TEMPERATURE DEPENDENCE OF N_2-, O_2-, AND AIR-BROADENED HALF-WIDTHS OF WATER VAPOR TRANSITIONS

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Several NASA EOS instruments, the Atmospheric Infrared Sounder (AIRS) on Aqua, and the Tropospheric Emission Spectrometer (TES) and the High Resolution Dynamics Limb Sounder (HIRDLS) on AURA, will be measuring water vapor in the earth's atmosphere in the 3.2 to 17.76 μm spectral region. In order to do retrievals of temperature and concentration profiles, the spectral parameters for many thousands of water vapor transitions and their temperature dependence must be known. To help ameliorate this situation complex Robert-Bonamy (CRB) mean relative thermal velocity approximation calculations were made at 225 and 296 K to determine N_2-, O_2-, and air broadened half-widths and line shifts for 5442 transitions of the principal isotopologue of water vapor for the eleven vibrational bands in this region. From these data the temperature dependence of the half-width for each transition was determined. The intermolecular potential parameters are adjusted as described in Gamache and Hartmann, JQSRT 2004:83; 119-47. For a more limited number of transitions CRB calculations with velocity averaging were made at 7 temperatures in the range 200-980 K and the temperature dependence of the half-width evaluated. Where possible this work is compared with measurement. It is shown that the standard temperature dependence model for the half-width is not correct for a number of transitions.