

Interactive comment on “Modelling Nitrification Inhibitor Effects on N₂O Emissions after Fall and Spring-Applied Slurry by Reducing Nitrifier NH₄⁺ Oxidation Rate” by Robert F. Grant et al.

Anonymous Referee #3

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Nitrification inhibitors (NI) have attracted much interest recently because retarding nitrification by NI can reduce the emission of N₂O from farmland, thus reducing the climate forcing of food production. However, it is difficult to simulate effects of nitrification inhibitors on N₂O emission from agriculture due to complex interaction among NI, nutrients, soils and weather. This paper modified Ecosystem model to incorporate NI processes and applied it to evaluate effects of NI on N₂O emissions. Thus, the topic of the paper is highly relevant. However, it may require some changes before acceptance for publication. Below is a list of major and minor comments.

Major comments

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1. Many of the described method in this study are already stated in their previous works. Some of them have included from their previously published works.
2. In Section 3.1, more details are needed; for example, describe the vegetation, in terms of species, snow depth, drainage patterns of the fields, slope, This information will help for repeatability of this study. Also, this information can be used in a larger study for globalizing the model capability addressed in this study.
3. In Section 4, it is unclear what site boundaries were modelled. Ecosystem could be a 3D model for water and nutrient transports in S4. Did the authors simulate the 3D fluxes in soils in this study? More details should be provided for the site topology and slopes for a 3D simulation if yes.
4. In Section 5, though the paper stressed effects of snowmelt and freeze-thaw on NI and N₂O emissions, no results were reported on the freeze-thaw processes, such as snowpack depths, and snowmelt water pools. For example, in Section 5.2.1, oxygen transfer and uptake are explained using snowmelt and drainage of meltwater. However, snowpack was not provided in both measurement and simulations. In Lines 439-441, the smaller rises and subsequent declines in N₂O in Fig. 5 were attributed to effects of information of thawing and refreezing. However, Fig. 5 does not provide information of snow depth and freeze-thaw.

Minor comments

5. Lines 49-51, give references.
6. Lines 74-77, a testing of modelled NI effects on N₂O emissions has been performed in Science of The Total Environment recently.
7. In Conclusions, it is better to include quantitative results of NI effects.

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