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Atmos. Chem. Phys. Discuss., author comment AC2
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Reply on RC2

Jan Eiof Jonson et al.

Author comment on "Modelling changes in secondary inorganic aerosol formation and nitrogen deposition in Europe from 2005 to 2030" by Jan Eiof Jonson et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-342-AC2, 2021

Comments to remarks from reviewer 1
General comments:

There are inconsistencies in the use of different types of subscripts for NOx, SOx etc.

We have changed the naming of the species to be more consistent (ammonium replaced by NH_3, ammonium replaced by NH_4^+ etc).

There are different types of quotes used in different parts of the manuscript.

We are not sure what quotes the reviewer is referring to here. We have however made substantial changes in the manuscript that hopefully has changed this problem.

The manuscript needs a thorough read and correction of grammar and syntax.

We have corrected errors pointed out by both reviewers, and also errors we have detected ourselves.

This may not be important, but there is no EU28 anymore since the exodus of the UK from EU. What the authors mean by the term is clear now (in the year 2021), but might not be for future readers. I suggest that the term EU28 is defined before first use. It can then remain in the text as is.

Near the top of section 2 (Model description) we have added:

(EU28 includes the current EU27 countries and United Kingdom). UK was added to the EU definition as they were part of EU in both 2005 and 2017. As a result they are/were

committed to the emission ceiling directive.

Specific comments:

P2 L28: There is no Appendix B.

This refers to appendix B in the EMEP report. This has been made more clear.

P2 L44: dot (.) missing after sulphate.

Dot added.

P2 L51: sulphat -> sulphate (missing e)

Changed to SO_4^{2-}

P3 L80: Either ``both these studies'' or ``These two studies''

Changed to "These two studies ... "

P3 L80: Provide some numbers to support your claim.

We have added more information about the model performance in these two studies:

Out of the 14 models included in the study by Vivanco et al. (2018) the EMEP model was one of very few with low fractional biases compared to measurements for the wet depositions of reduced nitrogen (-0.01), oxidised nitrogen (-0.05), and SO42- (-0.11). For the trend studies presented in Theobald et al. (2019) the fractional bias for the years 1990 to 2010 was -0.18, -0.02, and 0.22 for the wet deposition of reduced nitrogen, oxidised nitrogen, and SO_4^{2-} respectively, but the overall overestimation chemSO_4^{2-} was mainly caused by an overestimation in the first years of the period.

P4 L87: Either ``...nitrogen can also have acidifying impacts in ecosystems...'', or ``nitrogen can also cause acidification of ecosystems...''

Changed to:

".... nitrogen can also have acidifying impacts in ecosystems ....."

P4 L107: There is no appendix B.

Appendix B refers to appendix B in the EMEP report.

Changed to:

…. listed in in appendix~B in EMEP (2020).

P4 L109-115: This needs a bit of discussion: how do the ECLIPSEv6a emissions

compare to the EMEP emissions for the countries that they were replaced? Are there significant differences? How do you account for the discontinuity of emissions between the datasets? What do you use for emissions for 2017 for the other countries?

For non EU28 countries there are no EMEP 2030 emission projections available, so we chose to use the 2005 and 2030 Eclipse emissions for these years. For 2017 we have used the model run used in the 2019 EMEP report, as this provides a link to the oficial EMEP reporting process. In this section we have included more information about the 2017 emissions.

The description of how EMEP and Eclipse emissions are used and combined is improved in the first parts of section 3.

P5 L150: Provide number of the portion that leaves the model domain.

New formulation here:

The remaining 0.2-0.3 is either deposited at sea or in non-EU countries. About 15% of the NH_3 emitted within the model domain is advected out of the model domain, but much of this is coming from non EU countries close to the eastern model boundaries.

Table 1 caption: The (Em.) and (Dep.) are not used in the table, hence no need to define them. Also, since N. Macedonia and Bosnia H. are defined, GB should also be defined. If by GB you mean Great Britain, you should probably change it to UK to be also consistent with Table 3.

We have removed the definitions of (Em.) and (Dep.) from Table 1.

GB is changed to UK, defined as the "The United Kingdom of Great Britain and Northern Ireland" in the caption.