

Seasonal variations of oceanic CO₂ disequilibrium and anthropogenic CO₂ in the subarctic North Pacific

*Bofeng Li¹, Shukuta Satori¹, Kasai Hiromi², Hiroshi Kuroda², Taniuchi Yukiko², Daisuke Hasegawa³, Yutaka Watanabe¹

1. Hokkaido University, 2. Hokkaido National Fisheries Research Institute, Japan Fisheries and Education Research, 3. Tohoku National Fisheries Research Institute, Japan Fisheries and Education Research

Assuming that the CO₂ above the surface mixed layer depth (MLD) mixes very well with air, we used a simple and new method to estimate air-sea CO₂ disequilibrium value at the MLD (C_{diseq}) as follow [Li *et al.*, 2019];

$$C_{\text{diseq}} = C_{\text{MLD}} - C_{\text{sat, MLD}} - C_{\text{soft, MLD}} - C_{\text{carb, MLD}}$$

where C_{MLD} is the observed dissolved inorganic carbon (DIC); $C_{\text{sat, MLD}}$ is saturated DIC; $C_{\text{soft, MLD}}$ is derived from the remineralization of organic matter; $C_{\text{carb, MLD}}$ is derived from the dissolution of CaCO₃ in the MLD. We collected the DIC and total alkalinity (TA) samples in the subarctic North Pacific in four seasons, and measured all the DIC and TA by using semi-closed cell simultaneous method [Li *et al.*, 2016].

C_{diseq} in this region changed from -38.29 to $-56.93 \mu\text{mol kg}^{-1}$ in wintertime and from -9.65 to $1.02 \mu\text{mol kg}^{-1}$ summertime, indicating a strong seasonal change in C_{diseq} . Applying these values of C_{diseq} to the approach for estimating C_{ant} in this region, we also found a strong seasonal variation in C_{ant} .

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