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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An extended Kalman-filter for regional scale inverse emission estimation" *by* D. Brunner et al.

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This is a really well written paper, describing the setup of and application a Kalman filter based estimation of emissions. Uncertainties are properly described, and noteworthy are the use of log transformed emissions to obtain positive definiteness, and the inclusion of temporal correlations in the residuals. I recommend publication. My minor comments concern mostly the comprehensibility.

General Comments:

The authors correctly state that the estimates are subject to bias errors in transport, and that this is not accounted for in the estimates. May be this should be discussed a bit in context of the uncertainties stated in the paper for the emissions.

Specific comments

Pg 29196 Ln 16: "Kyoto protocol“ you probably mean UNFCCC

Pg 29204 Ln 7-11: Selection of release altitude: the authors should comment on how the amplitude of simulated CO depends on the release altitude. I would assume that not just the correlation coefficient changes, but also the slope of modeled vs. observed enhancements above background.

Pg 29210, Ln 17: May be to the reader with less experience with Kalman filtering the authors can comment on the multiple use of the same observations in three iterations of Kalman filtering, and how this impacts the resulting uncertainties in the emission estimates. Are those posterior emission uncertainties still realistic, or do they keep decreasing with each iteration?

Pg 29210, Ln 27: “The respective initial uncertainties are set to 0.1% and 0.001% of the background concentration.“ This is unclear, does the 0.1% apply to the background, and the 0.001% to the trend? Then with a zero initial trend this would not really make sense.

Pg 29211 Ln 24: Here the first reference to a table is to Table 4, so the tables should be reordered accordingly

Pg 29217 Ln 20: replace "parameters settings“ with "parameter settings“

Pg 29219 Ln 10: is the prior to posterior increase in RMS differences in table 3 (HFC-152a for MHD) related to the choice of a factor three smaller than optimal background uncertainty?

Pg 29221 Ln 28: add "in“ between "model“ and "Derwent“

Pg 29221 Ln 28: Why was the impact of the background prediction error not included in the sensitivity analysis, given that it has an impact on the magnitude of the estimated emissions?

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Interactive Comment