

Interactive comment on “Investigating uptake of N₂O in agricultural soils using a high-precision dynamic chamber method” by N. J. Cowan et al.

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The manuscript describes a very carefully carried out study on possibly N₂O uptake by agricultural soils. It shows that the magnitude of N₂O uptake by such soils is rather small (0–10 $\mu\text{g N m}^{-2} \text{ h}^{-1}$), which is in agreement with earlier studies, and that only 4 fluxes were non-ambiguous showing uptake. The paper also suggest that earlier reports on occasional N₂O uptake by agricultural soils might be wrong, since detection limits of the measuring systems used were not sufficiently considered. I do agree with this conclusion. The manuscript is concise, well written and fits very well to the scope of the journal. There are only a few points to be mentioned. Some of the studies cited on N₂O uptake by agricultural soils (Papen et al. 2001, Butterbach-Bahl et al. 2002)

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were carried out at N limited forest sites in Germany and thus do not fit to the argumentation. There is also a recently published study using QCL in combination with static chambers which should be considered. (Savage et al. 2014, High temporal frequency measurements of greenhouse gas emissions from soils. Biogeosciences 11, 2709-2720). Savage et al show that N₂O uptake for an agricultural site was hardly observed while at the forested wetland site persistent soil N₂O uptake occurred. However, it should be noted that the reported detection limit in the study of Savage et al. is with 0.7 $\mu\text{g N m}^{-2} \text{ h}^{-1}$ approx. 4-7 times better as in this study. Seeing both studies, and earlier reports on soil N₂O uptake by N limited forest soils, one possibly can hypothesize that the microbial community of agricultural soils, used to temporally high loads of inorganic nitrogen, has a rather limited (or even no) capacity for a net-consumption of atmospheric N₂O.

Page 8127, line 12-13: The studies by Papen et al 2001 and Butterbach-Bahl et al 2002 were carried at N limited forest sites (Papen et al: Black Forest, Butterbach-Bahl et al: Northeastern German lowlands). And yes, we have seen sporadic N₂O uptake. See also Rosenkranz et al. 2006 for N₂O uptake at a Mediterranean pine forest stand (Rosenkranz P et al. 2006, N₂O, NO and CH₄ exchange, and microbial N turnover over a Mediterranean pine forest soil. Biogeosciences, 3, 121-133) which also provides information on detection limits. Page 8128, line 8 follow.: That is very much in line with the work by Arjan Hensen et al 2006 (AGEE 112, 146-152)

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