THE WATER VAPOR CONTINUUM ABSORPTION IN THE 8 TO 12 μm REGION AT TEMPERATURES FROM 311 K to 352 K

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The water vapor continuum absorption in the atmospheric 8 - 12 μm window strongly affects the Earth's outgoing radiation and therefore is of great importance for radiative balance calculations. Quantitative measurements of the water vapor continuum were first made by Burch and coworkers[a] in the early 1980's and published in a number of AFGL reports. At that time many scientific groups in the world used long-base and long-path cells combined with spectrometers or tunable lasers to get more precise data over an extended range of conditions. Recently a cavity ring-down laser spectroscopy technique was employed to measure water vapor continuum absorption coefficients with a precision of about 1%[b]. We have measured the continuum using a 2 m base White cell coupled to the BOMEM DA002 FTIR spectrometer. A path length of 84 or 116 m was used in our experiments. The continuum is fairly weak in the region studied and it was necessary to record the spectra of water vapor samples at elevated temperatures, which allow pressures ranging from 40 to 120 torr. With these conditions, continuum absorbance could be accurately measured. We have recorded more than 150 spectra over the spectral range from 780 to 3500 cm^{-1}at temperatures from 311 K to 352 K. The resolution was 0.1 cm^{-1}. This value is a compromise which provides an acceptable signal-to-noise ratio within approximately two hours of scanning. A longer time leads to increased errors caused by the base line drift. We have determined binary absorption coefficients at 15 frequencies over the spectral range from 820 to 1157 cm^{-1}. Our data compared with models and data from other laboratories are in reasonable agreement at lower temperature but differ as much as 50% at higher temperatures depending on the wave number. Some results concerning a comparison of observed rotational structure with calculated spectra with the HITRAN date base will be presented.

[a] Burch, D. E., Continuum Absorption by H2O, Rep. AFGL-TR-81-0300, 46pp., Air Force Geophysics Lab., Hanscom AFB, MA, (1982).

[b] J. G. Cormier, J. T. Hodges, and J. R. Drummond. Infrared water vapor continuum absorption at atmospheric temperatures. J. Chem. Phys. **122**, 114309, (2005)