

Interactive comment on “Satellite-inferred European carbon sink larger than expected” by M. Reuter et al.

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Using a regional inversion system, five satellite products of XCO₂, and a few sensitivity experiments, the authors suggest that the European carbon sink is 2-3 times larger than estimated by bottom-up studies. They do not speculate on what could be that wrong in bottom-up studies. The inconsistency (and actually other inconsistencies in other regions of the globe, which should be accounted for in the discussion) was seen before with global inversion systems also assimilating satellite data, but this study is the first one that isolates satellite data over Europe in the inversion. Here I wish to discuss two weaknesses of the authors' demonstration.

- In global inversions, all regional seasonal fluxes are coupled to some extent, be-
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cause mass is conserved at the global scale. By using a regional framework, the authors decouple the seasons: their STILT back-trajectories are ended after 480 h or even sooner (Appendix A). As a consequence, decreasing the annual sink based on January–April increments (RemoteC results) is rigorously distinct from decreasing the annual sink based on growing season increments (the other satellite-based results). Therefore the results presented are internally inconsistent, behind an apparent agreement about the annual sink. In other words, the RemoteC results seem to invalidate the increasing sink inferred from the other products and vice-versa.

- One of the satellite products assimilated here (UoL FP v4.0) and an earlier version (v2.1) of a second one (RemoteC v2.11) were evaluated in an ESA report (Notholt et al., 2013), that is coauthored by some of the present authors, including the first one, that says in its summary: “The demanding relative accuracy (regional-scale bias) requirement of < 0.5 ppm is however somewhat exceeded by all products (typically ~ 1 ppm or even somewhat better has been achieved).” This statement casts some doubts on the reliability of the extra seasonal regional gradient of $\simeq 0.5$ ppm in the satellite data¹ that would drive the $\simeq 0.5$ PgC unexpected sink inferred by this inversion system over Europe. Further, in contrast to the authors (p. 21834, l.15 ; p. 21846, l.3), I see no reason why some (or even most) of the retrieval systematic errors would not be shared by the five satellite products, for instance simply because they share the same spectroscopy data or because they are all bias-corrected with the same sparse and imperfect reference measurements. But actually, as noted above and in contrast to some statements made in the paper (*ibid*), only four out of the five satellite products show the same unexpected pattern.

¹This number comes from a simple back-of-the-envelope computation, but other sensitivity studies with state-dependent systematic errors of a few tenths of ppm in satellite products leading to a similar 0.5 PgC/yr bias for Europe can be found in Chevallier et al. (2007, 2010).

References

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