

Atmospheric composition monitoring at ISSJ

Michel Van Roozendael¹, Martine De Mazière¹, Bart Dils¹, Caroline Fayt¹, Martina Friedrich¹, François Hendrick¹, Christian Hermans¹, Bavo Langerock¹, Gaia Pinardi¹, Corinne Vigouroux¹, Minqiang Zhou¹

¹Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Ukkel, Belgium

michelv@aeronomie.be

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1. Project description

1.1 UV-Vis observations

Since its first installation at the Jungfraujoch in summer 1991, BIRA-IASB has performed long-term measurements of the atmospheric composition using ground-based UV-visible remote-sensing spectrometers that complemented Fourier Transform Infrared measurements by the University of Liège. The original focus was on the monitoring of the long-term evolution of the stratospheric NO₂ and ozone layers instrument (Hendrick et al., 2012) using a SAOZ (Système d'Analyse par Observations Zénithales) system. In 2010, a MAX-DOAS instrument was installed allowing to extend the focus of our monitoring to the free-tropospheric composition (Franco et al., 2015). Such measurements have been regularly used as background references for the validation of satellite experiments (e.g. Verhoest et al., 2021; Pinardi et al., 2020).

Unfortunately, the SAOZ instrument broke down in early 2011. However, the NO₂ and O₃ monitoring could be continued using the MAX-DOAS instrument until May 2016. At this point in time, the time-series of measurements had to be interrupted. Although it was (and it is still) our intention to refurbish the UV-visible instrumentation operated at the Jungfraujoch, the planned updates had to be postponed until now. Although a new zenith-sky instrument is ready for use and now fully tested in Brussels since mid-2021, its installation could not be realised yet, mainly due to staff issues and Covid19 related difficulties. Our next visit to the site is planned in March 2022, when we will install the new zenith-sky DOAS spectrometer. At the same time, we will evaluate the actions needed to upgrade the MAX-DOAS instrument. A budget was secured to do so as part of the Belgium contribution to the ACTRIS Research Infrastructure (see below).

1.2 International coordination activities

European ACTRIS Research Infrastructure (www.actris.eu), BIRA-IASB is responsible for the Reactive Trace Gases Remote Sensing (RTGRS) component, in particular for the CREGARS (Centre for Reactive Trace Gases Remote Sensing) Central Facility.

Together with the University of Liège and the University of Bremen, it manages the CREGARS-FTIR Unit. Likewise, it also manages the CREGARS-UVVIS unit in collaboration with CNRS, LATMOS and the University of Innsbruck. The implementation of CREGARS-FTIR and CREGARS-UVVIS are ongoing. The FTIR instrument operated by the University of Liège at Jungfraujoch together with the BIRA-IASB UV-Vis spectrometers have been proposed as ACTRIS RTGRS Belgian National Facility. As such, they will receive operational support from CREGARS. BIRA-IASB coordinates the Belgian federal project ACTRIS-BE that supports the implementation of ACTRIS at the Belgian federal level (2018-2022). From 2022 onwards, ACTRIS target data recorded at the Jungfraujoch will also become available from the ACTRIS data portal.

As in previous years, BIRA-IASB remains in charge of the CAMS-27 contract, which aims at providing a rapid-delivery and quality-controlled NDACC data stream to CAMS. These data including the Jungfraujoch Zenith-sky, MAX-DOAS and FTIR data are used for the validation of products from the Copernicus Atmospheric Monitoring Service (CAMS), led by ECMWF.

Similarly, BIRA-IASB is in charge of the Sentinel-5 Precursor (S5P) operational validation service (VDAF) within the ESA S5P Mission Performance Center (MPC). In this context, BIRA-IASB coordinates the validation of the S5P products using NDACC data, including the Jungfraujoch FTIR and UVVIS data.

Finally, in the frame of the Copernicus Climate Change Service (C3S), BIRA-IASB is responsible for the ingestion of long-term NDACC ozone, CO and CH₄ time series in the Climate Data Store (CDS; <https://cds.climate.copernicus.eu/>). Long-term Jungfraujoch FTIR and UVVIS ozone time series are now available in the CDS; Jungfraujoch FTIR CO and CH₄ data will follow as part of the ongoing extension of the service.

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Address

Royal Belgian Institute for Space Aeronomy
Ringlaan 3
B-1180 Brussels
Belgium

Contacts

Dr. Michel Van Roozendael (primary contact point)
Tel. +32 2 373 0416
e-mail: michelv@aeronomie.be
Prof. Dr. Martine De Mazière
Tel. +32 2 373 0400
e-mail: martine@ aeronomie.be

Internet data bases

<http://www.ndacc.org/> (data archival in NDACC data base)
<https://evdc.esa.int/> (data archival in ESA CAL/VAL EVDC database at NILU)

Notes:

- All the data sets submitted in these data bases are generated using HDF GEOMS formats
- The NDACC database is ‘read’ by the CAMS validation server on a daily basis, for using the data for the validation of the CAMS NRT and reanalysis products. A similar facility has been implemented for the SSP-MPC VDAF system.

Collaborating partners / networks

Dr. E. Mahieu, Université de Liège, Liège, Belgique
Dr. M. Chipperfield, University of Leeds, Leeds, UK
Dr. A. Pazmino, LATMOS, Guyancourt, France
Prof. P. Coheur, Université Libre de Bruxelles, Brussels, Belgium
International Network for the Detection of Atmospheric Composition Changes (NDACC)
OMI, TROPOMI (S5P), and Metop GOME-2 and IASI satellite communities
KNMI and S&T for the CAMS and S5P MPC Validation Server
CNR (Italy) and ECMWF for the delivery of NDACC data to C3S
ACTRIS: Strong responsibilities at European and Belgian level

Scientific publications and public outreach 2020

Refereed journal articles and their internet access

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