GRILLE SPECTROMETER EXPERIMENT ONBOARD THE NASA ATLAS-1 MISSION AS PART OF BISA PROJECT "TROPOSPHERIC AND STRATOSPHERIC COMPOSITION MEASUREMENTS BY SPECTROSCOPY METHODS"

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The Grille spectrometer is an infrared absorption spectrometer that has been developed in the early seventies for the study of the vertical distribution of atmospheric minority constituents in the atmosphere, in particular NO_x species in the stratosphere, by solar occultation absorption in the 2.5 to 10 micron spectral range.

Grille spectrometer instruments have been flown onboard stratospheric balloons, leading to early observations of NO and NO_2 and of HCl, as well as onboard airplanes, among which Concorde. A spaceborne version of the instrument has participated in the Spacelab-1 mission in December 1983 : this 9-days flight has allowed to determine vertical concentration profiles within the lower stratosphere up to the lower thermosphere ($<$ 130 km altitude) of the following constituents : NO, NO_2 and N_2O, HCl and HF, Co and CO_2, H_2O, CH_4 and O_3. Therefore the actual presence of the same instrument onboard the NASA Space Shuttle during the ATLAS-1 mission is very important for extending this series of observations up to the present times.

The ATLAS (Atmospheric Laboratory for Applications and Science) missions will investigate how Earth's atmosphere and climate are affected by the Sun and by the products of industrial complexes and agricultural activities ; the first 7-days mission is scheduled for launch by the end of March 1992 and includes in its payload 11 instruments for the study of the Earth atmosphere, solar and space plasma physics and astronomy. As such, it will be able to examine the linkages that exist between all main parts of the atmosphere through dynamical and chemical couplings, and its relationships with the solar radiation, in particular in the ultraviolet region of the solar

spectrum, as called for in the core programme of IGBP. The mission design should allow to adapt part of the observations planning to the possible occurrence of sporadic events, e.g., solar proton events, auroras, or volcanic eruptions.

Additional information will be retrieved from the observations that are planned in overlap with UARS (Upper Atmosphere Research Satellite) measurements, which will give access to more dynamical and atmospheric (photo-) chemistry data.

The Grille spectrometer design allows tha simultaneous observation in two different spectral windows, thus enabling the study of some of the close couplings between chemically active species that exist in the atmosphere through physical and (photo-) chemical interactions. Onboard ATLAS-1, absorption measurements will be made of the NO_x species up to more than 100 km altitude, paying special attention to their mutual couplings and to the exchange between thermosphere and stratosphere. Reactions between NO_x and the chlorine compounds strongly influence the role of the latter in the ozone destruction cycle ; therefore simultaneous measurements of HF and HCl are scheduled also. The NO_x play a crucial role in the questions of the ozone hole and of the greenhouse warming and should be subject to biogenic and anthropogenic changes since the earlier 1983 measurements. The same holds true for the CO_x (CO and CO_2 will be measured up to at least 130 km altitude) and for CH_4 and H_2O, to be measured simultaneously. Also O_3 can be detected up to the lower mesosphere : in particular its coupling with CO will be aimed at.

In addition to the absorption measurements, the Grille spectrometer intends to record atmospheric emission spectra, mainly for the study of Non Local Thermodynamic Equilibrium (NLTE) conditions : several emission programs will study emissions of CO_2, H_2O and NO.

In conclusion, the flight of the Grille spectrometer onboard ATLAS-1 will provide an extension of the series of regular observations of the Earth atmospheric composition that has been made in the past by the same instrument, permitting the detection of possible trends. In particular via its integration on a mission that is entirely dedicated to aeronomic studies, it will contribute to the understanding of the global middle atmospheric processes.