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Interactive comment on "Estimating Surface Carbon Fluxes Based on a Local Ensemble Transform Kalman Filter with a Short Assimilation Window and a Long Observation Window" by Yun Liu et al.

Anonymous Referee #1

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1 General Comments

The authors provide a novel re-imaging of the canonical RIP technique in the LETKF through the no-cost smoothing approach in order to provide a better spin-up of the ensemble accuracy. The method is used to estimate surface carbon fluxes through a sophisticated model using real-world observations. Quantifying Earth's is an essential part of our modern understanding of the Earth's climate.

The approach is certainly novel and has the potential to be applicable to a wide range of geophysical—and large-scale in general—data assimilation problems.

2 Specific Comments

Section 3: It is not immediately clear what error is being measured, and why it is not a time-averaged RMSE.

Section 2.2 talks about throwing away 'low-quality' observations. As the authors no doubt know, the Burns Effect places a significant burden on making sure that no unique correct observations are discarded. The reviewer would like to see more justification for this sort of heuristic.

In Section 2.2 again, the reviewer would like to see more justification of this type of pseudo-observation.

In section 2.5: As far as the reviewer can tell the paper never explicitly mentions the size of the component space (nor frankly any roughly estimated dynamical properties of either the system or the model) of the model, thus it is impossible to gauge the sufficiency of the ensemble size.

In Section 2.6 Additional clarification about additive inflation being randomly selected from the nature run would be appreciated.

In the conclusion the authors talk about advantages over that of 4D-LETKF, but omit to mention vanilla 4D techniques, which are still state-of-the-art, and against which such computationally intensive smoothing would have to compete.

3 Technical Corrections

The overall document could use some basic proofreading to address fundamental grammatical and lexical issues. A non exhaustive list:

- p11 l1: LETKF
- p11 l11: LETKF
- p12 l5: the first two months
- Honestly all of section 2.6