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Geoscientific Model Development Discussions

Interactive comment on "An evaluation of ambient ammonia concentrations over southern Ontario simulated with different dry deposition schemes within STILT-Chem v0.8" *by* D. Wen et al.

Anonymous Referee #1

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General comments: The manuscript evaluates the ambient ammonia concentrations over southern Ontario as observed with passive samplers and calculated by the STILT-Chem v0.8 model. Three different dry deposition schemes were tested and validated with the observations. Two of the three dry deposition schemes were already present in the STILT-Chem model and were uni-directional. The third dry deposition scheme is bi-directional. For this deposition scheme different values are set for the stomatal and ground emission potentials for different land-use categories and for low-N and high-N canopies. Model results are evaluated using many different types of statistical approaches. However, it is questionable if all these statistics are really necessary and useful in the evaluation of the model results. Simple scatter plots with linear regression

statistics are missing in this manuscript. Plots like Fig. 4 in Wen et al. (2013) are desirable in this paper as well (By the way, I can hardly believe that the regression line in the left panel of Fig. 4 of Wen et al. 2013 is correct?). In this way, Figure 3, 4, and 6 can be combined, while much more information is obtained about the spatial correlation between model results and observations. Different symbols could be used for forest and agricultural sites, while different colors can be used for the different model simulations. I doubt whether the bi-directional approach as proposed by Zhang et al. (2010) is the appropriate way to model spatial variations in bi-directional ammonia exchange with the surface. In my opinion, it is wrong to couple the soil emission potential to land-use categories as it is a soil property and not a vegetation property. Therefore, it's not strange that results of the bi-directional dry deposition scheme are not convincingly better than the results of the uni-directional deposition schemes.

Specific comments: p 6076 l 9-10: this is likely due to too high stomatal and soil emission potentials p 6076 l 16-18: Don't forget that the observations might be influenced by local sources, which means that the observations are probably not representative for the grid size resolution of the model. p 6077 l 11: 'Wichink Kruit et al., 2012' should be moved to line 16 p 6077 l 15,20: 'Kruit et al., 2010' should be 'Wichink Kruit et al., 2010' p 6078 l 2: Add reference 'Wichink Kruit et al., 2012' after NH3. p 6080 l 12-13: How important is this pathway to the lower canopy? It would be more consistent with the other schemes not to account for the pathway to the lower canopy. p 6081 l 6: What is meant with improved representation here? Improved compared to what? And why? p 6083 l 16-24: I doubt whether the bi-directional approach as proposed by Zhang et al. (2010) is the appropriate way to model spatial variations in bi-directional ammonia exchange with the surface. In my opinion, it is wrong to couple the soil emission potential to land-use categories as it is a soil property and not a vegetation property. Especially the overestimation in the low concentration range might be caused by too high emission potentials. p 6087 l 3-6: Why is it reasonable for ammonia emissions to treat all point sources as surface sources? Do you mean that due the small contribution of the

point sources to the total emission, the error in the emission estimate is small? p 6087 l 17: 'mode' should be 'model' p 6090 l 20: Might this be a meteorology effect? p 6092 l 1: What about the ZBE scheme? An effective Vd ($\sim$F/C) can be presented for this scheme. p 6092 l 3: What is meant by infinite minimum canopy stomatal resistance? p 6094 l 6: How does this figure look for the ZDD scheme? p 6095 l 5: But then also an even larger overestimation of the low concentrations will be obtained, or? p 6095 l 6-20: It looks like there is a general reduction in the deposition in the ZBE scheme, which leads to an overestimation of the low concentration range and a better correspondence in the high concentration range. A coupling of Gamma_s to pollution level in the area (as in Wichink Kruit et al., 2010) could probably improve the ZBE model performance. p 6096 l 2: What about the effect of local sources on the observations? p 6096 l 13-16: I totally agree. p 6106 Table 4: Why is this so different from the values for agricultural sites in Table 3? p 6109-6112: scatterplots similar to Fig 4 in Wen et al. (2013) would be useful. See also General comments. p 6113: add effective Vd for ZBE. p 6115: add the other two schemes to this figure.

Interactive comment on Geosci. Model Dev. Discuss., 6, 6075, 2013.