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Close correlations between total ozone content of the atmosphere and solar activity during certain 27-days periods of solar rotation

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It has been established that the variations of solar activity (F 10.7 cm) during the 11-years solar cycle affect stratospheric ozone (Willett, 1962 ; Paetzold, 1969 ; Angell and Korshever, 1976). Nevertheless, they induce only small variations of total ozone content of the atmosphere (TOZ) (Keating et al., 1981 ; Chandra, 1984 ; Reinsel et al., 1987 and 1988).

Considering statistical daily TOZ and F 10.7 cm over a solar cycle and during months, seasons or entire years, a correlation between the two variables was found, using the transformation:

$$\text{F 10.7 cm / TOZ} = \alpha g + g\beta \text{ F10.7 cm} \quad (1)$$

TOZ is approximately a homographic function of F 10.7 cm.

β is always positive; α is either positive or negative.

We will take as a characteristic example the daily ozone values measured at the Observatoire de Haute Provence during three years -two years close to the solar minimum (1985, 1986) and one year at the solar maximum (1989)-. The square correlation coefficient rises from solar minimum (R^2 = 0.24) to solar maximum (R^2 = 0.94), indicating a progressive control of TOZ by F 10.7 cm, to the detriment of atmospheric transport.

In order to reconfirm a possible close correlation between ozone and solar flux, we tried to establish its possible existence during solar rotation cycles. Actually, we observed a number of strong solar rotation maximum -for years close to the maximum of 11-years solar cycle- with variations as high as those observed during the 11-years

solar cycle (150-200 units of F 10.7 cm). As an example, we will work on the solar rotation cycle number 11-2003- to establish a link between F 10.7 cm and TOZ at Los Angeles California for the same period (October 12^{th}-November 5^{th}). The model used formerly (1) was observed once again. It allows us to define two phases: the first one corresponding to the increase of solar flux to the maximum, and the second one corresponding to the decrease of solar flux to the minimum. The correlation coefficients observed ($R^2 \geq 0.99$) suggest a close correlation between ozone and solar flux. The breaking period (October 29^{th} – November 1^{st}) between the two phases comes with a dramatic change: on one hand in the geomagnetic and flare solar activity (active sun ? quiet sun) and on the other hand in the meteorology of the Los Angeles region (high pressure and temperature ? low pressure, precipitation). These results are discussed in terms of mechanism, forcing UV and meteorological forecasting.

Moreover, we are studying a possible extension of these correlations from Middle-Latitudes to Polar Regions.