

MetaData File provided: July 1996.
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Data Set Description:

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Instrument in operation:

A Bruker 120HR Infrared Fourier Transform Spectrometer (FTIR)

Site(s): International Scientific Station of the Jungfraujoch
NDACC Station, Swiss Alps,
46.55 N, 7.98 E, 3580m a.s.l., Switzerland

Measurement Quantities:

Total & Partial Vertical Column Abundances above Jungfraujoch (in number molecules per sq. cm)

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Reference Articles:

A complete list is available from <http://labos.ulg.ac.be/girpas/en/publications/>

Selected recent related references (chronological order):

Zander, R., Mahieu, E., Demoulin, P., Duchatelet, P., Roland, G., Servais, C.,
De Mazière, M., Reimann, S. and Rinsland, C. P.: Our changing atmosphere: evidence based on long-term infrared solar observations at the Jungfraujoch since 1950, *Science of The Total Environment*, 391(2-3), 184-195, doi:10.1016/j.scitotenv.2007.10.018, 2008.

Duchatelet, P., Mahieu, E., Ruhnke, R., Feng, W., Chipperfield, M., Demoulin, P., Bernath, P., Boone, C. D., Walker, K. A., Servais, C. and Flock, O.: An approach to retrieve information on the carbonyl fluoride (COF₂) vertical distributions above Jungfraujoch by FTIR multi-spectrum multi-window fitting, *Atmospheric Chemistry and Physics*, 9(22), 9027-9042, doi:10.5194/acp-9-9027-2009, 2009.

Zander, R., Duchatelet, P., Mahieu, E., Demoulin, P., Roland, G., Servais, C., Auwera, J. V., Perrin, A., Rinsland, C. P. and Crutzen, P. J.: Formic acid above the Jungfraujoch during 1985-2007: observed variability, seasonality, but no long-term background evolution, *Atmospheric Chemistry and Physics*, 10(20), 10047-10065, doi:10.5194/acp-10-10047-2010, 2010.

Dils, B., Cui, J., Henne, S., Mahieu, E., Steinbacher, M. and De Mazière, M.: 1997–2007 CO trend at the high Alpine site Jungfraujoch: a comparison between NDIR surface in situ and FTIR remote sensing observations, *Atmospheric Chemistry and Physics*, 11(13), 6735–6748, doi:10.5194/acp-11-6735-2011, 2011.

Rinsland, C. P., Mahieu, E., Demoulin, P., Zander, R., Servais, C. and Hartmann, J.-M.: Decrease of the carbon tetrachloride (CCl₄) loading above Jungfraujoch, based on high resolution infrared solar spectra recorded between 1999 and 2011, *Journal of Quantitative Spectroscopy and Radiative Transfer*, 113(11), 1322–1329, doi:10.1016/j.jqsrt.2012.02.016, 2012.

Bader, W., Stavrakou, T., Muller, J.-F., Reimann, S., Boone, C. D., Harrison, J. J., Flock, O., Bovy, B., Franco, B., Lejeune, B., Servais, C. and Mahieu, E.: Long-term evolution and seasonal modulation of methanol above Jungfraujoch (46.5° N, 8.0° E): optimisation of the retrieval strategy, comparison with model simulations and independent observations, *Atmospheric Measurement Techniques*, 7(11), 3861–3872, doi:10.5194/amt-7-3861-2014, 2014.

Mahieu, E., Chipperfield, M. P., Notholt, J., Reddman, T., Anderson, J., Bernath, P. F., Blumenstock, T., Coffey, M. T., Dhomse, S. S., Feng, W., Franco, B., Froidevaux, L., Griffith, D. W. T., Hannigan, J. W., Hase, F., Hossaini, R., Jones, N. B., Morino, I., Murata, I., Nakajima, H., Palm, M., Paton-Walsh, C., Russell, J. M., Schneider, M., Servais, C., Smale, D. and Walker, K. A.: Recent Northern Hemisphere stratospheric HCl increase due to atmospheric circulation changes, *Nature*, 515(7525), 104–107, doi:10.1038/nature13857, 2014.

Franco, B., Mahieu, E., Emmons, L. K., Tzompa-Sosa, Z. A., Fischer, E. V, Sudo, K., Bovy, B., Conway, S., Griffin, D., Hannigan, J. W., Strong, K. and Walker, K. A.: Evaluating ethane and methane emissions associated with the development of oil and natural gas extraction in North America, *Environ. Res. Lett.*, 11(4), 44010, doi:10.1088/1748-9326/11/4/044010, 2016.

Helmig, D., Rossabi, S., Hueber, J., Tans, P., Montzka, S. A., Masarie, K., Thoning, K., Plass-Duelmer, C., Claude, A., Carpenter, L. J., Lewis, A. C., Punjabi, S., Reimann, S., Vollmer, M. K., Steinbrecher, R., Hannigan, J. W., Emmons, L. K., Mahieu, E., Franco, B., Smale, D. and Pozzer, A.: Reversal of global atmospheric ethane and propane trends largely due to US oil and natural gas production, *Nature Geoscience*, 9(7), 490–495, doi:10.1038/ngeo2721, 2016.

Bader, W., Bovy, B., Conway, S., Strong, K., Smale, D., Turner, A. J., Blumenstock, T., Boone, C., Collaud Coen, M., Coulon, A., Garcia, O., Griffith, D. W. T., Hase, F., Hausmann, P., Jones, N., Krummel, P., Murata, I., Morino, I., Nakajima, H., O'Doherty, S., Paton-Walsh, C., Robinson, J., Sandrin, R., Schneider, M., Servais, C., Sussmann, R. and Mahieu, E.: The recent increase of atmospheric methane from 10 years of ground-based NDACC FTIR observations since 2005, *Atmos. Chem. Phys.*, 17(3), 2255–2277, doi:10.5194/acp-17-2255-2017, 2017.

Lejeune, B., Mahieu, E., Vollmer, M. K., Reimann, S., Bernath, P. F., Boone, C.

D., Walker, K. A. and Servais, C.: Optimized approach to retrieve information on atmospheric carbonyl sulfide (OCS) above the Jungfraujoch station and change in its abundance since 1995, J. Quant. Spectrosc. Radiat. Transf., 186, 81-95, doi:10.1016/j.jqsrt.2016.06.001, 2017.

Instrument Description:

The Fourier Transform Spectrometer in operation at the Jungfraujoch since 1990 is a commercial "Bruker IFS 120 HR". Spectra are recorded either in the 1-5.4 or 8-14 micrometers intervals (atmospheric windows) depending on beamsplitters and detectors selections, with an ultimate resolution of 0.001 cm⁻¹ (maximum OPD of 5m).

Beforehand, a FTIR instrument built at the Institute of Astrophysics in Liege ("home-made") has been routinely used from 1984 until 2008 by Ph. Demoulin. It achieved an ultimate resolution of 0.0025 cm⁻¹ (max OPD of 2m) and both spectral domains mentioned above were also covered with this instrument.

Algorithm Description:

As of October 2017, vertical total and partial column abundances are retrieved using the SFIT4 algorithm (in place of SFIT2) implementing the Optimal Estimation Method of Rodgers, fitting one or several carefully selected microwindows containing isolated and well characterized line(s) of the target gas.

Ancillary data: -Line compilations: HITRAN 2008 in most cases, complemented by pseudolines for ClONO₂, C₂H₆... -Physical models: PT profiles provided by the NCEP (National Centers for Environmental Prediction) for noontime are systematically used. -A priori vertical distributions for the target and interfering gases correspond in most cases to a mean of monthly profiles derived for 1980-2020 from a dedicated WACCM simulation (v6), except for water vapor for which NCEP or ERA-Interim reanalyses are used.

Expected Precision/Accuracy of Instrument:

Based on regular tests with NDACC HCl-sealed cells, precision and accuracy are estimated at +/- 2%.

Instruments History:

-See Zander et al. (2008).