SPECTROSCOPIC MEASUREMENTS OF ATMOSPHERIC CHANGES (SMAC)

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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 from satellites, on the ground and in the laboratory.

The principal objectives of this project are to provide the earliest detection, by ground-based spectroscopic measurements, of changes and trends occurring in the chemical composition of the atmosphere and to determine, in the laboratory, the spectroscopic properties of the atmospheric constituents which govern these changes.

The first part will be achieved by daily measurements of several components for the purpose of understanding the stratospheric processes. In addition, such systematic measurements will allow to validate the numerical model used for trend studies and the satellite measurements to be carried out in the current decade by UARS.

These measurements are carried out at the NDSC (Network for the Detection of Stratospheric Change) Alpine Station. 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 midlatitude monitoring activities in the Northern Hemisphere.

Measurements are performed by Differential Optical Absorption Spectroscopy (DOAS) in the UV and visible ranges and Fourier Transform Spectroscopy (FTS) in the infrared. This work is conducted in close collaboration with the University of Liège.

The quality of the measurements obtained by satellite and groundbased instruments depends directly on the quality of the basic spectroscopic data used in their evaluation. It is therefore important 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). This work is conducted in close collaboration with the Free University of Brussels.

References

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