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Positive future climate feedback due to changes in oceanic DMS emissions

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The global ocean is the largest natural source of dimethylsulphide (DMS) gas to the atmosphere. DMS is produced by phytoplankton and is released to the surface ocean if cells are degraded. Once it enters the atmosphere, it might contribute to the nucleation particles important for cloud formation, which then effect the Earth's radiation budget and climate. Future global warming and ocean acidification is projected to alter marine DMS production and emission. However the none of the models assessed in the last IPCC report includes the DMS-climate feedback. Recent study indicated that under high CO_2 emissions future, the oceanic DMS emission is projected to decrease by 12 to 24% by the end of this century, potentially leading to an equilibrium temperature response of 0.1K to 0.76K. Here, for the first time using a fully interactive Earth system model including a microphysical aerosol module with sulfur chemistry, we perform simulations on future climate projection with coupled DMS feedback. Under the highest pH sensitivity, our simulation shows that projected DMS production and emission decrease relative to the preindustrial state by 50% and 36%, respectively toward the end of the 21st century under the RCP8.5 emissions scenario. The largest emission reduction is simulated in the Southern Ocean. On contrast, emissions at polar latitudes increase owing to the sea ice retreat. This large change in marine sulfur emisson leads to an additional global warming of 0.3K relative to the reference simulation without DMS-climate feedback at the end of the 21st century. Both simulations also produce similar trajectories in atmospheric CO_2 concentration, consistent with little change in the cumulative oceanic and terrestrial carbon sinks.