NASA-CR-193810

FINAL REPORT
for
GRANT NAG 5-1060

Title: "Analysis of Satellite-Derived Ozone and Water Vapor Measurements"

Period covered: July 15, 1988 - September 30, 1992

Institution: Iowa State University
Ames, IA 50011

Principal Investigator: John L. Stanford
Professor of Physics

SUMMARY

Research under this grant has involved analyses of satellite-derived measurements of water vapor and total ozone.

Upper tropospheric water vapor data from the Nimbus 7 temperature-humidity infrared radiometer (THIR) 6.7 micron channel were analyzed by Fourier transformation to provide wavenumber spectra for a case of an upper level system over Europe. The power law spectrum for horizontal scales from 60 to several hundred km suggests that when convective cloud energy sources are not present, the enstrophy-cascading process (with variance proportional to the minus 3 power of wavenumber) may hold to much smaller scales than previously thought. Details have been published in Manney and Stanford (1990).

Several investigations of the middle atmosphere (stratosphere and mesosphere) were also conducted. Slow atmospheric oscillations with periods of 1-2 months were investigated in total ozone measurements and in ionospheric data. Using one-point correlation maps and total ozone mapping spectrometer (TOMS) data, strong statistical evidence was found for the planetary-scale oscillations at these periods. A dipole-like pattern in the tropical equatorial Indian ocean-western Pacific region was documented, along with wavetrain-like patterns emanating into the extratropics (Gao and Stanford, 1990). While attempting to follow the oscillations upward above stratosphere, oscillations were studied in ionospheric data (D-region radio wave absorption, in the upper mesosphere, around 80-90 km altitude). Cross-spectral analyses with solar flux data revealed that much of the observed 1-2 month variance in the ionospheric D-region was well correlated to solar variations (Stanford and Saksena, 1989).

Further research has involved investigations of the photochemical lifetime of greenhouse gases methane and nitrous oxide. Using Nimbus 7 satellite data, a new analysis technique was employed to determine the lifetime of these gases in situ in the upper stratosphere. The lifetimes are found to be in good agreement with theoretical estimates. Details may be found in Stanford and Ziemke (1991).

(NASA-CR-193810) ANALYSIS OF SATELLITE-DERIVED OZONE AND WATER VAPOR MEASUREMENTS Final Report, 15 Jul. 1988 - 30 Sep. 1992 (Iowa State Univ. of Science and Technology) 2 p

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The focus of our research has steadily progressed upward from the troposphere into the stratosphere, and funding is now provided through the Atmospheric Chemistry Program, Modeling and Analysis. We appreciate funding continuity which has allowed a smooth transition between programs.

PUBLISHED PAPERS sponsored by this grant (copies have previously been sent to the requested NASA offices):

1. Stanford, J. L., and R. C. Saksena, 1989: Oscillations in D-region Absorption at Periods of One to Two Months. J. Atmos. & Terrestrial Phys., 51, 975-981.

2. Manney, G. L., and J. L. Stanford, 1990: Wavenumber Spectra from THIR 6.7 Micron Water Vapor Data, J. Geophys. Res., 95, 909-913.

3. Gao, X. H., and J. L. Stanford, 1990: Low Frequency Oscillations in Total Ozone Measurements. J. Geophys. Res., 95, 13, 797-13806.

4. Stanford, J. L. and J. R. Ziemke, 1991: CH4 and N20 Photochemical Lifetimes in the Upper Stratosphere: in situ estimates using SAMS data. Geophys. Res. Letts., 18, 677-680.

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