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www.atmos-chem-phys-discuss.net/12/26351/2012/acpd-12-26351-2012.html

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1.MEGAPOLI (Megacities: Emissions, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation) was supported by the European Commission under the Seventh Framework Programme. See: http://megapoli.info/

European Commission

Science for Environment Policy

Black carbon pollution from megacities and effects on global air quality

Air pollution from the world's megacities not only has local impacts, but can spread to remote regions of the world. Recent research has highlighted, for example, that megacities are a source of black carbon pollution in the lowest kilometre of atmosphere in the Arctic, with European megacities contributing more than others.

Across the world, populations are shifting from rural to urban areas and the development of megacities and large urban clusters is putting pressure on the environment. Air pollution from these cities is of particular concern.

One air pollutant, black carbon (BC), is emitted as fine particles by the incomplete combustion of fossil fuels and biomass. BC from the world's megacities affects the health of city residents and the local environment, and can also travel long distances through the atmosphere, affecting remote areas.

This study, part-funded by the EU project MEGAPOLI[1], modelled the transport and deposition of BC emitted from 36 of the world's megacities from 2003 to 2005.

In general, the latitude of a city is the most important factor affecting the local and even regional and global spread of BC emissions. For example, BC emitted from high-latitude cities, such as those in Europe and northern North America, is initially transported rapidly through the lower atmosphere and has strong regional-scale impacts. Geographic features also affect the dispersal of BC pollution. Mountains surrounding three sides of the Po Valley urban cluster in Italy, for example, limit the early phase of pollutant transport and increase the impact of pollution inside this area.

The study also found that BC from megacities was transported long distances to both the North and South Poles. In the Arctic, BC pollution transported from urban areas was found to come mainly from the Northern European megacities of St. Petersburg, Moscow, London and the Ruhr Valley region in western Germany. Due to its high-latitude location, St. Petersburg was responsible for more of the BC in the lowest kilometre of the Arctic atmosphere than all the Asian megacities combined.

Compared with the 2 330 tons of BC deposited in the Arctic from the 26 megacities in the Northern Hemisphere (i.e. roughly 80 tons per city), the study estimated that only 45 tons of BC was deposited in the Antarctic from the eight Southern Hemisphere megacities (only around 6 tons per city). In fact, shipping in the Antarctic emits more BC during a year in the region than the southern megacities account for in terms of deposition.

People living within megacities tend to be more exposed to BC emissions than those living beyond the city boundaries. However, this is not the case for Beijing, Tianjin and Karachi, the study finds. These cities all export high concentrations of BC in the low-level atmosphere and have large populations outside the city, thus the total accumulated population exposure to BC is in fact larger outside these cities' boundaries.