The multidecadal FTIR monitoring program of ULiège at the Jungfraujoch station

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A bit of history

The first infrared solar observations were carried out at the Jungfraujoch station by Pr Migeotte in 1950-1951, using a grating spectrometer. They resumed in the mid-1970s with a grating instrument offering an improved spectral resolution. At that time, several species linked to stratospheric ozone were targeted. Since the mid-1980s, Fourier Transform InfraRed (FTIR) spectrometers have been in operation, on a routine basis. Broadband very high resolution infrared solar absorption spectra are recorded using a combination of optical filters and cooled detectors (HgCdTe/MCT or InSb). Panel A of Figure 1 illustrates the five spectral ranges routinely recorded by the current FTIR instrument in operation at the Jungfraujoch, covering together the 2 to 14 µm spectral range.

Over the years and decades, more than 60,000 spectra have been recorded, gathering a unique observational database, worldwide, in terms of measurement density, quality and time coverage.

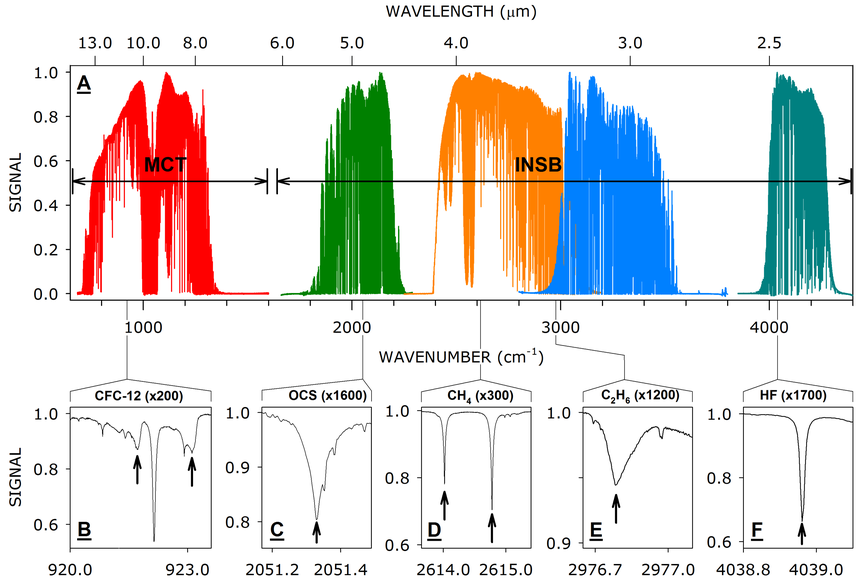

FIGURE 1. The spectral ranges routinely recorded at the Jungfraujoch station with our FTIR spectrometer are reproduced in panel A. Panels B to F show, after an horizontal zooming by 200 to 1700 times, a suite of microwindows used to retrieve some of the target species of our atmospheric monitoring program (Mahieu et al., 2017).

Sample results

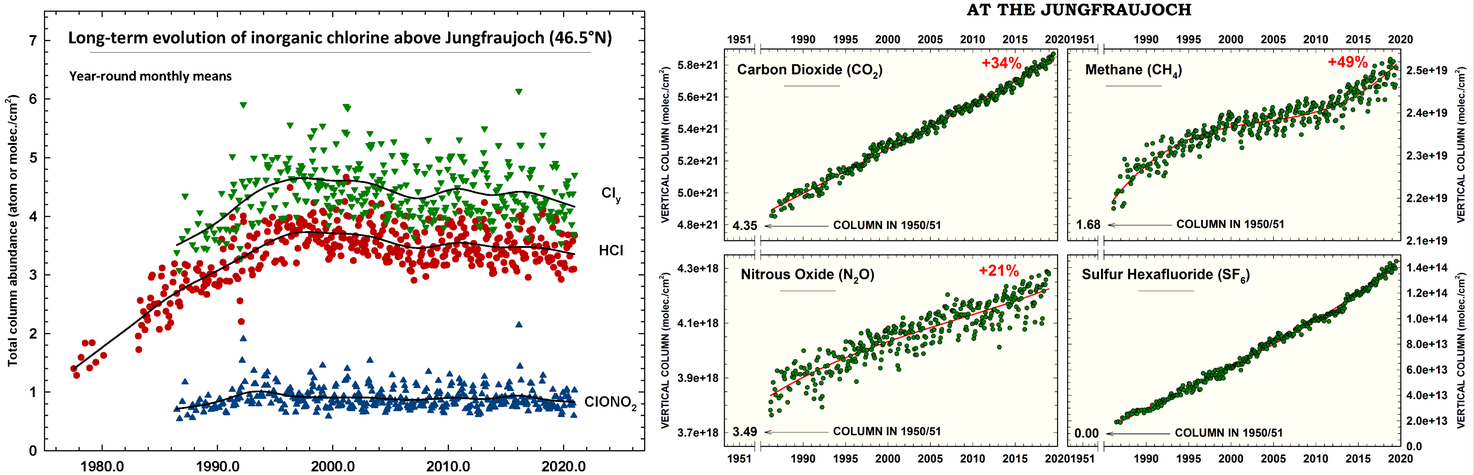

TABLE 1. Inventory of the target species currently retrieved from the Jungfraujoch FTIR solar spectra. This list is constantly growing, and peroxyacetyl nitrate (PAN), a reservoir of pollution, was recently added (Mahieu et al., 2021)

List of species monitored by FTIR remote-sensing at the Jungfraujoch station		
Greenhouse gases	H_2O, CO_2, CH_4, N_2O, CF_4, SF_6	Support to the Kyoto Protocol and the Paris Agreement
Ozone-related	O_3, NO, NO_2, $ClONO_2$, HCl, HF, COF_2, CFC-11, -12, HCFC-22, -142b, CCl_4, CH_3Cl	Support to the Montreal Protocol
Air quality, biomass burning, oil & gas sector	CO, CH_3OH, C_2H_6, C_2H_2, C_2H_4, HCN, HCOOH, HCHO, NH_3, PAN	Support to the Copernicus CAMS program of EU
Others	OCS, N_2, isotopologues	Various applications

References

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Acknowledgments

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