

1.242 Impacts of East Asian black carbon emissions on the Arctic climate and air quality: Contributions from anthropogenic and biomass burning sources.

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Abstract:

Black carbon (BC) is one of key air pollutants that have great impacts on the climate and environment in the Arctic, where temperatures have increased more rapidly than the global average during the recent decades. East Asia is considered to be a major source region of anthropogenic pollutants with its BC emissions having a dominant contribution of 36 % in the northern hemisphere. Here we examined pathways and efficiency of transport of BC from various anthropogenic and biomass burning emission sources to the Arctic as well as quantified the source contributions, by Asia-specific tagged tracer simulations implemented in a global chemistry-transport model GEOS-Chem. The global domain was divided into 16 and 27 regions for anthropogenic and biomass burning emissions, respectively. We found that BC emitted from East Asia was transported mainly in the middle troposphere (~5 km) into the Arctic due to uplifting during the poleward transport. The East Asian contribution was dominant for BC in the middle troposphere (41 %) and the BC burden over the Arctic (27 %) because of its large emissions. This suggested that East Asia BC is important for radiative forcing at the top of the atmosphere. In contrast, BC emitted from Europe and Russia was transported to the Arctic mainly in the lower troposphere during winter and spring, i.e., the Arctic haze season. In particular, Russia BC had a dominant contribution of 62 % to the Arctic BC near the surface and 35 % to the deposition as annual mean. This suggested that BC from Russia and Europe is more important for surface air pollution and warming in the Arctic. These results suggested that East Asian and Russian sources play different roles in the Arctic climate and air quality.