



Preface of Special Issue

Aerosol and Air Quality Research in Asia

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First established in 1999, the Asian Aerosol Conferences (AACs) have grown rapidly in terms of international participation and the range of topics being discussed, and these now cover virtually every aspect of aerosol science and technology and air quality research. Most selected papers in this special issue were presented at the 7th Asian Aerosol Conference (AAC-2011), which was held in Xi'an, China, from August 17 to 20, 2011. The conference was organized by the Asian Aerosol Research Assembly (AARA), Chinese Association of Aerosol Science and Technology (CAAST), and Institute of Earth Environment, Chinese Academy of Sciences. A total of 550 participants from 21 countries and representing academia, industry, and regulatory agencies attended AAC-2011, which included ~350 plenary, platform, and poster presentations. Some articles were also included in the special issue, even though they were not presented at AAC-2011, due that to their significant contributions to the scientific community.

Atmospheric trace constituents i.e., trace gases, and particulate matter (PM), play key roles in the Earth's atmosphere, and because they influence tropospheric weather systems, they are also important for both the global climate and human health. For several decades efforts have been made to understand the complicated physical and chemical processes that govern the concentrations and distributions of these constituents of the atmosphere and their corresponding influences. In all, 42 papers have been collected for this special issue, and they cover a wide range of subjects, including field measurements, modeling, simulation in chamber studies, and novel environmental technology. These papers, all of which were peer reviewed, describe the recent progress that has been made in the interdisciplinary fields of environmental science.

This special issue contains numerous reports involving field measurements of a wide range of substances, including PM, inorganic trace gases, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), heavy metals and bio-aerosols. In addition to the on-site field measurements, optical and satellite detection methods were also used in many of these studies.

Asian dust storms are seasonal events that significantly influence regional air quality, weather, and climate. Five papers focusing on dust are included in this issue. Li *et al.* studied the chemical modification of dust particles during several dust-storm episodes, while Tsai *et al.* investigated the influence of Asian dust storms and biomass burning in southeast Asia by analyzing the marine aerosol samples from southern Taiwan. Ling *et al.* conducted a study of micro-meteorological elements, and investigated the vertical profiles of dust during an event over the Loess Plateau in March 2010. The dust studies included in this cover many different areas and adopt various perspectives. For example, Dobrzinsky *et al.* characterized desert road dust aerosol from Afghanistan and Iraq, while Zhao *et al.* reported on dust detection from space using the moderate resolution imaging spectroradiometer (MODIS).

PM has become a subject of global concern because of its effects on both climate and human health, and there are nine papers in this issue that deal with PM from both remote and urban areas. In a case study set in a rural area of northern China, Zhu *et al.* investigated the seasonal and outdoor chemical components of PM_{2.5}, including organic carbon and elemental carbon (OC/EC) ratios, sulfate and nitrate and other species. Ren *et al.* observed the ionic and elemental components in PM_{2.5} collected from an aircraft that flew over eastern coastal China. Herlekar *et al.* investigated PM₁₀ markers of EC and OC in Mumbai, and they showed that the sources of OC were mainly anthropogenic. Zhang *et al.* measured diurnal variations of PM_{2.5} mass concentrations in Xi'an, and investigated the factors that affected pollutant dispersion in urban street canyons under low-wind conditions. Begum *et al.* investigated OC and BC in PM_{2.5} from an urban site at Dhaka, Bangladesh, and calculated the contribution of secondary organic aerosol to the total OC loadings. Du *et al.* measured aerosol number size distributions between 10 nm and 10 μm in their examination of new particle formation events in Shanghai, China. Pavese *et al.* reported on the concentrations of BC and OC in southern Italy from different sources and production processes. Kuo *et al.* investigated the behavior of metals during the vitrification of fly ash, and concluded that the procedure is technologically promising. Finally, Liao *et al.* determined the concentrations of

polybrominated diphenyl ether in fly ash from an electric arc furnace, and found the levels were one to three orders-of-magnitude higher than in environmental soils.

The multiplatform measurements used for the studies included in this issue provide different perspectives on aerosol-related issues, and these observations include both optical measurements and satellite retrievals. Detailed analyses of data from MICROTOPS-II sunphotometers, the AERONET network, and the MODIS and OMI sensors led Vijayakumar *et al.* to conclude that higher values of aerosol optical depth and lower values of precipitable water content occurred during a drought year compared with normal monsoon conditions. Pawar *et al.* determined the aerosol optical depth and incoming global solar flux at Pune, India, and calculated the short-wave aerosol direct radiative forcing.

Source characterization studies in this special issue cover a wide range of species, including VOCs, PAHs, bio-aerosols, and trace gases from both natural and anthropogenic sources. Cheng *et al.* characterized particle-bound PAHs in real time at a heavy travelled roadside site in Hong Kong using a continuous photo-electric aerosol sensor. Li *et al.* showed a correlation between aromatic hydrocarbons and benzo[a]pyrene from fugitive coke-oven emissions in Shanxi, China. Huang *et al.* measured 71 VOCs in the Kaohsiung municipal sewer system in southern Taiwan, and the authors identified the presumptive sources based on the results of statistical analyses. Wei *et al.* determined the loadings of airborne crocidolite asbestos fibers in indoor and outdoor air in a rural area of China, and found higher concentrations in areas where outcrop asbestos was present in soils compared to those without such outcrops.

Trace gases, i.e. ozone, and greenhouse gases, including CO₂ and methane, still draw considerable attention, especially in developing countries, even after decades of study. Reddy *et al.* analyzed the diurnal and seasonal behavior of surface ozone and its precursors at a semi-arid rural site in southern India. Rajab *et al.* investigated the interannual variability in methane concentrations over peninsular Malaysia from 2003–2009 using atmospheric infrared sounder data. Lin *et al.* investigated the energy flows and CO₂ emissions of a steel mill and waste management plant in southern Taiwan, and concluded that there were tangible benefits in creating a steam network between the two.

One paper in this issue is concerned with bio-aerosols, with Chen *et al.* investigating the concentrations and size distributions of airborne bacteria and fungi at three sites in Guangzhou during summer, and finding the highest concentrations of bacteria at the most densely populated site. The impact of buildings on urban air quality is also reported in this issue, with Kim *et al.* investigating the VOC emissions from building materials in residential buildings with radiant floor heating systems. Based on their investigations, they developed a numerical model and found that the VOC emissions from flooring materials increased along with the temperature.

Several papers report on progress in various aspects of model development. For example, Sitarski modeled the capture of soot particles by marine fog, and found a 10 to 200-fold enhancement due to diffusio-phoretic effects. Yetilmeszo *et al.* employed a prognostic approach based on fuzzy-logic to forecast suspended dust levels in Khaldiya, a residential area of Kuwait. The relationships between recent air quality and changes in visibility in megacities in four regions of China were reported by Lin *et al.* In a study on the removal of hydrogen sulfide by iron rich soils, Ko *et al.* used a deactivation kinetic model to predict the breakthrough curve for a non-catalytic gas-solid reaction. In a study of mercury, Fang *et al.* investigated total suspended particle (TSP) concentrations, Hg concentrations in TSP, dry deposition velocities, and particulate Hg dry deposition at two sites in Taiwan. Finally, Yamamoto *et al.* introduced a new unique constant which relates to the cumulative number distribution with volume-ratio grid spacing in initially particle-free nucleation-condensation systems.

Simulation chamber studies provide further insights into atmospheric chemical and physical processes, and a number of these are included in this issue. Along these lines, Wang *et al.* characterized both gas phase and particulate air pollutants released from environmental tobacco smoke using both on-line and off-line analytical methods. In a combustion chamber study, Wu *et al.* investigated a semi-direct injection spark ignition system for motorcycles, with a focus on emissions and performance improvement. Tuan *et al.* reported an incineration chamber study of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) in incineration flue gases, and found that two copper-containing compounds had different effects on the formation of PCDD/Fs as the flue gases cooled.

With reference to technology, there are two articles concerning CO₂ capture, two on nano materials, two on novel sampling methods and one on combustion. Chang *et al.* reported on aqueous carbonation (CO₂ capture) using blended hydraulic slag cement in a slurry reactor. Chiu *et al.* presented some of the key points associated with chemical looping technology, along with their implications for CO₂ capture. Han *et al.* reported on the preparation of TiO₂-coated polyester fiber filters by spray-coating, and the potential application of photocatalytic degradation to the purification of indoor air. As for new synthesis technology, Kim *et al.* reported on an electron-beam irradiation system that was used for the gas-phase synthesis of SiO₂ nanoparticles. There are also two articles dealing with new sampling technology for ambient measurements. Hata *et al.* described the application of a supplemental stage for a cascade impactor for nanoparticle sampling that involves the use of

inertial filter technology, while Shou *et al.* developed a novel portable porous membrane denuder for measurement of SO₂.

As a guest editor, I would like to sincerely thank all of the authors and Prof. Wen-Jhy Lee for their impressive contributions to this special issue, and their papers highlight the results of work that is at the forefront of aerosol and air quality research in Asia.

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