Sea-ice loss amplifies summer-time decadal CO₂ increase and ocean acidification rates in the western Arctic Ocean

by

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Abstract

The Arctic Ocean is potentially a major sink for atmospheric CO₂ as is suggested by its low partial pressure of CO₂ (pCO₂). While the Arctic Ocean has experienced rapid warming and sea-ice loss, their impacts on long-term pCO₂ trends, rate of ocean acidification and their seasonal variations are unknown. Here we report decadal changes of summer-time sea surface pCO₂ and ocean acidification from 1994-2017 in the western Arctic Ocean. We find widely variable changes in sea surface pCO₂ with an increasing rate in the ice-free deep Canada Basin twice higher than that of the atmosphere CO₂, which contrasts with no significant change in the shallow waters of the Chukchi Sea shelf. Acidification rates in the Canada Basin is also much faster than other ocean basins. Our analysis suggests that the reduced ice concentration in the Canada Basin facilitated an enhanced CO₂ uptake, a rapidly increasing sea surface pCO₂, and an amplified seasonal variation of pCO₂ as well as rate ocean acidification. Thus, the summer-time CO₂ sink intensity has rapidly reduced during the low ice period of later summer in the Canada Basin and is expected to reach zero within the following decade. In contrast, strong biological uptake of CO₂ in the shelf waters has held pCO₂ lower with less seasonal difference in the Chukchi Sea and thus air-sea CO₂ difference and CO₂ sink have increased and are expected to increase further in the future. Improved understanding of processes regulating seasonal variability of pCO₂ and acidification in the Arctic Ocean is essential for reliable forecasting of multi-decadal response of the ocean carbon cycle to climate change.

Date : 11 November, 2019 (Monday)
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(Host faculty: Prof. GAN Jianping)

All Are Welcome!