Foreword

The impacts of global changes on the natural environment of the polar regions have been observed and investigated by scientists over recent decades. For example, the melting of glaciers and the changes induced in both the global carbon cycle and the freeze–thaw cycle of the polar regions due to global warming have exerted pressure on the polar environment. Furthermore, the warming climate, changes in hydrological conditions, and changes to the rates of methane and nitrous oxide production and respiration in different types of soil have also constituted a challenge to polar region ecosystems.

Environmental changes in the polar regions, especially Antarctica, have been influenced by very few anthropogenic factors because of the remoteness of these areas. However, heavy metal elements, persistent organic pollutants, and organophosphorus esters have been found in polar regions following transportation via atmospheric and oceanic circulations, and even by human activity. All the effects related to both natural environmental changes and human activities are cumulative, doubling the challenges faced by the polar ecosystem.

The polar environment ecosystem includes invertebrates, birds, mammals, algae, land plants, lichens, and microorganisms. The ecosystem response to polar environmental change includes the appearance of new species of microorganisms, alteration to the habits and population dynamics of plants and animals, and variation in biodiversity. Because of the minimal impact of human activity in polar regions, polar ecosystem response to environmental change is very significant for scientific research because polar life is recognized as a bioindicator of global change.

Over recent decades, research scientists from around the world have paid increasing attention to the investigation and monitoring of environmental changes in polar regions. In particular, Chinese scientists have achieved considerable progress in the research fields of the polar atmosphere, oceans, glaciers, and marine life. We would like to gather and publish these results in this special issue of *Advances in Polar Science.* For this issue, we have two reviews and six articles contributed by Chinese researchers and their international collaborators.

The first review focuses on Antarctic birds and mammals, i.e., penguins and seals, and it highlights the need for long-term, continuous monitoring and investigation to assess the impact of climate change on these species. Another one reports the discovery of organic pollutant organophosphorus esters on the Antarctic Ice Sheet. The first article reports the creation of 13 permanent plots on Fildes Peninsula, King George Island, Antarctica, which are used as a network for long-term monitoring of vegetation, including *Deschampsia Antarctica* (a native vascular plant), mosses, lichens, and microorganisms. This network is serving as a platform for multidisciplinary Antarctic research studies including botany, microbiology, ecology, and environmental science. After studies of diversity and population characteristics, the second and third articles address an important discovery that cultured fungi of the Arctic aquatic environment could be used as prototype drugs for medicinal proposes. The nucleotide differences of the *mbf1* gene in the lichenized fungus *Umbilicaria decussate* from the Antarctic, Arctic Regions, and extra-polar Armenia were compared and the data obtained proven useful in further polar studies. The remaining three articles consider the serious situation of pollution in the polar regions as a warning. These important works highlights the influence of the temperature, nutrients, and moisture of soil in the High Arctic in summer on CO_2 fluxes, ecosystem respiration, and net ecosystem exchange. The rates of methane and nitrous oxide production and respiration from different soils are also reported, and their relationships with the activity of the freeze–thaw cycle of the coastal Antarctic tundra are indicated. In the final article, studying heavy metal elements, two pre-treatment methods for mercury stable isotope analysis are introduced and their use with Antarctic moss demonstrated successfully.

Guest Editors:
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