

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## reviewer comment on acp-2021-873

Anonymous Referee #1

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Referee comment on "Net ecosystem exchange (NEE) estimates 2006–2019 over Europe from a pre-operational ensemble-inversion system" by Saqr Munassar et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-873-RC1>, 2021

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### General comments

Authors present an analysis of the European terrestrial carbon cycle variability in 2006–2019 made with the pre-operational inverse modeling framework "CarboScope Regional". The CO<sub>2</sub> flux estimates are shown to be largely independent from the prior fluxes in the area of dense observations. The results confirm dominance of the observational constraint on fluxes and the importance of climate controls on the interannual flux variability. Authors find the inverse model predicts statistically significant positive CO<sub>2</sub> flux anomalies in 2018–2019 related to hot and dry climate in those anomalous years. The paper is well written and can be considered for publication after minor revisions.

### Detailed comments

L75–80 Although some of the information can be found in references, to improve readability it is useful to give few more details about the CSR such as optimization scheme and temporal resolution of flux corrections.

L104 Need to give detail – where station types come from.

L248–L300 The correlation of posterior fluxes with climate indices has been reported in detail. To enhance the validation of interannual flux variability, can authors add comparison with interannually varying regional flux estimates by independent process-based models, and possibly, top-down?

L407 Need a reference here on systematic bias in transport models.

#### Technical corrections

L18 Phrase 'We further investigate the unprecedented increase of temperature ...' is somewhat incomplete, better write that one investigates the impact of 'unprecedented increase ..' on the carbon cycle.

L103 'South-eastern Europe (light red).' Line out of place.

L265 'fluxes of both' can be replaced with 'fluxes estimated with both'

L405 'widespread scale' can be reduced to 'wide scale'

L424-425 The phrase 'spatial correlation length of prior error' can be reformulated, it would be more accurate to avoid using 'prior' as this spatial correlation is applied to posterior flux corrections.

L460 Paper number in Chevallier 2012b is missing (Global Biogeochem. Cycles, 26, GB1021, doi:10.1029/2010GB003974)