Oral | Symbol A (Atmospheric, Ocean, and Environmental Sciences) | A-CG Complex & General

[A-CG36_30PM1]Science in the Arctic Region

Convener:*Sei-Ichi Saitoh(Faculty of Fisheries Sciences, Hokkaido University), Jun Inoue(National Instituteof Polar Resarch), Naomi Harada(Japan Agency for Marine-Earth Science and Technology), Rikie Suzuki(Research Institute for Global Change, Japan Agency for Marine-Earth Science and Technology), Chair:Sei-Ichi Saitoh(Faculty of Fisheries Sciences, Hokkaido University)

Wed. Apr 30, 2014 2:15 PM - 2:45 PM 311 (3F)

The Arctic region and surrounding circumpolar region is the key area for the study of global change because the anthropogenic impact is projected to be the largest in this area due to the complicated feedback processes of the nature. A number of international and interdisciplinary research projects are in progress for the studies on the atmosphere-ocean-land system under the extension program of the International Polar Year (IPY) during 2007 to 2008. In order to understand the feedback processes occurring in the Arctic and to project the global warming in the future, we need to establish the intense observational network and to exchange the knowledge and information by combining the different scientific communities under the common interest of the Arctic. Contributions from Green Network of Excellence (GRENE) Arctic Climate Change Research Project are also welcome.

2:15 PM - 2:30 PM

△[ACG36-P01_PG]Sea ice and ocean primary production and phenology in the Arctic Ocean

3-min talk in an oral session

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Keywords:Arctic Ocean, primary production, phenology, sea ice algae, phytoplankton

In the Arctic Ocean, both phytoplankton and sea ice algae are important contributors to primary production and the arctic food web. We use a coupled ice algal and pelagic ecosystem model embedded in the global physical model POP-CICE (Parallel Ocean Program- Los Alamos Sea Ice Model) to study the ecosystem response to climate changes. The model results showed a mean seasonal cycle of ice algal production from March to May and subsequent ocean production from May to September in the Arctic. The ice algal production, although smaller than that of the ocean, is of ecological importance as a food source for higher trophic levels during the long arctic winter before ice melt. The simulated mean open-ocean upper 100m primary production within the Arctic Circle was 413 Tg C/yrin the years 1998 to 2006, close to the remote sensing derived estimate of 419 Tg C /yr but with higher interannual variations. The mean sea ice algal production in the Northern Hemisphere from 1998 to 2007 was 21.3 Tg C/yr, which is in the range of multi-observational estimations of 9 to 73 Tg C/yr based on in situ measurements. Arctic organisms are adapted to the strong seasonality of environmental forcing. Climate warming causes shrinking ice coverage and earlier ice retreat in the Arctic, which is likely to change the timing of primary production. Using a synthesis of available satellite observation data and the coupled ice-ocean ecosystem model, we found that, over a large portion of the Arctic marginal seas, the timing variability of ice retreat at a specific location has a strong impact on the timing variability of pelagic phytoplankton peaks but weak or no impact on the timing of ice-algae blooms in those regions. The model predicts latitudinal and regional differences in the timing of ice algae biomass peak (varying from April to May) and the time lags between ice algae and pelagic phytoplankton peaks (varying from 45 to 90 days). The correlation between the time lag and ice retreat is significant in areas where ice retreat has no significant impact on ice-algae peak timing, suggesting that changes in pelagic phytoplankton peak

timing control the variability of time lags. Phenological variability of primary production is likely to have consequences for higher trophic levels, particularly for the zooplankton grazers, whose main food source is composed of the dually pulsed algae production of the Arctic.