B07-P15

NUTRIENT SUPPLY AND BIOLOGICAL RESPONSE CAUSED BY WIND-INDUCED FORCING IN THE NORHERN CHUKCHI SEA

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There is no observational evidence that wind-driven ocean mixing can change the stratification of the water and impact biological production in the Pacific sector of the Arctic Ocean. In this sector, imports of low-salinity water from the Pacific Ocean, river water, and sea-ice meltwater promote a strong pycnocline (halocline) that stabilizes the upper water column. At a fixed-point observation station in the northern Chukchi Sea during autumn 2013, we performed 6-hourly conductivity-temperature-depth (CTD)/water samplings and microstructure turbulence measurements for about 2 weeks. This enabled us to estimate vertical nutrient fluxes and the impact of different types of turbulent mixing on biological activity. Convective mixing associated with internal waves due to semi-diurnal inertial motions within a weakly stratified surface layer was not strong enough to increase the levels of surface nutrients and the phytoplankton biomass. However, direct mixing caused by intense gale-force winds (>10 m s-1) influenced the increases in upward nutrient fluxes, biological productivity, and phytoplankton biomass, particularly large phytoplankton such as diatoms. For diatom production, it was essential that silicate should be supplied from a subsurface silicate maximum, a new feature that we identified during autumn in the northern Chukchi Sea. Water mass distributions obtained from wide-area observations suggested that the subsurface silicate maximum water was possibly derived from the ventilated halocline in the Canada Basin.