Arctic Haze: Effect of Anthropogenic and Biomass Burning Aerosols Transported from Europe to the Arctic

Research Highlight

Arctic haze is a well-known phenomenon that occurs during the winter and spring. It results from fires and human activities to the south that produce elevated concentrations of aerosols. In this study, researchers from France and the U.S. Department of Energy's Pacific Northwest National Laboratory investigated pollution that drifted north from Europe into the Scandinavian Arctic in April 2008. The researchers found that the European aerosols carried north in the event did not mix significantly with Arctic air. Further, the study showed that the event had a significant local atmospheric warming effect over northern Scandinavian snow and ice surfaces.

Using simulations from the WRF-Chem regional transport model, the team compared data from the 2008 POLARCAT-France airborne campaign to investigate the accuracy of model representations of aerosol movement from Europe to the Arctic. They evaluated particulates 2.5 microns or smaller in diameter (PM2.5) using European Monitoring and Evaluation Program (EMEP) measurements in source regions and POLARCAT aircraft measurements in the Scandinavian Arctic. The model agrees with actual measurements of total PM2.5, but disagrees on nitrate and carbon aerosols in source regions. The researchers also found that 2008 data originated from two different European plumes: 1) mixed manmade and fire plumes carried from Eastern Europe and Russia at low altitudes and 2) higher manmade plumes from central Europe uplifted by warm conveyor belt circulation. The model correctly represents average vertical aerosol distribution and optical properties during the 2008 event when compared to measurements and lidar profiles taken by aircraft, but underrepresents the rate of aerosol growth processes, especially condensation.

The team concludes that the indirect effect of cloud-aerosol interactions could offset the warming effect of European aerosols, but the indirect aerosol effect still is uncertain, especially in the Arctic. Further work is needed to obtain accurate estimates of its magnitude.

Reference(s)

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Cloud-Aerosol-Precipitation Interactions