SPECTROSCOPIC MEASUREMENTS OF ATMOSPHERIC CHANGES (SMAC)

Coordinator: Professor Paul C. SIMON, Chef de section, Institut d'Aéronomie Spatiale de Belgique
Professor Luc DELBOUILLE, Institut d'Astrophysique, Université de Liège
Professeur Réginald COLIN, Laboratoire de Chimie Physique moléculaire, Université Libre de Bruxelles
Address of the coordinator: Institut d'Aéronomie Spatiale de Belgique, Belgisch Instituut voor Ruimte-Aëronomie, 3 Avenue Circulaire, Ringlaan 3, B-1180 Bruxelles, B-1180 Brussel
Tél : 02/375.15.79 — Telex : 21563/Espace b. — Fax : 02/374.84.23
SPAN : ECD1:: 323IASB
STAR:: aero.oma.be::pauls
EUnet & Bitnet : pauls@aero.oma.be

On account of human activities, the chemical composition of the Earth's atmosphere is changing at an increasing rate since the industrial revolution. The changes in concentration of the minor constituents of natural or anthropogenic origin, will modify the radiative equilibrium and the stratospheric ozone budget. A major issue for global change is, therefore, the quantification of these changes and their impact.

The evaluation of global *atmospheric changes* and of their consequences must necessarily give a strong priority to precise and accurate *measurements* of trends and to the comprehension of the processes which determine the complex physical chemistry involved. Without precise measurements, long-term prediction of global changes based on models is impossible. The means to obtain these experimental data are, for a very large part, based on the use of molecular *spectroscopy* in the field and in the laboratory.

The principal objectives of this project are to provide the earliest detection, by spectroscopic field measurements, of trends occuring in the chemical composition of the atmosphere and to determine, in the laboratory, by experimental and computer techniques, the spectroscopic properties of the atmospheric constituents which govern these changes.

The first part will be achieved by daily, seasonal and yearly monitoring of temporal variations of several components for the purpose of understanding the aeronomical processes that govern these variations. A comparison of various spectroscopic techniques will be necessary in order to reduce the inherent uncertainties of each technique. In addition, such systematic mea-

surements will allow to validate the numerical model used for trend studies and the measurements to be carried out in the current decade by satellite (UARS, MIRAS, ...). Satellite measurements are adequate to give good global coverage but require important corrections in order to obtain reliable trend measurements, due to the instrument degradations in orbit.

The need for ground based stations spread over the planet for stratospheric monitoring is therefore essential. The organization of a worldwide network ("Network for the Detection of Stratospheric Change", NDSC) was initiated in Geneva, in November 1989, during a meeting organized by the World Meteorological Organisation and the International Ozone Commission. The network will encompass six or seven stations similarly equipped, located at various latitudes. It was recognized that the first one (namely the Alpine Station) was already operational and will stand model for the new ones. This station includes the Belgian Laboratory for Solar and Atmospheric Physics at the "Station Scientifique Internationale du Jungfraujoch" (Switzerland) and the "Observatoire de Haute Provence" (OHP, France) which are together responsible for mid-latitude monitoring activities in the Northern Hemisphere.

In addition, *tropospheric* measurements using long-path absorption are being carried out at present in an urban site at the "Université Libre de Bruxelles" (ULB) in the visible and ultraviolet region. It is also intended to carry out measurements with a similar technique at the Jungfraujoch Station (3600 m). It is hoped for that the comparison of the results obtained in two sites with different levels of pollution and different solar radiation conditions will lead to a better understanding of the photochemical processes involved and of the temporal and spatial variations of the constituents of the troposphere.

The quality of the measurements obtained in the field depends directly on the quality of the basic spectroscopic data used in their evaluation. It is therefore important, and in some cases urgent, to measure in the laboratory the spectroscopic parameters such as position, intensity, width and quantum assignment of the absorption lines used to detect, identify and measure the atmospheric molecules. Such data are also indispensable to evaluate numerical simulations, and the role of these molecules in the potential warming of the planet (greenhouse effect). These aspects will be mainly developed at the ULB on the basis of experimental spectroscopy (Fourier and laser) and computer simulations of spectra in atmospheric conditions.