Spatial characterization of $\Delta O_2$/Ar and net community production in the surface waters of the East Sea, the Northwest Pacific, and the Bering Sea

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Saturation anomaly of dissolved oxygen ($O_2$) in surface waters of the ocean is, in general, associated with physical and biological processes. Given that argon (Ar) have similar solubility and diffusivity in seawater to those of $O_2$, Ar measurement can be used to isolate the $O_2$ saturation anomaly related to physical processes such as the changes of seawater temperature and atmospheric pressure, and bubble injections among the various processes. Remaining biological $O_2$ anomaly, $\Delta O_2$/Ar ($=[O_2$/Ar]$_{\text{sample}}$/$[O_2$/Ar]$_{\text{saturation}}$−1), reflects the difference between photosynthetic production and respirational consumption of $O_2$ corresponding to net community production (NCP). To investigate the variability of biological productivity and its possible connection to atmospheric chemistry, we surveyed $\Delta O_2$/Ar in the surface waters along Araon cruise track from Incheon to Nome, Alaska (July 13 − 29, 2012), using an equilibrator inlet mass spectrometer. We divided the cruise track into four regions: Yellow Sea and South Sea of Korea (YS), East Sea (ES), Northwest Pacific (NP), and Bering Sea (BS). Each of the region showed distinctive oceanographic parameters including $\Delta O_2$/Ar. YS had $\Delta O_2$/Ar in the range of 0 − 8% and largest average of 4.3%. To the contrary, ES is the least productivity region, with average $\Delta O_2$/Ar of 1.5%. NP showed modest spatial variability of $\Delta O_2$/Ar with average of 2.8%. BS was the most dynamic region: $\Delta O_2$/Ar showed large variability from −10 to 10% in a very confined area. We will discuss the correlation of $\Delta O_2$/Ar with other physicochemical properties and NCP estimates in the presentation.