

Interactive comment on “A regional carbon flux data assimilation system and its preliminary evaluation in East Asia” by Z. Peng et al.

Anonymous Referee #1

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General Comments:

A regional ensemble-based data assimilation system was developed to estimate CO₂ surface fluxes and CO₂ concentrations from atmospheric trace gas observations. Because of a lack of a suitable dynamical model to couple forecasted CO₂ fluxes and analyzed CO₂ fluxes, a new smoothing operator is proposed to estimate forecasted CO₂ fluxes at finer scales. However, authors did not compare this new operator directly with the one used in the Carbon Tracker (Peters et al, 2007) to show its impact. The assimilation system needs to be described more clearly and the evaluations only in the OSSE context without using real observations are simply not enough. Therefore, a successful major revision is needed for this paper to be published.

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Specific Comments:

- 1) The introduction section seems too long as compared with the remaining other sections.
- 2) P.20352 Line 16: use F_0 to be consistent with formula (1)
- 3) P.20352, the way the prior scaling factor λ^p is updated is associated with the atmospheric transport model, which should be considered as an important scientific improvement over the one used in Carbon Tracker (Peters et al, 2007). Direct comparison is needed here to show this new smoothing operator, as authors mentioned in the paper, could avoid the “signal-to noise” problem and estimate the surface CO₂ fluxes at the grid scale.
- 4) P.20353, lines 16–20, the formulas seem confusing. In (3), j should start from $t-M+1$ and end at t . In (4), S^e and P^e should be identical, and both should be defined at j since the integration of transport model from $j=t-M+1$ to $j=t$ is involved. In formula (7), different symbol should be used to represent smoothing operator expressed by formula (2) because M has been used in (2) to denote the lag-window size. Also, it can be seen in (2), smoothing operator is a function of all λ in the window.
- 5) P. 20354: Merging subsection 2.4 with subsection 2.3.
- 6) P.20356: The prior scaling factor will be updated based on the inflated CO₂ concentration forecast, so it has been inflated indirectly. Why does it need to be inflated again in (17)?
- 7) P.20359 Line 9, specify the year of the OSSE experiments.
- 8) P.20360 Line 1–3: Fig.5 should be mentioned here.
- 9) P.20360 Line 15: “Fig.7” should be “Fig.6”
- 10) P.20362 Line 6: “Fig.9” should be “Fig.10”

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11) P20371 Fig.2: The flowchart seems confusing as it is not clear what next cycle should look like. Also, symbols used in the chart are inconsistent with those used in the text part of paper. For example, H in the text represents the whole observation operator including the atmospheric transport model, the bilinear interpolation and weighted CO₂ column average. While in the flowchart, it represents everything except the atmospheric transport model.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 20345, 2014.

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