NEW MEASUREMENTS OF THE WATER VAPOR ABSORPTION CROSS SECTION IN THE BLUE-VIOLET RANGE BY CAVITY-ENHANCED DIFFERENTIAL OPTICAL ABSORPTION SPECTROSCOPY

RANDALL CHIU, *Department of Chemistry and Biochemistry, University of Colorado Boulder, Boulder, CO, United States*; OLEG L. POLYANSKY, *Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, United Kingdom*; RAINER VOLKAMER, *Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO, USA*.

The absorption cross section of water vapor in the blue-violet range (415-460 nm) is currently not well known, and many weak spectral lines are not included in either the HIgh resolution TRANsmission molecular absorption (HITRAN) database or its HIgh TEMPerature companion, HITEMP. Direct measurements of the absorption cross section of water vapor in this region have been limited by the slant column density (SCD) of gaseous water molecules achievable in a laboratory setting. We use cavity-enhanced differential optical absorption spectroscopy (CE-DOAS) to generate water vapor SCDs comparable to those in field measurements. Our cavity consists of high-reflectivity ($R > 0.99995$) mirrors separated by 80 cm to realize effective path lengths up to 16 km; water vapor is generated from deionized water in a double-bubbler system. Broadband light sources (LEDs) with peak intensities at 420 and 455 nm allow us to measure multiple lines at moderately high spectral resolution (0.15 nm). The first spectra were measured at room temperature (298 K), but our setup allows us to explore temperature variations.

Our goals are to refine available line lists for gas-phase water by combining laboratory measurements with quantum chemical calculations, and to reevaluate field measurements. In particular, we will revisit field data from University of Colorado Airborne Multi-AXis Differential Optical Absorption Spectroscopy (CU AMAX-DOAS) instrument during the Tropical Ocean tRoposphere Exchange of Reactive halogen species and Oxygenated VOC (TORERO) campaign. As part of TORERO, comparisons of in situ and remote-sensing measurements of water vapor were performed, and AMAX-DOAS fits exhibited cosmetic residual structures when using HITRAN and HITEMP reference spectra. Our work has the potential to improve trace gas retrievals from many current and planned satellites, e.g. Ozone Monitoring Instrument (OMI), TROPOspheric Monitoring Instrument (TROPOMI), and Tropospheric Emissions: Monitoring of Pollution (TEMPO); and from aircraft-based remote-sensing instruments such as the CU AMAX-DOAS.