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SUMMARY OF THE RESULTS FROM ATMOS

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The ATMOS experiment was flown for the first time in April, 1985, as part of the Spacelab 3 payload. The instrument is a Michelson interferometer operating in the absorption (solar occultation) mode, covering the 2 to 16 microns wavelength range (600 to 4500 cm^{-1}) at a resolution of 0.01 cm^{-1}. During the Spacelab 3 mission ATMOS recorded 12 sunset and 4 sunrise occultations, on April 30th, and May 1st and 2nd. The sunsets occurred at latitudes between 25 and 33° N and the sunrises between 47 and 49° S.

The reduction and analysis of the data has been carried out with the ATMOS computer system, a dedicated facility at JPL with remote terminals at several coinvestigator sites in the US and in Europe. The analysis is currently proceeding towards the final determination of vertical profiles of:

1. Density, temperature and pressure;
2. Concentration of:
   - (i) minor gases
   - (ii) nitrogen trace species
   - (iii) halogen source gases
   - (iv) halogen products
   - (v) other trace gases;
3. Winds in the mesosphere and lower thermosphere;
4. Isotopic abundances.

In addition to these, useful upper limits (i.e. at or below the concentration levels predicted by current photochemical models) are being determined for other key species such as ClO, HOCl, HO_2, and H_2O_2.

An atlas of high signal-to-noise coadded spectra of the sun and of the upper atmosphere, at tangent altitude intervals of approximately two scale heights, is being prepared for publication later this year.

The Table summarises the altitude ranges over which the profiles of concentration can be retrieved for each of the molecular constituents identified in the ATMOS spectra thus far. In general, the precision of the retrieved values of mixing ratio is about 10%, and can be better than 5% for constituents which show a large number of spectral features (for example, O_3, CO_2, N_2O, HCl, HNO_3 etc.). The systematic uncertainties (excluding molecular spectral parameters) are estimated to be between 10 and 20%, depending on the spectral region involved. It is expected that these uncertainties will be reduced considerably as the refinement of the analyses proceeds. Nevertheless, the precision achieved at the present time is sufficient to reveal longitudinal variability (e.g. H_2O, O_3), hemispheric (or diurnal) differences, and vertical structure.

The analysis of the first data set has necessitated a careful verification and redefinition of the microwindows assigned to the species retrievals. In turn the ATMOS spectra are proving to be of great value in clarifying deficiencies in the basic molecular spectral parameters.

TABLE 1 MOLECULAR SPECIES IDENTIFIED IN THE ATMOS SPECTRA

Constituent	Altitude Range (km)	Comments/Isotopes
N_2	< 18 - 35	Pressure at the tangent altitude
CO_2	5 - 140	T,P,ρ; C12, C13, O16, O17, O18
CO	5 - 120	C12, C13, O16, O17, O18
H_2O	5 - 85	HDO between 5 and 35 km
O_3	< 10 - 90	O_3(16,16,18) < 20 to 42 km
N_2O	5 - 65	
CH_4	5 - 80	C12, C13
NO	< 18 - 140	
NO_2	< 18 - 50	
N_2O_5	20 - 38	Max. 1.6 x 10^{-9} at 32 km (sunrise)
HNO_3	18 - 50	
HNO_4	18 - 40	Max. 3 x 10^{-10} at 28 km (sunset)
CF_4	5 - 40	
CCl_4	5 - 20	
F11, 12, 22	5 - ~ 35	Several bands observed
CH_3Cl	18 - 35	Several Q branches
CH_3CCl_3		
HCl	12 - 60	3 x 10^{-9} above 45 km
HF	< 15 - 55	6 x 10^{-10} above 45 km
COF_2	18 - 40	2 bands; max. ~ 1.3 x 10^{-10} near 32 km
$ClONO_2$	18 - 35	5 bands; max. ~ 1.5 x 10^{-9} near 30 km
OCS	< 18 - 20	2 bands observed
HCN	< 18 - 30	
C_2H_2	5 - 14	
C_2H_6	5 - 10	