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Biogeochemical cycle in the Arctic with a global coupled sea ice-ocean-ecosystem model

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In the Arctic Ocean, both phytoplankton and sea ice algae are important contributors to the primary production and modulators of biogeochemical cycle. A global coupled ice-ocean-ecosystem model was established to investigate ice-ocean biogeochemical cycle and the ice-ocean ecosystem modules are fully coupled in the physical model POP-CICE (Parallel Ocean Program- Los Alamos Sea Ice Model). The model results are compared with various observations and the focus here are on the perspectives of the ice and ocean primary production and nutrients cycling in the Arctic Regions. The modeled sea ice algal carbon production shows reasonable seasonal successions of blooms from the subarctic toward the central Arctic and is in the comparable ranges of observations in the Chukchi Sea and the total amount in the pan-Arctic Regions. The phytoplankton blooms in the ocean starts with ice-edge blooms in the marginal ice zone, especially on shelf regions where nutrients concentrations are high. The ocean primary production is one order higher than the ice algal production in the subarctic seas and the shelf regions of the Arctic, while both are low in the central arctic due to nutrient limitation. The model reproduced the spatial distribution of the annual carbon production levels in the upper 100m of the Arctic Ocean. The DMS and DMSP concentrations are calculated in both sea ice and ocean, and preliminary results of the seasonal cycle of DMS, DMSP concentrations and fluxes at the air-sea interface are shown.