Arctic in Rapid Transition: Understanding Climate-Relevant Aerosol Processes and the ART of Not Running Behind

Julia Schmale

École Polytechnique Fédérale de Lausanne, Switzerland

Author list (excluding presenting author)

Abstract

The Arctic is warming up to four times faster than the global average, a phenomenon called Arctic amplification. And what happens in the Arctic does not stay in the Arctic. The rapid transition of the region has global repercussions. Some of the most evident Arctic changes are related to the loss of the Greenland ice sheet and the sea ice, coastal erosion and permafrost thaw, increased forest fire activity as well as increased warm and moist air mass intrusions into the central Arctic. While not immediately evident, above changes have strong implications for emissions of aerosols and their precursors, as well as their atmospheric processing. This in turn impacts the Arctic energy budget both through aerosol radiation interaction and aerosol cloud interactions. In the central Arctic, cloud formation and radiative properties are particularly susceptible to aerosols, because their number concentration can be very low. To date, the climatic effects of aerosols in the Arctic have mostly been constrained in terms of anthropogenic emissions and direct radiation interactions, where a significant warming contribution has been found. What is missing, are effects of natural aerosols and aerosol-cloud interactions. It is hence of utmost importance to fully understand the present-day aerosol-climate interactions, constrain the most relevant processes and how they relate to Arctic change in order to anticipate future impacts. What is more, the Arctic is approaching tipping points that might be transgressed by the end of the century as the global community is not on track to fulfill the Paris Agreement. Therefore, voices are becoming louder to perform climate intervention to save the Arctic. Several of the potential methods are directly related to aerosol processes, e.g., marine cloud brightening or stratospheric aerosol injection. A thorough scientific effort is needed to assess the implications of such potential interventions.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

CATCH: the Cryosphere and Atmospheric Chemistry, PACES: Air Pollution in the Arctic: Climate, Environment, and Societies

IGAC Regional Working Groups

Southern Hemisphere Working Group