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## ***Interactive comment on “Comparison of modelled and monitored deposition fluxes of sulphur and nitrogen to ICP-forest sites in Europe” by O. Westling et al.***

**O. Westling et al.**

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1. The paper presents a well written and useful comparison between modelled and in- dependently measured deposition data for SO<sub>4</sub>, NO<sub>3</sub> and NH<sub>4</sub>. Especially for SO<sub>4</sub> it shows that the EMEP model can reasonable predict the regional deposition pattern. In view of the differences in scales (50 km by 50 km grid versus plot measurements) the authors convincingly demonstrated that the EMEP model is delivering reasonable deposition estimates also for NO<sub>3</sub> and NH<sub>4</sub>, though the scatter between measured and modelled data is much larger here. However, the study does also clearly show that the main uncertainty in predicting accurately the local deposition situation is associated with a correct precipitation estimate. Thus future evaluations may need to concentrate on a more regional scale, for which also the data quality of measurements can be bet- ter assessed. It would be useful if the authors would also provide a perspective of future directions of

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model developments to address the observed differences between simulations and measurements and to outline strategies for further model testing.

**Reply:**

We have added text throughout the manuscript to discuss these uncertainties and their reasons in more detail. We have also added text to the conclusions to bring up the good point about the need for more work on the regional scale.

2. Page 938, line 20: Insert a short comment why these countries were selected and not others and why Italy has only three measuring sites

**Reply:**

This paragraph has been re-written slightly to clarify this point that these were the countries passing the quality-assurance and data-completeness criteria.

3. Page 938, line 25: It is stated that deposition data for deciduous forest are uncertain, since at most sites stemflow is not measured. For some sites in Sweden and Germany where stemflow was measured you obtained a correction factor. Was this correction factor only applied to sites in Germany or Sweden or was this factor also applied to other sites in other countries?

**Reply:**

The German correction factor was applied to Germany, Denmark and France, while the Swedish correction factor was applied to Sweden. (Only Germany, Denmark, France and Sweden had deciduous sites). This has been added to the text, and the text re-written to clarify these points further.

4. Page 939, line 5-10: Are the sites where stemflow in beech stands was measured the same as in the above paragraph. And is the index mentioned here not the same as in the previous paragraph? This is confusing.

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5. Page 939, line 18: correct sentence: “It must be noted

**Reply:**

Corrected.

6. Page 940, line 2: correct formula “ $2 x$ ”

**Reply:**

Corrected.

7. Page 941, line 17: please specify the two different deciduous and coniferous land use classes. What are the differences?

**Reply:**

The EMEP forest classes are now explicitly written out, as temperate/boreal coniferous, Mediterranean coniferous forests, temperate/boreal deciduous, and Mediterranean broadleaf. The differences lie in such things as phenology and stomatal conductance parameters, but for this study we only use the two temperate/boreal classes so we have avoided going into details.

8. Page 944, line 20, Fig. 5: Since the authors used several sites in Germany and Sweden for the comparison of the seasonal trend in S deposition , it would be useful to show in the graph not only the mean value but also the SD. I would like to see if for the months where the largest differences between measured and modelled data were observed (for Germany) also the SD is largest. This would further support the argument of the authors that in Germany S deposition is more influenced by local sources as compared to Sweden.

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The referee suggests that SD should be added to the graph. However, from our point of view, adding error bars to the graph would not bring any relevant statistical confidence to the evaluation, as it would only show uncertainties associated with the deposition gradient in Germany, rather than uncertainties in the actual measurements. A SD evaluation would have been interesting to see for sites within the same grid cell, i.e. to get an indication of the variability within the grid cell. This evaluation would however require measurement data from several sites within a grid cell, and we have too few data for this.

9. Page 946, line 5 following: For S deposition it is argued that one of the main reasons for the discrepancy between modelled and measured deposition data is the higher measured precipitation values at the ICP sites (as compared to modelled grid values). This argument should also apply for N deposition and modelled data should therefore be lower as measured data. But this is not mentioned or discussed at all.

**Reply:**

We have re-analysed the data in some detail, and have now written the conclusions in a more balanced way. For sulphur we have shown that differences in precipitation amounts can account for a large part of the discrepancies found for the open-field deposition amounts. For nitrogen compounds, precipitation differences can account for some, but not all of the differences between ICP and EMEP. The additional figures and text should help to clarify these issues.

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