

Interactive comment on “Assimilation of wide-swath altimetry observations to correct large-scale river routing model parameters” by Charlotte M. Emery et al.

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General Comments

This paper presents a data assimilation experiment using synthetic observations from the planned Surface Water Ocean Topography (SWOT) mission to update the Manning roughness parameters of a large scale routing model. The assimilation method used in the Asynchronous Ensemble Kalman Filter (AEnKF) with a 21-day time window (one orbit repeat cycle) which allows for measurements at different locations acquired at different times to be included in a single assimilation step.

C1

The application of the AEnKF is logical considering the specificities of the data and this is a useful contribution to the work preparing for SWOT.

I recommend publication with major revisions, including a thorough review for improving language.

My main comment relates to the specificity of the study as a synthetic experiment and with how some of the simplifications/assumptions are presented. I recommend further discussion on the impact of these on a study using real data, and on the estimates of uncertainties which are crucial to any assimilation experiment.

These are specifically:

- 1) The assimilation of depth rather than elevation
- 2) The fact that the truth is generated by the same model:
 - no model structure error
 - there is a “real” Manning to converge to, which might not be the case with real data
 - even in PE3, the bathymetry is not significantly changed, only the river bed elevation.
- 3) Assumption of perfect forcing

Specific Comments

P6, l.21: this is brought up later when the anomalies are assimilated, but more focus should be placed here on the fact that depth is assimilated while SWOT will produce elevations. The conversion from level to depth is one of the big issues with using altimetry in hydrological studies. Does the SWOT simulator directly produce depths? You are assuming known river bed elevation, and this should be clearly specified. (I can see this is mentioned p11, l.26 but that is too late in the paper).

P7, l.9: similar issue as previous comment, elevation and not depth is required at 10cm accuracy. The depth accuracy will be much lower. You assume no representativeness

C2

error due to scale, but how about level vs. depth?

P8, l11: Would this be necessary if you had a better representation of your measurement error (re: previous comments)? What is the magnitude of this additional error?

Technical Corrections

At some points vague language is used (f.ex: "without really converging"), please be more precise.

P7, l.25: It is not clearly explained if x_k are the Mannings coefficients themselves or the multiplying factors as described above. This issue is repeated elsewhere in the paper and while I understand x_k does refer to the factors, please make sure this is clear throughout.

Figure 8: the black lines cannot really be seen, perhaps increase the width?

See attached pdf file for other technical corrections and comments

Please also note the supplement to this comment:

<https://www.hydrol-earth-syst-sci-discuss.net/hess-2019-242/hess-2019-242-RC2-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-242>, 2019.