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Assessing climatic impacts of shipping fuels: integrating MariTeam emission inventories with Earth system modeling

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Shipping plays a substantial role in global anthropogenic emissions and is a particularly challenging sector to decarbonize. COP28 emphasized the urgent need for accelerated emissions reduction in such sectors, and the IMO has a net-zero goal for 2050. Hence tools such as the MariTeam model presented here are essential in order to understand not only current emissions from shipping, but also the effect of decarbonization efforts like alternative fuels. The MariTeam model, a high-resolution AIS-based ship emission model, emerges as a crucial tool. It goes beyond merely assessing current shipping emissions, delving into the impact of decarbonization strategies, such as alternative fuels.

Utilizing ship technical data, including engine size and vessel dimensions, MariTeam calculates emissions for various species like CO_2, CH_4, N_2O, BC, OC, CO, NOx, and SOx on a global scale. Our presentation includes a comprehensive inventory of current shipping emissions in addition to the changes when alternative fuels are introduced.

To understand the climate effects, we employed the Norwegian Earth System Model (NorESM), coupled with MariTeam. Notably, shipping emissions lead to significant pollutant transport, particularly black carbon (BC) to the Arctic, with a 40% surface concentration increase, with the potential to accelerate cryosphere melt. Current shipping emissions are also found to mask global warming, impacting multiple aspects of the climate system. When exploring alternatives like blue ammonia and LNG, methane and nitrous oxide gain significance. Our results emphasize the importance of considering well-to-wake versus tank-to-wake, indicating the complexities when considering mitigation efforts for the shipping sector.