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Arctic Haze modelling: The importance of emission timing and location

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Over the last decades, it has proven extremely difficult to simulate the seasonality and levels of Arctic air pollution, using chemistry transport modelling. Most (if not all) models do not capture the high concentrations associated with the Arctic Haze in spring, and some even have a reversed seasonal cycle compared to the observations. Also the observed vertical profiles cannot be matched by the models. While this is true for many air pollutants, the deficiencies have become particularly clear when comparing model simulations and observations of Black Carbon (BC) for the Arctic. While changes of the wet scavenging parameterizations have improved the performance of some models recently, this problem is far from being solved.

Here, we investigate two issues that have been overlooked in the past: 1) The seasonality and episodicity of domestic emissions. Using the FLEXPART particle dispersion model, we compare simulations using annual mean emissions, monthly mean emissions, and daily emissions based on the concept of heating degree days. We demonstrate that emission variability is important for capturing Arctic BC concentrations. 2) we explore the effect of gas flaring emissions on Arctic BC concentrations. This source has not been taken into account by most model simulations in the past. We show that it can have a dramatic impact on Arctic BC concentrations.