Hydrol. Earth Syst. Sci. Discuss., 6, S232–S236, 2009
www.hydrol-earth-syst-sci-discuss.net/6/S232/2009/

Hydrology and Earth System Sciences Discussions

HESSD

6, S232–S236, 2009

Interactive Comment

Interactive comment on "Estimation of Mediterranean crops evapotranspiration by means of remote-sensing based models" *by* M. Minacapilli et al.

M. Minacapilli et al.

Received and published: 5 March 2009

Response to Referee #1

We would like to thank Referee #1 for his helpful comments on the submitted manuscript.

1. About the "main criticism"

The main criticism of Referee #1 concerns the "question whether the nature of the applied models allow applications to pixels as small as 3 x 3 m". The referee comment deals to the "scale problems" in hydrological models supposing that "quantities such as surface temperature, albedo, LAI, crop coefficients, ... playing a role in the models

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

and method of observation do not have a clear physical meaning on such a small spatial scale". Applications of Energy/mass (water) balance models by means of high resolution remote sensing data have been carried out in these last years thanks to the recent availability of a new generation of airborne VIS/NIR and TIR sensors (ATM, MIVIS, CASI, CASI2, POLDER, etc..). Examples of these type of applications can be found in Chavez et al. (2005), (2008), Jacob et al. (2000), French et al., (2003), Neale et al., (2005) whereas the effects of remote sensing pixel resolution on modeled energy flux has been investigated by Kustas et al. (2004), Olioso et al., (2006). In this context our point of view is that, in general, the pixel size is not necessary directly related to the scale of model application. To support this concept the common way to properly analyze the outputs of distributed models, as well described in a recent HESS review paper (Dehotin and Braud, 2008), is to identify the scale or the "reference size" by using the well known "neighborhood analysis" that consists in the choice of a proper area (size and shape), or window (number of adjacent pixels), where each pixel values can be averaged to characterize the output value of the process under analysis. This to avoid problems related to inaccurateness, outliers or spare values of a single pixel based analysis. For these reasons we performed our analysis and comparisons aggregating the outputs, in a first step, using a 15x15 m regular neighboring window (typical size of our fields). Also the scatterplot reported in the Fig.7 of the paper has been created using the averaged fluxes values over the 15x15 m neighboring window. Furthermore to obtain a representative ETd value for each crop type (Fig. 11) the neighborhood analysis has been extended to the single homogeneous crop field on the basis on a vector map. We would like to highlight that we also applied the two EB (SEBAL and TSEB) models directly using spatially degraded airborne input data in both VIS/NIR and TIR spectral regions to check the reliability of our analysis. The retrieved results provided the same patterns plotted in Fig 9a and 9b.

Another comment of the referee concerns that conclusions come only from one day. We agree that the conclusions are too strong considering that the comparison has been carried out only for a single day. Therefore we will modify this part in the revised

HESSD

6, S232–S236, 2009

Interactive Comment

paper. However it is to point out that we expected a better performances of the TSEB model compared with the SEBAL ones, because it is well known the greater reliability of TSEB in simulating fluxes over sparse canopy. As observed by other Authors (French et al. 2003; Gao and Di Long, 2008; Savige et al. 2005; Timmersmans et al, 2007) the TSEB approach "provides a more physical framework for estimating spatial variability in aerodynamic surface resistance by directly considering the effects of varying vegetation cover amount on coupling between the soil and atmosphere through the soil resistances" (Timmersmans et al, 2007). From this point of view our results, even for only a single day of comparison are in according with these considerations.

2. About the "minor criticism"

We are agree with the "alternative classification of vegetation models" suggested by the referee. But as our attention is focused on actual Evapotranspiration modeling, we adopted the following classical (Schumugge, 2002) classification:

a) Models based on the "Water mass conservation laws":

- Simplified tank-schemes (at various scale);

- Physical approach (based on Richards equation and root-sink submodel for soil/plant interactions) at point, field and landscape scale.

b)Models based on the "Energy conservation law"

- Single source (or big leaf) models;

- Two source models (with different resistance schemes, i.e., "in parallel" or "in series");

- Simplified or empirical approach based on VIS/NIR and TIR relationships (triangle method, SEBI, etc.).

In this framework we choose the SWAP model as "physical" water balance model, able to simulate the soil evaporation and plant transpiration components, and SEBAL and TSEB approach as single source and two-source EB models, respectively. The differences between SEBAL and TSEB models are reported in the paragraph 2 of the paper.

Finally we agree with the referee about the omitted discussion in the introduction part of the paper about the atmospheric processes and spatial variability of the meteorological input data. We will insert in the introduction and especially in the description of the two EB models the main assumptions and hypothesis concerning the above mentioned topics.

REFERENCES

Chavez, J.L., Neale, C.M.U., Prueger, J.H., Kustas, W.P.: Daily evapotranspiration estimates from extrapolating instantaneous airborne remote sensing ET values. Irrig Sci 27: 67-81, 2008.

Chavez, J.L., Neale, C.M.U., Prueger, J.H., Kustas, W.P: Comparing aircraft-based remotely sensed energy balance fluxes with eddy covariance tower data using heat flux source area functions. J Hydrom AMS 6(6): 923-940, 2005.

Dehotin, J. and Braud, I.: Which spatial discretization for distributed hydrological models? Proposition of methodology and illustration for medium to large-scale catchments. Hydrol. Earth Syst. Sci.,12, 769-796, 2008.

French, A. N., T. J. Schmugge, W. P. Kustas, K. L. Brubaker, and J. Prueger: Surface energy fluxes over El Reno, Oklahoma, using high-resolution remotely sensed data, Water Resour. Res., 39(6), 1164, doi:10.1029/2002WR001734, 2003.

Gao, Y, and Long, D.: Intercomparison of remote sensing-based models for estimation of evapotranspiration and accuracy assessment based on SWAT, Hydrol. Process. 22, 4850-4869 (2008).

Jacob, F., Olioso, A., Xingfa, G, Hanocq, J.F., Hautecoeur, O., ; Seguin, B., Su, Z. : Using airborne vis-NIR-TIR data and a surface energy balance model to map evapotranspiration at high spatial resolution. In Remote sensing and hydrology 2000, IAHS-AISH

HESSD

6, S232–S236, 2009

Interactive Comment

publication , ISSN 0144-7815, 2000.

Kustas, W.P., Li, F., Jackson, T.J., Pruger, J.H., MacPherson, J.I., Wolden, M.: Effects of remote sensing pixel resolution on modeled energy flux variability of croplands in Iowa. Remote Sensing of Environment. 92:535-547, 2004.

Neale, C., Jayanthi, H., Wright, J.: Irrigation water management using high resolution airborne remote sensing, Irrigation and Drainage Systems, Vol. 19, No. 3-4, pp. 321-336, 2005.

Olioso, A., Rivalland, V., Faivre, R., Weiss, M., Demarty, J., Wassenaar, T., Baret, F., Cardo, H., Rossello, P., Jacob, F., hasager, B., Inoue, Y.: Introducing Remote Sensing Data at various spatial resolutions into a dynamic SVAT model. In Earth Observation for vegetation monitoring and water management, Edited by D'Urso, G., Jochum M.A.O, and Moreno J., AIP Publication, 2006.

Savige, C., Western, A., Walker, J. P., Kalma, J. D., French, A. & Abuzar, M.: Obtaining surface energy fluxes from remotely sensed data. In: Proc. Modelling and Simulation (ed. by A. Zerger & R. M. Argent), 2946-2952, MODSIM 2005 Society of Australia and New Zealand, 2005.

Schumugge, T.J., Kustas W.P., Ritchie J.C., Jackson T.J. Rango, A.., (2002) Remote sensing in hydrology. Adv. Water Resour., 25, 1367-1385.

Timmermans, W.J., Kustas, W.P., Anderson M.C., French, A. N.: An intercomparison of the Surface Energy Balance Algorithm for Land (SEBAL) and the Two-Source Energy Balance (TSEB) modeling schemes, Remote sensing of environment, vol. 108, n. 4, pp. 369-384, 2007.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1, 2009.