Underway measurements of surface pCO_2 and total alkalnity in Kuroshio-Oyashio transition region

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We made measurements of surface partial pressure of CO_2 (pCO_2) and total alkalinity (TA) in Kuroshio-Oyashio transition region off the eastern Japan in June 2016. Surface TA was measured every 15 minutes. Spatial resolution of TA was 6 km in case of cruising at 12 knot.
Surface TA (open circle in Figure 1) showed fine spatial variation which can not be captured by the interpolation of the bottle sampling and measurement of TA (open square in Figure 1) at CTD station which located every 2 degrees in longitude. The estimation of TA by *Lee et al. [2006]* (gray dot in Figure 1) overestimated the measurement by up to 30 μmol/kg.
We calculated surface DIC from TA and pCO_2 obtained by the underway mesurements. Calulated DIC was in good agreement with the measured DIC taken from nearby CTD station. Difference and standard deviation between calculated and measured value were 0.8 and 5.4 μmol/kg respectively (N = 38). Underway measurement of pCO_2 and TA can reproduce other carbonate parmeters such as DIC and pH accurately. This method is beneficial to understand carbon cycling in coastal region and Kuroshio-Oyashio transition region where spatial variation of TA is large.
The variation of TA by precipitation and evapolation can be excluded by salinity normalization. Normalized alklainity to Salinity = 35 (NTA_{35}) has a large meridional gradient in the western North Pacific. NTA_{35} in the subtropical region and subarctic gyre were about 2300 and 2370 μmol/kg respectively [*Takatani et al. 2014*]. In our observation, NTA_{35} also showed large zonal varitaion and ranged 2310-2355 μmol/kg along 41°N and 2300-2325 μmol/kg along 37.5°N. These dynamic spatial variation of NTA_{35} was attributable to the complicated distribution of Kuroshio and Oyashio water. pCO_2 was concave against NTA_{35} and the smallest around NTA_{35} = 2320 μmol/kg. Below this NTA_{35}, pCO increased thermodynamically due to temperature rise. On the other hand, nutrients was significanly high above this NTA_{35}. This indicated that pCO_2 was high because the DIC supplied to the surface by the winter mixing had not been substantially reduced by biological production.

Keywords: Kuroshio-Oyashio transition region, Total alkalinity, pCO2

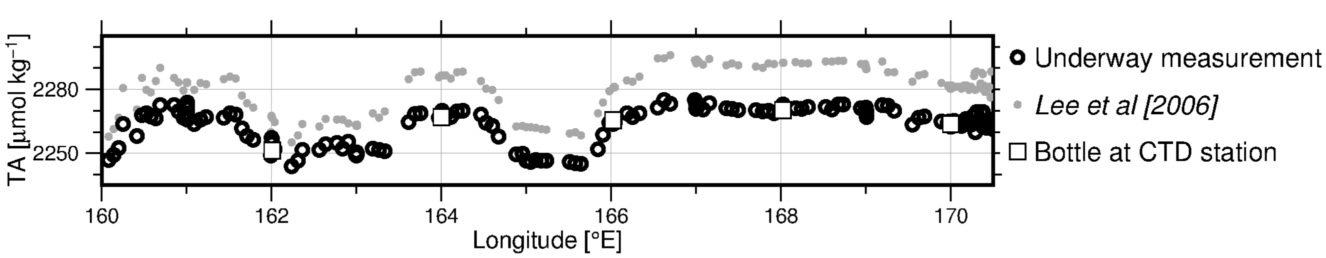

Figure 1 Zonal variation of surface total alkalinity along 41°N in June 2016.