

Interactive comment on “Consistent assimilation of MERIS FAPAR and atmospheric CO₂ into a terrestrial vegetation model and interactive mission benefit analysis” by T. Kaminski et al.

Anonymous Referee #4

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General comments

This paper describes the consistent or simultaneous assimilation of satellite-derived FAPAR data and CO₂ flask measurements for parameter estimation in a land surface model.

The CCDAS framework for this assimilation is extended for interactive mission benefit analysis using information on the sensitivity of observables to changes in model parameters to derive potential for uncertainty reduction in target quantities.

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This paper builds on previous studies from the same group using the CCDAS data assimilation system with CO₂ and FAPAR observations, separately. The key advances demonstrated here are the consistent assimilation of multiple data streams with the CCDAS system and the interactive mission benefit analysis technique.

This paper is well written and suitably accessible, dealing with technical details clearly and concisely. It is worthy of publication, subject to minor amendments, both showing new science (CO₂ and FAPAR assimilation in tandem) and offering a tool for directing earth observation resources (mission benefit analysis).

Specific comments

I would suggest that **section 4.1 (p. 10773-10774)** is unnecessary as it seems to summarise a previous paper (Knorr et al. 2010) rather than demonstrating anything new. I understand that it is useful for comparison between site scale and global studies, but I would suggest simply referring to Knorr et al. 2010 would be adequate for such comparisons, rather than reiterating the previously published results.

Further (minor) suggestions follow below:

- **p.10775, I.2** Suggest referring to Knorr et al. 2010 (previous comment) as I am unsure of the benefit of section 4.1 just for this comparison.
- **p.10778, I.23** I understand from the results that sensor resolution is less critical because of technical limitations. Results show that the hypothetical ‘ideal’ resolution sensor yields significant uncertainty reduction. I suggest qualifying the statement that ‘sensor resolution is less critical’ with a comment that required resolution for uncertainty reduction would be technically unfeasible, rather than not useful.

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- **p.10778, I.24** Could the authors expand on the mission length assessment? Why do they think that a short mission length is adequate (little or no interannual variability?) and what about long enough missions to observe potentially changing seasonality?

Technical corrections

- **p.10766, I.4** Spelling: change 'unchartered' to 'uncharted'.
- **p.10771, I.21** Suggest 'set up for the *design of in situ networks for observations of the carbon cycle*'.
- **p.10776, I.19** There seems to be a missing figure reference here (fig. 8).

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