Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-1008-SC1, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The regional EUROpean atmospheric transport inversion COMparison, EUROCOM: first results on European wide terrestrial carbon fluxes for the period 2006–2015" *by* Guillaume Monteil et al.

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Received and published: 19 December 2019

I believe this study is very relevant for assessing the consistency of regional scale NEE estimates from regional inverse modeling systems.

I have some comments regarding the display of information:

- In figure 1, it is difficult to obtain information on the temporal density and continuity of measurements from the size of the dots and there is no key. An additional figure similar to figure 2 in Kountouris et al. (2018) or figure 2 in Rödenbeck et al.

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(2003) would be more useful.

- Figure 2 and 3 would be more useful if it also included the sub-continental regions (at least as supplementary information).
- Figure 6 could be extend to also include other metrics, specifically correlations and standard deviation. I believe it would be more useful not to divide the plots by model but by metric in order to facilitate the model comparison. Order of the sites on the x-axis could be by latitude, longitude or altitude to observe if there are gradients.

It was my impression that since we are optimizing towards real data we are missing an assessment on how realistic the fluxes really are. Here I believe comparison of grid scale fluxes to Eddy Covariance measurements would be useful as well as comparison of spatial patterns (e.g. the spatial correlation and gradients) with satellite vegetation fluorescence products.

Furthermore, the use of dense measurement networks has the aim to distinguish small scale flux patterns. However, most of the analyses were at continental scale. I believe more analyses and discussion of the fluxes at the sub-continental scales is needed both for seasonal and interannual variability. At the interannual time scale, it would be useful to know if the variability shown by the inverse models reflects heat waves, droughts, cold spells, etc. If they are able to detect land use change or errors in the anthropogenic emissions.

Finally, the study only recommends increasing the density of the observation network, particularly in Southern and Eastern Europe. However, no analyses were made on the effects of the modeler's choices, e.g. measurement and prior errors, data selection, use of ocean fluxes. This choices could provide further recommendation for the development of these regional inverse modeling systems.

References:

Kountouris, P., Gerbig, C., Rödenbeck, C., Karstens, U., Koch, T. F., Heimann, M. (2018). Technical Note: Atmospheric CO_2 inversions on the mesoscale using data-driven prior uncertainties: methodology and system evaluation. Atmospheric Chemistry and Physics, 18(4), 3027–3045. http://doi.org/10.1029/2006JD008371

Rödenbeck, C., Houweling, S., Gloor, M., Heimann, M. (2003). CO_2 flux history 1982–2001 inferred from atmospheric data using a global inversion of atmospheric transport. Atmospheric Chemistry and Physics, 3, 2003.

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