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Hydrology and Earth System Sciences Discussions

Interactive comment on "The impact of land model structural, parameter, and forcing errors on the characterization of soil moisture uncertainty" *by* V. Maggioni et al.

V. Maggioni et al.

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We would like to thank Anonymous Referee #3 for his/her helpful comments and suggestions. Herein we provide brief answers to his/her comments but, during the final phase, we will be providing a more extensive response and will revise the manuscript to address the reviewer's comments.

1. The authors are willing to include a more detailed description of the Catchment Model in the revised manuscript and to describe possible soil moisture/vegetation interactions associated with these parameterizations. As suggested by the reviewer,

additional performance metrics will also be included in order to give a more comprehensive quantitative analysis of the results.

2. In this study, we are not looking for the most sensitive parameters, but rather identify a subset of parameters to which the model shows sensitivity to use in the parameter perturbation approach. The parameter combinations selected to represent the modeling uncertainty are those addressing the equifinality hypothesis, namely, providing indistinguishable (according to a metric threshold) model performances in terms of soil moisture simulations. As suggested by the reviewer, the sensitivity of the parameters might change as a function of the state variable. In the revised manuscript, we will make clear this point and refer to Rudiger et al. (2010), by specifying that in this study we are only looking at the impact of different parameter combinations on surface and root zone soil moisture model estimates.

3. Our previous study (Maggioni et al. 2011) did not show any dependence of the simulated soil moisture uncertainty on the spatial scale. Moreover, the 25km spatial resolution was chosen as the target of this study with a view toward satellite-driven land data assimilation at the global scale. Most global scale satellite products are available at 25 km resolution.

4. As we argue in the paper, 14 ensemble members should represent well the ensemble variability given that we deal with long time series and a large study domain. Specifically, we are considering a 3-year time series of 3-hourly model simulations, and a domain of 220 pixels (25-km resolution) covering the whole OK. These ensemble time series represent a significant sample size of independent data to ensure statistical significance. As to the way ensembles were created, we will make sure to clarify the procedure in the revised manuscript.

5. The average exceedance ratio reduces from 0.61 (0.64) in case F to 0.54 (0.59) in case M2F for surface (root zone) soil moisture due to the variability added by the prognostic perturbations. Therefore, by combining forcing and prognostic perturbations, we

improve the characterization of uncertainty in the soil moisture ensemble. However, this improvement is marginal compared to M1F method that drastically reduces ER (0.39 and 0.35 for surface and root zone soil moisture, resectevely). This statement will be included in the revised manuscript.

Minor Comments

1. We are here referring to both spatial and temporal uncertainties.

2. We mean that usually (over the globe) field observations are very scarce. We are not referring here to the specific Oklahoma case. We will make this clearer.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 2283, 2012.