THE WATER-VAPOR CONTINUUM ABSORPTION IN THE MID-INFRARED WINDOWS AT TEMPERATURES FROM 311 K TO 363 K

Yu. I. BARANOV, AND W. J. LAFFERTY, *Optical Technology Division, NIST, Gaithersburg, MD 20899-8441, USA*.

The water-vapor continuum absorption in the mid-infrared 10 μm and 4 μm atmospheric windows plays an important role in the radiative balance of the Earth. We have derived the continuum absorption coefficients from spectra recorded at NIST with a resolution of 0.1 cm^{-1} over a wide range of pressures from 2.8 kPa (21 torr) to 15.1 kPa (113 torr) and temperatures from 311 K to 363 K with path lengths ranging from 74 to 116 m. These measurements were performed with a BOMEM DA3-002 FTIR spectrometer with a 2 m base multi-pass cell. The spectral range was from 800 to 3500 cm^{-1}. We have published the results obtained in the 10 μm region recently [a]. At the conditions given above, the continuum absorption in the higher frequency atmospheric window is quite detectable reaching as high as 4%. In order to avoid mistakes caused by the non-linear behavior of a MCT detector we later recorded an additional set of spectra with a highly-linear InSb detector. Both sets of spectra provide absorption coefficients coinciding within error bars. Our results around 5 μm are in good agreement with those obtained from the widely used MT-CKD continuum model [b]. However, at shorter wave lengths, the values diverge dramatically increasing up to one order of magnitude at the center of the window. Despite the comparatively large uncertainties of our data, comparison with all other available results leads us to the conclusion that the MT-CKD model greatly underestimates the self-broadened continuum over the 4 μm atmospheric window. We have also extended our measurements to lower frequencies with the use of KRS-5 cell windows. The current spectral range is down to 600 cm^{-1}.

[a] Yu. I. Baranov, W. J. Lafferty, Q. Ma, R. H. Tipping, JQSRT **109**, 2291, (2008)
[b] S. A. Clough, F. X. Kneizys, and R. W. Davies, Atmos. Res. **23**, 229, (1989)