



Formic acid above the Jungfraujoch during 1985–2007: observed variability, seasonality, but no long-term background evolution

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This paper reports on daytime total vertical column abundances of formic acid (HCOOH) above the Northern mid-latitude, high altitude Jungfraujoch station (Switzerland; 46.5° N, 8.0° E, 3580 m alt.). The columns were derived from the analysis of infrared solar observations regularly performed with high spectral resolution Fourier transform spectrometers during over 1500 days between September 1985 and September 2007. The investigation was based on the spectrometric fitting of five spectral intervals, one encompassing the HCOOH ν_6 band Q branch at 1105 cm^{-1} , and four additional ones allowing to optimally account for critical temperature-sensitive or time-evolving interferences by other atmospheric gases, in particular HDO, CCl_2F_2 and CHClF_2 . The main results derived from the 22 years long database indicate that the free tropospheric burden of HCOOH above the Jungfraujoch undergoes important short-term daytime variability, diurnal and seasonal modulations, inter-annual anomalies, but no significant long-term background change.

A major progress in the remote determination of the atmospheric HCOOH columns reported here has resulted from the adoption of new, improved absolute spectral line intensities for the infrared ν_6 band of trans-formic acid, resulting in retrieved free tropospheric loadings being about a factor two smaller than if derived with previous spectroscopic parameters. Implications of this significant change with regard to earlier remote measurements of atmospheric formic acid and comparison with relevant Northern mid-latitude findings, both in situ and remote, will be assessed critically. Sparse HCOOH model predictions will also be evoked and assessed with respect to findings reported here.

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