Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AAS001-P13 Room: Convention Hall Time: May 27 17:15-18:45

Shipboard measurements of atmospheric O2 in the western Pacific by using a GC/TCD technique

Yasunori Tohjima[1*], Hiroaki Yamagishi[1], Hitoshi Mukai[1], Yukihiro Nojiri[1], Toshinobu Machida[1], Chika Minejima[1], Chihiro Miyazaki[1], Hiromichi Tsumori[1]

[1]NIES

We have been observing atmospheric O_2concentrations in the western Pacific onboard cargo ship, Trans Future 5 (TF5), since September 2007. TF5 has repeated round-trip cruises between Japan and Oceania (Australia and New Zealand) every 6 weeks. The changes in the atmospheric O_2 concentration are measured by a gas chromatograph equipped with a thermal conductivity detector (GC/TCD) every 10 minutes, and the precision of the 1-hour average is about 1 ppm. The shipboard O_2values during a period from October 2007 to July 2009 are compared with the O_2 values from about 300 flask samples, which were collected on the ship and later analyzed at our laboratory by using the same GC/TCD technique with the precision of about 1 ppm. The average of the differences between flask and onboard O_2values except the data obtained during June-July 2 008 is 0.0+/-1.9 ppm. This good agreement strongly supports the reliability of the onboard O_2 measurements. During the exceptional 2-month period, the intake flow rate was reduced from 8 L/ min to 5 L/min and the sample loop flow rate was reduced from 8 mL/min to 6 mL/min because of clogging of the pump filter and the mass flow controller, respectively, and the onboard O2 values were 4.6+/-1.8 ppm lower than the flask values on average. In the following analysis, we add the average difference of 4.6 ppm to the onboard O_2values obtained during the relevant 2-month period. To investigate the oceanic components of the observed O_2change, we use the tracer APO= O_2+1.1xCO_2instead of O_2only, where 1.1 represents the O_2:CO_2molar exchange ratio for land biotic photosynthesis and respiration. Here, we use onboard CO_2values determined by an NDIR analyzer. The time series of APO between 40 deg. S and 35 deg. N are binned into 1-degree latitude bands and the smooth-curve fits to the binned data are computed by using a combination of the least-square and digital filtering techniques. Then, the latitudinal differences in the seasonality and the annual averages of APO are investigated based on the smooth-curve fits. The seasonal amplitudes of APO show minima of 4 ppm between 10 deg. S and 15 deg. N and poleward increases with maxima of 13 ppm at 40 deg. S and 10 ppm at 35 deg. N. The latitudinal distribution of APO shows maxima between 5 deg. S and the equator and poleward decreases in both hemispheres. This APO latitudinal profile strongly supports the recent coupled ocean-atmosphere model predictions for this region. Because the density of the onboard data is much higher than that of the flask data (21 flasks per round-trip cruise), more detail features of the APO latitudinal distribution in the western Pacific have been revealed.

Keywords: atmospheric O2, shipboard measurements, atmospheric potential oxygen