

Interactive comment on “Regionalization of turbulent fluxes by combining aircraft measurements with footprint analysis” by T. El-Madany et al.

Anonymous Referee #2

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This paper assesses airborne flux measurements using a footprint model. The subject is appropriate for the journal. Listed below are my main concerns and some specific comments. On the basis of them, I believe that the paper can be accepted after major revisions.

Main concerns

1. As mentioned by the authors in Section 2.1, cloud cover varied during the flights between 1/8 and 6/8. Hence, photosynthetically active radiation (PAR) must have
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varied significantly. Variability in PAR certainly had an impact on CO₂ and H₂O fluxes. However, it is not clear how the authors accounted for this impact, i.e. how it was separated from the flux changes due to different sources (vegetation types).

2. From the description of the footprint tool used in this study, it is not clear how the surface conditions were taken into account. The authors mention that “The large standard deviation of the observed fluxes reflects the inhomogeneity of the surfaces with different compositions of vegetation, water surfaces, and urban areas.” (P7031). Is the model valid for heterogeneous surfaces as encountered in this study?

Specific comments

1. **P7019, L8ff:** The list of fluxnet networks is not exhaustive but implies to be so.
2. **P7019, L21:** Observations from flux towers are only representative for the surrounding vegetation type AND the surrounding topography.
3. **P7020, L22:** Depending on the atmospheric stability conditions, the area underneath the tower might actually contribute to the measurement.
4. **P7020, L28:** In addition to meteorological conditions, surface conditions will also affect the footprint extent.
5. **P7021, L4:** There’s no such a thing as a backward analytical footprint model. With the Lagrangian stochastic approach, footprints may be calculated from “forward” or “backward” simulations.

6. **P7021, Section 2.1:** Please describe the spatial variability of the parameters.
7. **P7023, L7:** Please clarify: mean over which time period?
8. **P7024, L22:** Clarify what you mean by “1% isopleth”.
9. **P7024, Section 2.5:** Please explain the concept of a “total footprint” in more detail. I would expect a total footprint to represent the source area of the averaged flux measurement, i.e. for 4 km length of the flight line. However, this would not match Fig. 1B.
10. **P7027, Section 2.8:** Is the information from the land use data weighted by the footprint function?
11. **P7029, Section 3.1:** Instead of $w'C'$, do you mean $\overline{w'C'}$?
12. **P7033, Conclusions:** The upscaling exercise should be part of the results section rather than the conclusion. Given the high uncertainty (>50%), these results should be used only very carefully.
13. **P7041, F1:** Not clear where sensor/flight track is located.
14. **P7044, F4:** Please plot mean wind direction.
15. **P7047, F7:** Specify r^2 .
16. **P7049/50, F9 & 10:** Please describe the figures in more detail. Are the correlations from land use types within the footprints only? If so, wouldn't you expect significant correlations?

Interactive comment on Biogeosciences Discuss., 6, 7017, 2009.