Bare soil evaporation (BSE) in ORCHIDEE
A short introduction

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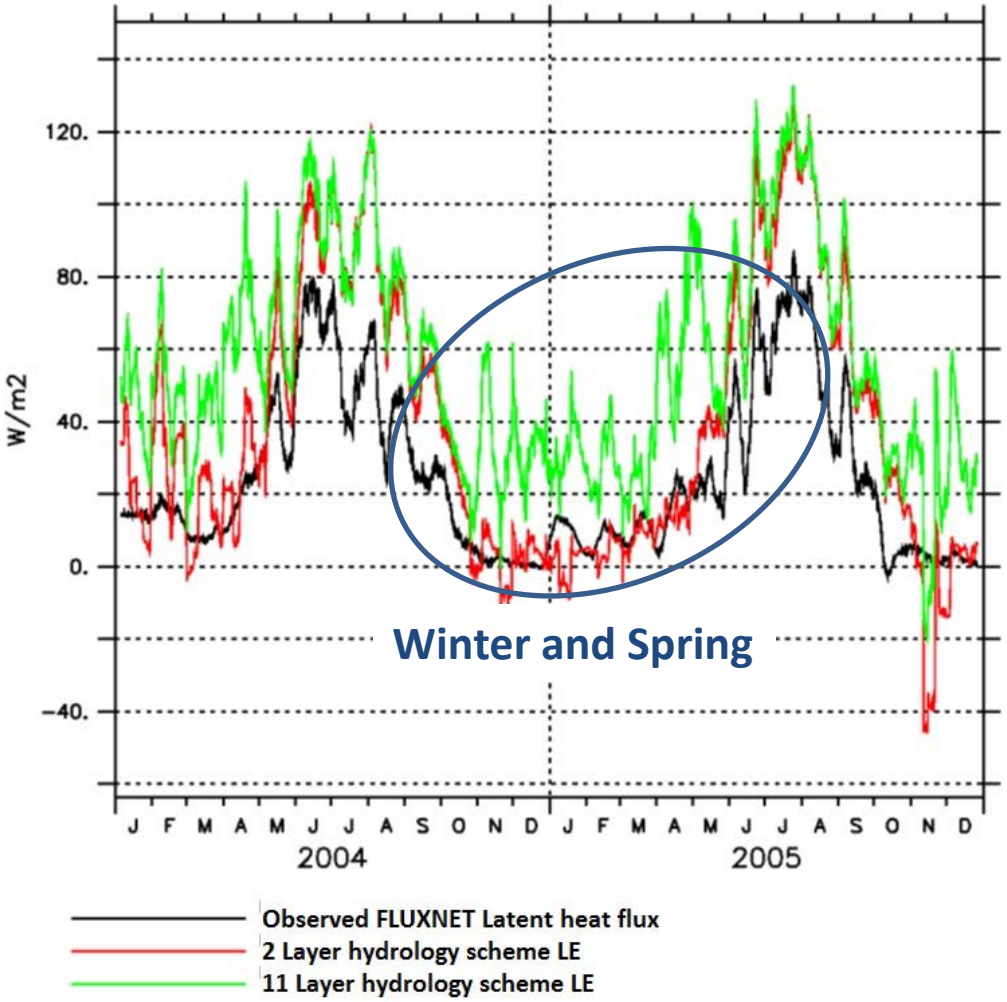
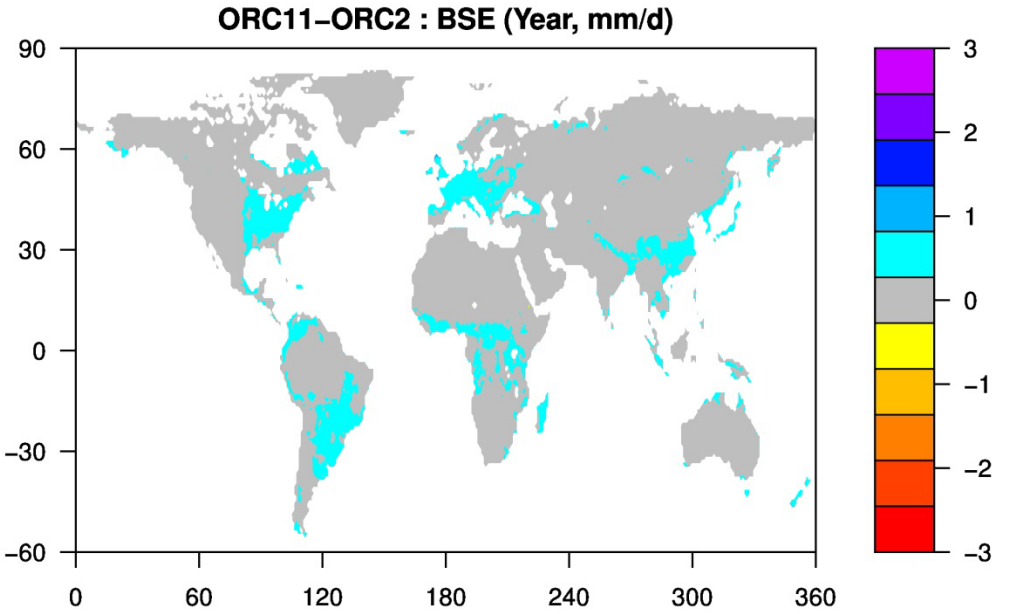
BSE is very sensitive to soil hydrology in ORCHIDEE

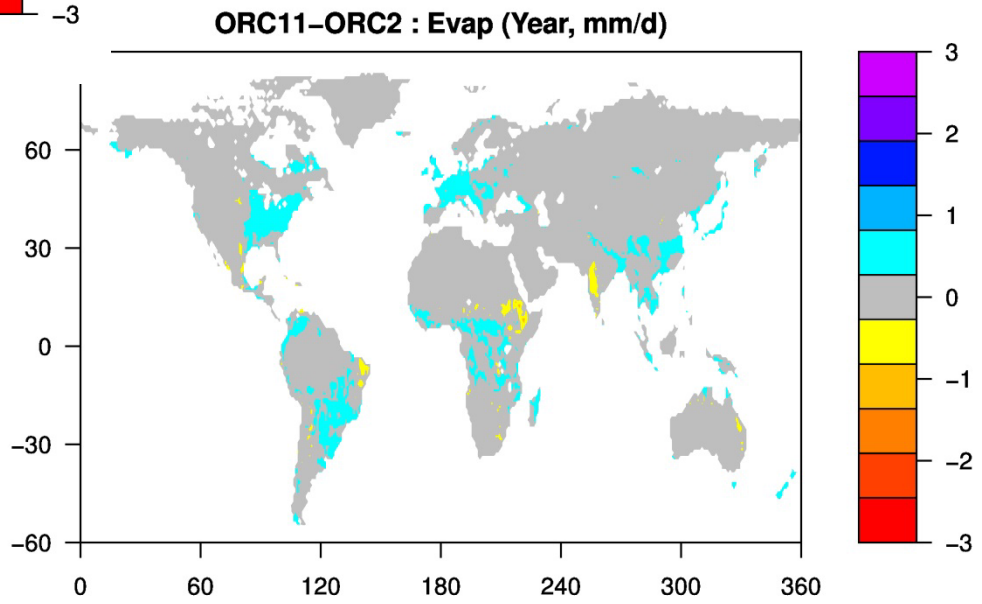


Servettaz, 2014
US-Bar
Temperate deciduous forest

BSE is very sensitive to soil hydrology in ORCHIDEE

Simulations off-line de M. Guimberteau (30 ans)





Bare soil evaporation depends on soil resistance

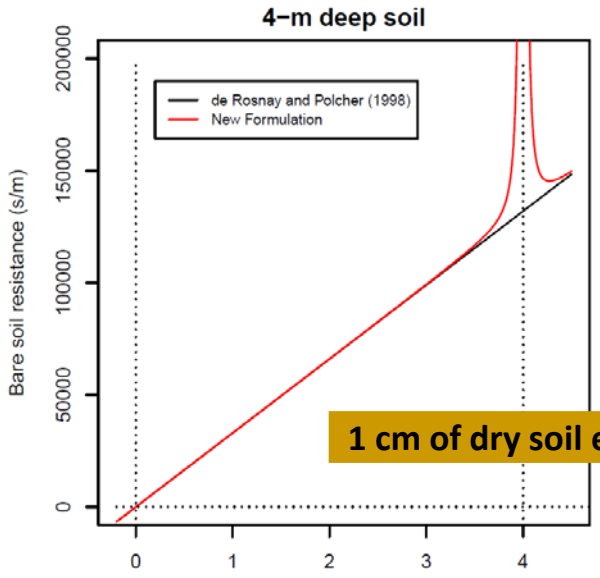
➡ r_{sol} is the main control of water stress onto bare soil evaporation

$$E_{sol} = \rho U_s \frac{q_{sat}(T_s) - q_{air}}{r_a + r_{sol}}$$

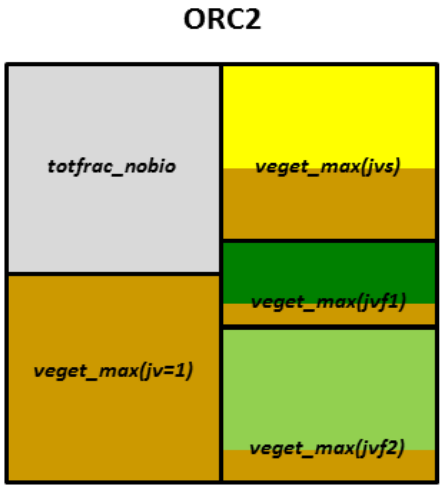
$$E_{pot} = \rho \frac{q_{sat}(T_s) - q_{air}}{r_a}$$

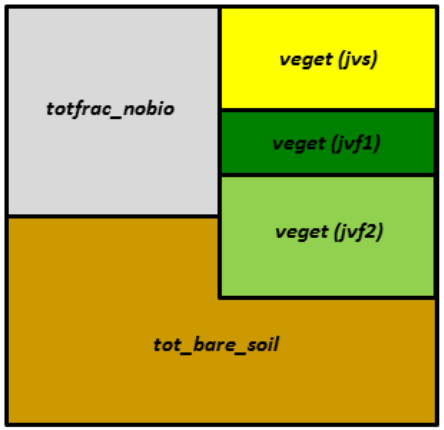
➡ r_{sol} depends on the dry soil height of **PFT 1**

$$r_{\text{soil}} = r_{\text{soil}}^{\text{m}} \left(h_{\text{dry}} + \frac{1}{100(h_{\text{tot}} - h_{\text{dry}})^2} \right)$$



1 cm of dry soil exerts r_{soil} = 330 s/m





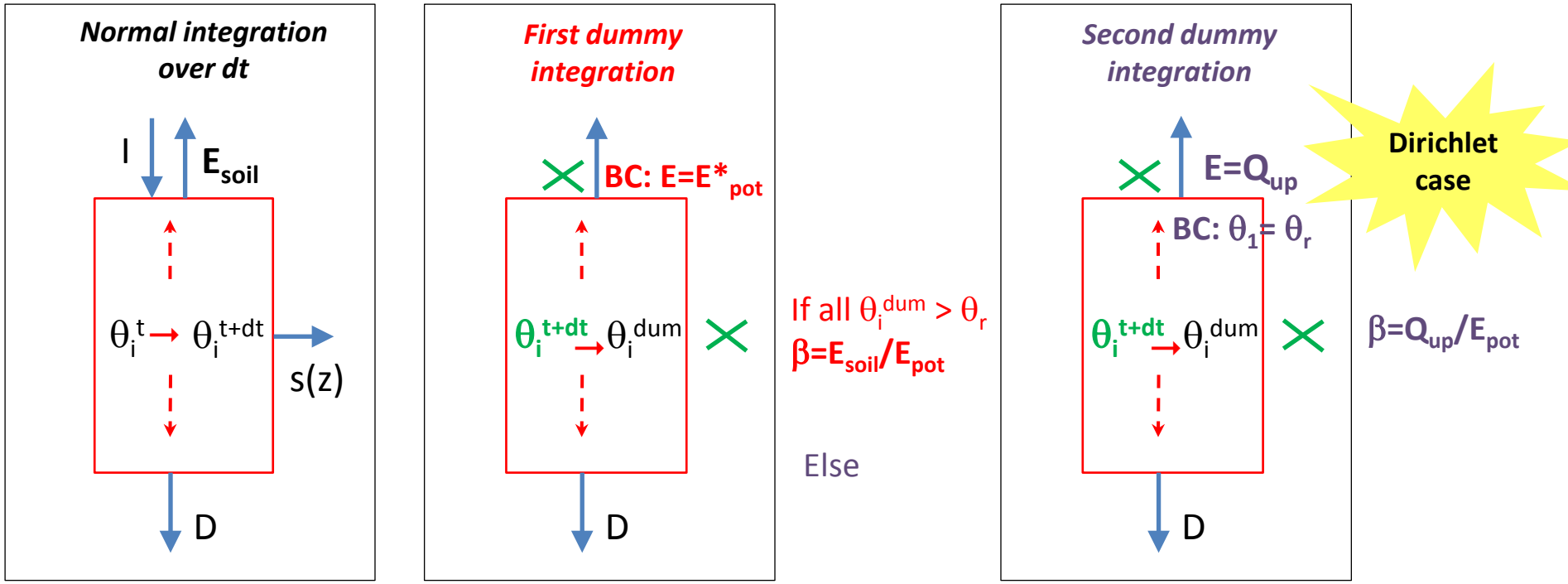
(Bare) soil evaporation controlled by demand/supply

➡ The principle is that soil evaporation follows a supply/demand approach

$$E_{soil} = \min(E^{*}_{pot}, Q_{up})$$

$$E^{*}_{pot} = \rho \frac{q_{sat}(T_w) - q_{air}}{r_a} = CorrFrac.E_{pot}$$

➡ In practice, this relies on dummy integrations of the water diffusion scheme



(Bare) soil evaporation controlled by demand/supply

➡ **Further comments**

- Note that β comes from imposing E^*_{pot}, but dividing by E_{pot} so β should never reach 1
- $\beta/2$ if the mean moisture in the litter (4 top layers) is below the wilting point

➡ **β thus E_{soil} is calculated separately in the three soiltiles**

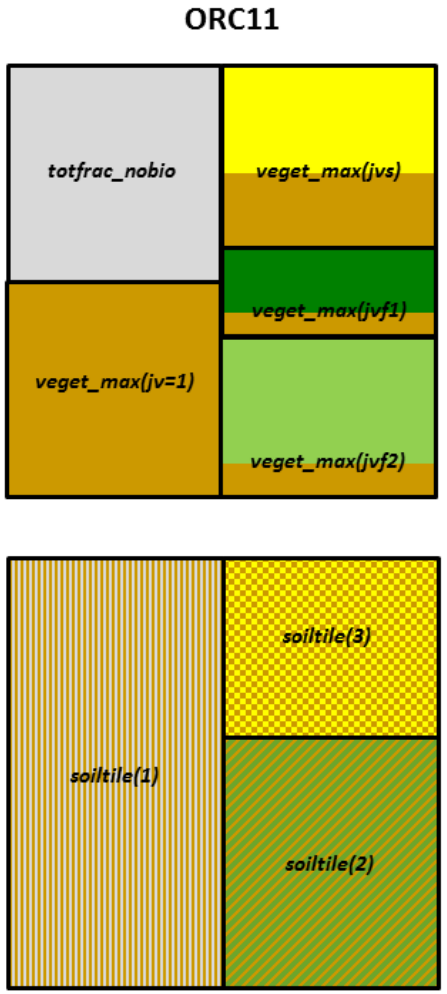
In each soiltile: β is further multiplied by frac_bare_ns

At the scale of the grid-cell:

$\beta_4 = [\Sigma_{jst} \beta_{jst} * soiltile(jst)] * vegtot$

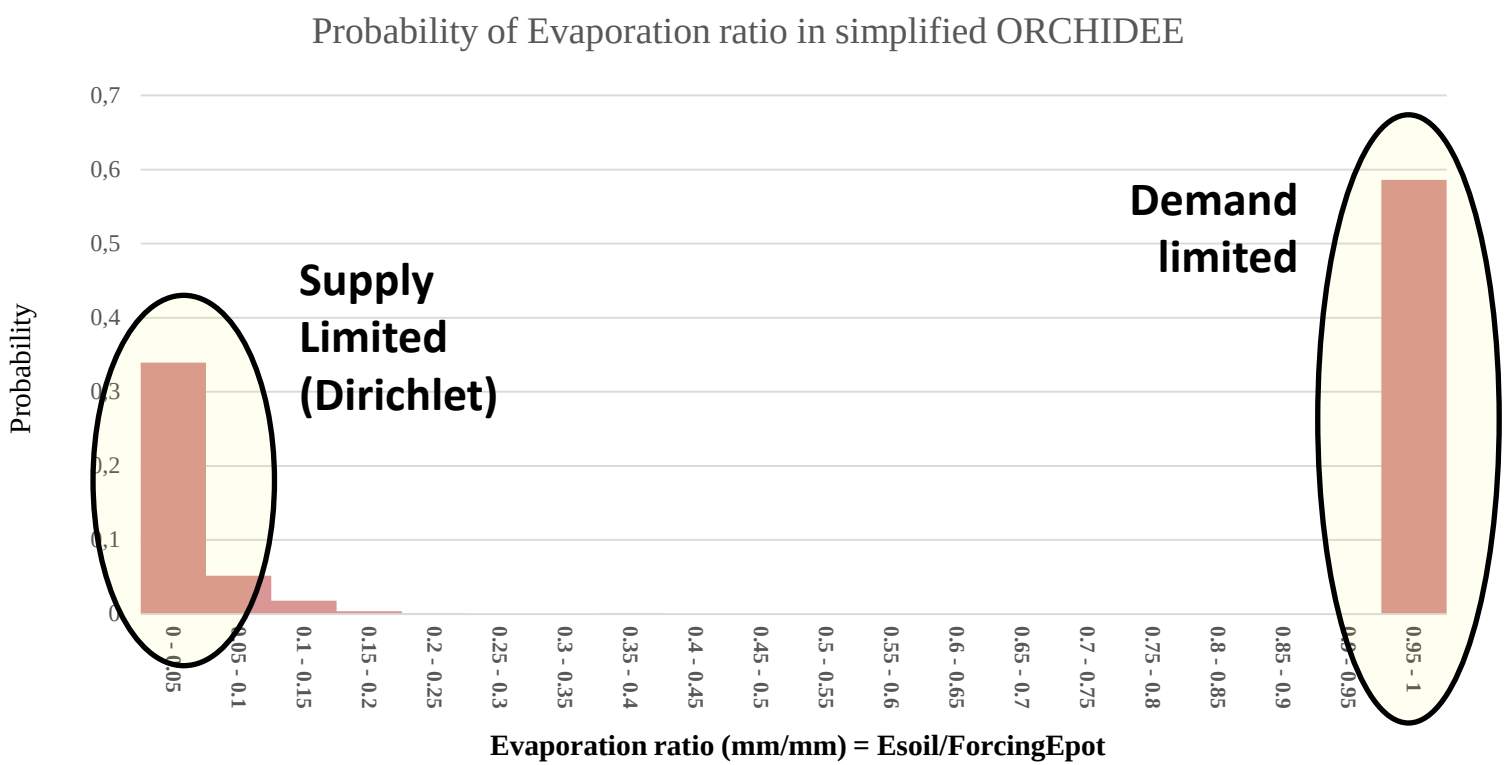
(but Σ_{jst} soiltile(jst) $\geq$ vegtot)

Question: how is z0 defined in each soiltile?



All-or-nothing behavior with multi-layer hydrology

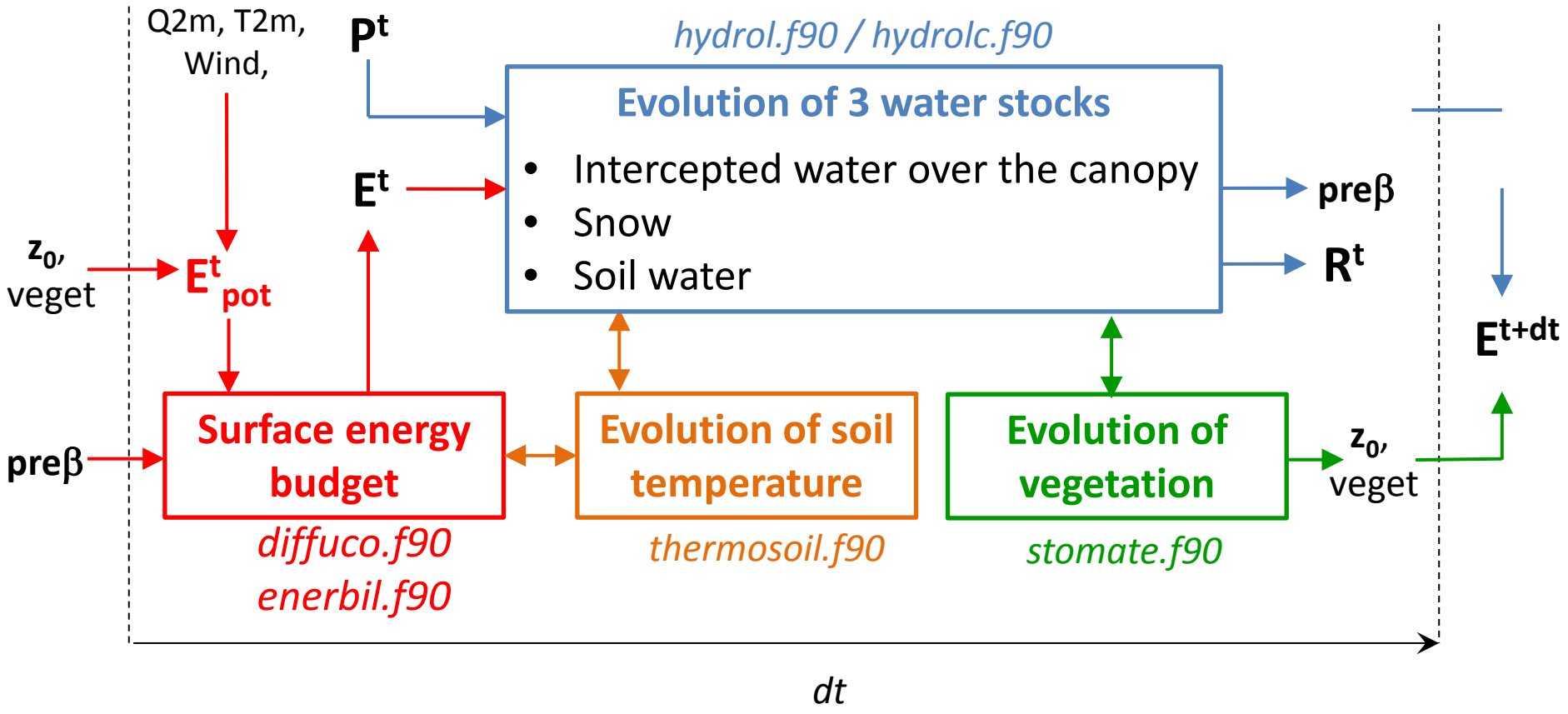
Result from R simple calculations (Tootchi, 2015)



BSE may be too high because we lack soil moisture stress

To be followed by Ardalan

BSE involved in both the water and energy budgets



E and β are separated into contributions for tranpiration, bare soil evaporation, etc.