Name of research institute or organization:

Royal Belgian Institute for Space Aeronomy (BIRA-IASB)

Title of project:

Atmospheric physics and chemistry

Part of this programme:

NDACC, ACTRIS, GAIA-CLIM, QA4ECV, Sentinel-5 Precursor CalVal AO, CAMS, ESA FRM4DOAS

Project leader and team:

Dr. M. Van Roozendael: project leader UV-Vis
Dr. Martine De Mazière: project leader FTIR
Bart Dils, Bavo Langerock, Corinne Vigouroux, Caroline Fayt, François Hendrick, Christian Hermans, Gaia Pinardi: team scientists

Project description:

UV-Vis (main results, significance of results, progress in 2016)

BIRA-IASB has been maintaining its UV-Vis atmospheric composition monitoring activities at the Jungfraujoch throughout the year 2016. Although the installation of a new mini-SAOZ system planned in the course of 2016 had to be delayed due to the intensive BIRA involvement in the international CINDI-2 campaign in Cabauw (September 2016), the MAXDOAS system has been in operation delivering high quality measurements of NO_2, O_3, HCHO and BrO. For the sake of redundancy and to mitigate the risk of instrumental breakdown with the MAXDOAS system it is still planned to install an additional zenith-sky system based on a low-cost Avantes spectrometer. This system is under development at BIRA (all elements have been ordered) and it will be installed at the Jungfraujoch in the course of 2017. The operational processing chain developed in 2016 as part of the NORS project has been maintained in 2016 and been used to provide rapid delivery NO_2 and O_3 measurements in support of the Copernicus Atmospheric Monitoring Service (CAMS). These measurements are also delivered to the NOAA NCEP data base feeding both the rapid-delivery and the consolidated servers of the Network for the Detection of Atmospheric Composition Change (NDACC).

In addition to acting as a scientific coordinator for the CINDI-2 international intercomparison campaign, which will provide a thorough assessment of the overall UV-Vis DOAS monitoring capabilities leading to the certification of a number of new groups within NDACC, BIRA-IASB has been awarded the ESA FRM4DOAS project which aims at developing and demonstrating a centralized processing system for MAXDOAS instruments. Operated within NDACC and with ESA support, this system will allow for quality-controlled and harmonized near-real-time processing of a large number of MAXDOAS systems that will in this way provide a key contribution to the validation of future satellite air-quality missions, in particular the ESA Sentinel 4, 5 and 5P. These efforts are in line with other satellite validation activities developed at BIRA in various projects and programmes, such as the QA4ECV project, the EUMETSAT AC-SAF and more recently the Sentinel-5 Precursor operational validation facility (VDAF) being developed as part of the Sentinel-5 Precursor Mission Performance Center (MPC).

FTIR solar absorption spectrometry (main results, significance of results, progress in 2016)

C. Vigouroux of BIRA-IASB has been coordinating the contribution of the NDACC FTIR ozone data to the Tropospheric Ozone Assessment Report (TOAR). This study should be published in 2017. The Jungfraujoch FTIR ozone data delivered by University of Liège have been included in both studies. C. Vigouroux is also involved in the new SPARC initiative LOTUS, Long-term Ozone Trends and Uncertainties in the Stratosphere, aiming at a better understanding of several key open issues identified by previous ozone trends assessments, most notably on the understanding of uncertainties in the trend analysis chain: she will be responsible for the NDACC FTIR ozone data.

Starting in March 2015, BIRA-IASB is involved in the H2020 GAIA-CLIM (Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring) project which is aiming at improving our ability to use ground-based and sub-orbital observations to characterize satellite observations for a number of atmospheric Essential Climate Variables (ECVs). Work being undertaken by BIRA-IASB to establish fully traceable reference-quality measurements for total ozone using ground-based UV-visible spectroscopy and for O_3 and H_2O profile measurements using ground-based FTIR solar absorption spectrometry will have an impact on such measurements being performed at the Jungfraujoch. A traceability chain for the data acquisition and processing models has been established and common procedures for uncertainty budget evaluations have been agreed and implemented by the NDACC FTIR and UV-VIS communities.

In the frame of the EU QA4ECV project (Quality Assurance for ECV products), BIRA-IASB is leading a task for characterizing and establishing MAXDOAS tropospheric NO_2 and H_2CO column measurements as well as NDACC and TCCON FTIR CO profile measurements as traceable reference data sets for satellite validation. The Institute is in contact with the University of Liège to include the Jungfraujoch NDACC FTIR CO data in this reference data set.

BIRA-IASB is also responsible for the use of NDACC data, including the Jungfraujoch SAOZ, MAXDOAS and FTIR data for the validation of various products of the Copernicus Atmospheric Monitoring Service (CAMS), led by ECMWF. The results are reported on quarterly basis in the validation reports that are available at https://atmosphere.copernicus.eu/quarterly_validation_reports. Jungfraujoch NDACC data are included as soon as they are submitted to the NDACC database. BIRA-IASB is now responsible for establishing a contract (CAMS-27) between ECMWF and the NDACC partners to guarantee a continuous rapid-delivery and quality-controlled data stream to CAMS. Similarly, BIRA-IASB is coordinating the validation of the S5P products using NDACC data, including the Jungfraujoch FTIR data.

Key words:

Atmospheric composition, long-term monitoring, optical remote sensing, vertical inversion methods, satellite and model validation

Internet data bases:

The data are archived in the NDACC database (http://www.ndacc.org/), in the NADIR/NILU database (http://www.nilu.no/projects/nadir).
Data processed for ENVISAT validation purposes are also submitted to the ENVISAT CAL/VAL database (http://nadir.nilu.no/calval).
Revised HDF GEOMS formats for UV-Vis DOAS and FTIR data products have been implemented at the NDACC data base, as a contribution to the NORS and QA4ECV project.
In the framework of NORS, a Rapid-Delivery submission system has been implemented for several NDACC sites (among them Jungfraujoch), by which measurements are provided to the data base within 1 day to 1 month after data acquisition.

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 re-analysis products.

Collaborating partners/networks:

Collaborations with University of Liège and NDACC partners
Collaboration with European FTIR and UV-Vis teams and modelling teams in the frame of the EU projects GAIA-CLIM and QA4ECV
Collaboration with M. Chipperfield of Univ. Leeds
Both the UV-Vis and FTIR observations contribute to the international Network for the Detection of Atmospheric Composition Changes (NDACC)
Collaboration with F. Goutail, J.-P. Pommerau and A. Pazmino of LATMOS, France (SAOZ)
Collaboration with the OMI, TROPOMI (S5P), and MetOp GOME-2 and IASI satellite communities
Collaboration with Université Libre de Bruxelles for IASI FORLI data validation
Collaboration with S&T for the CAMS, QA4ECV and S5P Validation Server

Scientific publications and public outreach 2016:

Refereed journal articles and their internet access

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