



Simulation of surface temperature heterogeneity prior to assimilation: the Saada2/SudMed experiment



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CONTEXT

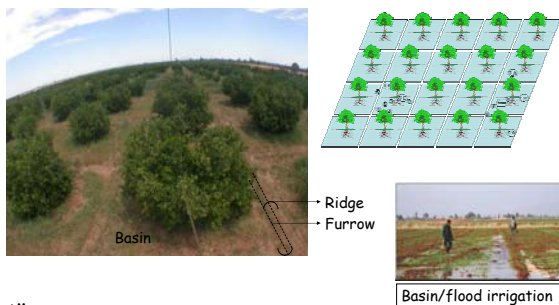
Evaluation of evaporation estimation methods to compute irrigation requirements is usually based on assessing model performance in computing total latent heat flux. However, improving water use efficiency for most irrigation practices means that bare soil evaporation is reduced and transpiration is close to the maximum. This implies that model performance must be assessed for the evaporation components rather than the total. Measuring routinely these components separately is difficult, because most methods like the eddy correlation technique measure the sole total. Directional surface temperature measurement could be a mean to evaluate how the model partitions the available energy into transpiration and soil evaporation. Prior to assimilating the remotely sensed directional temperatures, we must check that the surface temperatures simulated by the model for the different vegetation surfaces (shaded and unshaded bare soil, shaded and unshaded leaves) match the remotely sensed observed temperatures of these individual components.

OBJECTIVES

In order to check whether a Soil-Vegetation-Atmosphere Transfer model, ICARE, has the adequate description of the energy and water budget components in the case of semi-arid sparse vegetation stands, an experimental set-up was designed and installed at the Saada2 orange orchard within the frame of the SudMed project. In particular, many thermoradiometers and heat flux plates were installed to sample the variability in surface temperature and ground heat flux. The objectives of this experiment are:

- to document the heterogeneity of the water and energy balance of a sparse orchard;
- to check the ability of current Soil-Vegetation-Atmosphere models to reproduce/take into account/bypass this heterogeneity prior to assimilation

The Saada2 orange tree site



Basin/flood irrigation

Allometry

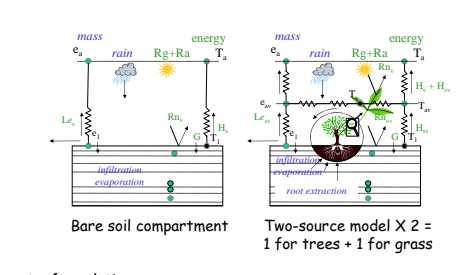
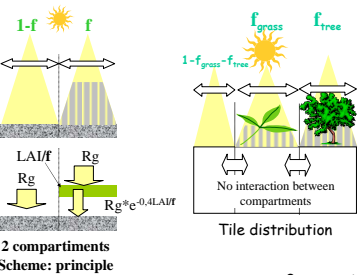
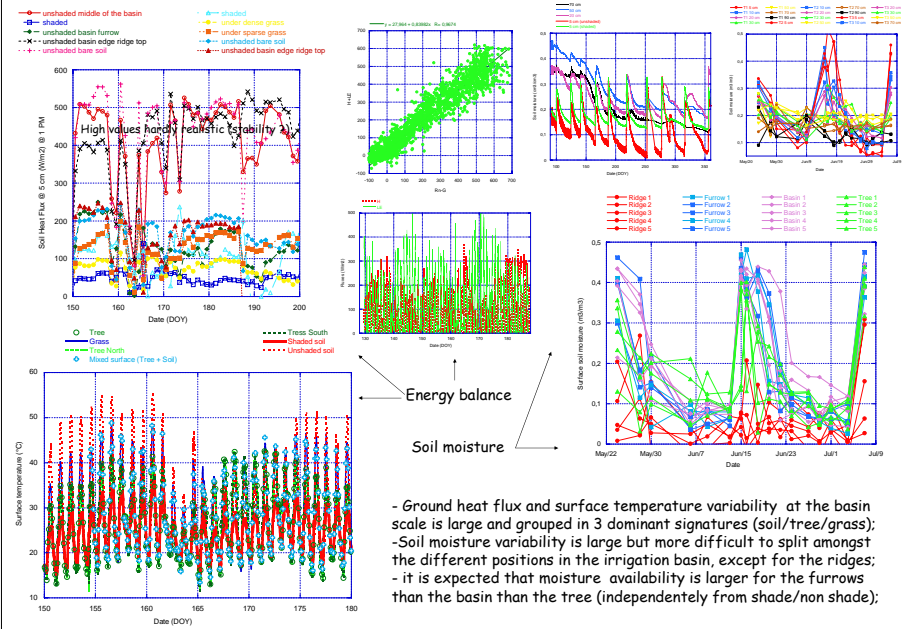
Allometry	mean	Std dev	min	max
Height (m)	3.25	0.37	2.5	3.85
Width (m)	3.74	0.65	2.25	4.7
TVAI	3.85	0.80	2.13	5.27

Trees

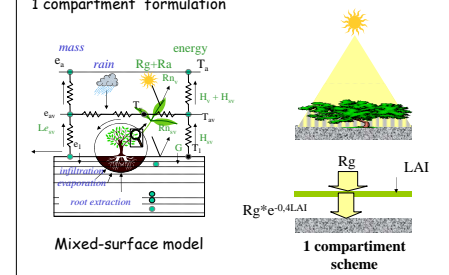
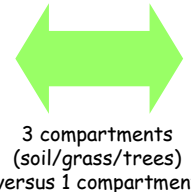
Date	Cover fraction	Height (m)	LAI
02/5/2005	0.25	0.27	0.48 ± 0.08
17/5/2005	0.29	0.38	0.67 ± 0.13
05/6/2005	0.31	0.61	0.78 ± 0.13
21/6/2005	0.5	0.69	0.95 ± 0.24
10/7/2005	0.51	0.74	1.07 ± 0.22

Saada2 is a complex system with 3 components: unshaded soil, trees and grass

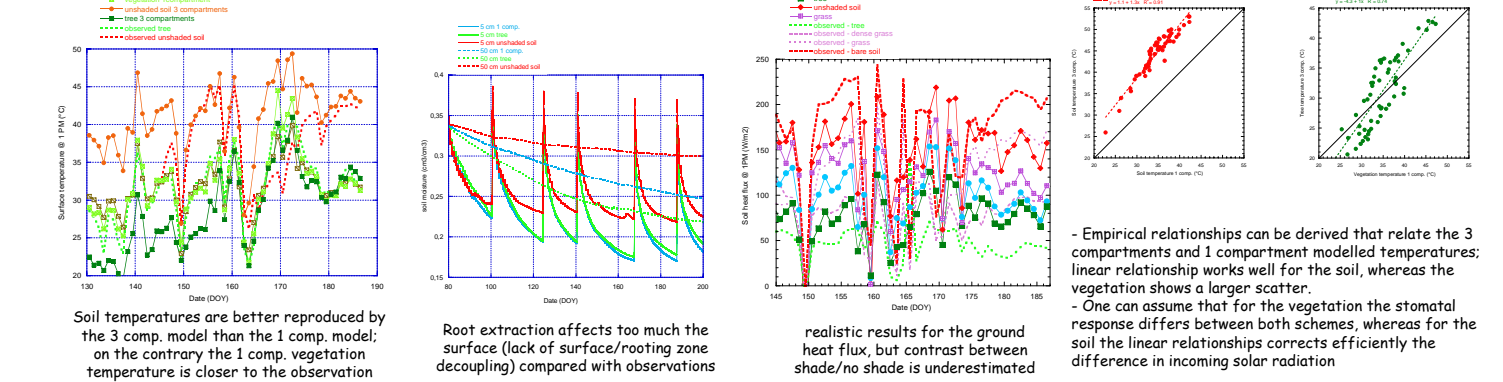
Observed heterogeneity of the water and energy budgets



2 ICARE SVAT formulations



Results



CONCLUSIONS

- Saada2 is an interesting dataset to describe the heterogeneity of the water and energy budgets for most sparse semi-arid orchards under flood irrigation
- the variability of the energy balance is reasonably well reproduced by the 3 compartments ICARE, while the 1 compartment ICARE provides a realistic average energy balance
- to assess the relevance of the 3 compartment description for the water balance, the use of independent measurements of transpiration (e.g. sap flow) is needed