Hydrology and
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Interactive comment on "Identification of hydrological model parameters variation using ensemble Kalman filter" *by* Chao Deng et al.

Anonymous Referee #2

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General evaluation:

This paper illustrates that temporally variable parameters can be estimated with EnKF. The paper can be resubmitted after major revision and I give a series of comments to be handled. The two main points are:

(1) Do the found parameter variations in the real-world case show a significant trend? Why do these parameter values fluctuate so strongly?

(2) The explanation of the apparent trend in the parameters is not convincing to me. I ask the authors to provide long-term time series of precip and potential ET, discuss the potential role of factors like increasing water use efficiency of the vegetation and increased groundwater pumping in the area. Other data sources like trends in groundwater levels would also be helpful. It should be remembered that with this very simple

hydrological model the parameters incorporate many processes and a physical interpretation is difficult.

Detailed points:

L 52: This should not give time dependent parameters and points to a problem in the model.

L62-L63: Rephrase.

L73: Add Kurtz et al. (2012, WRR) who performed a detailed study on modelling time dependent parameters for a hydrological system. Also Montzka et al. (2013, VZJ) estimated time dependent parameters.

L75: Please provide more details about this study as Vrugt et al. (2013) showed problems associated with estimating time dependent parameters.

L76: retrieve,

L80: see earlier comment.

L117: skip typical.

L119: give original references (i.e., Evensen (1994), Burgers et al. (1998)).

L137: "following" instead of "followed".

L138-L139: Why is this needed? This is normally only applied for the particle filter.

L155: give an earlier reference.

Page 10: I think it would be better to use the standard notation like overbar for an average and C for covariance matrix.

L178: What does this mean? Tuned? Trial and error? Parameters do not have physical meaning.

L186: This is however usually applied for the particle filter. Is it done here?

L228: It should be made clear and explicitly stated that these are synthetically generated parameter time series.

L275: Reformulate.

L282: What about crop/vegetation data?

L291: The estimation of parameters

L314: skip "to".

L321: "(. . .) to a certain degree"

L332: "On the other hand, the bottom panel demonstrates that (. . .)"

L341: Is the trend slope significantly different from zero? The fluctuations are so strong that this seems not so clear. These strong fluctuations should also be explained .

L349-L351: Rephrase sentence.

L357-L358: Rephrase sentence. Skip "the" and "parameter" instead of "parameters".

L380: change to: "assimilating runoff observations".

L384: skip "drawn as follows".

L405: "parameter" instead of "parameters".

Figure 8: I would expect that in the long-term the water balance should be zero and if precipitation does not decrease, why would runoff reduce? Please plot in the paper also long term time series of yearly precipitation and potential evapotranspiration. Is it possible that ET reduced in relation to other factors and that the relation between actual ET, potential ET and precipitation was related to a CO_2-induced change in water use efficiency of the plants? Were groundwater abstractions increased in this area?