

## Seasonal to interannual variations in surface phosphate concentration in Oyashio region: Role of wind-induced coastally trapped currents

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Oyashio region, which is located on the Pacific side of the eastern Hokkaido Island in Japan, is one of the most biologically productive regions, and is known to contribute to the availability of a large amount of macronutrient such as nitrate and phosphate [Saito et al. 2002] and iron which is an essential micronutrient in HNLC region [Nishioka et al. 2011]. Therefore, to clarify the mechanism controlling the transport process of these materials into the surface layer is important for the future projection of primary production and the sustainable management of fishery resources.

In this study, we investigate causes of seasonal to interannual variations in surface phosphate concentration (hereafter phosphate) in the Oyashio region using a biogeochemical model with iron cycle [Uchimoto et al. 2014; Nakanowatari et al. 2017]. The hindcast experiment from 1979-2010 shows that the model qualitatively simulates seasonal to interannual variations of observed phosphate in the Oyashio region. The simulated phosphate at the surface shows the maximum value (1.4mM) in February, which is comparable to the observed climatological value (1.7 mM). The interannual variability of the simulated phosphate is prominent in January, which is significantly correlated with the observed data ( $r=0.47$ ). The phosphate budget analysis indicates that the seasonal to interannual variations of phosphate are attributed to the local mixing effect and the lateral advection of phosphate-rich water from the Kuril Straits, in which tidal mixing upwells the high phosphate water from lower depths. The theoretical analysis of the ocean current field indicates that the lateral advection is driven by the wind-induced coastally trapped current formed along the east coast of the Sakhalin Island to the Hokkaido Island, which is regulated by the large-scale atmospheric circulations of Aleutian low and Siberian high pressure system. These results suggest the importance of wind-driven current system in the Sea of Okhotsk on the macronutrient feeding in the Oyashio region.

Keywords: biogeochemical model, phosphate , Oyashio region, budget analysis, wind-driven ocean circulation