Temporal and spatial distribution of surface $pCO_2$ in the Ulleung Basin of the East Sea/Sea of Japan

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To clarify the temporal and spatial distribution of partial pressure of CO2 ($pCO_2$) in surface seawater and its major controlling factors in the Ulleung Basin of the East Sea/Sea of Japan, we measured surface $pCO_2$, sea surface temperature (SST) and sea surface salinity (SSS) by underway measurement system and nutrients, alkalinity and chlorophyll-a of surface seawater by hydrocasting in spring (April 2006), summer (August 2007), autumn (October 2008) and winter (February 2008). SST showed a typical seasonal variation as a mid-latitude temperate ocean in the northern hemisphere with high in summer and low in winter, while SSS showed an opposite seasonal trend with SST due to the concentrated rainfall in summer by seasonal monsoon. Temporal distribution of surface $pCO_2$ showed a similar tendency with SST variations, but its magnitude of change was less than the estimate by thermal effect due to the SST changes. In summer, the lower surface $pCO_2$, which was less than expected by the SST, probably arose from the dilution effect of less saline, low $pCO_2$ surface water by increased seasonal rainfall and river discharges. In winter, the higher surface $pCO_2$ was likely due to the strong vertical mixing derived by the deep surface mixed layer. Surface waters were spatially divided into several waters, such as western coastal water, eastern Ulleung Basin water and middle water, based on hydrographic characteristics not only SST and SSS but also surface $pCO_2$. The Ulleung Basin of the East Sea acted as a CO2 sink, except summer when it acted as a weak CO2 source.