Rapid progress of ocean acidification over the Southern Ocean

B. F. Li,[1]* X. L. Pan,[2] Y. W. Watanabe[1]

[1] *Faculty of Environmental Earth Science, Hokkaido University, Sapporo, Japan*
[2] *Graduate School of Environmental Science, Hokkaido University, Sapporo, Japan*

The Southern Ocean (SO, south of 30°S) covers 30% of the global ocean surface area and is presumed to account for 40% of the global ocean's anthropogenic CO_2 (DIC_{anth}) absorption as shown by numerical modeling calculations (*Khatiwala et. al.* 2013). This may lead to an intensive anthropogenic acidification in the SO. Clarifying the ocean dynamics of the anthropogenic component of the carbon system in the SO is crucial for gaining a deep understanding of the human impact on the ocean. However, natural processes also influence the change of ocean pH. Distinguishing anthropogenic and natural components from the observed dissolved inorganic carbon (DIC) and pH is essential for clarifying the acidification in the SO. Here we separated the anthropogenic and natural components by combining new parameterization techniques with high-resolution grid data constructed based on ship-based observations. During the 1990s–2010s, ocean acidification affected by anthropogenic effect covered most of the surface and intermediate depths by 3500 m over the SO, and the maximum decreasing rate of anthropogenic pH was 0.004 pH $year^{-1}$ as twice decreasing of the global average. This remarkable decline of pH in the SO must be resulted from the increase in DIC_{anth} of 10.9 Pg-C (1 Pg = 10^{15} g). The increase of DIC_{anth} in the SO was comparable to 11% of the global emission amount of CO_2, implying the SO absorbing half of global ocean's DIC_{anth} is the largest uptake region of atmospheric anthropogenic carbon into the ocean interior.

References

Khatiwala S, Tanhua T, Fletcher SM, Gerber M, Doney SC, Graven HD, et al. Global ocean storage of anthropogenic carbon. *Biogeosciences* 2013, **10**(4): 2169-2191.