2.001 Transport and deposition of wildfire-emitted black carbon on Arctic ice (2002–2013).

Presenting Author:
Wei Min Hao, US Forest Service, whao@fs.fed.us

Co-Authors:
Shawn Urbanski, US Forest Service
Alex Petkov, US Forest Service
Bryce Nordgren, US Forest Service
Rachel Corley, US Forest Service
Robin Silverstein, US Forest Service
Nikolaos Evangeliou, Norwegian Institute for Air Research
Yves Balkanski, Laboratoire des Sciences du Climat et de l'Environnement (LSCE)

Abstract:

Black carbon (BC) is the second most important species for climate forcing after carbon dioxide. BC deposited in the Arctic can lead to accelerated ice melting. We report the transport and deposition on Arctic ice from wildfire-emitted BC in Northern Eurasia during a 12- year period of 2002 to 2013. We first developed daily BC emissions from wildfires in Northern Eurasia at a 500 m × 500 m resolution during this period. BC emissions were estimated based on the MODIS land cover maps and detected burned areas, the Forest Inventory Survey of the Russian Federation, and emission factors of BC for different types of wildfires. Annual BC emissions from wildfires varied considerably with an average of 0.82±0.50 Tg. BC emissions were dominated by forest fires which accounted for about two-thirds of the emissions,followed by grassland fires (15%). More than 90% of the BC emissions from forest fires occurred in Russia. Central and Western Asia was the major region for grassland fire emissions. Overall, Russia contributed 83% of the total BC emissions from wildfires in Northern Eurasia. The transport and deposition of BC on Arctic ice was simulated daily during the 12 years using the French LMDz-OR-INCA global chemistry-aerosol-climate model. The model has 39 hybrid vertical levels and a horizontal resolution of 1.29° longitude × 0.94° latitude. The model was run using 6-hourly ERA Interim Re-analysis data. The results shows that about 7.9% of emitted BC from wildfires in Northern Eurasia was deposited on the Arctic ice, accounting for 45-78% of the BC deposited from all sources. About 20% of the BC deposition occurred in springtime, which is the most effective period for acceleration of melting of ice. The simulated BC concentrations were consistent with observations at the Arctic monitoring stations of Albert, Barrow, Nord, Zeppelin, and Tiksi.