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Variations in the atmospheric Ar/N2 and APO observed at Tsukuba, Ochi-Ishi, Hateruma and Minamitorishima, Japan

ISHIDOYA, Shigeyuki[1*] ; MURAYAMA, Shohei[1] ; TOHJIMA, Yasunori[2] ; TSUBOI, Kazuhiro[3] ; MATSUEDA, Hidekazu[3] ; TAGUCHI, Shoichi[1] ; PATRA, Prabir[4] ; KONDO, Hiroaki[1]

[1]National Institute of Advanced Industrial Science and Technology (AIST), [2]National Institute for Environmental Studies (NIES), [3]Meteorological Research Institute (MRI), [4]Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

Atmospheric Ar/N_2 ratio is a unique tracer of spatiotemporally-integrated air-sea heat fluxes, and expected to be a new tool to validate changes in the global ocean heat content (e.g. Keeling et al. 2004; Cassar et al., 2008). The Ar/N_2 ratio is also useful to estimate thermal and biological components of Atmospheric Potential Oxygen (APO = O_2 +1.1xCO_2) separately, so that it will contribute to better understanding of the oceanic carbon cycle. Therefore, we have developed a high-precision measurement system of the atmospheric Ar/N_2 ratio and APO (Ishidoya and Murayama, 2014), which is applicable both for continuous observations and analyses of discrete flask air samples, and started systematic observations of the Ar/N_2 and APO at Tsukuba (36N, 140E) and Hateruma Island (24N, 124E), Japan since 2012 and at Cape Ochi-Ishi (43N, 146E) and Minamitorishima Island (24N, 154E), Japan since 2013. Clear seasonal cycles of the Ar/N_2 ratio were observed at all the sites, and the peak-to-peak amplitudes of the seasonal cycles were in the range of 15 - 50 per meg. The observed amplitudes were found to be significantly larger than those calculated using atmospheric transport models and the seasonal air-sea N_2 fluxes climatology (TransCom fluxes; Garcia and Keeling et al., 2001) with a scaling factor to convert changes in the atmospheric N_2 concentration to those in the Ar/N_2 ratio (Blaine, 2005). We will also present preliminary estimations of the thermal and the biological APO at our sites by using the observed seasonal Ar/N_2 and APO cycles.

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Keywords: Atmospheric Ar/N2 ratio, Atmospheric Potential Oxygen (APO), Air-sea heat flux