Atmos. Chem. Phys. Discuss., 14, C3473–C3476, 2014
www.atmos-chem-phys-discuss.net/14/C3473/2014/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Model study on the dependence of primary marine aerosol emission on the sea surface temperature" *by* S. Barthel et al.

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Received and published: 11 June 2014

We thank the reviewer very much for the critical reading of the manuscript and raising some questions to it. We tried to include all remarks within the new revised manuscript and react to the single remarks by the reviewer intended and italic below.

Line 77-78. What measurements? A reference would be good here.

- Reference added

Eq.4 misses all powers of temperature Tw

- Forgotten powers added

Eq.7, dlogDp should probably be dlog10Dp

- Changed into log10Dp

Line 498-502. The resistance analogy does not work for aerosols, which has been demonstrated in series of recent and old publications. Regarding the particular reference to Seinfield & Pandis, 2006, they refer to Zhang (2001) parameterization, which is known to give huge dry deposition fluxes with no correspondence to observations. The error is particularly large over water and for accumulation-mode aerosols. Since dry deposition is a significant factor when the sea salt emission and near-surface concentrations are considered, a proper discussion of the subject and quantification of the related uncertainty are needed.

- We included a short discussion of the deposition: "The comparison of the PM1 and PM2.5 concentrations to the measurements at different stations indicated that the deposition rates may be overestimated by the model. The dry deposition parameterization used in the COSMO-MUSCAT model may overpredict the deposition rates within the PM1 and PM2.5 size ranges (Kouznetsov and Sofiev 2012). Using a dry deposition scheme, which results in lower deposition rates, would lead to the aerosols being transported farther inland within the model. That would enhance the role of the effect of the SST on PMA concentrations inland. However the model setup using the current dry deposition scheme has been used in several model simulations obtaining good results (Heinold et al. 2011, Wolke et al. 2012, Niedermeier et al. 2014). The role of dry deposition parameterization for the modelling of PMA concentrations will be investigated in a future study."

Line 661. Temperature varying by a factor of 6 sounds strange. Please rephrase using xx degrees as a measure of variation.

– Temperature variation is kept as general remark: "The monthly averaged measured

sodium concentration at Virolahti II is by a factor of 0.7 lower in January compared to June, although the wind speed increases by a factor of 1.8. This points towards the importance of SST for PMA emissions. Its decrease is in the same order of magnitude compared to other regions but with 1°C the SST is much lower than in other regions 5°C in the German Bay or 9°C in the Irish Sea)."

Lines 650-670. Substantial part of Baltic Sea freezes, which efficiently reduces the emission fluxes and observed concentrations. I guess, this is accounted for in COSMO but discussion here would be good.

- (See also response to reviewer 3) We thank the reviewer very much for mentioning the sea ice problem. We found that while COSMO uses a sea ice parameterisation this was not used by MUSCAT. This resulted in sea salt emissions in sea ice covered regions. We fixed this problem and restarted the model simulations for January 2007. In January 2007 the area in the Baltic Sea covered with ice was small. Larger areas of the sea became frozen not before beginning of February of that year (http://www.ijis.iarc.uaf.edu/cgi-bin/seaicemonitor.cgi?lang=e). Thus we found no significant difference for the results at Virolahti with or without considering sea ice. The other stations are less influenced by sea ice. The inclusion of sea ice in the model is mentioned in the revised manuscript: "Further data needed to compute the emission rates are the SST and the sea ice coverage. Both were taken from the meteorological driver model COSMO. While the sea ice coverage is calculated by the model, the SST data fields are directly taken from reanalysed input data of the GME model."

Section 4.1. Reading so many numbers from the text is painful. Arranging the mean modelled and observed values into a single table (or into separate tables for each size range) would dramatically simplify the presentation.

- Tables with the monthly averaged sodium concentrations added.

Fig.13. The different color scales make the factors of Zb13 non-comparable with the other two.

- We changed the colours, centering at a Factor of 1.

References:

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Kouznetsov, R., and Sofiev, M.: A methodology for evaluation of vertical dispersion and dry deposition of atmospheric aerosols, J. Geophys. Res., 117, D01202, doi:10.1029/2011JD016366, 2012.

Niedermeier, N., Held, A., Müller, T., Heinold, B., Schepanski, K., Tegen, I., Kandler, K., Ebert, M., Weinbruch, S., Read, K., Lee, J., Fomba, K. W., Müller, K., Herrmann, H., and Wiedensohler, A.: Mass deposition fluxes of Saharan mineral dust to the tropical northeast Atlantic Ocean: an intercomparison of methods, Atmos. Chem. Phys., 14, 2245-2266, doi:10.5194/acp-14-2245-2014, 2014.

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 377, 2014.