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Hydrology and Earth System Sciences Discussions

Interactive comment on "Improving the characterization of initial condition for ensemble streamflow prediction using data assimilation" *by* C. M. DeChant and H. Moradkhani

Anonymous Referee #4

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This paper is following a long series of papers on ensemble DA techniques and their applications by the author(s) from 2005 onwards. There are no advances in the PF technique itself. However, it is applied in a very important area from operational perspectives. Too often we have seen the "death valley" that lies between researchers' delicately designed experiments and the operational environment. This study sets up an example of bridging the gap between research and operations, by applying a well-know technique in research community into the operational ESP at multiple operational basins for the first time. The necessity of ensemble initialization of ESP has been long recognized by RFCs and the OHD, but not explored yet. Overall, the paper well fits into

the scope of this special issue. On top of comments/suggestions from other reviewers, I have only several minor comments mostly for clarification purpose.

1. I would suggest the authors list the (# of) SNOTEL sties used in assimilation experiments at each basin (Table 1). In the same table, the authors may also want to list how many tiers (elevation bands) of each basin (I guess not all of them are three-tiered?) to support the discussions on the representation of different bands by SNOTEL sites in the result section.

2. From Fig. 2, the statement "This figure shows that the middle elevation band is well represented in terms of elevation" (P7212, L8-9) seems not evident. To reach that conclusion, each band for each basin should be highlighted, along with the DEM overlap. Thus, the corresponding results need to be revisited. Actually, many SNOTEL sites are located in the top band of basins in general.

3. P7213, L19, are SNOW17 parameters updated in this study? If yes, which ones?

4. Equation (2), the author should specify how areal SWE (which is assimilated to the SNOW17 via the PF) is produced from point observations. In addition, how is the observation error is defined? For a specific basin, is it consistent for each year? Is it consistent for different basins?

5. SWE is assimilated to update snow water storage. Except for that, are there any other SNOW17 states also updated?

6. P7215, L17-26, please be more specific about "sequential state estimation experiment", how is that set up? Why "a sufficient number of time-steps" is required here? Given that the major difference between ESP-DA and ESP is initialization, it worth presenting how the ensemble states are generated for at least one test basin for demonstration purposes.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 7207, 2011.