Hydrology and Earth System Sciences Discussions

Interactive comment on "Advancing data assimilation in operational hydrologic forecasting: progresses, challenges, and emerging opportunities" *by* Y. Liu et al.

The paper provides a broad review, from multiple angles, of DA application in operational hydrologic forecast regarding its progresses, theoretical and practical challenges, and research opportunities. Generally speaking, the paper is well written and surveys adequate literature for its purposes, as well as offers a well-designed decomposition of related macro-topics to many interesting perspectives that may help one better understand some details about hydrologic DA research and application. However, the authors need to consider and address these comments and suggestions before publication of the draft.

(1) Because the paper focuses on challenge and opportunity (also progress) for DA application in operational hydrologic forecast, the current way of introduction of DA theory (section 2) looks like somehow redundant. A more concise way of introduction would be appropriate.

(2)Page 3421, the second paragraph, here the authors want to contrast the DA for hydrology application with that for meteorological and atmospheric application; however, the picture is vague: why DA application for meteorology could achieve more progress (as the authors claimed in the paper) ; is this difference mainly related to the building of community-supported, open-source modelling systems, or other physical or dynamical reasons (regarding the difference between land hydrologic and atmospheric systems) could play an important role?

(3)Section 3.1, here the authors talked less about another group of precipitation uncertainty and its representation in operational DA for hydrology: the uncertainty from GCM or regional climate model that produce the precipitation forecast; because a lot of seasonal (and large-scale) hydrological forecast applications are based on using precipitation from these models, more discussion and references are needed for this category;

(4)Section 3.3.4,it's not clear that how to quantify the capability of the multi-model ensembles for representing the uncertainty of simulating processes; e.g., the options that the multi-model framework provides may not fully include all the possible processes-level representations, or say, incomplete sampling of the structural space;

(5)Page 3441,second paragraph (Line13-29),here the authors talked about mapping coarse resolution remote sensing data with model estimates; there is an important issue that can affect the efficiency of DA methods to use remote sensing data: the intrinsic correlation among model estimates that are within a same grid of remote sensing data; say, if the model estimates show large heterogeneity, the benefit of knowing their spatial aggregation might be relatively small compared with the homogeneity counter-

parts. Since this issue might provide both challenge and opportunity for DA application, the authors may want to give comment and discussion about it.