

***Interactive comment on “Kalman filters for assimilating near-surface observations in the Richards equation – Part 3: Retrieving states and parameters from laboratory evaporation experiments” by H. Medina et al.***

**Anonymous Referee #2**

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The authors present an interesting experiment that employs laboratory environment to evaluate the performance of a dual kalman filter for estimating states and parameters. Please see specific comments below:

1. I think the section describing the context of this contribution is rather poor. The subject of dual state parameter estimation is not new (Boulet et al. (2002), Moradkhani et al. (2005), Qin et al. (2009), Montzka et al. (2011), Liu and Gupta (2007), De Lannoy et al. (2007) to name a few). One common theme in these studies is that the

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state augmentation methods ignore the time-invariance property of the parameters, which is how these soil parameters are handled in most modeling systems. In this study also, this issue is ignored. In fact, Liu and Gupta (2007) provides a description of the limitation of the joint state and parameter estimation approaches. I suggest that the authors revise the introduction section and provide a better context of this work in view of all these prior works.

2. Line 25 (p 13375): What is "noise observations.." ? In fact, this whole sentence is awkward.

3. Line 10 (p 13377): "Actually, data assimilation ..." - this sentence looks out of place, including the reference.

4. Since the authors have control of the laboratory environment, I wonder why some of these parameters (Ks) weren't measured directly (instead of relying on an earlier published work)?

5. The trends in Figures 2 and 3 are interesting. Why is it that the values of alpha converge to a higher value, though the starting point is closer to the reference truth? Similar trends can also be seen in n where it is moving away from the reference value.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 13373, 2012.