

Name of research institute or organization:

**Belgian Institute for Space Aeronomy (BIRA-IASB)**

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Title of project:

Atmospheric physics and chemistry

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Project leader and team:

Dr. Martine De Mazière: project leader FTIR

Dr. M. Van Roozendael: project leader UV-Vis

Brice Barret, Caroline Fayt, François Hendrick, Christian Hermans, Jean-Christopher Lambert: team scientists

Pierre Gérard, José Granville: team support engineers

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Project description:

UV-Vis

BIRA-IASB operates a zenith-sky looking UV-visible spectrometer installed on the Sphinx platform since June 1990. Of the French CNRS SAOZ (Système d'Analyse par Observations Zénithales) design, this instrument has been qualified for operation within the international NDSC (Network for the Detection of Stratospheric Changes). Twice daily at twilight, it provides measurements of the ozone and nitrogen dioxide total columns suitable for long-term climatological studies and for satellite validation. In 2002, the SAOZ NO<sub>2</sub> and O<sub>3</sub> column data have been submitted to the ENVISAT Cal/Val data base and used for the initial validation of the SCIAMACHY data products within the ESA CINAMON project (coordination at IASB). Besides this, an algorithm for the vertical profile inversion of stratospheric NO<sub>2</sub> has been designed as part of the EU project QUILT. After an initial phase of evaluation and validation, this algorithm will be applied to the Jungfraujoch data series.

FTIR solar absorption spectrometry

BIRA-IASB participates in the observations of the atmospheric composition by Fourier transform infrared spectrometry coordinated by the University of Liege (see report by ULg). In 2002, BIRA has focused on the development and characterisation of vertical inversion techniques. In 2001, we carried out a complete characterisation of the vertical profiles of ozone retrieved from the FTIR spectra. In 2002, a similar procedure has been to FTIR measurements of CO. The retrieved vertical profiles and total columns have been compared with in-situ surface measurements of CO done by EMPA and with observations of CO from the satellite instrument MOPITT onboard Terra. Overall the agreements are very good, taking into account the limits of each measurement technique. The results prove the sensitivity of the FTIR measurements of CO from the lower stratosphere down to the surface. This shows that the FTIR spectrometry has a unique capability to derive tropospheric abundances for a number of species for which hardly any other experimental data exist at present. Long-term records of other species (N<sub>2</sub>O, CH<sub>4</sub>, some CFC) will be re-analysed using the vertical inversion methods.

Key words

Ozone, nitrogen dioxide, CO, atmospheric composition, long-term monitoring, optical remote sensing, vertical inversion methods

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Internet databases

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The data are archived in the NDSC database (<http://www.ndsc.ncep.noaa.gov/>) and in the NADIR/NILU database (<http://www.nilu.no/projects/nadir>).

Collaborating partners/networks:

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Collaborations with University of Liège, and NDSC partners.

Both the UV-Vis and FTIR observations contribute to the NDSC, international Network for Detection of Stratospheric Change.

Collaboration with B. Buchmann, EMPA.

Scientific publications and public outreach 2002:

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Barret, B., M. De Mazière, P. Demoulin, Retrieval and characterisation of ozone profiles from solar infrared spectra at the Jungfraujoch”, *J. Geophys. Res.*, 10.1029/2001JD001298, 2002.

De Mazière, M., and B. Barret, Retrieval of tropospheric information from ground-based FTIR observations, supported by synergistic exploitation of various ground-based and space-borne measurement techniques and data, in “*Annual Report 2001-TROPOSAT: The Use and Usability of Satellite Data for Tropospheric Research*”, EUROTRAC-2 International Scientific Secretariat (ISS), GSF-National Research Centre for Environment and Health, Munich, Germany, p. 146-150, May 2002.

De Mazière, M., R. Colin, D. de Muer, R. Zander, The Earth Observing System: Synergy between Ground-based and Satellite Observations and Model Experiments, in *Space Scientific Research in Belgium, Volume 3: Earth Sciences, Part III, 1994-2000*, pp. 9-32, 2002.

Lambert, J.-C., M. Van Roozendael, M. De Mazière, Development, Validation and Exploitation of ERS-2 GOME Satellite Data: Overview and Perspectives for ENVISAT, in *Space Scientific Research in Belgium, Volume 3: Earth Sciences, Part III, 1994-2000*, pp. 47-66, 2002.

Newman, P.A., N. R. P. Harris, A. Adriani, G. Amanatidis, J. Anderson, G. Braathen, W. Brune, K. Carslaw, M. Craig, P. DeCola, M. Guirlet, S. Hipskind, M. Kurylo, H. Küllmann, N. Larsen, G. Mégie, J.-P. Pommereau, L. Poole, M. Schoeberl, F. Stroh, B. Toon, C. Trepte, and M. Van Roozendael, An overview of the SOLVE-THESEO 2000 campaign, *J. Geophys. Res.*, in press, 2002.

Zander, R., E. Mahieu, C. Servais, G. Roland, P. Duchatelet, P. Demoulin, L. Delbouille, C.P. Rinsland, M. De Mazière and R. Blomme, Potential of the NDSC in support of the Kyoto Protocol: Examples from the station Jungfraujoch, Switzerland, in *Proceedings of "The Third International Symposium on Non-CO2 Greenhouse Gases: Scientific Understanding, Control Options and Policy Aspects"*, Maastricht, Netherlands, 21-23 January 2002, J. Van Ham et al. Eds., Millpress-Rotterdam Publ., ISBN 90 77017-70-4, pp. 305-310, 2002.

**Poster Presentations**

De Mazière, M. and B. Barret, Retrieval of tropospheric information from ground-based FTIR observations, supported by synergistic exploitation of various ground-based and spaceborne measurement techniques and data, Poster presented at the EUROTRAC-2 2002 Symposium, Garmisch-Partenkirchen, March 11-15, 2002.

Duchatelet, P., E. Mahieu, R. Zander, P. Demoulin, B. Barret and C.P. Rinsland, Updating the Jungfraujoch FTIR databases: current status, Poster presented at the 6th European Symposium on Stratospheric Ozone, Göteborg, Sweden, Sept. 2-6, 2002.

Hendrick, F., M. Van Roozendael, C. Fayt, C. Hermans, J.-C. Lambert, and M. De Mazière, Long-term total column NO<sub>2</sub> SAOZ measurements at the Jungfraujoch, as part of the NDSC, Poster presentation at the Workshop on Atmospheric Research at the Jungfraujoch and in the Alps, 182th Annual Congress of the Swiss Academy of Sciences, Davos, Switzerland, 24-27 September 2002

Lambert, J.-C., J. Granville, V. Soebijanta, and M. Van Roozendael, Preliminary Evaluation of GOME Data Processor Upgrade to Version 3.0, Invited talk at the GOME User Consultation Meeting, ESA/ESRIN, Frascati, Italy, 28-29 January 2002.

Lambert, J.-C., A Review of Observational Data on Stratospheric NO<sub>2</sub>, Solicited oral presentation at the World Space Congress II/34th COSPAR Scientific Assembly, Special Session on COSPAR International Reference Atmospheres (CIRA), Houston, Texas (USA), 10-19 October 2002.

Lambert, J.-C., J. Granville, F. Hendrick, M. P. Chipperfield, and M. Van Roozendael, Diurnal cycle of stratospheric NO<sub>2</sub> and its effects on the interpretation of multi-platform measurements, Poster presentation at the World Space Congress II/34th COSPAR Scientific Assembly, Session on Trace Constituents in the Troposphere and Lower Stratosphere, Houston, Texas (USA), 10-19 October 2002.

Mahieu, E., C.P. Rinsland, R. Zander, P. Duchatelet, C. Servais and M. De Mazière, Tropospheric and Stratospheric Carbonyl Sulfide (OCS): Long-term Trends and Seasonal Cycles above the Jungfraujoch Station, Poster presented at the 6th European Symposium on Stratospheric Ozone, Göteborg, Sweden, Sept. 2-6, 2002.

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