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Interactive comment on “Ammonia emissions from beech forest after leaf fall – measurements and modelling” by K. Hansen et al.

Anonymous Referee #1

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General comments

Although the paper is well written and interesting, it could be further improved by paying more attention to the sources of these remarkable high ammonia emissions during the fall. At this moment, the authors suggest a relationship with the decreasing leaf area index (LAI) but they only surmise what the controlling factors behind these emissions could be:

1. Larger NH_3 emission potential Γ of the senescent leaves, connected with remobilization of nitrogen from senescent leaves during the the retranslocation process (page 11, r 5-8)? 2. Ammonia emission from decomposing leaf litter (page 11, r 8-13) ? 3. Volatilization of ammonia from evaporating water film on leaves and moist soil (page 11, r22)?

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The flux measurements could be compared with bidirectional models in order to better understand the mechanisms behind these emissions. It is currently not clear what the emission potential of the canopy or the litter layer is. The authors applied the deposition model DAMOS, which is, however, unidirectional (using a surface resistance) and therefore inept to explain the emissions. An effort should be done to include/calculate a canopy, stomatal and ground-layer compensation point (see Massad et al., 2010) in the flux modeling.

Specific comments

- Introduction: page 3 ,r18-21: please add cuticular desorptions (and reference) for other possible ammonia emission sources

- Leaf area index (page 4, r 13-24, page 9 r 3-5, page 11, r 1-2, page13, r7-8)

There is some confusion about the determination of the LAI and the PAI. The plant area index (PAI) consists of a leaf area index (LAI) and a stem area index (SAI). From Figure 1 can be seen that before leaf fall the PAI coincides with the LAI, implying that the SAI equals zero. How do the authors explain this? A good estimate of the SAI in deciduous forests can be obtained from the LAI measurements (licor-2000) during the winter period. From Figure 1 can be observed that the winter PAI (SAI) approaches 1? It therefore never drops to zero as written on page 11, r 17. The authors also mention the “green LAI”, which I didn’t encounter in scientific literature until now. It was said to be derived from observations of leaf defoliation and leaf fall (page 4, r20-21). Was the specific leaf area (SLA) of the beech leaves known to infer the LAI from the leaf fall?

- Decomposition of leaves in the fall:

The authors suggest that enhanced decomposition of plant material could explain the emissions on 2-4 and 12-14 November(r23-24). During these events weather conditions (precipitation followed by dry periods with relatively high air temperatures) were found to be suitable for decomposition of the beech litter. It would be interesting if the

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authors would add some information about the characteristics of the leaf litter, e.g. C/N ratio or pH of the mineral soil. Is the C/N ratio of the beech litter low enough to trigger substantial decomposition in the fall, even at temperatures below 20°C? Is there a well-developed forest floor (?Mg ha⁻¹) or is the forest floor/organic layer lacking at the measuring site? Are we dealing with an acidic or calcareous mineral soil?

- Desorption of ammonia from leaves

Page 10, r 19-20: authors also mentioned desorption of ammonia from senescing leaves as possible ammonia source. Is it conceivable that that leaves in the senescent phase become more hydrophobic and water films on leaves evaporate faster?

- 2.4. Ammonia flux measurements

Calculation of ammonia flux measurement uncertainty: It is not clear for the reader how the measurement uncertainty of the ammonia flux has been calculated (as shown in Figure 6). This should be clarified in the methodology.

Does the leaf fall in the beech forest (and the accompanying change in the turbulence characteristics) resulted in thorough changes in the calculation of the b-coefficient throughout the measurement period?

technical corrections

Table2: change uncertainty by standard deviation σ ?

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