Geophysical Research Abstracts
Vol. 13, EGU2011-5269, 2011
EGU General Assembly 2011

Determination of triple oxygen isotope composition of tropospheric CO2

Sasadhar Mahata (1), Mao-Chang Liang (1,2,3), and Chung-Ho Wang (4)

(1) Research Center for Enviromental Changes, Academia Sinica, Taiwan (sasadhar@gate.sinica.edu.tw), (2) Graduate Institute of Astronomy, National Central University, Taiwan, (3) Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan, (4) Institute of Earth Sciences, Academia Sinica, Taiwan

The isotopic composition of carbon dioxide originating at the surface is modified in the stratosphere. Given that the only source of oxygen anomaly ($\Delta^{17}O = \delta^{17}O - 0.516 \times \delta^{18}O > 0$) is in the stratosphere, such isotopic signal provides a powerful tracer for studying biogeochemical cycles involving carbon dioxide. In addition to the exiting fluorination method that can achieve a precision as high as $\sim$0.1 per mil, we improved a previously proposed technique, $CeO_2 + CO_2$ equilibrium at high temperature, to a precision of $\sim$0.13 per mil and better. Such improvement allows us monitor the changes of biogeochemical CO_2 in detail. We successfully measure $\Delta^{17}O$ in near surface carbon dioxide. The temporal variation of $\Delta^{17}O$ is apparent. In addition, a 3-D numerical model that includes the isotopic fractionation in the atmosphere has been developed. In this model we assume the biological processes produce neutral $\Delta^{17}O$, i.e., mass-dependent CO_2. Processes that affect $\Delta^{17}O$ in the troposphere are (1) chemistry in the atmosphere (mainly $CO_2 + O(^1D)$ isotope exchange), (2) large circulation that brings the isotopically heavy CO_2 to near the surface, and (3) biological processes that "reset" the isotopic composition. Implications for constraining the sources and sinks of CO_2 using its isotope signature are discussed

References

[1] Assonov, S.S. and C.A.M. Brenninkmeijer, Rapid Communications in Mass Spectrometry, 2001. 15: p.2426-2437

[2] Hofmann M. E.G. and A. Pack, Anal. Chem., 2010. 82(11):p. 4357-4361

[3] Liang, M. C., J. Tang., C. Y. Chan, X. D. Zeng and Y. L. Yung (2008), *Geophys. Res. Lett,* 35, L20816, doi: 10.1029/2008GL035246

[4] Hoag, K. J., C. J. Still, I. Y. Fung, and K. A. Boering (2005), *Geophys. Res. Lett,* 32, L02802, doi: 10.1029/2004GL021011