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Open Burning and the Arctic: Current Knowledge and Priorities for Future Research

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This presentation will describe scientific findings from the conference on “Open Burning and the Arctic” held in St. Petersburg, Russia, in November 2010. This meeting explored the impacts of emissions from open fires on Arctic climate, particularly black carbon (BC) emissions from set fires in Northern Eurasia, and included fire, forestry, atmospheric, and Arctic scientists from Russia, the US, Canada, and European nations. Open burning in this area is an important source of BC in the Arctic, where warming is occurring at nearly twice the rate of the rest of the planet. BC from these fires is likely an important warmer of the Arctic climate, particularly in spring when ice and snow are melting. These fires, often set intentionally on croplands, rangelands, steppe, and woodlands, can also have negative health, safety, and economic effects. The meeting also included policymakers, activists, agricultural scientists, and government officials examining approaches to reducing set fires and the local impacts from those fires.

The meeting concluded that:

- The most important climate forcer, even in the Arctic, is clearly carbon dioxide, and global climate impacts of BC remain quite uncertain (particularly when considering pollutants co-emitted with BC and aerosol indirect effects). However, atmospheric BC, when deposited to snow in the Arctic during late winter and spring, has a definite positive forcing due to the snow albedo effect.
- Vegetation fire emissions (VFE) in Eurasia make a significant contribution of BC to the Arctic lower-atmosphere and snow surface.
- Transport of aerosols to the Arctic is more efficient from Eurasia than from North America, especially in winter and spring when Arctic BC concentrations are highest. As a result of this and the greater extent of snow and ice cover in the springtime, BC emissions from spring fires in Eurasia affect Arctic climate more than BC emissions from summer fires, despite the larger extent of the summertime fires.
- Eurasian VFE plumes reach the North American side of the Arctic, but it is not clear what fraction of these plumes remains aloft and what fraction reaches the lower atmosphere where BC can be deposited to snow.
- VFE produce other light-absorbing particles (i.e., “brown” organic carbon) as well as BC, which also darken surface snow. Mitigation of open burning would reduce both types of light-absorbing particles.
- BC from spring VFE may also impact climate forcing by reducing albedo of seasonal snow at mid-latitudes (40° - 60° N). The resulting mid-latitude warming may in turn contribute to Arctic warming, as well as reducing snow cover at mid- to high-latitudes. These effects need more examination in model investigations; studies which quantify the climate effects (including effects on snow and ice cover) of realistic BC mitigation measures would be particularly useful.

Participants also described priority areas of further study, for both the short term (1 - 2 years) and medium term, to improve understanding of the impacts of BC from open fires on the Arctic climate, which will be described in the presentation. It is intended that with this information, the larger community can move more quickly towards relevant, focused investigations and potential mitigation.