3.101 Variations in atmospheric CO2 and its δ13C and δ18O observed at Minamitorishima Island in the western North Pacific.

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Abstract:

The station of Minamitorishima (MNM; 24°18’N, 153°58’E) is a unique monitoring site of background air at northern mid latitudes, which is situated on a remote coral island in the western North Pacific, about 1,950 km southeast of Tokyo. The Japan Meteorological Agency has made long-term continuous observations of atmospheric concentrations of major greenhouse gases at MNM. For better understandings of mechanism governing the CO_2 variation, systematic measurements of atmospheric CO_2 and its $\delta^{13}C$ and $\delta^{18}O$ have been carried out at MNM by analyzing discrete flask air samples since 2011. The CO_2 concentration shows a clear seasonal cycle with a decrease from summer to early autumn and an increase from late autumn to early spring, which is in opposite phase with the $\delta^{13}C$ cycle. Comparative analyses between both of the seasonal components suggest that the cycles are due mainly to a seasonal-dependent CO_2 exchange with C_3 plants in land biosphere. However, the variation from June to October is found to be related to CO_2 exchange with a significantly heavier $\delta^{13}C$ signal compared to the other period of the year. On the other hand, $\delta^{18}O$ shows a seasonal cycle with a decrease from summer to late autumn and an increase thereafter until early summer, due to influences of not only carbon but also hydrological cycles. Secular increase of the CO_2 concentration and decrease of $\delta^{13}C$ due to anthropogenic CO_2 emission are also observed, accompanied by year-to-year variations in opposite phase with each other,

while $\delta^{18}O$ shows a secular increase trend until 2016 and then a decrease trend. These secular trends may reflect variations in global carbon and hydrological cycles associated with the ENSO events.
In addition to these results, preliminary results of continuous measurements of the $\delta^{13}C$ and $\delta^{18}O$ using a laser spectroscopy initiated in March 2018 will also be presented.