Geophysical Research Abstracts
Vol. 20, EGU2018-10500, 2018
EGU General Assembly 2018

Using historic visibility data as a proxy for urban PM pollution: applied to East African cities

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Globally, many cities in low and middle-income countries (LMICs) do not have air quality monitoring programs even though they often have high and dangerous levels of air pollution. In particular, LMICs often have high particulate matter levels, often in breach of WHO guidelines, due to numerous sources of particulate matter air pollution such as vehicles, open burning and urban industries. The paucity of historic air pollution data in these locations makes it difficult to understand their current situation and to predict their future air pollution trajectory.

In this presentation, there will be a discussion of how historic visibility measurements that have been routinely recorded at airports and other locations worldwide can be used to better understand past patterns of particulate matter air pollution. These measurements have been made globally since at least the 1950s. These measurements go back much further than the data records from air quality satellites, which go back at most 15 years. In particular, the conversion of visibility to a proxy of particulate matter mass concentration will be explained. The hygroscopicity of the particles, as observed by the observed differences in visibility degradation at varying relative humidity conditions, can also be used to derive data about particle composition (Singh et al. 2017).

The historic visibility approach will be exemplified by constructing the particulate matter climatology of East African urban centres for the last 50 years. The populations of cities in the East African region, such as Nairobi (Kenya), Kampala (Uganda) and Dar es Salaam (Tanzania), have expanded rapidly over this time period. In addition to the massive population growth, the GDP per capita in these cities has also grown significantly resulting in much increased rates of fuel use and motorization, which link directly to increased particulate matter emissions. Changes in particle hygroscopicity and hence composition will be highlighted, as will likely reasons for the observed changes.

Singh, A., Bloss, W.J. and Pope, F.D., 2017. 60 years of UK visibility measurements: impact of meteorology and atmospheric pollutants on visibility. Atmospheric Chemistry and Physics, 17(3), pp.2085-2101. https://doi.org/10.5194/acp-17-2085-2017