

Interactive  
comment

## ***Interactive comment on “A new step-wise Carbon Cycle Data Assimilation System using multiple data streams to constrain the simulated land surface carbon cycle” by P. Peylin et al.***

**Anonymous Referee #1**

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Peylin and colleagues describe a Carbon Cycle Data Assimilation System based on the land-surface model ORCHIDEE optimized against NDVI data, eddy covariance CO<sub>2</sub> flux data, and atmospheric CO<sub>2</sub> data. For practical reasons, these three data streams are used successively in three steps. The paper describes the system, assesses its performance (especially the self-consistency across the three steps), and some features of the resulting carbon cycle fluxes and stocks. The authors conclude that the ORCHIDEE land-surface model is now structurally adequate enough to bridge the information from the three data streams, though they also highlight further steps that need to be taken to represent the global carbon cycle more accurately.

The study represents an interesting and relevant development in the understanding of

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the carbon cycle consistent with available data. There are open issues (for example the short assimilation period precluding various processes to be constrained and assessed) but these are clearly acknowledged in the paper. I find the presentation clear and convincing. In my opinion, the work should be published in Geoscientific Model Development.

Minor comments:

p 5 | 6: The associativity is true for linear systems, but is it really also true for non-linear systems? (I nevertheless agree to the arguments given in favor of the step-wise approach.)

p 8 | 13: What is the uncertainty due to incomplete sampling of the diurnal cycle?

p 14 | 25-26: I was wondering whether the presence of step functions, creating discontinuities, still allows a well-defined solution of the minimization?

p 17 | 25-30: Add references for "University of Stuttgart" and "ENSTO-E". Explain abbreviation "IER".

p 20 | 14: What does "conditions" mean here?

p 21 | 4: Clarify whether this is the prior before step 1 or before step 3?

p 22 | 21: Can you give just a brief summary of the reasons here?

p 25 | 24: These are clearly not the numbers shown in Fig 10 right.

p 27 | 6: Can you explain (here or earlier) why you used individual grid points rather than the whole grid?

p 29 | 10: I think you should also mention the errors in the prescribed fossil fuel and ocean fluxes.

Fig 5: I don't see any grey lines.

Typos and suggested formulations:

p 2 | 7: "uncertainties of simulated carbon fluxes and stocks"

p 3 | 15: "Carbon cycle compoenets"

p 7 | 13: "propagate"

p 8 | 7: missing "-"?

p 10 | 1: "the third step"

p 12 | 5: suprious "the"

p 17 eq 7: The first ")" seems to belong to the index. There seems to be a "," missing before "LAT".

p 17 | 19 "outgassing"

p 18 | 29 Why "Fig 8"?

p 22 | 17: "from" rather than "between"?

Fig 5 caption: "optimized"

Fig 7 caption: prior before step 1 or before step 3?

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