Black carbon from wildfires is travelling across Europe

New research has recorded high levels of airborne aerosol black carbon (BC) in Lithuania during two periods in 2008 and 2009. Further investigation indicated this is from smoke produced by wildfires in Ukraine and southwest Russia, which then travels northwards.

Aerosol black carbon is small particles suspended in the atmosphere that are produced through incomplete combustion of fossil fuels, biofuel and biomass. Long-term exposure to BC can contribute to respiratory health problems. Furthermore, BC contributes to global warming and melting of arctic sea ice. The transport of aerosols over long distances and borders is an increasingly recognised problem.

A detailed study, conducted as part of the EU EUSAAR project, measured the concentration of BC at an environmental pollution research station in Lithuania during 31 March-3 April 2008 and again in 2-8 April 2009. These periods were chosen because there were large amounts of biomass burning due to wildfires in the southern part of Russia, Ukraine and Belarus during these times.

The study demonstrated that the 1-hour mean aerosol particle number concentration for BC was 11,000 ng (nanograms) per m$^3$ during the biomass burning periods. In comparison, the normal, background mean concentration value was 750 ng per m$^3$. A carbon isotope (a chemical ‘footprint’) examination of the particles indicated that the aerosol particles were from the wildfire location. The researchers also identified high levels of other pollutants, such as sulfur and nitrogen compounds, which are a result of biomass burning.

Analysis of satellite data in conjunction with fire detection data indicated substantial emissions and long-range transport of smoke from large fires burning in the southern part of Russia and Ukraine. A modelling analysis suggested that in 2008 particles from biomass burning in this area travelled to Lithuania within three days and caused high peaks in BC concentrations.

In 2009 the increase BC was more immediate. It appears that air masses were transported from southern Russia, Ukraine and Belarus to the Baltic Sea and Scandinavia, passing over Kaliningrad. The pollution spread locally over Lithuania. Although there was a fall in BC after 6 to 7 days, concentrations did not recover to pre-event levels as BC has a long atmospheric lifetime and the continuing release of fine particles from the fire locations.

The results indicate that biomass burning in regions such as southwest Russia, Ukraine and Belarus can produce particulate matter, especially BC that is then transported in the air to Lithuania. It is likely that the pollution reaches even further north as levels of BC and other aerosols have also been rising in Scandinavia and northern Europe during spring periods when biomass burning often occurs.

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