STRATWARM AND SOLAR ACTIVITY

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СТРАТОСФЕРНОЕ НАГРЕВАНИЕ И СОЛНЕЧНАЯ АКТИВНОСТЬ, Лоренц М. – Используя метод перекрывающихся эпох, мы изучали соотношение между распространением стратосферного нагревания и индексами солнечной активности по данным на значительном временном интервале 23-го солнечного цикла (1996–2000). По результатам анализа можно допустить, что в некоторых случаях распространение стратосферного тепла коррелирует с некоторыми индексами солнечной активности (например с коронарным индексом). Массив статистических данных, к сожалению, невелик, поэтому результаты анализа носят лишь информативный характер. Мы намерены продолжить исследование взаимосвязи солнечной активности и стратосферного нагревания.

Using the superposed epoch analysis the relation between the occurrence of the stratwarm and solar activity indices on the rising branch of the solar cycle 23 (1996–2000) was studied. The results obtained allowed us to conclude that in some cases the occurrence of the stratwarm could correlate with some indices of the solar activity (*e.g.* the coronal index). The statistical data set is unfortunately rather small and, therefore, the results are on the whole only informative. We intend to continue the investigation of the relationship between the solar activity and the stratwarm.

INTRODUCTION

It is evident that the solar variability influences on the Earth's climate (see, *e.g.*, [2]).

The variation in the Sun's total energetic output does not exceed usually the value of 0.1 % between periods of maximum and minimum activity over the 11-year solar cycle. The magnitude of the variations of the solar radiation is a strong function of wavelength, with the highest amplitude in the ultraviolet (UV, EUV) range.

Solar irradiance variations below 300 nm are especially important since the irradiance is totally absorbed in various layers of the Earth's atmosphere. Consequently, it plays a significant role in the heating the Earth's atmosphere and establishing its chemical composition through the photodissociation and photoionization processes [3]. The UV irradiance between 200 and 285 nm penetrates to the stratosphere and is the major source of the stratospheric heating and the ozone photodissociation. There is an evidence that ozone change is an influence on the climate. Reduction of ozone in the stratosphere changes the temperature distribution in the stratosphere and strongly influences the wind regime in the stratosphere that, in turn, affects the global climate.

The northern hemisphere winter stratosphere is characterized by the occurrence of midwinter sudden warmings [1]. Stratospheric sudden warmings (stratwarms) of differing intensity take place every winter with very few events occurring in any winter season. These warmings are characterized by rapid, eddy-forced increases in temperature at high latitudes. The major warmings generally occur ones or twice during the winter.

DATA AND METHOD OF PROCESSING

The initial data, characterizing the degree of coronal activity, were a homogenous data set of coronal index [4, 5] obtained from the daily measurements of the world-wide coronographic network. There is a good correlation between the green corona intensity and the solar irradiance in the UV/EUV spectral range [6].

The data of the total solar irradiance (TSI) "SOHO/VIRGO Total Solar Irradiance, 1996-Version 3.50 – Updated" were obtained from the Solar Geophysical Data (SGD) bulletin published by NOAA, U.S. Department of Commerce. Short time variations are probably caused mainly by the short wavelength region of the solar irradiance. The values of the Mg II index have been downloaded from the internet resources (NOAA, U.S. Department of Commerce, Space Environment Center). Solar Radio Flux data (10.7 cm) were obtained from the SGD.

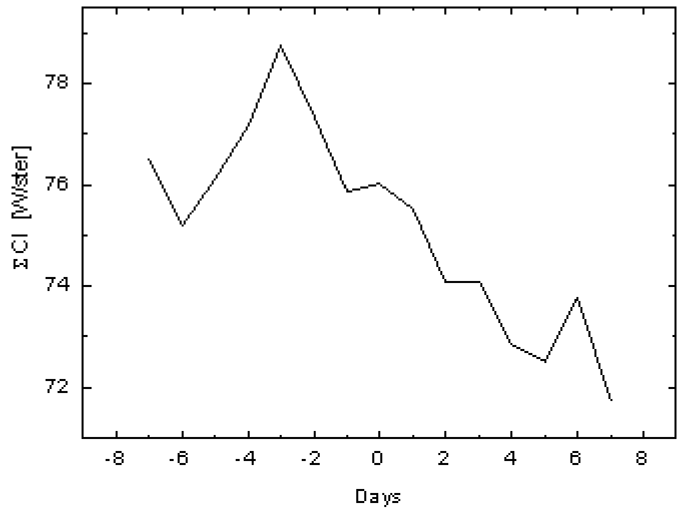

Figure 1. SPE analysis of the coronal index (CI)

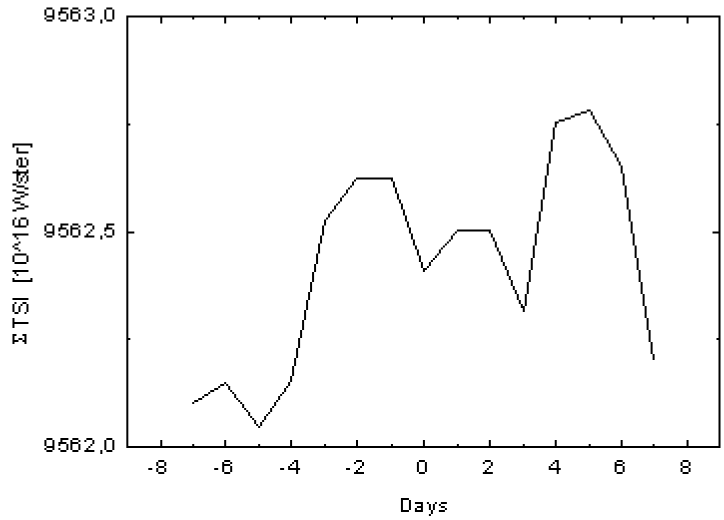

Figure 2. SPE analysis of the total solar irradiance (TSI)

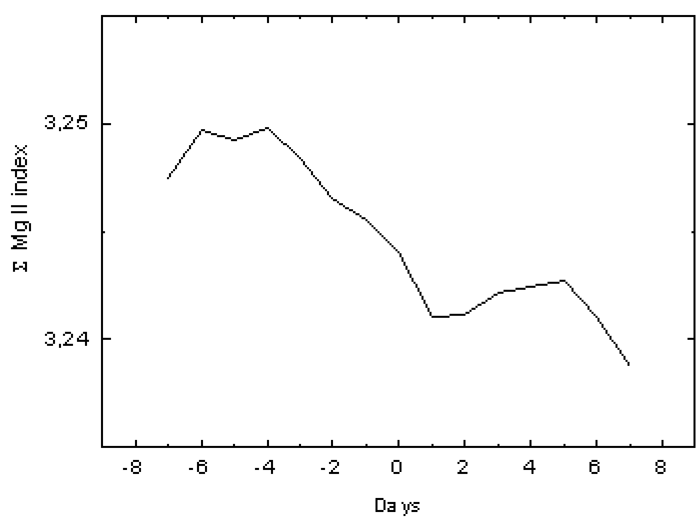

Figure 3. SPE analysis of the Mg II index

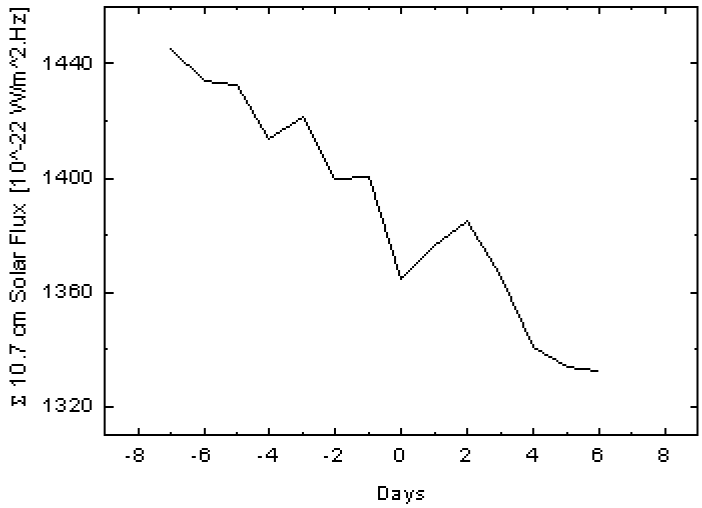

Figure 4. SPE analysis of the 10.7 cm Solar Flux

The stratwarm data were obtained from the SGD for the time period 1996–2000. The selection criterion which was used for the stratwarm data was the minimal duration of five days after an onset of the stratwarm (see Table).

The onset of the selected stratwarms for the time period 1996–2000

Year	Month	Day	Year	Month	Day
1996	01	10	1998	02	21
	02	19		12	06
	12	24	1999	02	18
1997	02	03	2000	02	03
	12	27		03	08
1998	02	02		12	08

The analysis was carried out using the superposed epoch analysis (SPE) in which the zero day has to be defined as the first day of the onset of a selected stratwarm.

DISCUSSION AND CONCLUSION

The obtained curves of the SPE analysis are shown in Figures 1–4. The most significant correlation is between the coronal index (CI) and the stratwarm, and between the 10.7 cm Solar Radio Flux and the stratwarm, respectively. It is difficult to evaluate these results, simply due to the fact that there were just limited data sets available. It corresponds to the fact that the current knowledge on the studied influence may be insufficient to evaluate the effect of solar variability on the Earth's atmosphere.

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