Presentation Abstract


Sea ice distributions exert an important control on Arctic Ocean biogeochemistry. Phytoplankton in the upper ocean are responsive to changes in light availability, temperature, and vertical mixing dynamics—all variables affected by sea ice. As Arctic sea ice declines, the pelagic habitat will expand both in space and seasonal duration. Changes in surface forcing may affect vertical mixing, resulting in greater nutrient supply. These changes may increase pan-Arctic primary productivity, enhance fluxes of CO2 from atmosphere to ocean, and result in greater amounts of surface-to-depth export of organic material. However, competing factors may result in changes of the opposite sign; for instance, warmer temperatures may promote tighter trophic coupling, greater upper-ocean recycling, and reduced export ratios. In this talk, I present preliminary results from 21st Century integrations using CESM1. These indicate that changes in the future Arctic Ocean ecosystem are complex. While pan-Arctic primary productivity is likely to increase with sea ice decline, export of organic material from the surface ocean to depth becomes less efficient. Algal community composition is sensitive to changes in seasonal light distributions; under future scenarios small phytoplankton become more prevalent at the expense of diatoms. These changes, in addition to warmer sea surface temperatures, lead to tighter trophic coupling in the surface ocean, with the net effect of reducing export ratios. Further investigation will focus on determining the impact these changes have on regional to global-scale carbon and nutrient budgets.