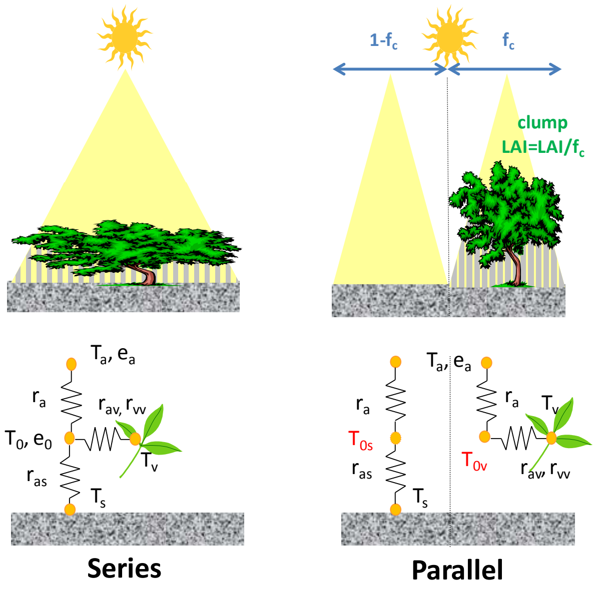
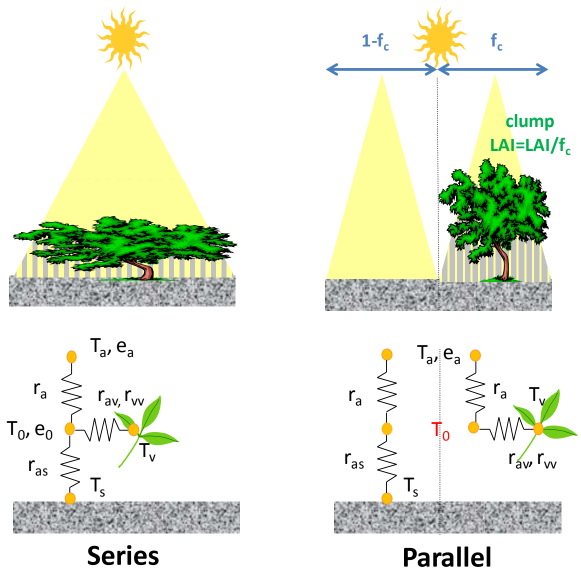


Old Figure 1



New Figure 1

Demonstration of Eq. 24:

Expressing the continuity and the total component fluxes in each branch can be further developed in Eqs. 22 and 23:

$$H_s = \rho c_p \frac{T_s - T_a}{r_{as} + r_a} = \rho c_p \frac{T_s - T_{0s}}{r_{as}} = \rho c_p \frac{T_{0s} - T_a}{r_a} \quad (22)$$

for the soil, and

$$H_v = \rho c_p \frac{T_v - T_a}{r_{av} + r_a} = \rho c_p \frac{T_v - T_{0v}}{r_{av}} = \rho c_p \frac{T_{0v} - T_a}{r_a} \quad (23)$$

for the vegetation.

In Kustas et al. (1999), in both series and parallel versions, stability correction is computed using the MO length L which depends on total H and total LE; in SPARSE, we use the Richardson number which depends on an average aerodynamic temperature T_0 representing also the total $H = \rho c_p \frac{T_0 - T_a}{r_a}$. H in the parallel version is computed according to:

$$H = (1 - f_c) H_s + f_c H_v \quad (26)$$

where H_s is expressed according to (22) and H_v to (23).

Since $H_s = \rho c_p \frac{T_{0s} - T_a}{r_a}$ (22b)

for the soil, and

$$H_v = \rho c_p \frac{T_{0v} - T_a}{r_a} \quad (23b)$$

for the vegetation, we have therefore (by combining 22b, 23b and 26):

$$T_0 = (1 - f_c)T_{0s} + f_c T_{0v} \quad (24)$$

Furthermore, (22) and (23) lead to:

$$T_{0v} = \frac{r_a T_v + r_{av} T_a}{r_a + r_{av}}$$

and

$$T_{0s} = \frac{r_a T_s + r_{as} T_a}{r_a + r_{as}}$$

Thus T_{0s} and T_{0v} are slightly different (they can differ by up to 1.5 degree in our case).

Since computing T_{0s} and T_{0v} is not compulsory, we can suppress them throughout the paper and simplify the parallel model presentation by replacing the corresponding paragraph with:

"For the parallel model, the sensible heat flux rate above each patch is:

$$H_s = \rho c_p \frac{T_s - T_a}{r_{as} + r_a} \quad (22)$$

for the soil, and

$$H_v = \rho c_p \frac{T_v - T_a}{r_{av} + r_a} \quad (23)$$

for the vegetation.

The value of the Leaf Area Index used for the parallel model is a "clump LAI" obtained by dividing the total LAI by the fraction cover of the vegetation f_c (Lhomme and Chehbouni, 1999). Total fluxes are the sum of the soil and vegetation components also weighted by their relative contribution, f_c for the vegetation and $1\text{-}f_c$ for the soil:

$$LE = (1 - f_c)LE_s + f_c LE_v \quad (24)$$

where LE_s is expressed according to (20) and LE_v to (21), and

$$H = (1 - f_c)H_s + f_c H_v \quad (25)$$

where H_s is expressed according to (22) and H_v to (23).

The stability correction for the aerodynamic resistance r_a depends on an average aerodynamic temperature computed from the total sensible heat flux H:

$$T_0 = T_a + \frac{H r_a}{\rho c_p} \quad (26)"$$