

Evaluation of controlling factors on isotope ratios of atmospheric oxygen

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Isotope ratios of atmospheric oxygen can be regarded as constant both through spatially and temporally (several hundreds of years), which values are believed as +23.5 and +11.9 with respect to standard mean ocean water (SMOW) for O-18/O-16 and O-17/O-16, respectively.

Both isotope ratios show positive values and explanation why heavier isotopes are enriched in the atmosphere is directly related to evaluate the global mass balance of atmospheric oxygen. Concentration of the atmospheric oxygen is essentially controlled by photosynthesis and respiration and its isotope ratio is controlled by these two factors, their ratio between terrestrial and marine ecosystems, and mass independent isotope fractionation process (MIF) at the stratosphere.

Stratospheric MIF due to the photochemical reaction with ozone has been well recognized according to both experimental and observational investigations, however there are few studies that evaluate its influence to isotope ratios of tropospheric oxygen quantitatively.

In this study, isotopic balance of the tropospheric oxygen is calculated based on the box model approach, and significance of the stratospheric MIF is evaluated.