Foreword

Short-lived climatically important atmospheric aerosols and trace gases such as ozone play major roles in global and regional climates, the chemistry of the atmosphere, and the biogeochemical cycling of nutrients such as phosphorus. Because of the large spatial and temporal variations in their characteristics, it is of the utmost importance to have observations from different regions of the globe to understand how they behave in different environments. The polar regions of Earth are extremely sensitive to climate change and are considered to be relatively unspoiled, being situated far from sources of anthropogenic pollution emissions. This makes them ideal places to study natural aerosol processes and to assess the impacts of long-range atmospheric transport. Atmospheric aerosols over the Arctic and Antarctic have been widely studied to provide information on different characteristics including chemical compositions, particle numbers and size distributions, and optical proprieties, etc.

The Chinese National Antarctic Research Expedition (CHINARE) initiated its first voyage of scientific survey in Antarctica and the Southern Ocean in 1984, followed by the start of Arctic and the Arctic Ocean surveys in 1999. The sampling and analysis of marine and atmospheric aerosols over polar continents and oceans have now been carried out for more than fifteen years in the Arctic and thirty years in the Antarctic. This special issue of Advances in Polar Science summarizes the recent advances via ground and ship-based observations achieved by Chinese scientists during both Antarctic and Arctic campaigns under the support of the Program of China Polar Environment Investigation and Assessment.

In this special issue, the first three papers focus on the chemical composition of bulk aerosol in the maritime Antarctic. Zhang et al. (2015a) and Zhang et al. (2015b) both report the year-round characteristics of trace elements, including the ions of methane-sulfonic acid (MSA) and non-sea-salt sulfate (nss-SO$_4^{2-}$), at Zhongshan Station, East Antarctica and Great Wall Station, Antarctic Peninsula, respectively. Both papers show strong seasonal variations in aerosol chemical composition which helps to understand the sources of aerosols to this climatically sensitive region. Zhao et al. (2015) report ship-based observations of aerosols over the marine atmospheric boundary layer whilst in transit from China to the Antarctic and further clarify the potential sources of the aerosols they measured. This also provides the opportunity to make comparisons between mid-latitudes and the Antarctic.

Six further papers focus on chemical composition of aerosols collected in the marine boundary by shipboard measurements, and on short-lived gases (ozone, O$_3$ and carbon monoxide, CO) from ground-based observations in the Arctic. It is widely understood that atmospheric iodine is involved in a variety of photochemical reactions in the troposphere. Here Kang et al. (2015) present data on the concentration and speciation of iodine in aerosols in the Arctic Ocean during the summer time. These results provide solid evidence of cycling of atmospheric iodine in the Arctic. When compared with the iodine containing aerosols, aerosols comprising of sulfur have been widely investigated. However, few measurements have been reported from in the Arctic Ocean. Liu et al. (2015) provide updated results on methane sulfonic acid (MSA) and find similar trends in variations of total iodine (TI) and MSA concentrations. They further suggest that, with future warming, the concentrations of MSA may increase in the Arctic because of the melting of sea ice. Sun et al. (2015) report on phosphorus speciation in aerosols to help understand the nutrient cycles of phosphorus in the marine boundary layer, a subject that has been neglected until now. Wu et al. (2015) report on the levels and sources of anthropogenic pollutants such as polychlorinated biphenyls (PCBs), which are classified as persistent organic pollutants under the Stockholm Convention. This group of pollutants is now banned in most of the world. It was found that besides long-range transport, intense ice retreat enhances the volatilization of
previously accumulated PCBs from sea ice. Li et al. (2015) report continuous measurements of the concentrations of carbon monoxide (CO) and ozone (O₃), which are involved in different kinds of photochemical processes, influencing the oxidizing capacity of the troposphere. Their results provide updated data on spatial variation to better understand photochemistry in the troposphere over the Arctic Ocean. Luo et al. (2015) report on ground-based observations of O₃ in the stratosphere by passive differential optical absorption spectroscopy. These results are in good agreement with the satellite-borne ozone monitoring data and provide evidence to understand ozone depletion in the Arctic.

We expect that this special issue will provide a forum for the international scientific community to understand how Chinese scientists have made and are making progress and contributing to the improvement of knowledge of polar atmospheric chemistry. It is hoped that this will encourage future international collaboration.

As guest editors of this Special Issue, we would like to acknowledge all the authors for their valuable contributions and the anonymous reviewers for their time and efforts to ensure high standards of the submitted manuscripts. We are also grateful to Prof. Ian Allison, one of the Co-Editors-in-Chief of *Advances in Polar Science* and Dr. Jing Huang for their encouragement to make this Special Issue possible.

Guest Editors:

Prof. Liqi Chen, Prof. Zhouqing Xie, Prof. Yuan Gao

28 September 2015