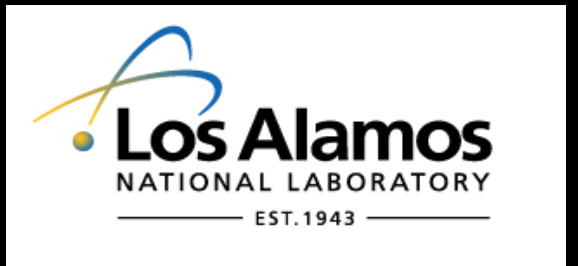


The impact of a changing environment on Arctic Marine production

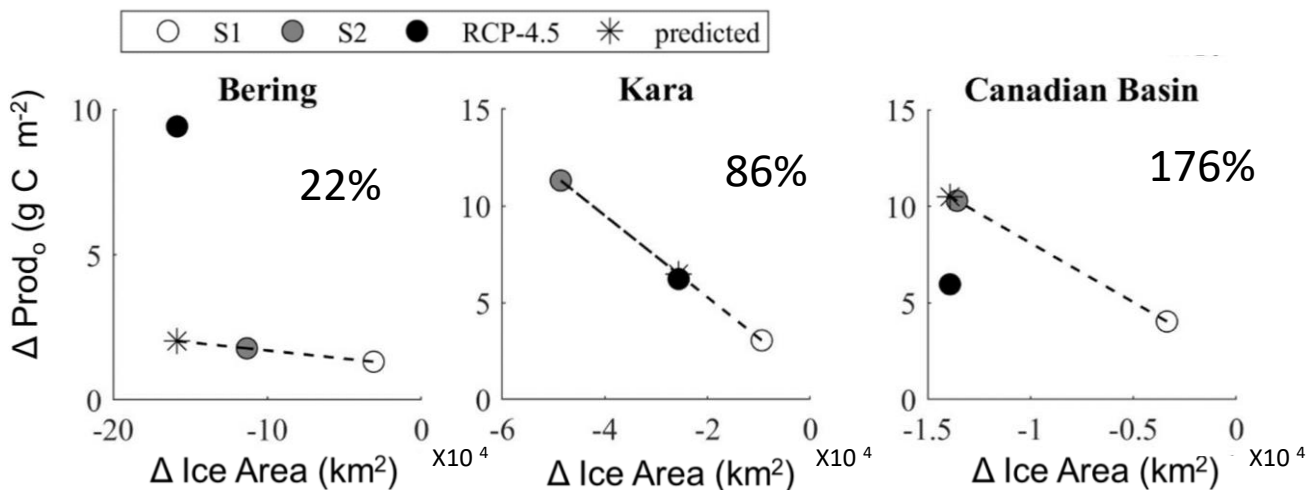
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Science motivation and summary,

- Changes to water temperature, sea-ice cover, and nutrient concentrations due to changes in the global climate system are likely to have large implications for Arctic marine ecosystems, and consequently for Arctic marine production and the carbon cycle.
- Used E3SMv0-HiLAT Earth system model to approximate the relative importance of ice vs. temperature on Arctic marine ecosystem dynamics.
- Varying by region, reduced sea ice could account for 22-100 % of the increase in annual ocean primary production under a warmer climate scenario.
- Changes to carbon fixation by primary producers may be an order of magnitude greater than changes to air-sea CO₂ flux under future warming.



	Change in Tg C y ⁻¹ under RCP 4.5 warming	
Region	Atm-Ocn CO ₂ Flux	Annual primary production
Bering	-13.9	22.74
ESS	0.1	3.26
Kara	0.5	5.38
Nordic	-5.1	20.50
Basins	5.7	28.66

Ongoing research

- Through changes in the growing season length, wildfire frequency, and permafrost thaw, warming climate is also speculated to increase river nutrient loading.
- Modified the river nutrient forcing in the HiLAT model and assessed the impact on annual primary production in the coastal Arctic:
 - Doubling river nitrate increases primary production by ~20-30% percent in the coastal regions of the Laptev and Kara. The response in the marginal seas i.e. the Bering, Chukchi and Nordic Seas is minimal.

Future research

- Exploring the impact of riverine POC, DOC and DIC on Arctic primary production – and partitioning of carbon between the pelagic and benthic food web.
- River forcing experiments with higher resolution model that better resolves coast.
- Arctic marine BGC feedbacks to climate and carbon cycle dynamics.

Relationship to white paper,

Ecosystem perturbation experiments

- Perturbation experiments with refined riverine forcing help assess which processes are more critical than others in regulating Arctic marine production and broader carbon dynamics.
- Guide required structural changes with respect to treatment of river inputs to the marine environment.