

Interactive comment on “Evaluation of a regional air-quality model with bi-directional NH₃ exchange coupled to an agro-ecosystem model” by J. O. Bash et al.

Anonymous Referee #1

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The work presented in this manuscript describes the results from integrating a bi-directional exchange model for NH₃ in the CMAQ model. To my knowledge this is the first paper that attempts to couple NH₃ bi-directional exchange formalisms to an atmospheric air quality model and therefore is a significant advance in the area.

The paper is clearly written and the results of the simulations are evaluated against available data in the continental US domain. It is regrettable that not much long term measurements of NH₃ concentrations are available at the moment to evaluate the model simulations, however the authors' clearly state that this is planned future work.

I only have some minor comments.

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I agree with referee #2 concerning the ambiguity in description of what is novel in this paper compared to the Cooter et al. (2012) and the Denis et al (2012) papers. Perhaps a clearer description in the introduction would help making things easier to follow.

The authors state in page 11388 lines 27 – 30 that it is not clear whether the changes in the case called “bidirectional” compared to the “base” case are due to fertilizer application changes or to the bidirectional exchange of ammonia. The authors then try to test this by rerunning the model with a seven fold increase in fertilizer application. It would have been interesting to evaluate the model with four case studies (ie. (i)base case, (ii) fully coupled case (presented in this paper), (iii) Epic coupled case (no bidirectional exchange) and (iv) bidirectional exchange case (not coupled to EPIC)) to better understand the origins of the increased or improved biases.

At what height were the aerosol concentrations measured? Those were compared to model simulations at what height? A discussion around that would be helpful.

The compensation point is mentioned in several places in the manuscript but not defined; it would be helpful to have a brief definition.

Page 11388 line 19, I presume “in the base case” is a typo and should not be in this sentence.

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