Geoscientific
Model Development
Discussions

Interactive comment on "**TerrSysMP-PDAF (version 1.0): a modular high-performance data assimilation framework for an integrated land surface–subsurface model**" *by* **W. Kurtz et al.**

Anonymous Referee #1

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General Comments

The paper "TerrSysMP-PDAF (version 1.0): A modular high-performance data assimilation framework for an integrated land surface–subsurface model" by W. Kurtz, G. He, S. Kollet, R. Maxwell, H. Vereecken, and H.-J. Hendricks Franssen, presents efforts to couple the TerrSysMP model to the PDAF assimilation library. Overall, the paper is clear and provides an adequate level of description of the new system. This paper will be an important future reference for upcoming assimilation studies performed using this system.

In the introduction, I'd like to see comparisons with other similar modelling systems

(coupled Atmosphere, Land Surface, and Groundwater) capable of assimilation. How does the TerrSysMP-PDAF compare with other assimilation capable systems? Ultimately, to answer the question: what makes the TerrSysMP-PDAF unique?

The writing style - although understandable can be clumsy to read due to long sentences without commas. I've listed a few cases below. A word processor (like MS Word) will pick up most of these run-on sentences.

Overall, I found the paper to be worth publication once the comments above and below are taken into account.

Specific Comments

p.9632 ∼ln.4 –> It's unclear where does the observation to model index mapping fit into the system? Is the observations handled by the PDAF and assumed to be fixed in location with known model indices? More explanation is required here.

p.9632 ∼ln.13 –> Why is the TerrSysMP restricted to the EnKF? Will it not work with a deterministic (non-localized) filter?

Localization is often useful (essential in some cases) in assimilation applications. Is that not implemented?

Figure 8 shows four time series plots of Soil moisture at four locations. Are these four locations where there are observations. It's not very informative to validate using the same measurements that were used in the assimilation. Could you not find 4 points distal (or in between the assimilated measurements) for validation?

p.9643 ∼ln. 20 It is surprising that there is such little change in the energy fluxes after assimilation. Especially in the grassland area (right) as this regions seems to be where the impact of the assimilation is greatest for both corrections of soil moisture and the hydraulic conductivity. I'm not convinced that the minimal effect is solely due to the high groundwater (as you say) especially for a plant type with short roots.

The scaling factor and processor time is measured using two cases (identical ensemble and a more realistic case). It would be interesting to see results (or at least the author's thoughts) on the impact of using a model with a varying topography and thus overland flow calculations on the scaling factor.

Technical Corrections

Assess instead of access (3 times at least) In abstract, p9638 ln 1, and p 9638 ln 21

p9619 l.18 ... in the model input, which allows to...

p9619 l.21 ... model states, which are ...

p9619 l.24 . terrestrial system, including

p9620 l.9 Typically in these cases, point ...

p9622 l.10 integrated view of the terrestrial

p9622 l.23 are performed at a high

p9622 l.24 realisations are needed ...

p9622 l.25 There are a number of

p9624 l.9 only in a vertical

p9624 l.10 ie. there is no lateral.

p9624 l.27 allows it to solve

p9626 l.8 allows *for an integrated view *of the

p9626 l.12 Awkward sentence –> another important point that is noteworthy is that ....

p9626 l.16 has already shown to be highly scalable on the massively...

p9629 l.12 remove the ":" and replace with ".", then First.. the Secondly and Thirdly in the paragraph should be Second and Third .

p9634 l.2 CLM except for the special ...

p9635 l.2 ten layers, pressure, ...

p9636 l.8 DWD hasn't been introduced yet. What is it?

p.9638 assessed instead of accessed.