Estimating evapotranspiration from directional TIR data

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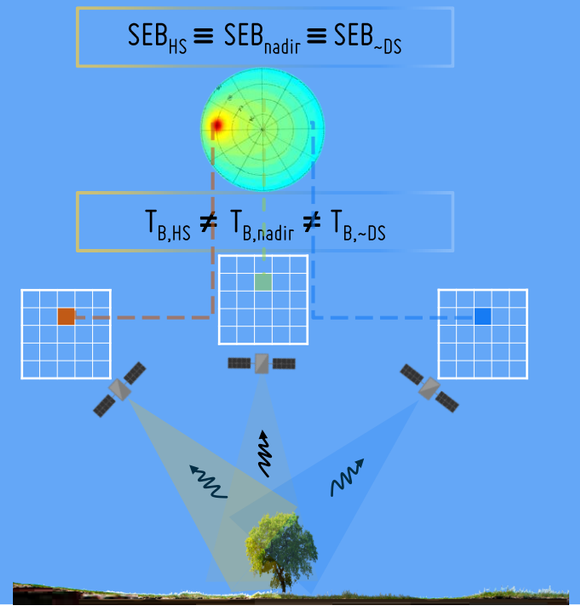


Methods : SPARSE & UFR97

- SPARSE (Soil Plant Atmosphere Remote Sensing Evapotranspiration, *Boulet et al., 2015, HESS*):

  - Two sources - soil/veg. thus 2 EB expressions:

$$R_{n,xx} - G^* = \lambda E_{xx} + H_{xx}; xx = \text{soil (g), veg. (v)}$$

  - RTM: out-of-canopy TIR formulation:

$$T_{rad.}(\theta_v) = f(T_g, T_v)$$

- Extended and coupled with the Unified François model (UFR97; *Bian et al., 2018, RSE*) – sunlit/shaded elements of soil/veg. sources:

  - Sunlit/shaded soil/veg. elements thus 4 EB eqs.:

$$R_{n,xx} - G^* = \lambda E_{xx} + H_{xx}; xx = \text{sunlit/shaded(s/h), soil/veg. (g/v)}$$

  - RTM: out-of-canopy TIR formulation:

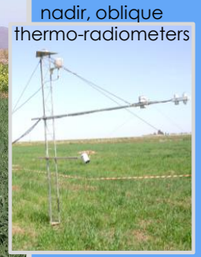
$$T_{rad.}(\theta_v, \Phi_v) = f(T_{gs}, T_{gh}, T_{vs}, T_{vh})$$

** G only applies to soil elements*

Evaluation data

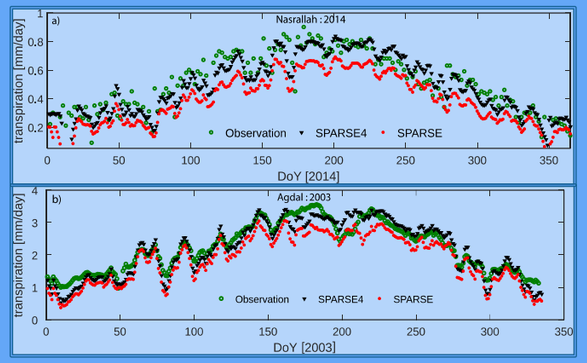
- Two Orchards - ~7% and ~60% veg. fraction cover, respectively

- R3 wheat site: two TIR datasets (simultaneously observed: oblique & nadir)

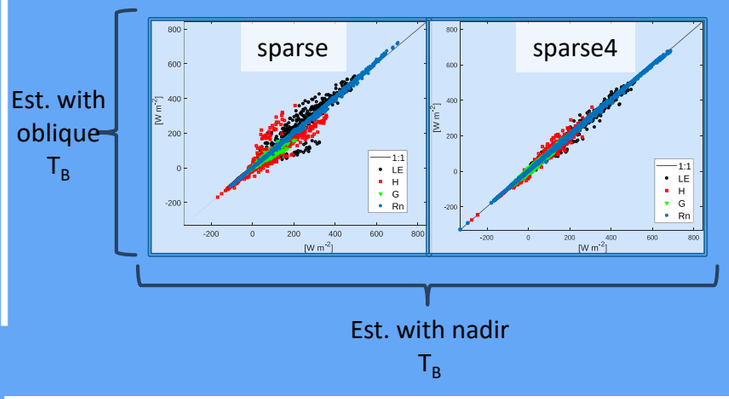


Results

- Flux partitioning : transpiration – Olive fields:



- Angular TIR data sensitivity (R3):



Conclusions

- With nadir T_B forcing, satisfactory overall fluxes are - as expected - estimated by both algorithms as anisotropic effects are negligible
- Inclusion of the solar direction (thus partitioning between diffuse/direct rad.) appears to improve the partitioning of overall LE
- Sensitivity of flux retrievals to direction of view is reduced; assessments encompassing a broad-range of viewing angles (including the hotspot region) are nonetheless necessary