Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2018-1080-RC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sea salt aerosol production via sublimating wind-blown saline snow particles over sea-ice: parameterizations and relevant micro-physical mechanisms" *by* Xin Yang et al.

Anonymous Referee #2

Received and published: 12 February 2019

Comment on "Sea salt aerosol production via sublimating wind-blown saline snow particles over sea-ice: parameterizations and relevant micro-physical mechanisms" by Yang et al.

General comments: This manuscript describes using cruise measurements of snow particles and aerosols particles at Weddell Sea to constraint the parameterizations of sea salt aerosol production from blowing snow events in the p-TOMCAT model. This work conducts several sensitivity model simulations, and suggest that two different micro-physics mechanisms can potentially explain the observations. However, given

the observational data is not available for aerosols <0.4 μm, the constraints for sub-micron aerosol is relatively weak, and thus it is hard to determine which of the two micro-physics mechanism is dominant. Overall, this work provides novel insights for the sea salt aerosols production over the polar regions and highlight the necessity of future observations. Therefore, I support the publication of this work in ACP if the following specific comments can be addressed.

Specific comments: P1 Line 23: Does "in size range of 0.4-10 μm" refer to radius or diameter?

P2 Line 10-13: What is the size converting ratio from blowing snow particles to SSA? Are all/most SSA with size of 0.375-10 μm being generated by from snow particles in 46-500 μm?

P7 Line 26: Adding a plot showing the probability distribution of surface snow salinity used in the model can be very helpful. Also, does the probability distribution of surface snow salinity changes in times during the cruise period? For example, is the surface snow more saline in the earlier winter time?

P8 L1: Does the cruise travel mostly in the first-year sea ice area or multi-year sea ice area? Does the measured SSA mostly come from first-year or multi-year sea ice?

P8 L15: If the snow age = 0, does it mean that they are fresh fallen snow? If this is the case, can they get saline in such short time period? Will the surface snow salinity can be substantially lower for those snow age = 0, compared to 1-3 days? Please justify for this assumption of snow age=0.

P9 L17: Please justify why N=10 or 20 are chosen here.

P10 L15: I don't quite understand this sentence. Open ocean contributes to $\sim$20% and sea ice contributes to 40-50%. Are the rest of observations (20-30%) contribute by non-sea-salt source? Please provide a little bit more details.

P12 L2: As the cruise traveled through marginal sea ice and packed sea ice region, I

am curious if there are any signals in the aerosol samples indicating the salinity difference between these two regions?

P12 L15: As mentioned in previous section (P11 L13), the model runs with reduced RH (SI_Base_A_R1 and SI_Base_A_R1) outperformed the run SI_Base_A, with SI_Base_A overestimating the aerosol number observation. However, from Figure 5, the run SI_Base_A seems to underestimate Na at some of the sites (Alert, Barrow, Palmer). How are the run with reduced RH perform comparing to these global sites?

Also, it seems that the RH is too high in the model, causing the overestimates of blowing snow production. Meanwhile, the model does not consider the drifting snow at low wind speeds, causing underestimates of the model. These two effect seem compensate each other in the model. Please elaborate in a little bit more details in how the model can be better constrained. For example, what types of observations are required or suggested to distinguish the effect of these two factors?

In addition, the comparison between the three model runs here (SI_Base_A, SI_Classic_AX10 and SI_Classic_BX20) are using different evaporation rate. Will the SI_Classic_A perform differently compared to SI_Base_A in the comparison in Figure 5?

Figure 1: Please providing lat/lon and/or location map for this plot if possible.

Table 1: SI_Base_A_T1 is named here, but in the manuscript, it is mentioned as SI_Base_A1_T1. Please check the simulation names for T1, T2 and T3 as well. Also, the model result for SI_Base_A1_T3 is not discussed in the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1080, 2018.