Hydrol. Earth Syst. Sci. Discuss., 8, C3182–C3187, 2011
www.hydrol-earth-syst-sci-discuss.net/8/C3182/2011/
© Author(s) 2011. This work is distributed under
the Creative Commons Attribute 3.0 License.

Hydrology and Earth System Sciences Discussions

Interactive comment on "Determining irrigation needs of sorghum from two-source energy balance and radiometric temperatures" *by* J. M. Sánchez et al.

J. M. Sánchez et al.

juanmanuel.sanchez@uclm.es

Received and published: 3 August 2011

First, we would like to thank the reviewer for his/her comment/suggestion since they have contributed to improve the paper. Appropriate changes have been made following each one of the reviewer's comments/suggestions. In the following, detailed and justified responses, as well as the corresponding modifications into the manuscript (with appropriate reference to particular page and line numbers) are given.

Answer to Comments:

% âĂŤâĂŤ introduction 3939:29 Please explain why SEBAL requires heterogeniety in

surface moisture conditions, and therefore not applicable to small fields.

Following this referee comment a new paragraph has been added (page 3, line 9): “A dry or “hot” pixel, where LE is assumed to be zero, and a wet or “cold” pixel, where H is expected to be zero, are required. Due to the difficulty to bring together these two extreme conditions, SEBAL is not applicable to small crop fields (Bastiaansen et al. 1998).”

% âĂŤâĂŤ- study site and materials The final height of the sorghum is nearly 5 m! What do you think the rooting depth is? Is the lysimeter deep enough to account for the depth of the roots?

Maximum root depth for a sweet sorghum crop can oscillate between 1-2 m (Allen et al., 1998). However, in the lysimeter plot, the rooting growth is limited by the average soil depth (around 0.4 m), because of the development of a more or less fragmented petrocalcic horizon. Therefore, the lysimeter deep (1.7 m) is enough to account for the depth of the roots (no more than 0.4-0.5 m).

% âĂŤâĂŤ– model description Please explain why it is necessary to make a distinction between r_aËĘh and r_aËĘa, and then how they are different. Specific mathematical expressions are needed for each. In the Norman et al. paper they are the same. From your definitions of the two variables, they seem to be the same to me. Distinction between rah and raa is made because (page 7, line 16): “. . .transport of heat and momentum is not equally efficient over the canopy (Sánchez et al. 2008)”. Also, as stated in the text (page 7, line 7): “rah is the aerodynamic resistance to heat transfer between the canopy and the reference height at which the atmospheric data are measured (s m-1), raa is the aerodynamic resistance to heat transfer between the point z0M+d (z0M: canopy roughness length for momentum, d: displacement height) and the reference height (s m-1),”. The point z0M+d differs from the canopy height. The authors believe that including here further considerations at this point could mislead the reader. For this reason, the reader is referred to the paper containing all details about the model

HESSD

8, C3182–C3187, 2011

CC BY

scheme and equations.

In (7) the sky does not fill the entire upper hemisphere that the soil "sees." A large fraction of this hemisphere, when the vegetation fraction Pv is greater than about 0.5, is occupied by the vegetation canopy. Longwave emission from the vegetation canopy could be much higher than the longwave emission from the sky, espeically on clear days. Please explain why you can neglect emission from the vegetation that is incident on the soil surface.

We agree with the referee that in the soil-canopy-atmosphere system there can be also interaction between the soil and canopy components, and emissions from the vegetation may affect energy balance in the soil in the same way that emissions from this soil may affect energy balance for the canopy. However, the reader should note that according to STSEB scheme basis no direct coupling is allowed between soil and vegetation (Sánchez et al. 2008). In this sense this model is similar to a patch approach, and for this reason a weighting of the soil and canopy elements using their respective occupation partial areas is introduced instead.

A new sentence has been inserted (page 7, line 29): “Note that longwave emission from one component over the other is not accounted since no direct coupling is considered between soil and vegetation in the STSEB scheme (Sánchez et al. 2008).” This sentence adds to another already included in the text (page 8, line 6): “According to this framework, a complete and independent energy balance between the atmosphere and each component of the surface is established, from the assumption that all the fluxes act vertically”.

3946:14 Please explain what the "effective emissivity" is. I assume it is the surface emissivity, but it should be clearly stated.

Yes, this is the “effective surface emissivity”, first introduced in equation (2).

3946:17-20 This sentence needs to be rewritten, I do not understand it in its current

HESSD

8, C3182–C3187, 2011

CC BY

form.

Thanks to this referee comment we realized that this sentence needed clarification. This paragraph has been rewritten and completed (page 9, line 10): “Temperatures of the sunlit and shaded portions of a component (soil or vegetation) differ some degrees. Thanks to the wide field of view of the Apogee radiometers, and their deployment configuration over the sorghum, measured values of TR, and estimated values of Ts, accounted for both sunlit and shaded portions of the soil and canopy.”

3947:11 Please justify use of the value 0.2.

As stated in page 8, line 15: ”. . .CG can vary in a range of 0.2-0.5 depending on the soil type and moisture”. Some authors such as Idso et al. (1975) found this ratio increased from 0.22 to 0.51 as a wet soil dried for about 2 weeks. Other authors have carried out similar experiments, and a good review of their results is included in Choudhury et al. (1987). For this reason, this sentence has been completed to justify the value used (page 10, line 9): “A value of CG=0.2, appropriate for wet soils (Choudhury et al. 1987), was assumed in Eq. (9) to estimate G values.” Anyway, for this particular study note that impact of this value is minor due to the low values of G registered in this experiment.

3948:18 suggest "underestimate by"

This expression has been corrected.

3948:25 Please be consistent with your use of the "+ or -" notation.

We have reviewed the whole manuscript and added +/- to all RMSD values to keep consistency.

% âĂŤâĂŤâĂŤâĂŤ Figure 4 These subplots are difficult to read because they are so small. Consider making the height of each subplot larger. The time axis is ok.

According to this suggestion, plots in Figure 4 have been enlarged a bit, but not too

HESSD

8, C3182–C3187, 2011

much since two new plots have been added to Figure 4 to accomplish the requirement from another referee.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 3937, 2011.

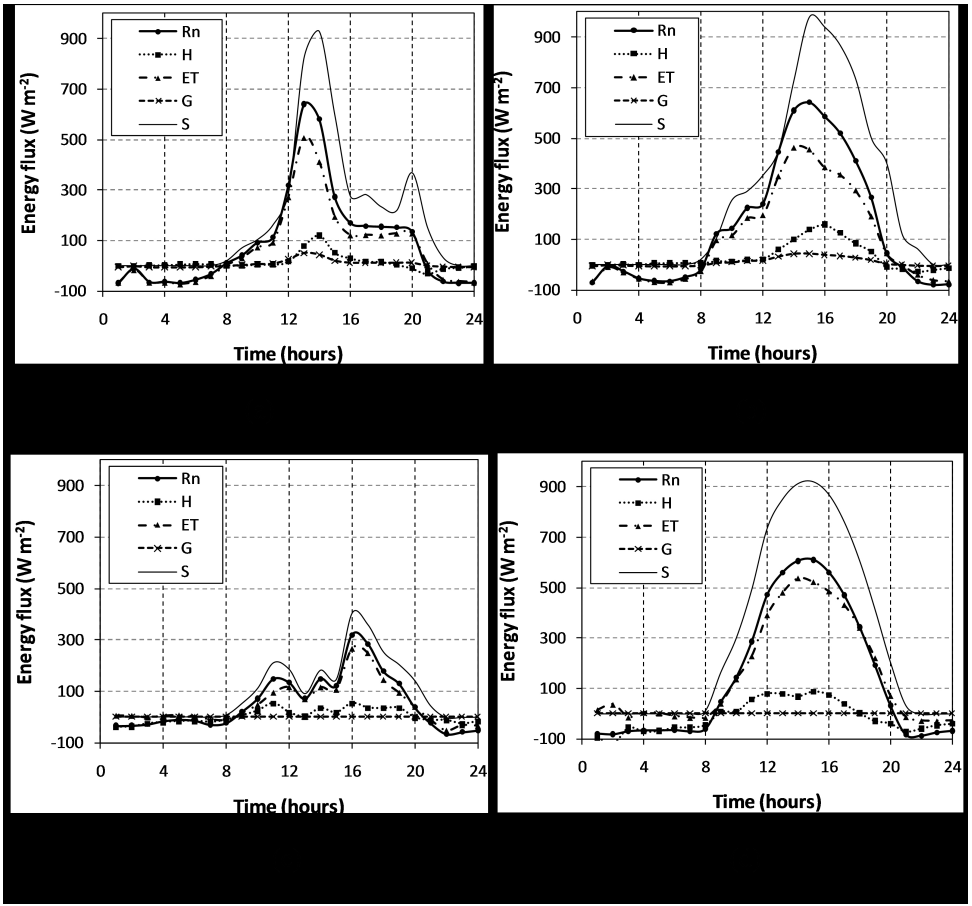

Fig. 1. New Figure 4

HESSD
8, C3182–C3187, 2011

CC BY