

Interactive comment on “Inverse modelling of European N₂O emissions: assimilating observations from different networks” by M. Corazza et al.

Anonymous Referee #2

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The authors have developed an inverse modelling system for optimizing N₂O emissions based on variational data assimilation. The study focuses on the European domain, using observations from different networks. Although N₂O inversions have been performed before, the present study adds significantly to this by its regional focus, the use of a bias correction scheme, and an assessment of the impact of the prior emission estimate. Particularly, bias correction is a critical issue since measurements analysed in different laboratories show considerable offsets. The method developed in this study appears to successfully identify and correct these offsets.

The paper is both relevant and very well written, and can be accepted after the following

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minor comments have been responded to.

P26327: Other stations than Schauinsland may also – but less visibly – suffer from local influences. Have the authors thought about a strategy to deal with this in a more general way than for this specific station?

P26334, L14: Why choose an observational error of 0.3 ppb if the repeatability of NOAA air samples is 0.4 ppb (1 sigma)?

P26336: The general picture is that the a priori simulation underestimates the observed concentrations in the course of the year. This is corrected with a considerable overall increase of posterior emissions compared to the prior. As the authors state, for the stations ALT and BRW this leads to a significant overestimate in the posterior simulation. Could this indicate that European increments have been too strong? Might there be an issue with modeled transport (e.g., strat-trop exchange at high latitudes)? Or is there a different explanation?

P26343: Perhaps it could be added here that systematic comparisons of standards and measurements are also necessary to avoid time-varying biases, which are probably much more difficult to be quantified by the inverse modelling system.

Table 2: Why are the numbers for Mace Head bias and Ochsenkopf standard deviation different from Fig. 1?

Table 6: Could the authors provide more details on how the potential additional model error has been estimated?

Technical comments

P26340, L2: of the order of should be on the order of

Table 1: Why are there two ‘number 1’ CHIOTTO stations: TT1 and HU1?

Fig. 4: Reduction should start with lowercase.

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