Contributions of Emissions From Biomass Burning in High Northern Latitudes to Interannual Variations in Atmospheric CO_2, CH_4, and CO

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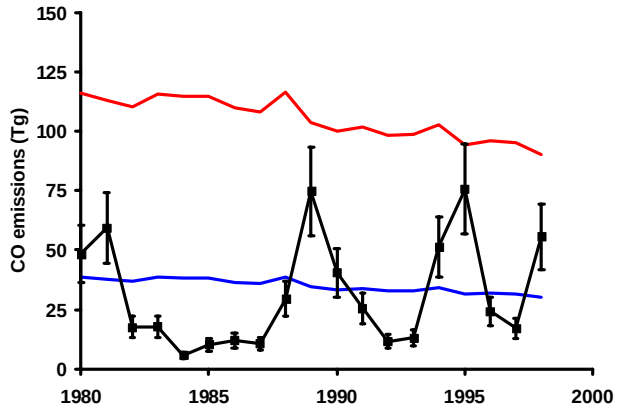
It has been estimated that annual emissions of CO_2, CO, and CH_4 from biomass burning in high northern latitude (HNL) regions, which during the 1990s, ranged between 61.3-427.3 Tg total C, 53.7-340.1 Tg of C in CO_2, 19-140.6 Tg of CO, and 0.6-4.5 Tg CH_4. Most differences result from variability in areas burned in the boreal forest where approximately 1 year in 5 is a high-fire year, during which areas burned, on average, is a factor of 8 greater than during low fire years. During high fire years, biomass burning in high northern latitude (HNL) biomes produce 10-15% of global fire emissions of CO_2, CO, and CH_4. In 1998 HNL CO fire emissions were 90% of annual emissions from combustion of fossil fuels in North America, Europe, and Russia. During high fire years CO emissions from biomass burning in North America are much greater that emissions from fossil fuel burning during the summer months (May-August) (figure). Annual average CO emissions from biomass burning in North America between 1980 and 1998 are equal to 30% of annual industrial/transportation emissions, and 90% of these emissions occur during the 4-month fire season in the United States and Canada. Emissions during high fire years are large enough to result in anomalous signatures in the atmospheric records of CO_2, CO, and CH_4. As a result, emissions from HNL fires are important in understanding interannual variations in atmospheric observations of CO_2, CH_4, and CO. Over the past four decades, the area burned in the North American boreal forest has more than doubled, and satellite data suggest similar patterns of fire in the Russian boreal forest. If the trend of increased fire activity continues, it will reduce the relative strength of the boreal region's terrestrial carbon sink and have important implications for implementation of the Kyoto Protocol.



Patterns of CO emissions from fires (black line) and fossil fuel combustion in North America (red line is the annual CO emissions and the blue line is the emissions during the fire season – May to August).