

Interactive comment on “Sensitivity of modeled atmospheric nitrogen species to variations in sea salt emissions in the North and Baltic Sea regions” by D. Neumann et al.

Anonymous Referee #1

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This article describes an evaluation of the sea salt emissions in the CMAQ model and the impact of sea salt aerosols on the concentrations of other aerosol components in the North and Baltic Sea regions. In addition to evaluating the default sea salt emissions in the model, the article also presents results where salinity impacts are included, surf zone emissions are removed, and sea salt emissions are turned off entirely. The article is well-written with the results providing a nice assessment of the interaction between sea salt and anthropogenic pollution in a region with sources from industry, shipping, and agriculture. That being said, I think that the article is poor fit to Atmospheric Chemistry and Physics due to its strong focus on model evaluation and would be more appropriate for a modeling-specific journal such as Geoscientific

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Model Development. Rather than a general evaluation of speciated mass concentrations at certain sites, I think that the model evaluation needs to address scientific questions regarding sea salt emissions such as the chemical composition, size distribution, transport/deposition, and interaction with other aerosol components. While some of these evaluations may not be possible with the limited observational dataset, evaluating groups of stations with similar characteristics (inland vs coastal, remote vs urban, agricultural vs industrial, etc.) as opposed to individual stations may help identify strengths/weaknesses of the existing sea spray emission parameterization besides the lack of salinity-dependence. Please see the more specific comments below:

- 1) Page 29713, Sect. 2.4.3: Please add a more comprehensive description of the salinity inputs to the model.
- 2) Page 29716, Sect. 3.2: It is not clear to me why these three stations were selected for analysis in the main text and the others only in the supplement. As I suggested in my general comments above, grouping of stations with similar characteristics may allow for a more useful evaluation of the model.
- 3) Page 29717, Sect. 3.2.2: Despite the fact that the title refers to the sensitivity of nitrogen species to sea salt, the model comparison with sulfate comes before the nitrogen species. I would suggest removing most of the evaluation/discussion of sulfate or change the title to reflect the inclusion of non-nitrogen evaluations.
- 4) Page 29717-29718, Sect 3.2.3 and 3.2.4: Comparing the observed and simulated concentrations of nitrogen species based on the sum of the components instead of individually limits the evaluation of the sea salt aerosol chemistry. If these nitrogen components are available individually from the observational dataset, I'd suggest comparing ammonia, ammonium, nitrate and nitric acid separately.
- 5) Table 2: Despite sign change in the biases of sodium concentrations at two of the three stations between winter and summer, the text includes little discussion of the seasonal changes besides a general statement of the magnitude. I'd suggest adding

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discussion of the potential sea surface temperature dependence of the sea salt emissions or other factors which may influence the seasonality.

6) Table 2: The Table 2 caption includes a statistic (NMB) that are not found in the table and vice-versa for RAE

7) Typos: Page 29706, line 9: should be "As a model extension" Page 29737, figure caption: should be "concentrations" Pages 29743-29745, figure captions: These figures are not adding species to the graphs but simply replacing them. These captions should remove "the addition of"

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