Geophysical Research Abstracts
Vol. 18, EGU2016-16213, 2016
EGU General Assembly 2016

Portable and low-cost sensors in monitoring air qualities in China

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The fast dynamics and the associated high spatial variability of the atmosphere calls for monitoring techniques that are robust, portable, low-power and ideally cheap (which thus allows for easy deployment and little maintenance needs over long measurement period), yet still offering sufficient sensitivity for measuring typical air pollutants at their ambient levels. We have over years developed a measuring suite (SNAQ box, Sensor Network for Air Quality), which weighs ∼2.5 kg and has dimension of 30 cm (L)*20 cm (W)* 15 cm (H), and is capable of measuring wind speed and direction, relative humidity, gas species CO, NO, NO_2, O_3, SO_2 (all based on electrochemical sensors), CO_2 (based on NDIR, non-dispersive infrared) and total VOCs (based on PID, photoionization detector), and size-speciated particles (based on optical counting method with cut-off in size at 0.34 microns). Two of these boxes have been deployed in China during the 2015 Yangtze River campaign led by Fudan University, China during 22nd/Nov and 05th/Dec. One of the two boxes was mounted on a monitoring ship that sailed along the river aiming at capturing primarily emissions from ships, and the other was carried by a van that drove on roads but followed the track of the ship during the same period. Preliminary analysis of the data revealed that measurements were successful on both platforms for most of the targeted species with essentially no need of personnel interference during the entire campaign. Emission ratio of CO against NO_x, or that of CO/NO_x against CO_2, for different dominating emission sources (vehicles vs. ships), can be readily quantified. Ongoing analysis includes correlating the measured pollution levels with different source profiles as well as meteorology conditions and understanding the background aerosol size profiles. We conclude that this technique provides a viable solution not only for routine point measurements of air quality in China, but also as construction unit for building large measurement networks (due to its low cost and power demand) in places such as big cities in China where air quality has become an increasing concern.