1. Introduction

The Arctic environment is changing. The changes are large, rapid and system-wide. They have few equals elsewhere on Earth, and some are occurring at greater rates than predicted by computer models. Arctic Change has regional and global implications, and continued changes will have significant Arctic and worldwide environmental and societal consequences.

Nothing illustrates the scale of Arctic Change, and its regional and global implications, better than the dramatic recession of the Arctic sea ice cover in summer 2007 (Figure 1). That this should have occurred early in International Polar Year (IPY) 2007-2009 exemplifies the global importance of the Arctic and the need for continued and greater vigilance via enhanced, coordinated and sustained observing infrastructure, i.e., AON.

The magnitude and rate of the system-wide changes in the Arctic are such that there is broad consensus that enhanced, coordinated and sustained observing is vital. Current observing capabilities are not adequate to support the synthesis and modeling that are essential for better understanding of the regional and global causes and consequences of Arctic Change. Without improved observing capabilities and understanding of Arctic Change, regional and global society's ability to anticipate, predict and develop effective adaptive responses to future changes will be severely limited. Improved observing capabilities will be needed for the assessment of the effectiveness of efforts to mitigate the effects of global change and regional feedbacks in the Arctic.

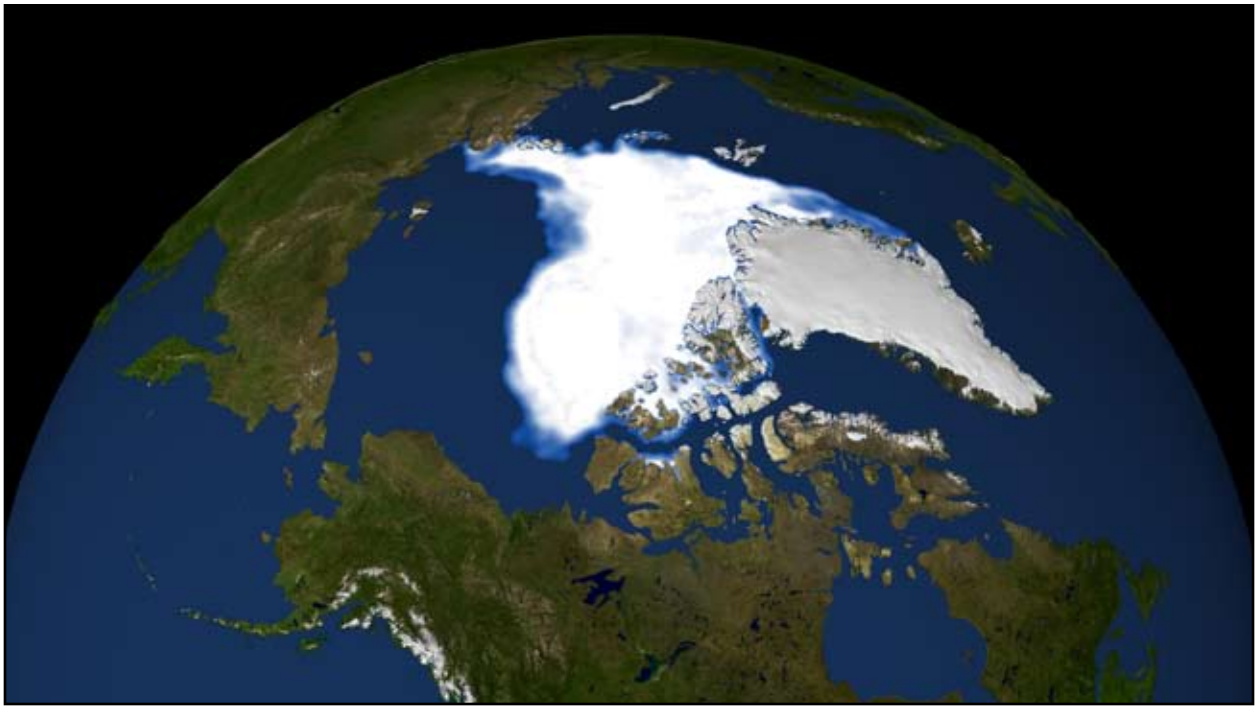

Figure 1. Arctic sea ice extent on 14 September 2007 as observed by the Special Sensor Microwave Imager (SSM/I) of the Defense Meteorological Satellite Program (DMSP). Source: NASA/Goddard Space Flight Center Scientific Visualization Studio.

This report focuses on US Federal observing activities in the Arctic as they relate to the development of AON to advance the goals of SEARCH. The report also describes many sub-Arctic observing activities. The Arctic is not isolated from the rest of the world, and AON must include the sub-Arctic observing sites. They are a vital to documenting northern environmental variation and change, and improving the understanding of interactions and feedbacks that occur between the Arctic and the rest of the world.

The report also shows that Federal Arctic observing activities extend beyond US territory. The need for enhanced Arctic observing capabilities is recognized by all Arctic countries, and also by many outside the Arctic. AON will be the US contribution to a multinational, pan-Arctic observing network to be developed in collaboration with other countries.

The report is organized as follows. Section 2 describes a few of the changes that are occurring in the Arctic; they illustrate the urgent need for improved Arctic observing. Section 3 provides some background to the development of consensus that the need for AON is indeed urgent. Section 4 offers a conceptual framework to guide the development of AON by defining, in broad terms, its participants, activities and outcomes.

Section 5 is a summary of the scope of current US Federal observing activities in the Arctic. Section 6 describes (a) Federal agencies' plans for future Arctic observing activities, (b) a conceptual framework for integration and coordination of existing and new observing activities, and (c) data and information management to meet the need for easy, free, open and timely access to all Federal Arctic observing data. Section 7 addresses the international cooperation necessary to realize the development of a multinational, pan-Arctic network. Section 8 concludes the report with a list of action items for Federal observing activities in the Arctic, particularly as they relate to the need for enhanced, coordinated and sustained observing to advance the goals of SEARCH.