EFFECTS OF EPP-NOx AND SOLAR UV VARIATIONS ON OZONE IN THE POLAR STRATOSPHERE: CORRELATIVE STUDIES USING UARS HALOE AND SBUV(/2) DATA

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OBJECTIVES:

- **To evaluate the relative importance of solar proton events (SPE's) and magnetospheric electron precipitation (EEP) in producing downward descending NO_x in the springtime polar stratosphere on interannual timescales.**

- **To evaluate the relative importance of energetic particle precipitation induced changes in NO_x (EPP-NO_x) and changes in solar ultraviolet (UV) spectral irradiance on polar ozone as a function of season.**

1 hPa SH Spring Polar NOx Time Series:

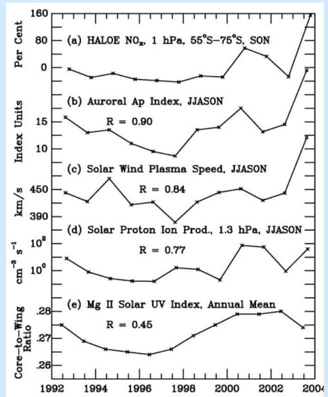

Figure 1: HALOE NO + NO_2 sunset data for SH spring (SON).

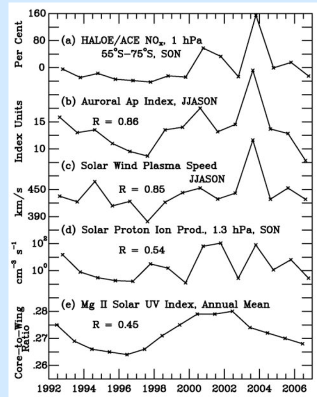

Figure 2: HALOE NO + NO_2 sunset data for SON supplemented by 3 years of ACE data**.

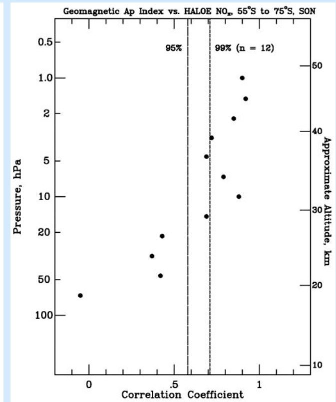

Figure 3: Correlation vs. Ap as a function of pressure level.

HALOE NO_x and O_3 Data (1 hPa, SH Polar, Spring):

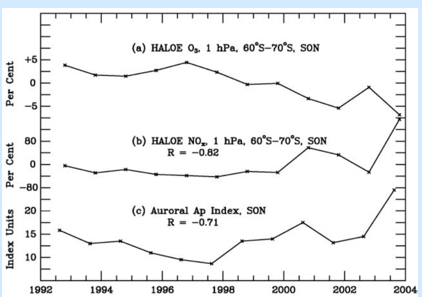

Figure 4: HALOE O_3 and NO + NO_2 sunset data for SH spring (SON). A clear negative correlation is evident. Also shown is the Ap index, which is closely correlated with the NO_x data.

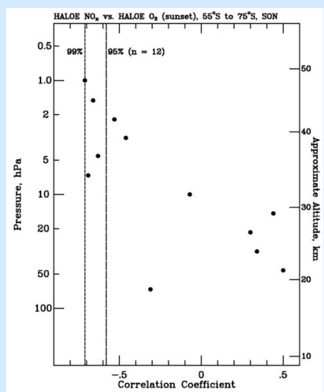

Figure 5: Correlation of HALOE NO_x vs. O_3 as a function of pressure level.

SBUV (/2) O_3 (1 hPa, Polar, Monthly Averages):

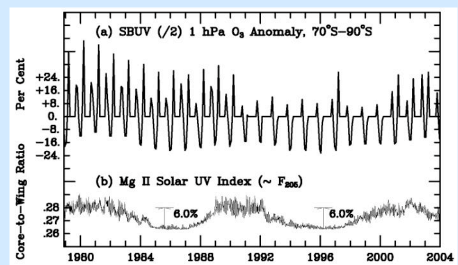

Figure 6: Southern Hemisphere. Note positive correlation during the summer season when polar ozone is a minimum.

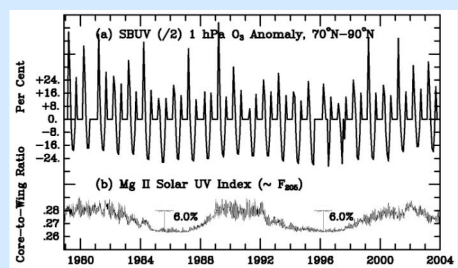

Figure 7: Same as Figure 6 but for the Northern Hemisphere.

CONCLUSIONS:

- **In the Southern Hemisphere where correlations are most significant, results show that the high-latitude spring HALOE NO_x data for the upper stratosphere and lower mesosphere correlate best (up to 0.86 at 1 hPa) with the Ap index, a measure of magnetospheric electron precipitation. Therefore, although SPE's can dominate over short time periods or even a complete season, EEP appears to mainly determine interannual NO_x variability over the whole 12-year interval analyzed here. Correlation coefficients continue to be significant down to about 10 hPa.**

- **Also in the SH, a negative correlation is obtained between HALOE ozone and NO_x (sunset) data at high latitudes during spring. This negative correlation is also significant down to about the 10 hPa level and is interpreted to be a consequence of direct photochemical destruction of ozone by downward descending EPP-NO_x. However, during the summer season, evidence is obtained for a positive solar cycle variation of SBUV ozone at high latitudes near the stratopause. This summertime ozone variation at high altitudes is interpreted to be a consequence of solar UV-induced changes in the ozone production rate.**

**ACE data provided by Cora Randall, P. Bernath, and ACE team.
Solar Proton Ion production rates provided by C. Jackman