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The Nitrous acid (HONO) is a major source of OH radicals in the Earth atmosphere. Satellite missions, like **IASI-NG** or **FORUM**, can potentially provide a global view of this species in the atmosphere. HONO was first detected at 11 μm by IASI during high events of fires [ATM1-ATM5]. The recent study of Franco et al. [ATM5] has demonstrated that using different absorption bands can potentially help for HONO detection. The goal of the present study is to generate individual line lists for the 16 μm , 11 μm , 8 μm and 5.8 μm absorption bands of Trans-HONO and Cis-HONO. These line lists could help for the future synergy between the **IASI-NG** and **FORUM** instruments.

The 11 μm bands were already the subject of a detail spectroscopic study [S11 μm].

The present work now deals with the 16 μm , 8 μm and 5.8 μm absorption bands

Line positions:

Using new high resolution FTS spectra recorded at SOLEIL in the 16 μm , 8 μm and 5.8 μm regions together with a detailed theoretical analysis, we were able to generate line positions parameters for these three absorption bands of Trans-HONO and Cis-HONO.

Line intensities:

The relative line intensities for the 16 μm , 11 μm , 8 μm and 5.8 μm were calibrated, on a relative scale, using the PNLL cross sections [PNLL].

More explicitly, one has:

$$\text{Ratio}(\text{Int}_{16\mu\text{m}}/\text{Int}_{11\mu\text{m}}/\text{Int}_{8\mu\text{m}}/\text{Int}_{5.8\mu\text{m}})_{\text{This_Line_list}} = \text{Ratio}(\text{Int}_{16\mu\text{m}}/\text{Int}_{11\mu\text{m}}/\text{Int}_{8\mu\text{m}}/\text{Int}_{5.8\mu\text{m}})_{\text{PNLL}}$$

In addition, in Ref. [S11 μm] the absolute line intensities for the 11 μm bands were calibrated relatively to the far-infrared bands of HONO.

These new lists should be of potential interest for the **IASI-NG** (Infrared Atmospheric Sounding Interferometer . New Generation) instrument which will be launched soon on board the METOP-SG satellite and for the future **FORUM** instrument.

Figure 1. Overview of the PNLL cross-sections [PNLL] and short description of the now existing detailed (line by line) line lists.

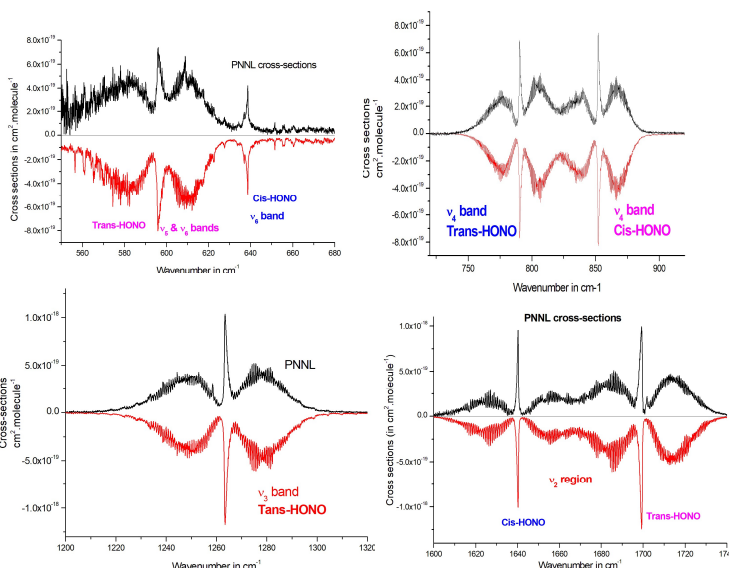
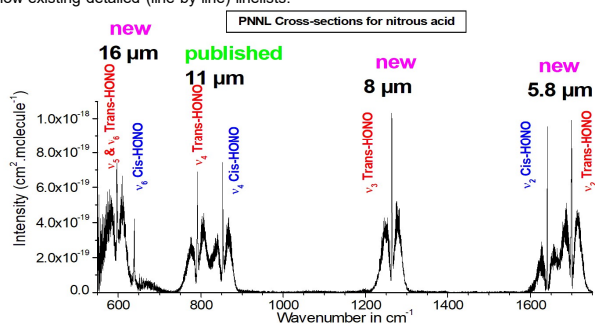


Figure 2 to 5: Computed cross-sections calculated using the present linelist for the 16 μm , 11 μm , 8 μm and 5.8 μm line lists for Trans- and Cis-HONO at T = 296 K as compared to the PNLL cross sections.

The calculated cross-sections are computed at T = 296 K (HONO diluted in an atmosphere of nitrogen and for $\gamma_{\text{HONO}} = 0.1 \text{ cm}^2/\text{Atm}$).

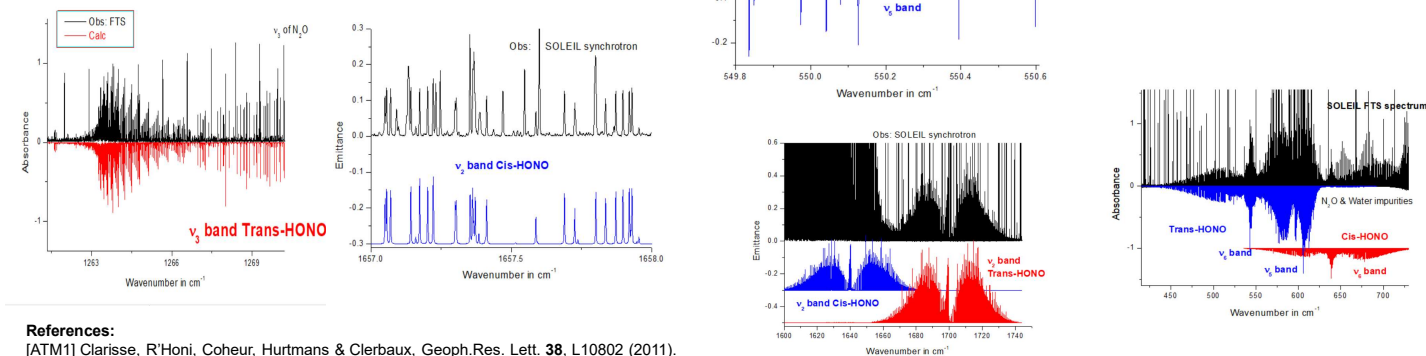
The calculated cross-sections (this work) does not account for the hot bands contribution (\approx vibrational partition function ZVib(296 K) = 1.1615).

For the 500-1700 cm^{-1} , our HONO line intensities are \approx 21% larger than expected from the PNLL values

Future studies: use these HONO line lists for (i) a test for IASI-NG (ii) within French activities around FORUM, an estimation of the impact of HONO contribution to the Earth radiative flux (See the presentation of Q.Libois & L. Labonnote)

		Trans-HONO	Cis-HONO	PNLL	PNLL	This work
		$\nu(\text{cm}^{-1})$	$\nu(\text{cm}^{-1})$	$\Delta\nu(\text{cm}^{-1})$	Intensity	Intensity
ν_1	O-H stretch	3590.8	3426.2		2.66E-17	2.82E-17
ν_2	N-O stretch	1699.8	1640.5			
ν_3	OH bend	1263.2	~1261 ^d		1.88E-17	2.00E-17
ν_4	O-N stretch	790.1	851.9		2.828E-17	3.01E-17
ν_5	ONO bend	595.6	609.2	550-680	\approx 2.90E-17	\approx 3.08E-17
ν_6	torsion	543.9	638.7			(3.54E-17 all)

Other figures: line by line comparisons between high resolution calculated and observed spectra (FTS @ SOLEIL).



References:

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