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Water-vapor Continuum Absorption: Experiment and Modeling in the THz Region

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We present recent experimental results on the spectroscopic continuum study in the far-IR region from 10 to 90 cm^{-1} (0.3 - 2.7 THz). This effort addresses the needs of few terrestrial and satellite projects for an accurate model of the water-vapor continuum to insure reliable data on atmospheric transmittance in available THz windows for a wide range of temperatures and relative humidities. For typical absorption coefficient of $k_c(\nu,T) < 10^{-5}$ cm^{-1}, the measurement of such weak absorption is only possible with long optical pathlengths in situ or in well-controlled laboratory conditions. The presentation will include an analysis of experimental THz techniques such as broadband Fourier transform spectroscopy, high resolution tunable THz laser scans [1] and enhanced absorption in a temperature-controlled multipass cell. The contributions to absorbance resulting from both structureless H_2O - H_2O and H_2O - N_2 continua have been measured in the temperature range 293 to 333 K over a wide pressure range with resolution of 0.04 to 0.12 cm^{-1}. Continuum data are compared to several theoretical predictions. A few models that explore the HITRAN databases as well as available experimental data in the THz region [1], lineshape analysis, broadening and cut-off factors are evaluated for accurate account of resonance contribution from water vapor absorption lines.

[1] V. B. Podobedov, D. F. Plusquellic and G. T. Fraser, "THz Laser Study of Self-Pressure and Temperature Broadening and Shifts of Water Vapor Lines for pressure up to 1.4 kPa", JQSRT 87 (2004) 377-385.