1.225 Determination on the triple oxygen isotopic compositions of tropospheric ozone in Asian Monsoon area.

Early Career Scientist

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Abstract:

Tropospheric ozone (O_3) is important as a greenhouse gas, as well as having harmful effects on respiration and photosynthesis. In addition, O_3 is important as an oxidant in the tropospheric photochemical reactions. In recent years, tropospheric ozone have been increasing in Eastern Asia, and thus we must understand the origin and behavior of tropospheric ozone accurately.
In this study, we determined the oxygen isotopic compositions including the triple oxygen isotopic compositions ($\Delta^{17}O$), by passing air sample through nitrite (NO_2^-)-coated filters, which allows the reaction of O_3 with NO_2^- to produce NO_3^-. The oxygen isotopic composition of NO_3^- was then determined to estimate the oxygen isotopic composition of O_3. Please note that the oxygen isotopic composition determined through this method is not the average isotope composition of oxygen atoms in O_3 ($\Delta^{17}O$ $(O_3)_{bulk}$), but is of that in the terminal positions ($\Delta^{17}O$ $(O_3)_{terminal}$) of O_3.
Observation on the atmospheric O_3 was conducted from August to December, 2017, at Nagoya University. The $\Delta^{17}O$ values of ozone were between +32‰~+39‰ which coincided well with those previously determined for tropospheric ozone (35‰±4‰). Besides, the $\Delta^{17}O$ values of ozone were the lowest in August, and were the highest in November. The seasonal variation in the $\Delta^{17}O$ values is most likely due to the stratospheric influence on the tropospheric O_3. We also found about 1‰ differences in

the $\Delta^{17}O$ values between day and night. We concluded that the formation of an inversion layer in night time was responsible for the lower $\Delta^{17}O$ values. That is to say, while the ^{17}O-depleted O_3 produced at ground level heights under the high pressure condition occupied major portion of O_3 in night time due to the inversion layer, the ^{17}O-enriched O_3 produced at the upper layers contributed to O_3 in day time through the active vertical convection.