

### $g_H$ について

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

個葉:  $g_H = k \sqrt{\frac{u}{l}}$

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### 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/(m<sup>2</sup>s) m/s

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

(kg m/s)/(m<sup>2</sup>s) = Ns/(m<sup>2</sup>s) = N/m<sup>2</sup>

**運動量フラックスはせん断応力**

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### 運動量フラックスはせん断応力

減速

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

$u' w' < 0$

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### フラックスは拡散係数で表現できる

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

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

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

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

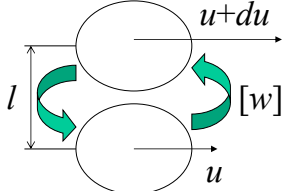
運動量濃度

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

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

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## 運動量フラックスで考える



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

単位時間当たり交換運動量

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

Prandtlの混合距離理論

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

$K_M$

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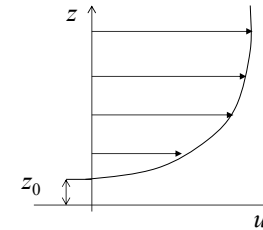
- $l = \kappa z$   $\kappa$ : カルマン定数
- $\tau, -\rho \overline{u'w'}$  は高さ方向で一定: コンスタントフラックス層
- $-\overline{u'w'} = u_*^2$  を導入

## 風速対数則

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

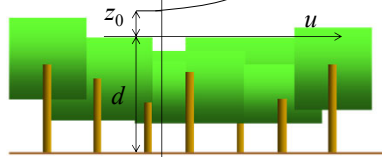
$$u = \frac{u_*}{\kappa} \ln \frac{z}{z_0}$$

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



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



さて、ある条件で

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

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

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

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

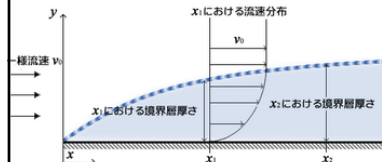
$$H = \rho c_p g_H (T_s - T_a) \text{ より}$$

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

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# 個葉

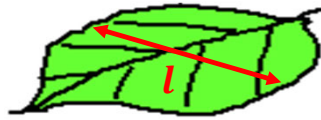
$$g_H = k \sqrt{\frac{u}{l}}$$



$$g_H = 1.4 \times \frac{0.664 \rho_a D_h R_e^{\frac{1}{2}} P_r^{\frac{1}{3}}}{l}$$



$$g_H = \underline{0.93 \rho_a D_h^{\frac{2}{3}} v^{\frac{1}{6}} \sqrt{\frac{u}{l}}}$$



$$S = l^2$$

# 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

