

THE ν_3 AND ν_4 BANDS OF NITRIC ACID (HNO_3) AT 7.6 μm FOR ATMOSPHERIC STUDIES

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Nitric acid (HNO_3) plays an important role as a reservoir molecule of the NO_x (nitrogen oxides) species in the stratosphere. The three strongest infrared bands of nitric acid are located at 11 μm (ν_5 and $2\nu_9$ bands), 7.6 μm (the ν_3 and ν_4 bands at 1326 and 1303 cm^{-1}) and 5.8 μm (ν_2 band). Although two times weaker than those located at 7.6 and 5.8 μm , the 11 μm region is the only one which is used for nitric acid retrievals in the atmosphere by several satellite instruments like MIPAS (Michelson Interferometer for Passive Atmospheric Sounding on ENVISAT) or ACE-FTS (ACE Fourier transform spectrometer on SCISAT). This is because the available spectroscopic parameters for HNO_3 in the HITRAN^a and GEISA^b databases are of very good quality in this spectral region. Of the two remaining bands, the 7.6 μm one is only partly masked by water, and therefore can be used also for nitric acid retrievals in the upper stratosphere. Moreover, because of their large difference in band intensity, combining measurements at 11 μm and 7.6 μm could maximize informations on the vertical distribution of HNO_3 in the atmosphere. However at 7.6 μm the spectroscopic parameters available in the HITRAN and GEISA databases are not so good. Indeed, these parameters originate from a list generated more than 20 years ago^c. The low quality of the list at 7.6 μm prevents HNO_3 retrievals and severely affects the retrievals of several species absorbing in the 7.5-7.7 μm region, like SO_2 . This work is a new and more accurate investigation of the line positions and intensities for the ν_3 and ν_4 bands of nitric acid located at 1326.187 and 1303.074 cm^{-1}). For this task, we used new infrared laboratory data combined with a new theoretical model. Examples showing substantial improvements will be given.^d

^aRothman et al. J. Quant. Spectrosc. Radiat. Transf., 110, 533-572, 2009

^bJacquinet et al. J. Quant. Spectrosc. Radiat. Transf., 112, 2395-2445, 2011

^cA. Perrin, O. Lado-Bordowski, and A. Valentin, Mol. Physics. 67, 249 (1989)

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