Geophysical Research Abstracts,
Vol. 11, EGU2009-11440, 2009
EGU General Assembly 2009
© Author(s) 2009

Water vapor isotopes measurements at Mauna Loa, Hawaii: Comparison of laser spectroscopy and remote sensing with traditional methods, and the need for ongoing monitoring

J. Galewsky (1), D. Noone (2), Z. Sharp (1), and J. Worden (3)

(1) University of New Mexico, Earth and Planetary Sciences, Albuquerque, United States (galewsky@unm.edu), (2) Department of Atmospheric and Oceanic Sciences, and Cooperative Institute for Research in Environmental Sciences, University of Colorado, Campus Box 216, Boulder, CO 80309-0216, (3) Jet Propulsion Laboratory, M/S 183-601 4800 Oak Grove Drive, Pasadena, CA 91108

The isotopic composition of water vapor (2H/1H and 18O/16 ratios) provides unique information on the transport pathways that link water sources to regional sinks, and thus proves useful in understanding large scale atmospheric humidity budgets. Recent advances in measurement technology allow the monitoring of water vapor isotope composition in ways which has can revolutionize investigations of atmospheric hydrology. Traditional measurement of isotopic composition requires trapping of samples with either large volume vacuum flasks or by trapping liquid samples with cryogens for later analyses using mass spectrometry, and are laborious and seldom span more than just short dedicated observational periods. On the other hand, laser absorption spectroscopy can provide almost continuous and autonomous in situ measurements of isotope abundances with precision almost that of traditional mass spectrometry, and observations from spacecraft can make almost daily maps of the global isotope distributions. In October of 2008 three laser based spectrometers were deployed at the Mauna Loa Laboratory in Hawaii to make continuous measurement of the 2H and 18O abundance of free tropospheric water vapor. These results are compared with traditional measurements and with measurements from two satellite platforms. While providing field validation of the new methodologies, the data show variability which captures the transport processes in the region. The data are used to characterize the role of large scale mixing of dry air, the influence of the boundary layer and the importance of moist convection in controlling the low humidity of subtropical air near Hawaii. Although the record is short, it demonstrates the usefulness of using robust isotope measurements to understand the budgets of the most important greenhouse gas. This work motivates establishing a continuous record of isotopes measurement at baseline sites, like Mauna Loa, such that the changes in water cycle can be understood and monitored as climate changes.