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Infrared quantitative spectroscopy and planetary atmospheres

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Optical measurements of atmospheric minor constituents are carried out using spectrometers working in the UV-visible, infrared and microwave spectral ranges. In all cases the quality of the analysis and of the interpretation of the atmospheric spectra requires the best possible knowledge of the molecular parameters of the species of interest. To illustrate this point we will concentrate on recent laboratory studies of nitric acid, chlorine nitrate and formaldehyde.

Nitric acid is one of the important minor constituent of the terrestrial atmosphere. Using new and accurate experimental results concerning the spectroscopic properties of the $H^{14}NO_3$ and $H^{15}NO_3$ molecules, as well as improved theoretical methods (Perrin et al., 2004), it has been possible to generate an improved set of line parameters for these molecules in the 11.2 μm spectral region. These line parameters were used to detect for the first time the $H^{15}NO_3$ molecule in the atmosphere analyzing atmospheric spectra recorded by the MIPAS experiment.

The retrievals of chlorine nitrate profiles are usually performed using absorption cross sections (Birk and Wagner, 2003). Following a high resolution analysis of the ν_3 and $\nu_4$bands of this species in the 12.8 μm region wepropose, as a possibility, to use line by line calculation simulating its ν_4Q-branch for the atmospheric temperature and pressure ranges.

For the measurement of atmospheric formaldehyde concentrations, mid-infrared and ultraviolet absorptions are both used by ground, air or satellite instruments. It is then of the utmost importance to have consistent spectral parameters in these various spectral domains. Consequently the aim of the study performed at LISA (Gratien et al., 2007) was to intercalibrate formaldehyde spectra in the infrared and ultraviolet regions acquiring simultaneously UV and IR spectra using a common optical cell. The results of the work will be presented. Also high resolution infrared data derived from Perrin et al., 2003 have been used to determine vertical distributions from the upper troposphere to the stratopause using the high spectral resolution measurements of MIPAS (Steck et al., 2008).

References:

M. Birk, G. Wagner, J. Quant. Spectros. Radiat.Transfer, 82, 443, 2003.

G. Brizzi, M. Carlotti, J.-M. Flaud, A. Perrin and M. Ridolfi, Geophys. Res. Lett., 34, L03802, 2006.

A. Gratien, B. Picquet-Varrault, J. Orphal, E. Perraudin, J.-F. Doussin and J.-M. Flaud, J. Geophys. Res., 112, D05305, 2007.

A. Perrin, F. Keller and J.-M. Flaud, J. Mol. Spectrosc., 221, 192, 2003.

A. Perrin, J. Orphal, J.-M. Flaud, S. Klee, G. Mellau, H. Mader, D. Walbrodt and M. Winnewisser, J. Mol. Spectrosc, 228, 375, 2004.

T. Steck, N. Glatthor, T. von Clarmann, H. Fischer, J. M. Flaud, B. Funke, U. Grabowski, M. Hopfner, S. Kellmann, A. Linden, A. Perrin, and G. P. Stiller, Atm. Chem. Phys., 8, 463, 2008.