

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.

J. O. Bash et al.

bash.jesse@epa.gov

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Response to Referee: 1

We greatly appreciate this reviewer's brief but constructive comments which have substantially improved the paper.

General comments:

1) 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

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follow.

Response: This was largely addressed in the response to referee #2. This manuscript details the first application of a coupled agro-ecosystem and photochemical air-quality model for continental scale air-quality simulations. This differs from the Cooter et al. (2012) manuscript which details continental scale EPIC model simulations and from Walker et al. (2012) which details the results of a measurement campaign and field scale modeling. This builds upon and expands on the work of both these manuscripts by scaling up the field scale modeling presented in Walker et al. (2012) and coupling CMAQ atmospheric deposition and evasion processes with the soil N geochemistry and nutrient management simulations in Cooter et al. (2012). CMAQ with NH₃ bidirectional exchange only uses the EPIC fertilization estimates and initial soil ammonium content as inputs. Nitrification processes in EPIC have been moved to CMAQ and CMAQ estimated NH₃ deposition and evasion parameterizations have been coupled with the soil ammonium pool to maintain the soil ammonium mass balance in 0.05 m and 1 m soil layers in CMAQ. The sentence beginning on line 13 page 11378 and section 2 have been edited to emphasize this distinction.

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

Response: The model estimates were made for a height of 19 m above the surface level and IMPROVE observations are taken at a height of 3 m above the surface level. The STN measurement height is not standard given the heterogeneity of the urban surface but are generally between 2 and 5 m. CMAQ results are generally not adjusted for sampling height for evaluations against STN and IMPROVE observations due to the low deposition rate and long atmospheric lifetime of PM2.5.

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

Response: The compensation point is now defined in the introduction.

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Specific comments

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

Response: This typo was corrected.

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