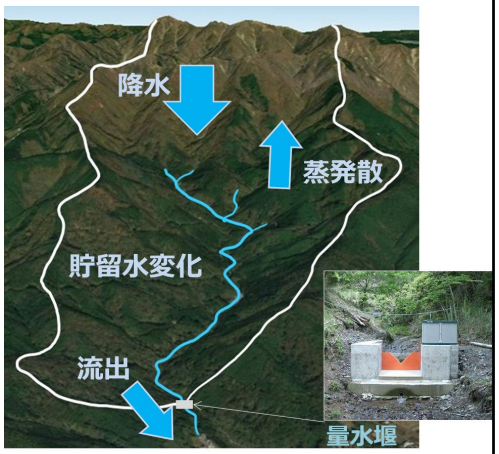
蒸発散の推定

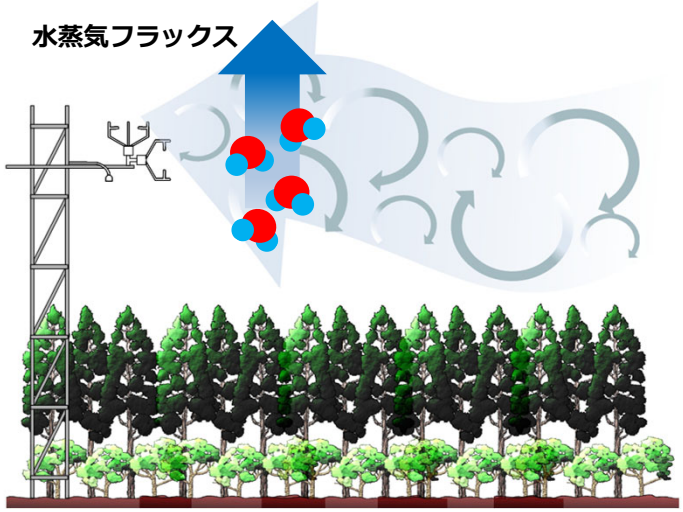
① 流域水収支：
流域試験地と量水堰



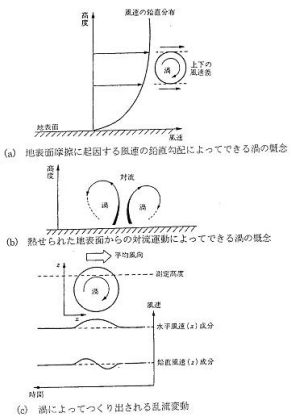
［流出］＝［降水］－［蒸発散］ －［貯留水量変化］

1

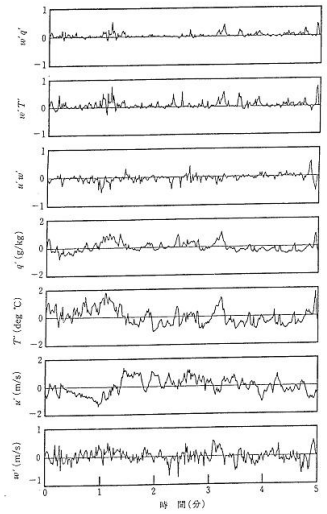
② 微気象学的方法：フラックス観測



2



渦と乱流（気象利用研究会，1998）



地表面付近で観測された乱流変動の例
（気象利用研究会，1998）

3

$F_C = \rho C \times w$

$C = \overline{C} + C'$

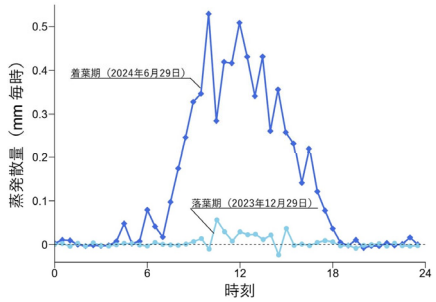
$w = \overline{w} + w'$

$F_C = \overline{\rho w C} = \rho \overline{w C}$

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

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

$F_C = \rho \overline{w'C'}$



4

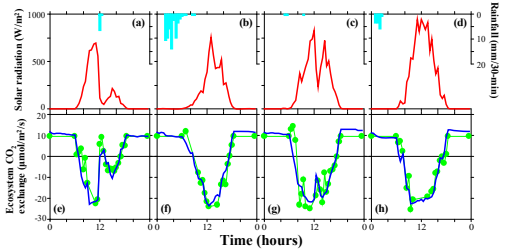
$$F_C = \rho C \times w$$

$$F_C = \overline{\rho w C} = \rho \overline{wC} \qquad C = \overline{C} + C' \qquad w = \overline{w} + w'$$

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

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

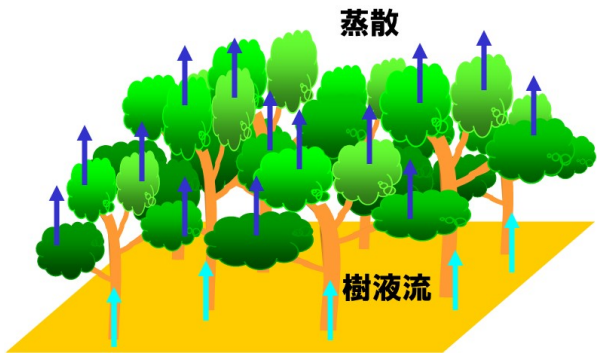
$$F_C = \rho \overline{w'C'}$$



色々な気象条件下における森林生態系のCO_2吸収／放出速度

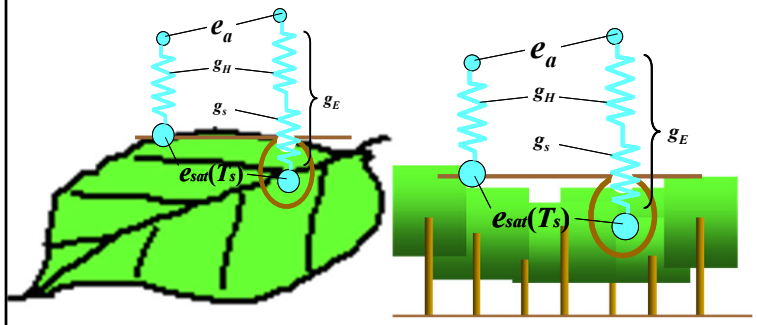
5

③-2 蒸発散直接計測：樹液流計測



6

群落も個葉も基本は“気孔”



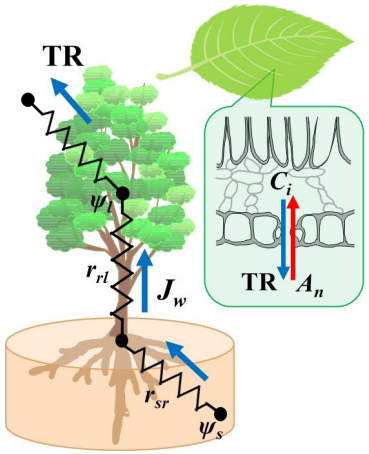
7

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

8



蒸散による
葉内の水ポテンシャル（ψ_l）
の低下

根付近の
土壌中の水ポテンシャル（ψ_s）
との引っ張り合い

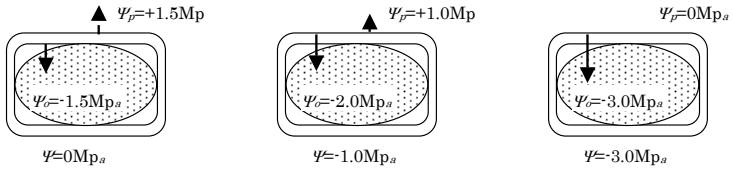
植物体内の水流・
根からの吸水（J_w）
の発生

$$J_w = \frac{\psi_s - \psi_l}{r_{sr} + r_{rl}} = \mathrm{TR}$$

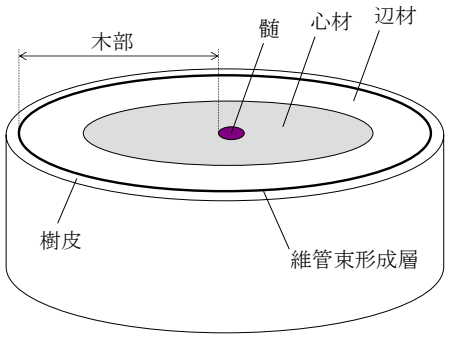
9

水ポテンシャル：水が持っているエネルギーの指標

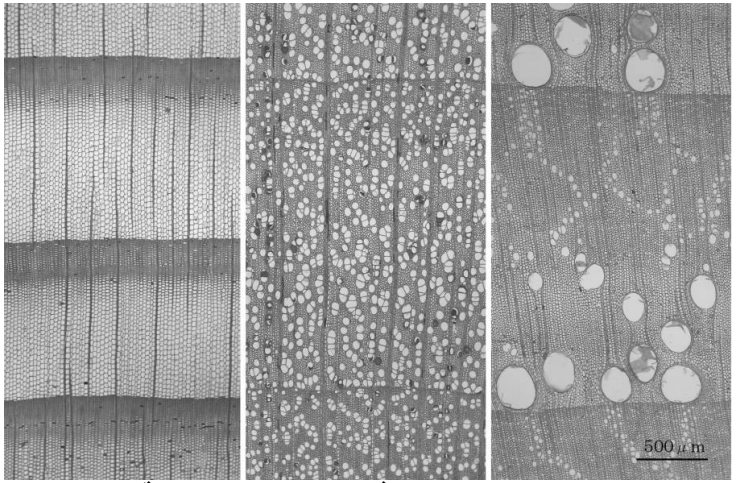
$$\Psi_{leaf} = \Psi_p + \Psi_o$$



10



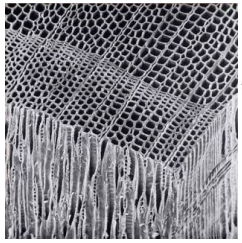
11

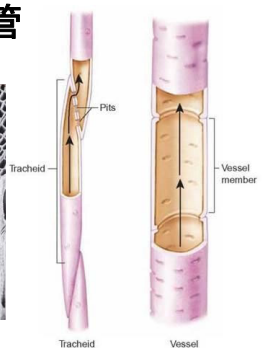


スギ　ヤマザクラ　クリ

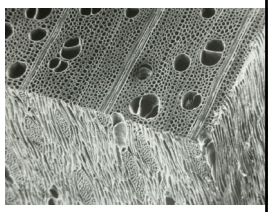
12

仮道管





道管



13

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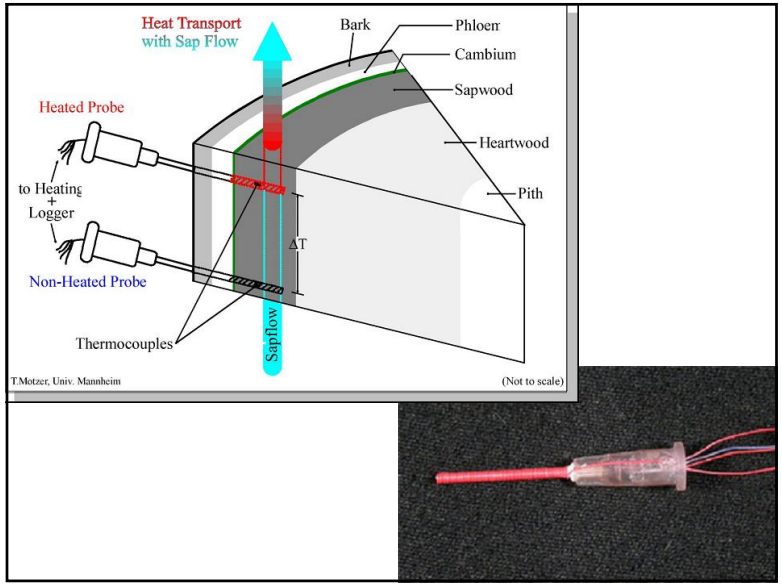
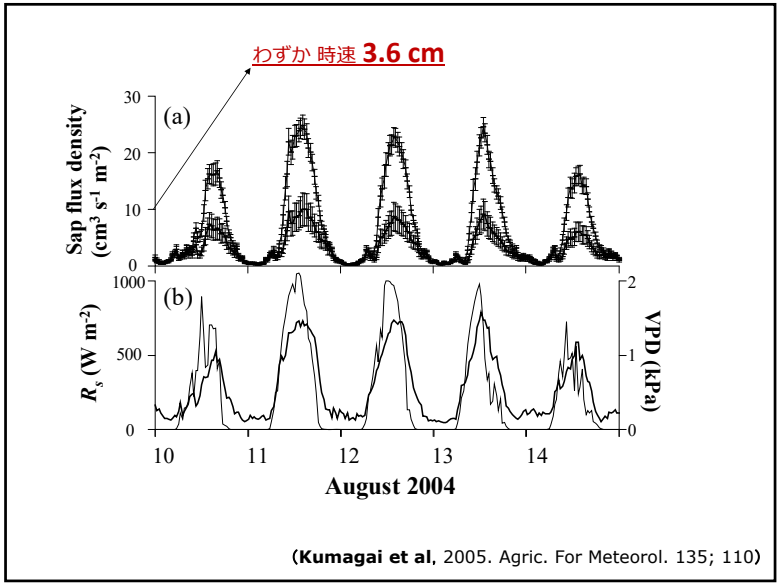


15



(**Kumagai et al**, 2005. Agric. For Meteorol. 135; 110)

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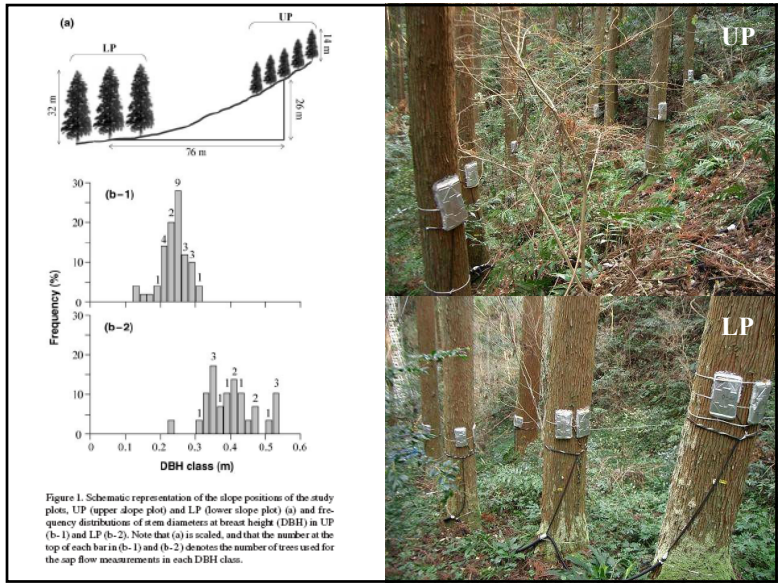

Figure 1. Schematic representation of the slope positions of the study plots, UP (upper slope plot) and LP (lower slope plot) (a) and frequency distributions of stem diameters at breast height (DBH) in UP (b-1) and LP (b-2). Note that (a) is scaled, and that the number at the top of each bar in (b-1) and (b-2) denotes the number of trees used for the sap flow measurements in each DBH class.

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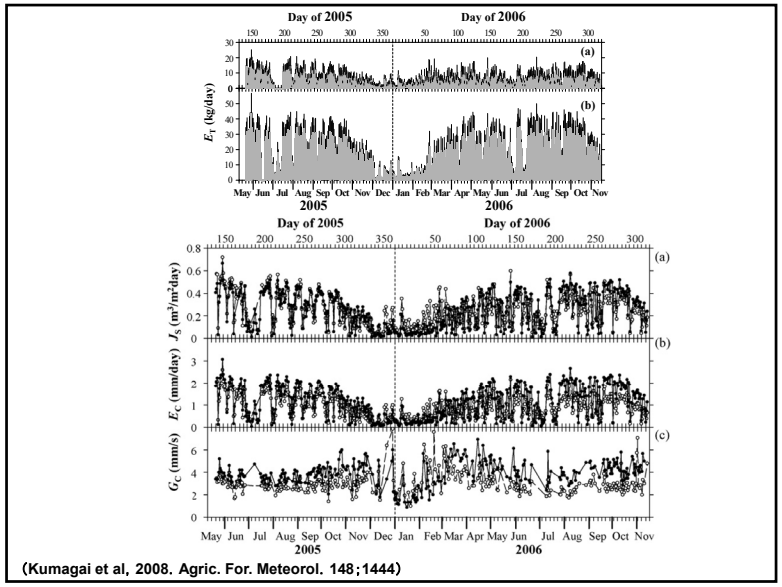

(Kumagai et al, 2008. Agric. For. Meteorol. 148;1444)

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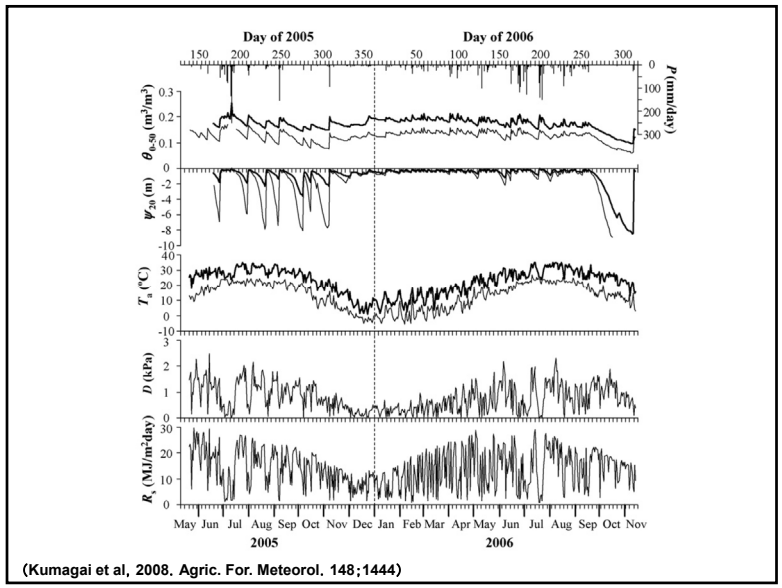

(Kumagai et al, 2008. Agric. For. Meteorol. 148;1444)

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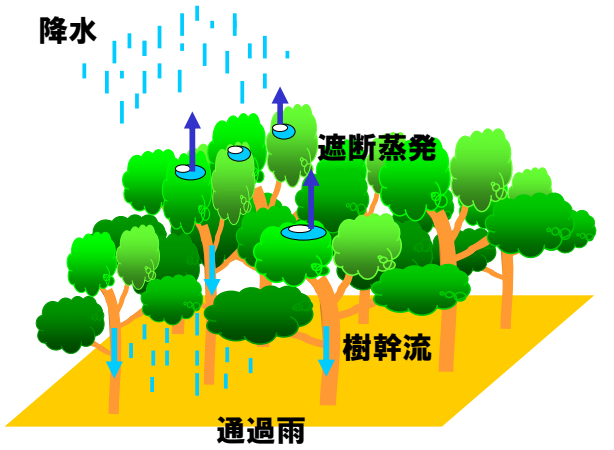
③-2 蒸発散直接計測：樹冠通過雨・樹幹流計測



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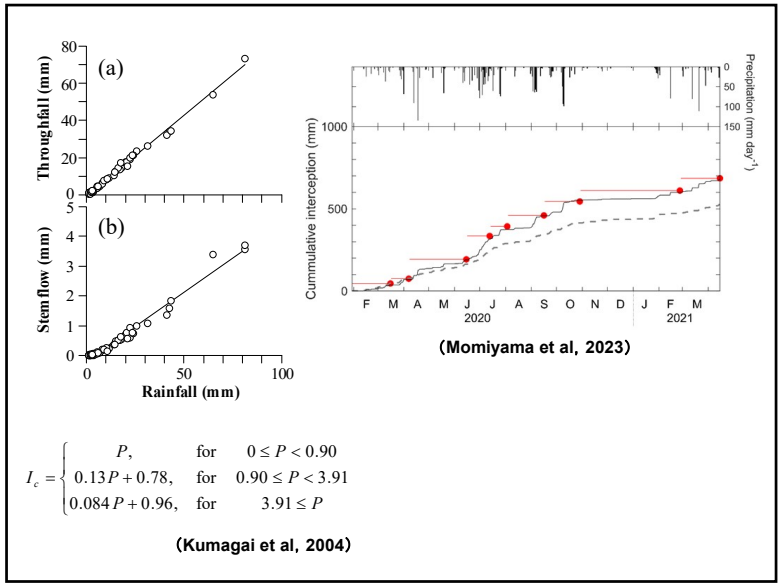
21


(a)
(b)
Throughfall (mm)
Stem flow (mm)
Rainfall (mm)
Cummulative interception (mm)
Precipitation (mm day-1)
F M A M J J A S O N D J F M
2020
2021
(Momiyama et al, 2023)
$I_c = \begin{cases} P, & \text{for } 0 \le P < 0.90 \\ 0.13P + 0.78, & \text{for } 0.90 \le P < 3.91 \\ 0.084P + 0.96, & \text{for } 3.91 \le P \end{cases}$
(Kumagai et al, 2004)

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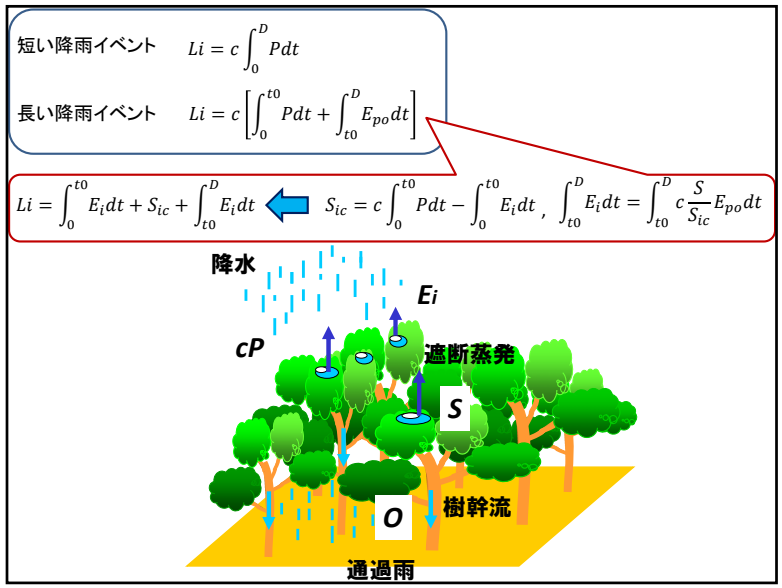
短い降雨イベント $Li = c\int_0^D Pdt$
長い降雨イベント $Li = c\left[\int_0^{t0} Pdt + \int_{t0}^D E_{po}dt\right]$
$Li = \int_0^{t0} E_i dt + S_{ic} + \int_{t0}^D E_i dt$ $S_{ic} = c\int_0^{t0} Pdt - \int_0^{t0} E_i dt$, $\int_{t0}^D E_i dt = \int_{t0}^D c\frac{S}{S_{ic}} E_{po} dt$
降水
Ei
cP
遮断蒸発
S
O
樹幹流
通過雨

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