

Modeling studies on pan-Arctic ice-algal productivity: Present status and future projection

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Seasonal, interannual, and decadal variations in the Arctic ice algal productivity (icePP) for 1980–2009 were investigated using daily outputs from five sea ice–ocean ecosystem models participating in the Forum for Arctic Modeling and Observational Synthesis (FAMOS) project.

The models show a shelf–basin contrast in the spatial distribution of icePP. The simulated icePP substantially varies among the four subregions (Chukchi Sea, Canada Basin, Eurasian Basin, and Barents Sea) and among the five models, respectively. The simulated annual total icePP has no common decadal trend at least for 1980–2009 among the five models in any of the four subregions, although snow depth and sea ice thickness in spring are mostly declining. The model intercomparison indicates that an appropriate balance of stable ice algal habitat (i.e., sea ice cover) and enough light availability is necessary to retain icePP. The selected value for the maximum growth rate (V_{\max}) of the ice algal photosynthesis term is a key source for the inter-model spreads. Understanding the simulated uncertainties on the pan-Arctic and decadal scales is expected to improve coupled sea ice–ocean ecosystem models. This step will be a baseline for further modeling/field studies and future projections.

Now, we are preparing a new model intercomparison project “Ice Algae Model Intercomparison Project phase 2 (IAMIP2)”. The experiment period will be extended to 150 years spanning from the mid-twentieth century to the end of the twenty-first century, using the same atmospheric forcing dataset based on outputs from the Coupled Model Intercomparison Project phase 6 (CMIP6).

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