Geophysical Research Abstracts
Vol. 21, EGU2019-14907-1, 2019
EGU General Assembly 2019

Examining the impact of aerosol size and composition on meteorology in a Beijing haze episode

Jessica Slater (1), Gordon Mcfiggans (1), Juha Tonttila (2), Sami Romakkaniemi (2), Paul Connolly (1), David Topping (1), Yele Sun (3), Zhijun Wu (4), Rutambhara Joshi (1), Eiko Nemitz (5), and Hugh Coe (1)

(1) University of Manchester, Earth and Environmental Sciences, Manchester, United Kingdom (jessica.slater-2@manchester.ac.uk), (2) Finnish Meteorological Institute, University of Eastern Finland, Kuopio, Finland, (3) Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China, (4) Peking University, Beijing, China, (5) Centre for Ecology and Hydrology, University of Edinburgh, China

Atmospheric aerosol concentrations have increased globally mainly due to anthropogenic activities such as industry, heating, transport and cooking. Increased aerosol concentrations can result in pollution events, particularly in urban mega-cities. The severity of pollution events is often defined by concentrations of PM2.5 (particulate matter with a diameter of 2.5 μm or less), which has an impact on both the climate and human health. Beijing, is a megacity which is well-known for poor air quality, often subjected to heavy pollution events termed ‘haze’, of which PM2.5 is a major contributor.

The extent to which aerosols absorb or scatter radiation is dependent on their size and composition; the impact of this interaction can lead to atmospheric warming or cooling. Meteorological measurements in Beijing show that polluted periods are accompanied by a decrease in temperature in the lower atmosphere and an increase in the upper atmosphere, reducing turbulent mixing due to buoyancy and lowering the planetary boundary layer height. Water vapour and aerosols become more concentrated in a smaller volume and so the aerosols swell and interact with radiation to a greater extent. These interactions between aerosols, radiation and meteorology thus form a positive feedback loop, exacerbating pollution episodes .

Observations in several cities have established the existence of this feedback loop and several regional modelling studies have examined the importance of aerosol-radiation interactions in enhancing polluted episodes. Through the use of a Large Eddy Scale model coupled to a Sectional Aerosol Module (UCLALES-SALSA), this work allows for much higher sensitivity studies on the impact of aerosol size and composition upon meteorology. Through the use of both meteorological and aerosol measurements taken in November-December 2016, I will present case studies quantifying the impact of changing aerosol characteristics on meteorology for a polluted multi-day period. This work will also identify whether aerosol size or composition is of more importance in prolonging and enhancing polluted episodes.