

Interactive comment on “Sensitivity of cloud condensation nuclei to regional changes in dimethyl-sulphide emissions” by M. T. Woodhouse et al.

Anonymous Referee #2

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In this study, the authors investigated the sensitivity of surface layer cloud condensation nuclei to regional changes in dimethyl-sulphide emissions. They found global surface layer CCN production per unit mass of sulfur emitted varies by more than a factor of 20 depending on which oceanic region the change in DMS emission flux is applied. They also pointed out that the production of aerosol sulfate through aqueous-phase oxidation of sulfur dioxide limits the amount of sulfur acid gas available for nucleation and condensational growth and therefore suppresses CCN formation, leading to the weak response of CCN to changes in DMS emission. This is an interesting and important work and worth being published on ACP. However, I have some questions would like to be addressed.

1. I still have doubts about the treatment of new particle formation in this work. Yu and Luo (Atmosphere, 2010) pointed out that enhanced DMS emission and photochemistry during the austral summer season lead to significant new particle formation via ion-mediated nucleation (IMN) and much higher particle number concentrations over Antarctica and surrounding oceans. In their sensitivity studies, they found binary homogeneous nucleation remarkably underestimated CN10 number concentration at the German Antarctic station Neumayer. They concluded that the downward entrainment of new particles formed in the free troposphere is not able to account for the CN10 values observed in the Antarctic boundary layer. What do the authors think about the contribution of DMS to CCN over Antarctica and surrounding oceans? Will it impact the sensitivity of surface layer CCN to regional changes in DMS emissions?

2. Figure 2b indicated that the change of DMS emission at SP2 patch can impact CCN concentrations over a number of different regions which include anthropogenic polluted areas such as Argentina and South Africa. Many studies have shown that binary homogeneous nucleation cannot explain the boundary layer nucleation events observed in these polluted areas. If boundary layer nucleation is considered, will the sensitivity of surface layer CCN to regional changes in DMS emissions be changed?

3. The author shown that the global mean sensitivities of surface layer CCN to regional changes in DMS emissions at SP1 and NA2 are much higher than other patches. Can the authors give more detailed discussion and explanation on this finding?

4. The typical cloud base height for low cloud is around 300-500 m. However, the authors limited the study to only surface layer CCN which usually locates lower than the cloud base height. I would like to suggest the authors to present the changes of column CCN concentration within boundary layer.

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