Rapid Change in Arctic Sea Ice: Assessing Drivers and Future Trajectories

1. Introduction

Sea ice is a key research focus of the CliC Project, and a core element of new efforts of WCRP to enhance credibility of Arctic climate prediction and projection. Observations indicated that Arctic sea ice has become one of the most rapidly changing components of the global climate system. Due to its nature, sea ice is much more sensitive to variations in external forcing than other climate system components, and it integrates the inter-dependent processes of the global energy and water cycles. Changes in sea ice also feed back into the overlying atmosphere and the underlying ocean, with the potential to further amplify environmental change as a system, impacting ecosystems and societies. Understanding present arctic sea ice conditions, its predictability and projecting future changes have therefore become central pieces of current climate studies.

The most prominent recent changes observed in arctic sea ice is the accelerating decrease in sea ice cover since the mid-1990s including the extreme loss of summer sea ice cover in 2007. Understanding this phenomenon would be a key to untangling the complex problem of rapid sea ice change and would enhance the credibility of future sea ice change projections. Existing studies have attributed such rapid changes to various factors including greenhouse-gas-emissions forcing, intensification of the North Atlantic and North Pacific warm water intrusion, shifts of atmospheric circulation and increases in poleward atmospheric heat transport, sea ice-induced albedo feedback and cloud-modulated and forced surface shortwave and longwave radiation, as well as preconditioning by wind-driven sea ice export. However, the fundamental driving forces behind these contributing factors and their relative importance have not been quantified. A coordinated effort to integrate the current state-of-knowledge and to conduct a synthetic analysis about the recently observed rapid sea ice change and its future occurrence are pressing needs. This effort falls well within the recommended research areas described in the recent WCRP White Paper (WP) and will help coordination of the forthcoming CMIP5 activities.

2. Objectives

This workshop has three objectives:

• To synthesize the state-of-knowledge and assess the leading drivers of systematic changes in Arctic sea ice cover, including triggers and terminators of rapid change episodes, and mechanisms that could aid intermittent or longer-term recovery of the perennial ice pack.
• To assess the role of the rapid sea ice change episode in influencing the ice cover’s future trajectory over interannual to decadal and century time scales and in determining the timing of a seasonally ice-free Arctic Ocean.

• To determine the large-scale atmospheric and oceanic consequences of sea ice loss

• To identify knowledge gaps and provide suggestions/recommendations for observational campaigns and for coordinating the forthcoming CMIP5 research activities.

3. Participants and Workshop Location and Time

We plan to have a small-scale workshop at IARC from 6-8 Oct. 2010, bringing together experts in both observations and model simulations from the areas of sea ice, atmosphere, and ocean. The tentatively estimated number of participants is about 30.

4. Expected Outcomes

We anticipate that the workshop will help the community of sea ice and climate modelers and observationalists to understand the nature of changes that the Arctic sea ice cover has been undergoing over the past few decades and in the state-of-the-art climate model simulations and projections, to identify research and observation needs and next steps that should be taken to improve projections of future sea ice changes on interannual to decadal and century timescales, and to put into perspective interannual variability relative to secular and long-term externally forced changes.

We plan to develop a review/synthesis paper wrapping up workshop outcomes. The tentative target of the publication will be the Bulletin of the American Meteorological Society or EOS.

5. Organizers and Sponsorship

The organizing committee consists of experts representing the core constituencies and sponsorship for the meeting, including IARC, the CliC Arctic Sea Ice Working Group, and the CliC and WRCP Programs. The members include:

Xiangdong Zhang (IARC/University of Alaska), Hajo Eicken (UAF/CliC), John Walsh (UAF), Sebastian Gerland (NPI/CliC), Vladimir Kattsov (MGO/Russia/WCRP), Greg Flato (CCCMA/Canada/WCRP).