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The impact of residential combustion emission on Arctic aerosol concentrations

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Arctic haze is a seasonal phenomenon with high concentrations of accumulation-mode aerosols occurring in the Arctic in winter and early spring. It has been challenging to reproduced this cylce and concentration levels with atmospheric transport and climate models. However, simulations have been improving recently and it has been shown, that a better scavenging parametrization as well as more realistic emissions are important to obtain better results. In this study we focus on the emission from residential heating, which depend on air temperature, as heating demand is higher on cold days. Varying this emission shows a clear effect on modeled Arctic concentrations. Arctic-mean and annual-mean concentrations of black carbon from Arctic domestic combustion emissions due to heating requirements, are nearly 70% higher when accounting for diurnal emission variability relative to constant emissions (Stohl et al., 2013). Emissions are high when ambient temperatures are low and cold air is transported to the Arctic. In order to capture this systematic effect, we created an interactive emission module for NorESM, a climate model, using the heating degree-day concept. Domestic combustion emissions of BC and other species are scaled interactively with the modeled ambient air temperatures, while securing that levels of annual total emissions from emission scenarios are reproduced. We compare the modeled aerosol concentration in the Arctic to observations and show the level of improvements achieved by using varying emission.