WATER VAPOR NEAR-UV ABSORPTION: LABORATORY SPECTRUM, FIELD EVIDENCE, AND ATMOSPHERIC IMPACTS

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Absorption of solar radiation by water vapor in the near-UV region is a poorly-understood but important issue in atmospheric science. To better understand water vapor near-UV absorption, we constructed a cavity ring-down spectrometer with a bandwidth comparable to those of field UV spectrometers and determined water vapor absorption cross-sections at 1 nm increments in the 290-350 nm region. We also measured water vapor absorption cross-sections at 0.05 nm intervals surrounding major absorption bands. We provide field evidence to support laboratory water vapor near-UV absorption measurements. Field UV residual spectra not only exhibited increased attenuation at higher atmospheric water vapor loadings but also showed structures suggested by the laboratory water vapor absorption spectrum. Spaceborne UV radiance spectra have spectral structures resembling the differential cross-section spectrum constructed from the laboratory wavelength-dependent water vapor absorption cross-sections. We incorporated water vapor absorption cross-section data into a radiative transfer model and obtained estimated energy budget of such absorption for the standard US atmosphere and for the tropics. We conclude that water vapor near-UV absorption is a significant contributor for climate simulation and ozone retrievals.