AGACC

Advanced exploitation of Ground-based measurements for Atmospheric Chemistry and Climate applications

DURATION OF THE PROJECT
Phase 1: 15/12/2005 – 14/12/2007
Phase 2: 15/12/2007 – 31/12/2009

BUDGET
1.116.826 €

KEYWORDS
Source gases, water vapour, aerosols, remote sensing, atmospheric composition

CONTEXT

The evolution of our environment, in particular climate and air quality, will have important socio-economic and health consequences. Better knowledge of this evolution and of the atmospheric processes involved will lead to more accurate prediction capabilities and thus allow policy makers to prepare knowledge-based adaptation and mitigation strategies. Therefore, AGACC joins international scientific research regarding these issues. It will exploit past and current observations for investigating chemical changes in the atmosphere that have an impact on the Earth's climate or air quality. It will contribute to the solution of actual related questions, like: Can one observe a change in the distribution of the atmospheric water vapour? What determines the evolution of methane? What about the aerosol load above Uccle and its impact on the surface radiation?

PROJECT DESCRIPTION

Objectives

The general objectives of the project are to derive new and improved data sets for the target geophysical parameters. These are lower tropospheric aerosols, water vapour in the troposphere and lower stratosphere, as well as methane and HCFCs (hydrochlorofluorocarbons, used primarily as a substitute for CFCs) that have a direct impact on climate. Also a number of source gases (carbon monoxide (CO), hydrogen cyanide, formaldehyde (H_2CO)) that influence the cleansing capacity of the atmosphere, and therefore indirectly also climate, will be studied. Some feasibility studies are planned for the detection of isotopologues of methane, CO and water (e.g., HDO): the isotopic composition allows one to distinguish between possible sources of the species. It will be investigated whether OH and C_2H_4 (ethylene), for which only few data exist, can be detected.
Possible synergies and complementarities between observation techniques will be exploited to gain more information.

The project will also care for a proper interpretation and dissemination of the research results, in order to maximize their use for atmospheric chemistry and climate applications and in environmental assessments (e.g., IPCC), in support of policy makers and for enhancing the awareness of the public.

Methodology

The instrumentation includes 3 types of spectrometers (Fourier transform infrared (FTIR), UV-Visible Multi-Axis Differential Optical Absorption Spectroscopy (MAXDOAS), and Brewer) and a sun photometer. They are operated in the field at Brussels (Ukkel - Uccle), Jungfraujoch (ISSJ) in the Swiss Alps and Ile de La Réunion in the subtropics in the Indian Ocean. Existing time series of balloon soundings performed at Ukkel since 1990 will be revised and corrected, for a precise determination of the water vapour profile in the upper troposphere/ lower stratosphere.
In addition, FTIR instruments will be used in the laboratory to identify improved spectroscopic parameters to support the FTIR data analyses, in particular for H_2O and HDO, ^{13}CO, C_2H_2 and H_2CO.

INTERACTION BETWEEN THE PARTNERS

The partners have complementary expertise, associated in particular with the different instruments that they are operating. In the context of this project, BIRA-IASB performs MAXDOAS observations at ISSJ, Ukkel and Ile de La Réunion. It is also responsible for the FTIR measurements at Ile de La Réunion and Ukkel, and sun photometer measurements of aerosol at Ukkel. The FTIR measurements at ISSJ are under the responsibility of the ULg team. KMI-IRM brings in the project knowledge concerning humidity measurements from radio soundings and aerosol observations with Brewer spectrometry. The ULB partner is leading the laboratory experiments – with support from BIRA-IASB -, and collaborates with the latter in the FTIR experiments at Ukkel

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and Ile de La Réunion.
The water vapour activities are shared mainly among ULB, KMI-IRM and BIRA-IASB, using radiosonde and FTIR observations. KMI-IRM and BIRA-IASB work together on the aerosol measurements above Ukkel from sun photometer, Brewer and MAXDOAS observations. ULg and BIRA-IASB will collaborate strongly on the detection of formaldehyde with MAXDOAS and FTIR instruments, in particular at ISSJ. For the development of retrieval strategies for the AGACC target gases, ULG will take the lead, and exchange findings with BIRA-IASB and ULB. ULB will support the FTIR data retrievals with laboratory data.

EXPECTED OUTCOMES

incl. link with international programmes

AGACC will deliver original and advanced datasets of the target parameters, playing an important role in tropospheric chemistry, climate, or air quality. It will characterize evolutions of greenhouse gases and of relevant related species at Ukkel and ISSJ. Examples are the time series and trends of relative humidity, and of aerosol load and surface radiation at Ukkel, or the evolution of methane and its isotopic partitioning above ISSJ. The aerosol results will enable the generation and dissemination of an improved UV-index prediction for Ukkel. AGACC will also provide an inventory of new HCFC/HFC compounds presenting infrared absorption features in ISSJ spectra, and an assessment of the feasibility to retrieve water vapour and some other target gases from FTIR spectra at the various sites. At Ile de La Réunion, new data will be collected.
In addition, new laboratory spectroscopic data will be provided and submitted to the relevant databases that are HITRAN and GEISA.
ULg, BIRA-IASB and KMI-IRM are all contributing to the Network for the Detection of Atmospheric Composition Change: relevant results from AGACC will be discussed in this international community, and possibly submitted to its database. The results will also be available to model teams, e.g., in the European ACCENT network and the SCOUT-O_3 community, to enable them to validate and improve their models and predictions for the future. Also satellite validation teams will make use of the data, e.g., of H_2CO.

PARTNERS - ACTIVITIES

BIRA-IASB's
mission is to acquire and disseminate scientific and technological expertise regarding space aeronomy, i.e., the physics and chemistry of the Earth, planetary and cometary atmospheres.

KMI-IRM
delivers services supported by research and long term standardised meteorological, climatological and geophysical observations in favour of the safety and information of the population, and of the socio-economical and scientific community.

ULg-GIRPAS
is monitoring the Earth atmosphere composition using state-of-the-art infrared instruments. Resulting geophysical databases are used to detect changes, of key relevance to e.g. the Kyoto and Montreal Protocols.

The ULB-SCQP
activities, which rely on fundamental aspects of molecular spectroscopy, are focused on laboratory measurements as well as on the remote-sensing of the Earth's atmosphere, from the ground and satellites.

CONTACT INFORMATION

Website of the project:
http://www.oma.be/AGACC/Home.html

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Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting http://www.belspo.be/fedra or http://www.belspo.be/ssd

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