
- $\tau, -\rho \overline{u'w'}$ は高さ方向で一定: コンスタントフラックス層
- $-\overline{u'w'} = u_*^2$ を導入

$$\rho u_*^2 = \rho l^2 \left(\frac{du}{dz} \right)^2$$

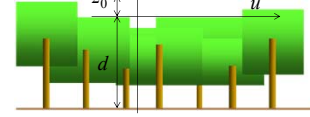
$$u_* = \kappa z \frac{du}{dz}$$

風速対数則

$$u = \frac{u_*}{\kappa} \ln \frac{z}{z_0}$$



$$u = \frac{u_*}{\kappa} \ln \frac{z-d}{z_0}$$



さて、ある条件で

$$K_M = K_H = K_E = \kappa u_* (z-d)$$

$$H = -K_H \frac{d(\rho c_p T)}{dz} \text{ を考えてみよう。}$$

$$\frac{H}{\rho c_p} = -K_H \frac{dT}{dz} = -\kappa^2 (z-d)^2 \frac{du}{dz} \frac{dT}{dz}$$

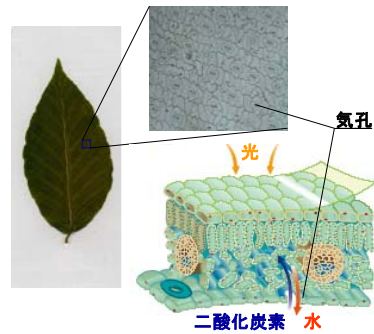
$$= -\kappa^2 \frac{du}{d \ln z} \frac{dT}{d \ln z}$$

$$H = \rho c_p g_H (T_s - T_a) \text{ より}$$

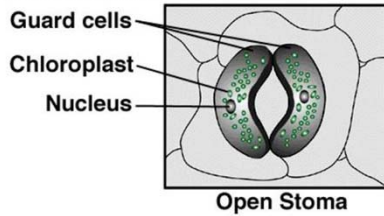
$$g_H = \frac{\kappa^2 u}{\left(\ln \frac{z-d}{z_0} \right)^2}$$

g_s について

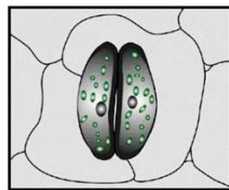
群落も個葉も基本は“気孔”



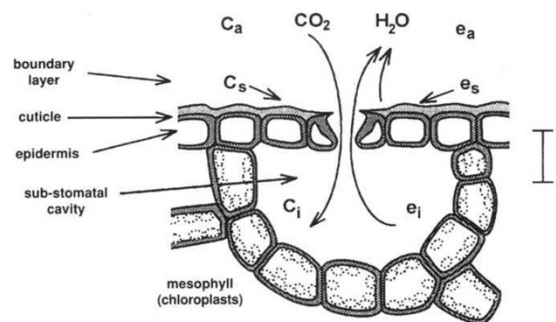
蒸散とは一
気孔の開閉だ



Open Stoma

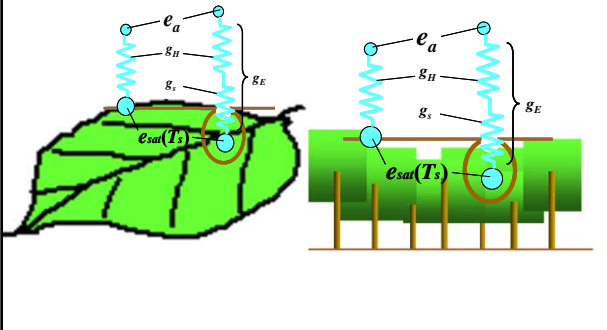


Closed Stoma

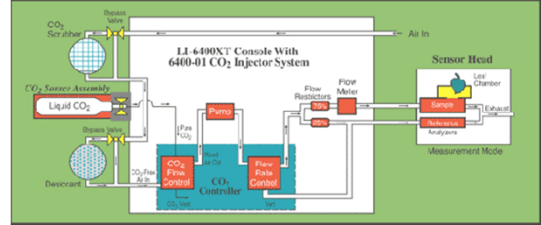


これを群落に適用することもある。

群落も個葉も基本は“気孔”



個葉



個葉

$$\frac{g_{sw} g_{aw}}{g_{sw} + g_{aw}} \approx g_{sw} \leftarrow g_{aw} = m \sqrt{\frac{u}{d}}$$

$$E = g_{sw} (C_{ws} - C_{wa})$$

既知

群落

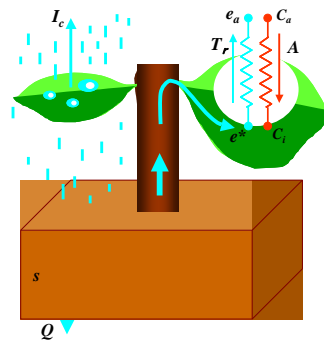
$$\lambda E = \frac{\Delta(R_n - G) + \rho c_p g_H (e_{sat}(T_a) - e_a)}{\Delta + (1 + g_H / g_s) \gamma}$$

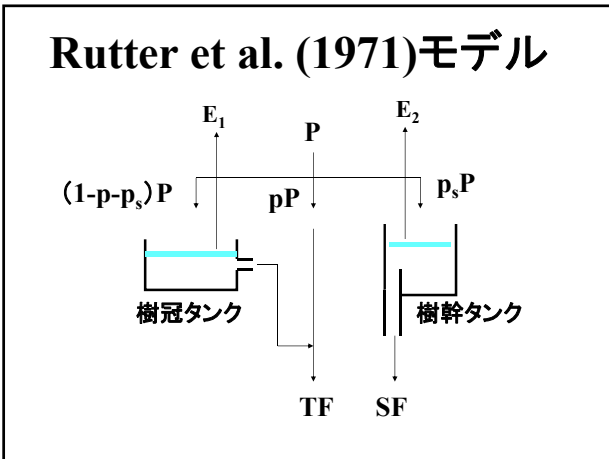
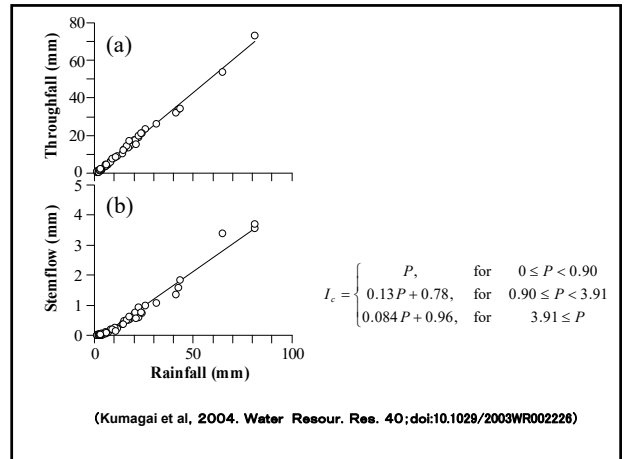
g_s 以外、気象観測により全て既知

色々な g_s (個葉でも群落でも) の表現

- $g_s = g_{s,max} f(R_s) g(T_a) h(D)$
- $g_s = g_{s,ref} - m \ln D$
- $g_s = m \frac{A_n RH}{C_s} + b$

遮断蒸発





$$\lambda E = \frac{\Delta(R_n - G) + \rho c_p g_H (e_{sat}(T_a) - e_a)}{\Delta + (1 + g_H / g_s) \gamma}$$

$g_s \rightarrow \infty$: 完全湿面