

## ***Interactive comment on “Linking agricultural crop management and air quality models for regional to national-scale nitrogen assessments” by E. J. Cooter et al.***

**Anonymous Referee #1**

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### GENERAL COMMENTS

The paper discusses a new approach to modelling ammonia emissions resulting from inorganic nitrogen fertilizer use. The new system couples a semi-empirical biogeochemical process model (EPIC) with a state-of-the-art regional air quality model (CMAQ). The coupling is bidirectional and data exchange between the two models occurs at every time step. Hence, the two models are coupled interactively. The goal for the new modelling framework is to provide estimates of NH<sub>3</sub> emissions for air quality modelling that are based on a semi-mechanistic process-based approach that can take into account the impact of environmental variables directly. This replaces the

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offline concept that is based on prescribed emissions.

Overall the study is of very high quality and there is not much for me to say. The modelling framework is described in detail, methods and parameterizations are all motivated by references from the literature or by evidence collected during the work for this project. The EPIC model is evaluated against observations and survey-based data. An example application of the coupled system is also included, again giving an idea of the model bias against available observations.

All in all this is a complete, consistent and well presented study that, in my opinion, merits publication in BG. There are only a few very minor revisions I would like to see done before final acceptance. I will comment on those in the following.

### SPECIFIC TECHNICAL COMMENT

none

### MINOR COMMENTS

L15P6096: I am not sure I fully understand what “temporally progressive spatial patterns” really are. Is there maybe a simpler way of describing what you mean. Are you talking about distributions that vary in space and time? I believe this expression also appears somewhere in the main text for which I commend the authors.

L3P6098: reference Sutton et al. appears again with different year but not in the list of references. reference missing or wrong year given?

L9P6101: the concept of “accumulated heat units” is introduced but no further detail is given. I think it would be helpful for the readers unfamiliar with the subject if a brief explanation would be added; one sentence would be enough.

L16P6103: the “use of a weather simulator” in EPIC is mentioned but not further discussed. Again, one or two additional sentences of explanation would help the reader.

L9P6105: I think it would help a balanced presentation if Figure 4 would include maybe

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one less favourable example of comparison for other crops/locations since it is mentioned in the text.

L22P6107: can you clarify what you mean by a “one atmosphere system”. I am not sure I am familiar with this term.

L19P6110: I am not a big fan of references in the Abstract and Conclusions but if it is absolutely necessary...

L4P6112: it is stated that “expert knowledge” is used in addition to USDA data and fertilizer sales. Can you clarify what you mean by this; are we talking about empirical data; an educated guess or some other data source.

P6124: For the final publication I'd like to see the quality of the plots in Figure 4 B, C and D to be more on par with Figure 4 A.

P6126: the caption specifies that both the black line and the black triangle represent median biases from the observations. Isn't one of them meant to be the mean bias? Or do I misunderstand the Figure entirely?

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