Science for Environment Policy
DG Environment News Alert Service
European Commission

18 June 2009

Forest fires increase mercury emissions

Mercury is a global pollutant arising from many sources, including biomass burning (BMB), which includes both wildfires and intentional fires to clear land. A recent study estimates that mercury emissions from BMB make up 8 per cent of total global mercury emissions.

Mercury emissions from BMB have received growing attention. Forests in particular act as mercury sinks because atmospheric mercury collects on foliage. Atmospheric mercury originates from both anthropogenic sources, such as industrial pollution and fossil fuel combustion, and natural sources, such as volcanoes. When the foliage dies and decomposes, the mercury enters the soil. BMB then releases mercury from vegetation and organic soil. The released mercury is deposited both locally and globally and can contribute to the formation of methyl mercury, dangerous to humans and animals. If it gets into the human diet, it is toxic to the developing brain.

New technologies, such as satellite remote sensing, make it possible to calculate distribution of mercury in a globally consistent manner. Previous studies have been very localised and lacked data for regions of the world where most BMB occurs. The study combined outputs from a global carbon emission model for BMB (Global Fire Emission Database version 2) with mercury emission factors for different ecosystems obtained by ground and air measurements. The GFED considers BMB in temperate, boreal and tropical forests as well as burning of savanna, agricultural waste, grass and tropical forests. Global and regional mercury emissions were estimated as a product of these two types of data for the period 1997-2006.

The study estimated that global mercury emissions from BMB were 675 tonnes per year with a variance of 240 tonnes either way. This is averaged across the period 1997-2006 and is about 8 per cent of known anthropogenic and natural atmospheric emissions. The large range reflects the geographical and temporal variation over that period. In terms of regions, the major emissions of mercury from BMB come from equatorial Asia (28 per cent), boreal Asia which consists of coniferous dominated Northern forest (15 per cent) and southern hemisphere South America (14 per cent). These do not coincide with the largest carbon emissions from BMB, which are mainly attributed to fires in African savannahs.

By season, the largest global emissions occur in August and September, the lowest during the northern winters. However, there is great variability under climatic circumstances such as drought; for example, there were high emissions during the Indonesian peat fires in 1997-1998. In addition, increasing temperatures in boreal regions will probably exacerbate the problem; boreal regions have large soil mercury pools and more frequent fires could be expected here in future.

Whilst 8 per cent may seem a small contribution to global mercury emissions, the regional impacts may be more pronounced. The formation of methyl mercury has severe health implications and the researchers encourage the control of mercury emissions. Restricting the global release of anthropogenic mercury would reduce the atmospheric and vegetation/soil pools over time and thus the release potential of fires. Limiting the burning of tropical and boreal forests would reduce mercury emissions and maintain a sink for atmospheric mercury. A warming climate will be felt particularly in boreal forests, which harbour large mercury pools. These are expected to have larger, more severe wildfires in the future.

Understanding the link between BMB and mercury emissions can also help us understand how mercury is distributed. In particular, mercury released from fires in equatorial Asia and tropical South America is often transported to higher altitudes due to strong convection in these regions and can then be dispersed over a large area. The authors also suggest this work could serve as part of the emission inventory for global modelling of mercury distribution.

Source: Friedli, H.R., Arellano, A.F., Cinnirella, S., Pirrone, N. (2009). Initial Estimates of Mercury Emissions to the Atmosphere from Global Biomass Burning. *Environmental Science & Technology*. 43: 3507-3513.

Contact: friedli@ucar.edu

Theme(s): Air pollution, Forests

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.