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Quantifying the Impact of BrO on Dimethylsulphide (DMS) in the Remote Marine Boundary Layer

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Observations in the remote marine boundary layer have shown daytime concentrations of BrO of a few ppt, sufficiently high to have a large impact on the oxidation of DMS. Also, remote ocean studies have found measured OH levels are unable to explain the observed daytime DMS variation, suggesting a contribution from other daytime oxidants. This is interesting as the reaction of DMS with BrO produces DMSO with unit efficiency. Hence, the presence of BrO will reduce the conversion efficiency of DMS to SO2, potentially decreasing the contribution of DMS to CCN. Quantifying the contribution of DMS to CCN, and the processes that control it, is important for understanding cloud lifetime and albedo over the remote ocean.

We have used a global chemical transport model (TOMCAT CTM), including bromine chemistry, coupled to a detailed size-resolved aerosol microphysics scheme (GLOMAP) to investigate the potential impact of BrO on DMS in the marine boundary layer. Our bromine scheme is similar to that described in Yang (JGR, 2005) and includes emissions from 6 organic bromocarbons and sea-salt. Heterogeneous recycling of BrONO2, N2O5 and HOBr on aerosol and cloud droplets is also included. This, we believe, is the first study to use an explicit sea-salt emissions scheme to study the impact of BrO on DMS.

Our results show BrO provides about 20% of the annual DMS sink, comparable to that of NO3 and OH. This effect is most important in the Southern Hemisphere poleward of 45°S where BrO contributes approximately 40% of DMS loss. Inclusion of bromine chemistry reduces our DMS burden by about 40%. Importantly for marine aerosol our results show a decrease in the DMS to SO2 conversion efficiency of 5%. The sensitivity of the role of BrO to heterogeneous recycling on aerosols, organic bromine emissions and sea salt emissions of inorganic bromine will also be discussed.