Geophysical Research Abstracts
Vol. 21, EGU2019-4915, 2019
EGU General Assembly 2019

The characteristics of atmospheric water vapor isotopic composition over middle and high latitudes marine boundary layer

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Water vapor isotopes have been useful for tracing the global hydrological cycle. Evaporation from the ocean represents the global moisture source, and the isotope fractionation at sea surface determines isotope ratio of water vapor in the marine boundary layer (MBL). To characterize the isotopic composition of water vapor isotope in MBL, we performed a shipboard measurement of the triple oxygen isotope ratios (d17O and d18O) and hydrogen isotope ratio (dD) along the transect line of the Korean ice breaker Araon from Lyttelton (43˚36’46” S, 172˚42’89” E), New Zealand to Jang Bogo Antarctic Station (74˚37’86” S, 164˚14’52” E) in Terra Nova Bay of the Ross Sea, Antarctica. The cruise was conducted from November 25 to December 4, 2018. A commercial Cavity Ring-Down Spectrometer (L2140-i, Picarro) equipped with a custom calibration device was used. Onboard data of the weather station and sea surface temperature were compared with the measured water vapor isotope composition to understand the vapor sources along with their mixing and isotope exchange processes. A striking water vapor isotope change was observed with the occurrence of sea ice in the range of -8.16‰ to -16.61‰ for δ17O, -15.57‰ to -31.57‰ for δ18O, and -105.59‰ to -237.55‰ for δD, which helped to assess the open sea surface as the moisture source.