THE $\nu_3$ AND $\nu_4$ BANDS OF NITRIC ACID ($HNO_3$) AT 7.6 $\mu$m 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 $\mu$m ($\nu_5$ and $2\nu_9$ bands), 7.6 $\mu$m (the $\nu_3$ and $\nu_4$ bands at 1326 and 1303 cm$^{-1}$) and 5.8 $\mu$m ($\nu_2$ band). Although two times weaker than those located at 7.6 and 5.8 $\mu$m, the 11 $\mu$m 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 $\mu$m 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 $\mu$m and 7.6 $\mu$m could maximize informations on the vertical distribution of $HNO_3$ in the atmosphere. However at 7.6 $\mu$m the spectroscopic parameters available in the HITRAN and GEISA databases are 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 $\mu$m prevents $HNO_3$ retrievals and severely affects the retrievals of several species absorbing in the 7.5-7.7 $\mu$m region, like $SO_2$. This work is a new and more accurate investigation of the line positions and intensities for the $\nu_3$ and $\nu_4$ 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]

[a] Rothman et al. J. Quant. Spectrosc. Radiat. Transf., 110, 533-572, 2009

[b] Jacquinet et al. J. Quant. Spectrosc. Radiat. Transf., 112, 2395-2445, 2011

[c] A. Perrin, O. Lado-Bordowski, and A.Valentin, Mol. Physics. 67, 249 (1989)

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