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Discussions

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Interactive comment on "A comparison of sea salt emission parameterizations in Northwestern Europe using a chemistry transport model setup" *by* Daniel Neumann et al.

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Response to the comments of Reviewer #2

We thank the reviewer for the constructive comments on the manuscript.

Major comments

0. The paper includes ample discussions of the results, thus making a nice contribution to sea salt modelling regarding the choice of parametrizations and demonstrating the uncertainties. Regretfully, the studied period is rather short,

C1

being limited to just a few months, January-February and June-August 2008, which makes the conclusions less robust. Moreover, there is significant inter-annual variability in sea salt production related to meteorological variability, and it'd be worth testing the parameterizations for a broader set of conditions. Regarding evaluation of the results for sea salt size distribution, much more measurements are available for later years than 2008, which would facilitate making more founded conclusions. I think that the limited character of the study should be pointed out in relevant places in the paper (abstract, study aim, conclusions). Then, why would not the authors also look at sodium concentration in precipitation, for which much more measurements are available.

Furthermore, I cannot see that the authors manage to achieve the stated aim, namely "to improve modeled atmospheric sea salt concentrations..", but rather "to contribute" to this improvement through testing some of the available source functions, pointing to their strength/weaknesses and recommending certain improvements to the parameterizations (though without priorly testing them).

> The sentences "Each two months in winter and summer 2008 were considered for this purpose. The shortness of these periods limits generalizability of the conclusions on other years." were added in the abstract. A final paragraph mentioning this topic and giving an outlook on "What should be done next" was added to the conclusions.

> A comparison of sodium concentrations in precipitation was added (Sect. 3.3).

> Statements such as "to improve modeled atmospheric sea salt concentrations.." were altered.

9. Does the abstract provide a concise and complete summary? Yes. I'd recommend to include in the abstract the time period for which the comparisons were performed.

> Included in the end of the second paragraph of the Abstract.

11. Is the language fluent and precise? Yes, mostly. In several cases, it's better to use "close to each other" or "similar" instead of "similar to each other"

> Replaced as suggested.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Largely Yes. Please, explain SST and SAL line 126.

> It was not absolutely clear which location in the text was indicated by line 126. An explanation of SAL and SST was added in line 6 on page 6 (which is approximately line 126) and an explanation of SAL to the caption of Table 1.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? I'd recommend to a bit shorten section 3.2, perhaps skipping describing all small details and rather offering more summarized findings.

> Section 3.2 is shorted (as requested by Reviewer #3, too).

Other comments

1. Please, be consistent in using "Na in PMx" instead of just PMx to avoid misunder- standings.

> Suggestion included. "sodium" was added at most locations and "Na$^+$" only at a few, because the usage of the first seemed to yield a better reading flow.

2. Check the sentence starting p. 1 line 23 (The parameterization of sea salt emissions has a long history..because..because..)

> The sentence was split into two sentences and slightly modified. It now reads: "*The parameterization of sea salt emissions has a long history ((e.g., Blanchard and Wood-cock, 1980; Fairall et al., 1983; Monahan and Muircheartaigh, 1980))*. **Such** *parameterizations are necessary in chemistry transport models (CTMs) and climate models* **because sea salt particles** *impact on atmospheric processes.*"

3. P.2 repetition in lines 1-3 and 12–13; lines 15–30 – relevance to PM pollution/ air quality?

> The lines 1–3 and 12–13 were merged at the location of lines 12–13 and a new reference (Chen et al., 2016) was added.

> Lines 15–23 were removed, line 26 slightly extended, and references from above were included in line 27. This passage (l.24–28) is very relevant because it gives a major reason why improving sea salt emissions in CTMs is important (except for just predicting sea salt concentrations with higher accuracy for the reason itself).

4. In sec. 2 (model description), it'd be useful to explain how sea salt dry and wet deposition is calculated in the model. In what heights/model layers the emitted sea salt is distributed? Also, what was the upper cut-off size in the modelled sea salt?

> Information on the dry deposition parameterization (Binkowski and Shankar, 1995) was added in the end of the first paragraph of Sect. 2.1 (Chemistry Transport Model). Sea salt is emitted into the bottom layer of the model grid (not in higher layers). This

information was added in the end of the first paragraph of Sect. 2.2.3 (Technical Implementation). The sea salt particle emissions as well as the particle concentrations are represented by log-normal distributions with variable geometric mean diameters and standard deviations. No hard-coded upper cut of size exists.

5. Section 2.3: given the strong dependence of sea salt production on wind speed, could the authors say something about the accuracy of the wind data?

> We assume that the wind speed is well reproduced and neither strongly over estimated nor strongly underestimated. The following sentence was added to the manuscript: "*The* 10 m *wind speed is well reproduced above the North Sea (Geyer, 2014; Geyer et al., 2015).*".

6. P. 10 line 5: explain the choice of Spearman's correlation (not Pearson's)

> It should be Pearson's correlation coefficient. It was changed in the text.

7. P. 12 line 14: change "least highest" to e.g. lowest

> modified

8. P. 13 line 1-2: positive/negative bias already means over/under-estimation – no need for repetition

> The second sentence was removed.

9.a) P. 15 line 3: similar to; or similar as....
<div align="center">C5</div>

9.b) 16-22: the obvious stuff; I'd recommend to edit: The analysis REVEALS...

9.c) 29: at the station Westerland

9.d) 33: dry deposition rate (instead of behaviour), perhaps

> a) changed "*similar data than*" to "*similar data as*"

> b) inserted an "as": "*on a similar level **as** at the station Melpitz*"; removed duplications; removed "this analysis reveals" completely;

> c) corrected

> d) corrected

10.a) P. 17 lines 8-9: this difference of OV14 treatment of surf zone should probably be noted before, while comparing/evaluating the results

10.b) line 31: partially over/under-estimate??? maybe better to say "on average"? Or "in general"?

> a) A paragraph on the surf zone emission treatment starting with "Another important aspect in sea salt modeling studies is the consideration of surf zone emissions ..." was added in Sect. 3.2.1.

> b) replaced "partially" by "in general"

11. P. 18 lines 5-8: it's somewhat unclear to me what the authors are trying to say here

> We removed the two sentences.