

The authors provide a novel approach to estimating surface carbon fluxes through an application of the LETKF. Using a combined RIP, and low-cost smoothing approach the authors re-create a procedure similar to that of a sliding window 4DVar approach.

1 General Comments

1. Whilst the LETKF is very strong an popular algorithm, the problem being solved here is not a state-space estimation problem, but a coupled state-space estimation and parameter estimation problem, at least that is what is described in p915. It is well known that perturbed observation filters, while not as good at the state estimation problem, excel at the parameter estimation problem. RIP and low-cost smoothing also exist for that type of filter. It would be beneficial to the reader to explicitly explain why in this particular application the authors believe that the LETKF would produce a better estimate of the quantities of interest, as in, the parameters.

2. Very much related to 1, the authors attempt to counter-balance the issue by adding what is essentially process noise to the inverse problem in the additive inflation step (section 2.6), which starts to violate the assumed analysis error statistics, and introduces variance in the estimates of the statistics similar to those in a perturbed observation filter. The upsides are discussed, but the downsides are glossed over, and no analysis is provided showing to what degree this effects their results.

3. On page 11, line 3, it is stated that a localization radius of 15000 km was chosen. The circumference of the earth is a little less than 3 times that, so with a localization radius that large, more than 2/3 of all grid points would be included for the analysis. Either there is a typo here, or the authors need to explain why a simple non-localized ETKF was not used.

2 Technical Comments

- p4l6, should probably read ‘perturbation’.
- p9l16, the ‘b’ should be a superscript.
- p11l9, should read ‘Inflation’ instead of ‘The inflation’.
- p15l13, ‘of the first two months’.
- p16l2, ‘compared with the truth’.
- p20l17 to stay consistent with the above line, ‘4, 8, and 30 days’.