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Discussions

Interactive comment on "Inferring soil salinity in a drip irrigation system from multi-configuration EMI measurements using Adaptive Markov Chain Monte Carlo" *by* Khan Zaib Jadoon et al.

Anonymous Referee #1

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The paper by Jadoon et al. addresses the estimation of parameter error for inversion of electromagnetic induction measurements, using a Bayesian framework. Overall the inversion approach and the Bayesian procedure for parameter error estimation have valid scientific merit. Nevertheless, I have some concerns on the experimental dataset that was used. The structure of the paper needs moderate revisions.

Specific comments Title. The paper never attempts to calibrate the ECa readings to actual salinity estimations. Therefore the title is not reflecting the contents of the paper. ECa does not equal to salinity. The interpretation of ECa is much more complex. The experimental data of the paper deals with a highly conductive medium (wet & saline soil) and a non-conductive one (dry soil). The results should be therefore discussed in

this light.

L67-78. This is a summary of what's done in the paper. I would rewrite this section featuring what the objectives of the paper are. (If you want to guide the reader through the paper by explaining the workflow, then do it at the beginning of the Materials and methods section.

L79. Start the Materials and methods section by describing the synthetic and experimental data. Currently such descriptions are in the Results and Discussion session: they do not belong there. L98-99 "The assumption made in this formulation is that each layer is uniform with infinite horizontal extent." It would not hurt to know a little more about this assumption. L99-101- "The electromagnetic forward model, which is based on high induction number assumption, returned more reliable apparent electrical conductivity values than the standard sensitivity curves of McNeill (1980)." This should be moved up (L 82?) and rephrased as: "preliminary analyses indicated that. . ." L103-108 "Lavoue et al. (2010) and Moghadas et al. (2012) . . . to be a homogeneous half-space." These lines seem a little out of place here. Maybe you should move them to the section where the experimental data is described.

L118 I think you should explain Eq (5) in words so to warrant faster understanding.

L134 "Here, an informative uniform prior for all five (three conductivities and two thickness) parameters" Describe the parameters earlier on. L135. Awkward wording: maybe a verb is missing? L136. "The problem now reduces to simulate (sample) this posterior." Awkward phrasing: reword the sentence.

L142-167. This part belongs in the Materials and methods section. L185. pdf (?): define at first appearance

L204. Experimental data. This is the section that needs the most re-writing. Large portions of this belong in the Materials and methods section. Specific notes. -Pullman is in the state of Washington. (there are other 4 cities with the same name in the USA)

- Could not understand the sentence "5TE and EMI measurements were carried out on the same day 8 hr after the drip irrigation system was stopped, so that the soil moisture concentration below the drippers be avoided, and the time be given for the reduction of soil moisture impact due to root water uptake, evaporation and infiltration (Jadoon et al., 2015)."

L239 here's my only methodological issue with this paper. You use as non-conductive scenario a soil that is completely dry. (By the way, what are the salinity values measured at this site? E.g., the conductivity of the saturated paste extract?). In their protocols for use of apparent electrical conductivity measurements in agriculture, Corwin and Lesch state that the soil volumetric water content should be at least 50% of the value at field capacity (ideally between 70% and field capacity. Otherwise, the liquid pathways of electrical conductivity through the soils would be interrupted, unpredictably increasing the resistivity of the soil. This is very likely reason why your results on the non-conductive scenario are not encouraging. My criticism is the following: with one scenario where ECa is known not to be reliable, is the other scenario (highly conductive medium) enough to provide context to your data analyses? I fear not. I think this paper would make much better of a point if other scenarios (e.g., increasing water contents?) were presented. See: Corwin, D.L., and S.M. Lesch. 2013. Protocols and guidelines for field-scale measurement of soil salinity distribution with ECa-directed soil sampling. J. Environ. Eng. Geophysics 18(1):1-25. and: Corwin, D.L., and S.M. Lesch. 2005b. Characterizing soil spatial variability with apparent soil electrical conductivity: I. Survey protocols. Comput. Electron. Agric. 46(1-3):103-134.

L283-291 this section should be rephrased and moved to the conclusion L292-3006 generally, this section is not a conclusion but a summary.