Marine Ecosystem Response to Perturbation Events: A Case Study of Iron Enrichment to HNLC Subarctic North Pacific

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Marine organisms play an important role for biogeochemical cycling and influence the global climate through producing/absorbing climate gasses. Although the rapid progress in our understanding on biology and ecology of each ecosystem component, the comprehensive understanding of marine ecosystem dynamics is still a challenging issue. Mesoscale *in situ* manipulation experiments are useful for the comprehensive understanding of ecosystem responses to perturbation in which various physical, chemical and biological parameters are possible to be measured with tracking the same populations of marine organisms.

Subarctic North Pacific is a high-nitrate low-chlorophyll (HNLC) region where iron limitation (<0.1 nM) prevent the nitrate uptake by phytoplankton and the chlorophyll concentration is kept low. It is known that a dust flux event relaxes the iron stress and induces a phytoplankton bloom, and the drastic change in biogeochemical processes are observed, e.g., depletion of sea-surface nitrate and silicic acid, carbon and opal flux to ocean interior. It is expected that such a dust event enhances the strength of biological carbon pump and marine CO_2 absorbing ability. In order to determine the influence of dust event on the marine ecosystem and biogeochemical cycle in HNLC water, 3 mesoscale iron enrichment experiments were carried out in the HNLC North Pacific. We made 64-80 km^2 iron patches and tracked the patches using inert tracer gas SF6 for 2-4 weeks. Although the iron enrichment induced increase in phytoplankton production in all the experiments, the ecosystem responses were totally different each other. The ecosystem components were most substantial factors inducing the differences. These experiments showed that we need further understanding on the ecological and biogeochemical function of ecosystem components to provide accurate forecasting capacity of ocean responses to natural climate shift and accelerating global change.