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A new spectroscopic linelist for the nu3 and nu4 bands of nitric acid (HNO_3) in the 7.6 microns region

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Nitric acid (HNO_3) plays an important role as a "reservoir" molecule for both the NO_x (nitrogen oxides) and HO_x (hydrogen 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 centred at 879 and 896 cm^{-1}), 7.6 μm (the ν_3 and ν_4 bands at 1326 and 1303 cm^{-1}) and 5.8 μm (ν_2 band at 1710 cm^{-1}). 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 [1] and GEISA [2] databases are of excellent 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_3in the atmosphere. However at 7.6 μm the spectroscopic parameters available in the HITRAN and GEISA database are of very low quality: this prevents HNO_3 atmospheric measurements at 7.6 μm and severely affects the retrievals of several species absorbing in the 7.5-7.7 μm region, like sulphur dioxide (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.

[1] Rothman et al. *J. Quant. Spectrosc. Radiat. Transf.,* **110**, 533–572, 2009.

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