Hydrol. Earth Syst. Sci. Discuss., 11, C5961–C5963, 2015
www.hydrol-earth-syst-sci-discuss.net/11/C5961/2015/

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Monitoring and modelling of soil–plant interactions: the joint use of ERT, sap flow and Eddy Covariance data to characterize the volume of an orange tree root zone" *by* G. Cassiani et al.

T. P. A. Ferre (Referee)

tyferre@gmail.com

Received and published: 7 January 2015

This is a very well considered hydrogeophysical investigation of soil-plant interactions in the root zone. The authors have collected a wide range of data, allowing for a clear interpretation of the value of geophysics for inferring root zone processes. In some cases, I think that their choices could simply be stated with less defense of their decisions to shorten the paper. But, in general, the work is presented clearly. I will review the main messages that I took from the paper and then make a suggestion for

revision below.

The authors have conducted a 3D ERT survey of water content changes over a two day period, including an irrigation event. The found that water content changes could be described adequately as 1D, vertical. They conducted laboratory analyses of soil hydraulic properties and assumed that they were constant throughout the domain. Similarly, they established a single universal pedotransfer function for the domain. Finally, they assessed the depth of the root zone based on observations of the time lapse data (and a somewhat unclear discussion regarding limiting the uptake to a restricted zone). WIth these restrictions, they fitted observed changes in ERT-inferred water contents with depth to model results with only one free parameter - the surface of the root zone.

The fit of the best model to the data is generally good. But, the lack of fit below 40 cm seems to indicate that the soil hydraulic properties imposed do not fully represent the system. Given the generally recognized difficulty of measuring soil hydraulic properties in the lab for field predictions, I would be tempted to allow some of the hydraulic parameters to vary during inversion, too, to get a better fit.

The preceding is a small detail. My larger concern is that the interpretation, in terms of an area involved with root water uptake, does not seem strongly supported. Isn't the rate of uptake a combination of root density and per-root uptake rate? That would seem more physically reasonable than assuming a constant rate of uptake with only some of the soil participating. Similarly, I would not necessarily expect constant root water uptake from each depth. Perhaps the authors reported the root density versus depth and I missed it. At a minimum, the authors could use HYDRUS with depth dependent root water uptake as a clearer representation of root processes. All of this is meant to encourage the authors to tighten up the interpretations related to root processes. This is a strong and unique data set that should help to establish hydrogeophysics in a relatively new field. It would be great to make sure that people in that field see information presented in a context that will speak clearly to them!

HESSD

11, C5961–C5963, 2015

Finally, I would ask the authors to make a special effort to demonstrate the value of the geophysical data. It would require an additional set of analyses, but it would be very helpful to try to interpret (with uncertainties reported) the root uptake with and without the ERT data. How much more can you say (or how much more accurately can you say it?) Again, it would be great to be able to point to this article when we want to make a quantitative case for including geophysics in root zone monitoring efforts!

Sincerely Ty Ferre

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 13353, 2014.