The Measurements of Humidity in the Atmosphere and Validation Experiments (MOHAVE) 2009 Campaign

T. Leblanc[1], D.N. Whiteman[2] and M.J. Kurylo[3]

[1]Jet Propulsion Laboratory, California Institute of Technology, Table Mountain Facility, 24490 Table Mountain Rd., P.O. Box 367, Wrightwood, CA 92397; 760-249-1071, E-mail: leblanc@tmf.jpl.nasa.gov
[2]National Aeronautics & Space Administration, Goddard Space Flight Center, Greenbelt, MD 20771
[3]Goddard Earth Science and Technology Center, University of Maryland, Greenbelt, MD 20771

The MOHAVE 2009 campaign took place at the Jet Propulsion Laboratory (JPL) Table Mountain Facility from October 11-27, 2009. This campaign allowed a thorough evaluation of Raman Lidar measurements throughout the troposphere by comparing them to RS92 radiosonde, NOAA-Frost Point, and Cryogenic Frost-Point Hygrometer (CFH) profiles. The campaign also hosted three other instruments/techniques, leading to the correlative measurement of temperature and water vapor from the ground to the mesopause, and ozone from the ground to the stratopause. The primary goals of the campaign were: 1) to identify and quantify Upper-Troposphere Humidity (UTH) changes associated with transport processes in the vicinity of the Sub-Tropical Jet, 2) to estimate the capability of the Raman lidar in detecting such UTH changes, and 3) to provide continuous water vapor profiles from the ground to the mesosphere by combining the measurements of the various participating instruments and techniques, including sonde, lidar, and microwave.

In order to achieve these goals, simultaneous and co-located measurements included: 3 water vapor Raman lidars (JPL and Goddard Space Flight Center (GSFC)) [0-20 km]; 16 CFH launches (JPL and GSFC) [0-30 km and total column]; 4 Frost-point Hygrometer launches (NOAA) [0-30 km and total column]; 58 RS92 launches (JPL and GSFC) [0-12 km and total column]; 2 improved microwave radiometers (Naval Research Laboratory and Univsity Bern) [20-80 km and total column]; 1 Fourier Transform Infrared Spectrophotometer (JPL) [total column]; 2 Global Positioning System receivers (JPL/NOAA and GSFC) [total column].

Additional high priority nights (i.e., selected timing and increased density of the measurements and balloon launches) corresponded to best coincidences with various satellite instruments.

Comparisons between the CFH and the JPL Raman lidar at Table Mountain show excellent agreement, with a systematic bias less than 2% up to 20 km altitude. Comparisons between the NOAA frost-point, Cryogenic Frost-Point, and Vaisala RS92 revealed systematic biases at various altitudes and relative humidity values already reported in the past. Comparisons of pressure/temperature profiles between RS92 and a new InterMet sensor revealed non-negligible systematic differences that critically impact the derivation of the Frost-Point water vapor mixing ratio. Comparisons of simultaneous and co-located Total Precipitable Water retrieved from at least six different instruments/techniques show general agreement within 10%.

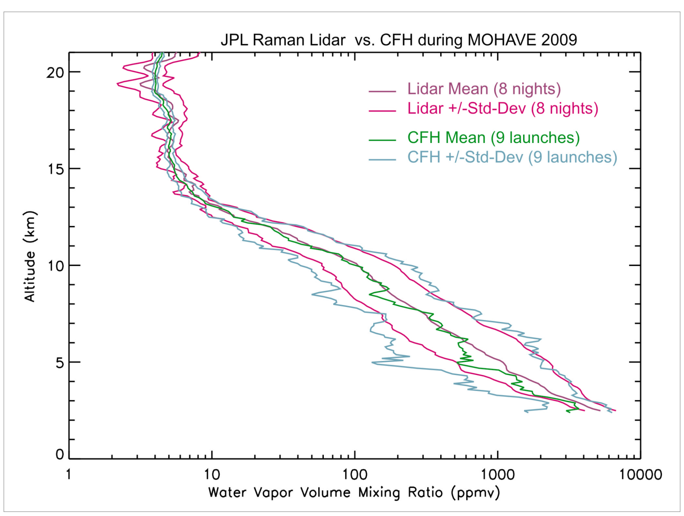

Figure 1. Comparisons between the CFH and the JPL Raman lidar at Table Mountain.