Chapter

Introductory Chapter: Antarctica - A Key to Global Change

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1. Introduction

"Antarctica" is a keystone to understand the past and present status on the Earth system, as well as to predict future figures of our planet as viewed from the polar region. The Antarctic region, composed by ice-covered continent in its center and surrounding the Southern Ocean, has been gradually investigated by a human being during the last half-century by all kinds of scientific branches: bioscience, physical sciences, geosciences, oceanography, environmental studies, and together with their technological innovative developments. Antarctica occupies a pivotal location to have an understanding of the evolution of the past supercontinents such as Rodinia and Gondwana as well as the present day plate movement among global tectonics. Major location names in the Antarctic region are illustrated in **Figure 1**.

2. Scope of the book

This book covers the topics on recent development of all kinds of scientific researches in and around the Antarctic region, with a viewpoint to monitor the current variations in the extreme environment, affected by remarkable changes in temperature and sea-ice extent, mass loss of ice-sheet and glaciers, variations in marine and terrestrial ecosystem including human activities. Multi-disciplinary and inter-disciplinary approaches are beneficial in bi-polar researches, being focused on the interrelated perspectives which will be needed to understand and quantify their connections with the prediction of future climate system change.

Scientific challenges in the Antarctic include a signature on the presence of the ice sheets, ice shelves, glaciers, and sea-ice in and around the continent. In this concern, particularly the cryosphere system is likely to be influenced by temporal-spatial variations in the surface environment in the Antarctic, and continuous researches of their variability provide direct evidence of climate change. For instance, cryosphere originated seismic signals have been significantly reported and can be classified into several kinds of generating sources: dynamics of ice sheets, ice-caps, sea-ice, oceanic tidal cracks, icebergs and calving fronts of the ice caps, and basal sliding of ice streams and glaciers [1–4].

Since the most exciting initiative in the Arctic region was the International Polar Year (IPY) in 2007–2008, which had been conducted at the 50th anniversary of the International Geophysical Year (IGY 1957–1958). The IPY was a big international program composed of multi-disciplinary science branches: upper atmosphere, meteorology, glaciology, geosciences, oceanography, and biosciences conducted by a significant number of polar scientists involved [5]. The initiative significantly

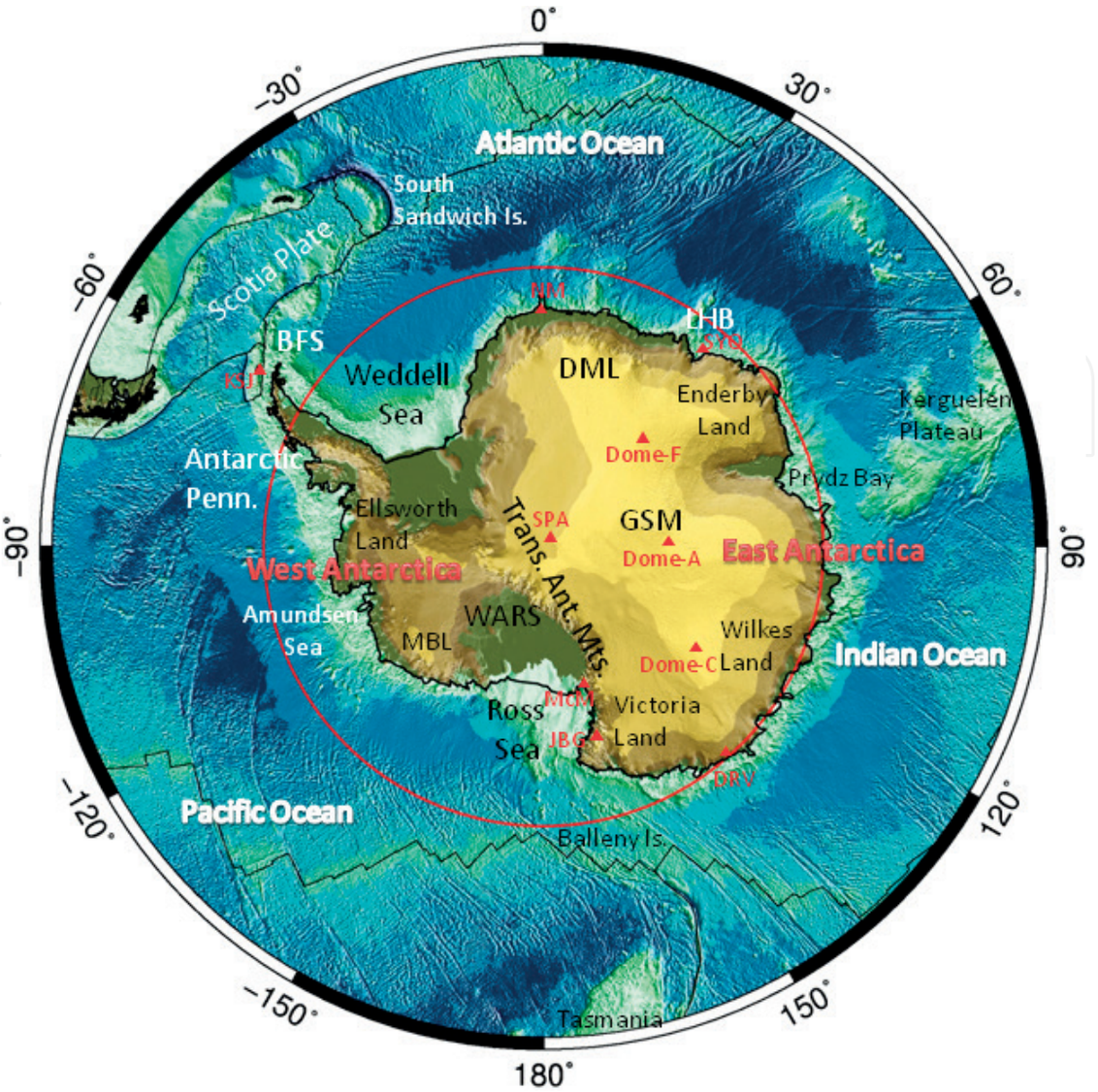

Figure 1.
Surface topography and bathymetry in the Antarctic (ETOPO1, [7]) with major geographic location names treated in this review chapter. Plate boundaries are after [8]. Red solid circle represents the "Antarctic circle" (66.6°S). Abbreviations are as follows. LHB; Lützow-Holm Bay, DML; Dronning Maud Land, GSM; Gamburtsev Subglacial Mountains; Trans. Ant. Mts.; Trans-Antarctic Mountains, WARS; West Antarctic Rift System, MBL; Marie Byrd Land, BFS; Bransfield Strait. Red solid triangles are the permanent stations. SYO; Syowa Station, NM; Neumayer Station, Dome-F (Fuji), Dome-A (Argus), Dome-C (Charlie), DRV; Dumont D'urville, SPA; South Pole Station, McM; McMurdo Station, JBG; Jang Bogo Station, and KSJ; King Sejong Station.

enhanced the exchange of ideas across nations and scientific disciplines to unveil the status and changes of planet Earth. This kind of inter-disciplinary approach helps us to understand and address grand challenges such as rapid environmental change and its impact on human society.

The recent seismological research achievements in the polar region, for instance, are compiled in the special issue on "Polar Science" [6]. By taking into account the above concerns, however, this book aims to collect many discipline achievements by a significant number of involved projects at the IPY and post era, primarily focusing on surface environmental variations associated with global change such as temperature warming, subglacial lakes distribution, ecosystem dynamics, sea level rise, and melting of the cryosphere.

It is also mentioned that, moreover, the contents in this book intend to appeal not only to the polar scientists but also to all general public who are interested in the present status of the Antarctic region. It is hopeful that this book could provide remarkable knowledge and new understanding regarding current environmental

variations and the past Earth's history within the global dynamics. This book could surely attain fruitful information on an advance of frontier researches in the Antarctic region which are currently suffering significant extents by climate change within the global system.

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