

SPARC Water Vapor Assessment: An overview of historical and contemporary comparisons with harvard water vapor

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The results of comparisons executed over the past two decades between Harvard Water Vapor (HWV) and other in situ and satellite measurements in the upper troposphere and lower stratosphere are examined with an emphasis on 1) assessing the realizable accuracy of the in situ measurements, 2) determining the significance of differences between measurements by HWV and other instruments, and 3) where possible, identifying the character of the observed differences as a function of calibration uncertainties, and/or systematic errors due to ambient sampling conditions including pressure, temperature, and sample flow rates, as well as instrumental or atmospheric variability. The results of the Aqua water Vapor Instrument Test (AquaVIT) laboratory comparison at the Aerosols Interaction and Dynamics in the Atmosphere (AIDA) facility in Karlsruhe, Germany, provide a basis for evaluating the differences that appear in situ. Similarly, comparisons in the laboratory and in flight between the heritage Harvard Lyman-alpha hygrometer and a suite of other water vapor instruments developed at Harvard, e.g. the Hoxotope, Integrated Cavity Output Spectroscopy (ICOS) and Harvard Herriott Hygrometer (HHH) instruments, which utilize independent sampling and detection methods, help to constrain uncertainties of the in situ data. It is within this context, that we review and analyze comparisons between HWV and the Halogen Occultation Experiment (HALOE) on the Upper Atmosphere Research Satellite from 1995 through 2004; HWV and water vapor data from the Aura Microwave Limb Sounder (MLS) from 2006 to the present; HWV and the balloon-borne NOAA/ESRL/GMD frost point hygrometer (CMDL), from 1993 to 2004; HWV and the NOAA Cryogenic Frostpoint Hygrometer (CFH) from 2001 to the present; in addition to preliminary results from comparisons between HWV and the NOAA Chemical Ionization Mass Spectrometer (CIMS) and the Fast In Situ Hygrometer (FISH) acquired during the Mid-latitude Cirrus Properties Experiment (MACPEX) campaign in March/April 2011.