3.067 Effect of shipping emissions on atmospheric composition over the Barents Sea.

Early Career Scientist

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Abstract:

The Arctic is undergoing unprecedented changes as a result of rapid warming and socio-economic drivers. Even though the region is a receptor of anthropogenic pollution from the highly populated mid-latitudes, there are also local sources of pollution, such as shipping, that are already contributing to perturbing atmospheric composition. The Barents Sea, located off the northern coasts of Norway and Russia, has year-round shipping traffic and is likely to grow in a warming Arctic because of the economic benefits related to the opening up of the North-east passage placing it in a strategic position for the transport of goods from Europe to Asia. An increase in the marine traffic has already been observed over the past years in this region, resulting in increased emissions of pollutants.

In this work, carried out as part of EU-FP7 project ICE-ARC (Ice, Climate, Economics - Arctic Research on Change), we study the contribution of the shipping emissions in the Barents Sea on atmospheric composition in the region for the high traffic summer period (July/August) using the regional chemistry-aerosol transport model WRF-Chem run at high resolution over the region. We examine impacts of shipping pollution on production of aerosols, in particular Secondary Organic Aerosol (SOA) and also on deposition (NO_3^-, SO_4^{2-}) of potentially important nutrients. The model is run using an analytical chemical mechanism for gas phase and aerosols (SAPRC99 coupled with VBS and MOSAIC) for present-day (2012) and future (2050) conditions with ECLIPSE anthropogenic emissions and Winter et al. (2014) shipping emissions. We take into account different future growth scenarios, such as CLE (current legislation) and HGS (high growth scenario), to investigate possible future changes in surface concentrations, total column burden and deposition fluxes. Potential chemistry-climate feedbacks are also examined such as those related to aerosol-cloud interactions or changes in photolysis rates due to shipping.