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Long-term ground-based microwave measurements of middle atmospheric water vapor from NDACC sites

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Changes in atmospheric composition discerned from long-term NDACC measurements of stratospheric and mesospheric water vapor showed significant increases in the early 1990s, but since the mid-1990s no significant trend in water vapor has been observed. We present measurements from the Vapor Millimeter-wave Spectrometer (WVMS) instruments deployed at Network for the Detection of Atmospheric Composition Change (NDACC) sites at Lauder, New Zealand (45.0S, 169.7E) since 1993, and from Mauna Loa, Hawaii (19.5N, 204.4E) since 1996. These instruments have, and continue to, make measurements nearly continuously. The data for long-term water vapor trend detection for the WVMS instruments is optimally in the lower and mid-mesosphere. These ground-based measurements are compared with coincident HALOE (1993-2005), ACE (2004-present), and Aura Microwave Limb Sounder (2004-present) measurements. Comparisons between the WVMS instruments and these instruments show similar interannual variations, and, in the case of HALOE, are of sufficient length to study the effect of the solar cycle in the mid and upper mesosphere [Nedoluha et al., JGR, 2009]. In the lower and mid-mesosphere most of the CH4 which has entered the middle atmosphere has been oxidized, hence changes in H2O can be caused by both changes in CH4 and changes in H2O entering the stratosphere. The global increase in surface CH4 since the mid-1990s has been <50 ppbv [Dlugokencky et al., GRL, 2009], and as this CH4 oxidizes it would cause an increase in H2O in the mid-mesosphere of <2% over ~15 years. We also discuss the extension of the WVMS time series using a new generation of instruments which, among other improvements, can extend the lower limit of the retrieval range from ~40km down to ~26km [Nedoluha et al., JGR, 2011].