MetaData File provided: July 1996.
Latest Revision: 29-Aug-2022.

Data Set Description:

PI: Emmanuel Mahieu
Institute of Astrophysics and Geophysics (UR SPHERES)
University of LIEGE

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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Starting with version IRWG2022:
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For earlier versions (v001 up to v007):
refer to the DATA_RULES_OF_USE statement available in each hdf archive

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Reference Articles:

A complete list is available from https://www.girpas.uliege.be/cms/c_5895270/en/publications

Selection of key publications (chronological order, from 2008 until 2021):

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

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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.

Prignon, M., Chabrillat, S., Minganti, D., O'Doherty, S., Servais, C., Stiller, G., Toon, G. C., Vollmer, M. K. and Mahieu, E.: Improved FTIR retrieval strategy for HCFC-22 (CHClF2), comparisons with in situ and satellite datasets with the support of models, and determination of its long-term trend above Jungfraujoch, Atmos. Chem. Phys., 19(19), 12309–12324, doi:10.5194/acp-19-12309-2019, 2019.

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Strahan, S. E., Smale, D., Douglass, A. R., Blumenstock, T., Hannigan, J. W., Hase, F., Jones, N. B., Mahieu, E., Notholt, J., Oman, L. D., Ortega, I., Palm, M., Prignon, M., Robinson, J., Schneider, M., Sussmann, R. and Velazco, V. A.: Observed Hemispheric Asymmetry in Stratospheric Transport Trends From 1994 to 2018, Geophys. Res. Lett., 47(17), doi:10.1029/2020GL088567, 2020.

Mahieu, E., Fischer, E. V., Franco, B., Palm, M., Wizenberg, T., Smale, D., Clarisse, L., Clerbaux, C., Coheur, P.-F., Hannigan, J. W., Lutsch, E., Notholt, J., Cantos, I. P., Prignon, M., Servais, C. and Strong, K.: First retrievals of peroxyacetyl nitrate (PAN) from ground-based FTIR solar spectra recorded at remote

sites, comparison with model and satellite data, Elem. Sci. Anthr., 9(1), doi:10.1525/elementa.2021.00027, 2021.

Prignon, M., Chabrillat, S., Friedrich, M., Smale, D., Strahan, S. E., Bernath, P. F., Chipperfield, M. P., Dhomse, S. S., Feng, W., Minganti, D., Servais, C. and Mahieu, E.: Stratospheric fluorine as a tracer of circulation changes: comparison between infrared remote-sensing observations and simulations with five modern reanalyses, J. Geophys. Res. Atmos., doi:10.1029/2021JD034995, 2021.

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. Spectra are recorded with resolutions spanning the 0.0061 to 0.0019 cm-1 (OPD between ~82 and 257 cm), depending on the optical filter and sun height.

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 (v.0.9.4.4 in place of SFIT2) implementing the Optimal Esimation 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, ERA-Interim or ERA-5 reanalyses are used.

Expected Precision/Accuracy of Instrument:
Based on regular tests with NDACC HBr-sealed cells, precision and accuracy are estimated at +/- 2%.

Instruments History:
-See Zander et al. (2008).
- or in French: Mahieu, E., Bader, W., Bovy, B., Demoulin, P., Flock, O., Franco, B., Lejeune, B., Prignon, M., Roland, G. and Servais, C.: Surveillance de l'atmosphère terrestre depuis la station du Jungfraujoch : une épopée liégeoise entamée voici plus de 65 ans !, Bull. la Société Géographique Liège, 68(Hommage au Professeur Michel Erpicum), 119–130 [online] Available from: http://popups.ulg.ac.be/0770-7576/index.php?id=4592&file=1, 2017.