HIGH SPEED SOLAR WIND CONTRIBUTION TO THE SOLAR-TERRESTRIAL SYSTEM

Simeon Asenovski

Space Research and Technology Institute – Bulgarian Academy of Sciences
e-mail: asenovski@space.bas.bg

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Abstract: *One of the most sensible drivers of geomagnetic disturbances are high speed solar wind streams (HSS), which have maximum during the descending phase of solar cycle. They are characterized with super-radially expanding from coronal holes. The level of the high speed solar wind streams influence to the geomagnetic field varies from cycle to cycle, and is supposed to be determined by the solar activity and thickness of the heliospheric current sheet which is related to the portions of time that the Earth spends in the slow and fast solar wind domains. Here it is shown the variation of the geomagnetic filed for a relatively long-time periods, when the Earth is under the influence mostly by HSS.*

ПРИНОС НА ВИСОКОСКОРОСТНИТЕ ПОТОЦИ СЛЪНЧЕВ ВЯТЪР КЪМ СЛЪНЧЕВО-ЗЕМНАТА СИСТЕМА

Симеон Асеновски

Институт за космически изследвания и технологии – Българска академия на науките
e-mail: asenovski@space.bas.bg

Ключови думи: *Високоскоростни потоци слънчев вятър, слънчева активност*

Резюме: *Една от най-забележимите причини за наличието на геомагнитни смущения са високоскоростните потоци слънчев вятър, които имат максимална честота на появяване по време на намаляващата фаза на слънчева активност. Те се характеризират със супер-радиално разпространение от слънчевата корона. Нивото на въздействие на потоците бърз слънчев вятър върху геомагнитното поле, варира през различните слънчеви цикли, като се предполага, че това въздействие зависи от слънчевата активност и дебелината на хелиосферния токов слой. Тук е изследвана вариацията на геомагнитното поле за относително дълъг период от време, когато Земята е предимно под влиянието на Високоскоростните потоци слънчев вятър.*

Introduction

Richardson et al. (2000) [1] classified the solar wind into corotating high- speed streams (HSS), slower solar wind, and transient flows associated with CMEs, In order to assess the contribution of each type of solar wind flow to geomagnetic activity during the different phases of the solar activity cycle. They found that, on the average, at solar minimum the Earth is embedded in HSS for ~60% of the time, ~30% for slow solar wind, and ~< 10% for CMEs. Respectively, the average geomagnetic activity at sunspot minimum is dominated by HSS. In a later paper [2] extended the studied period to over 4 solar cycles (1963–2011) and found that the low geomagnetic activity levels during the last solar minimum were associated with low geomagnetic activity averages for each of the three types of solar wind.

The goal of the present paper is to examine the averaged variation of the geomagnetic field (Dst and Kp indexes) during the period of the prolonged HSS influences.

HSS and Solar cycles

In Fig. 1 is shown relatively big coronal hole which is source of HSS. Coronal holes are biggest and in most geoeffective position during the sunspot declining phase [3].

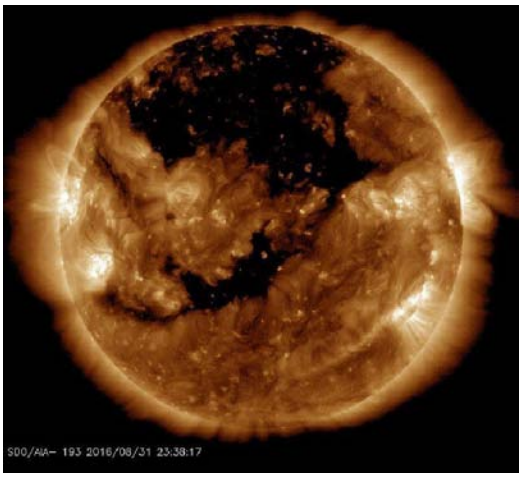

Fig. 1. Coronal holes - sources of the high speed solar wind streams

In Table 1 the averaged values of the HSS parameters for the different cycles are shown.

Table 1

Parameter	SC21	SC22	SC23	SC24
Hours	7878	7161	9811	8690
Scalar B, nT	5.9	5.9	5.6	4.7
Bx, nT	-0.36	0.15	0.27	-0.18
By, nT	0.34	0.03	-0.09	0.08
Bz, nT	0.22	-0.01	-0.11	0.02
T, K	178230	146090	205240	132840
Dens, N/c	5.6	6.1	6.9	4.1
Speed, km/s	512	508	463	518
Press	2.7	2.8	2.5	1.9

Geomagnetic disturbances

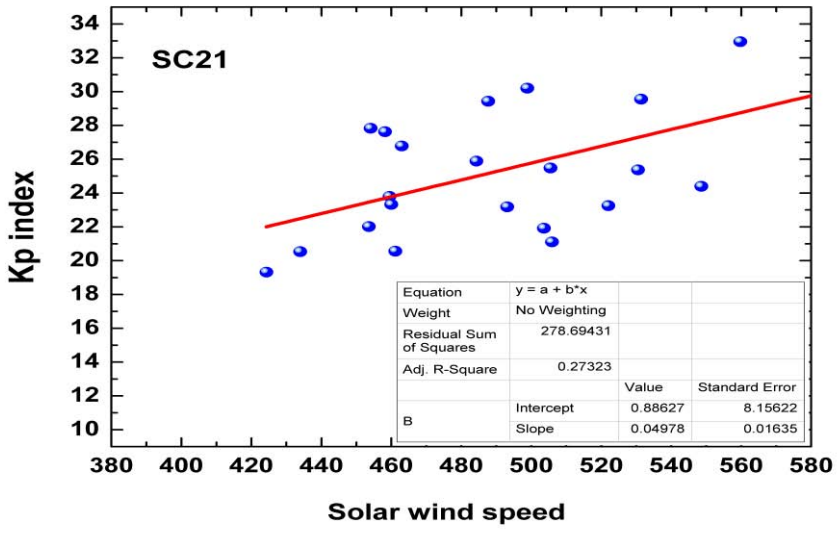

Fig. 2. Kp index as a function of averaged solar wind speed during the descending phase of Solar cycle 21

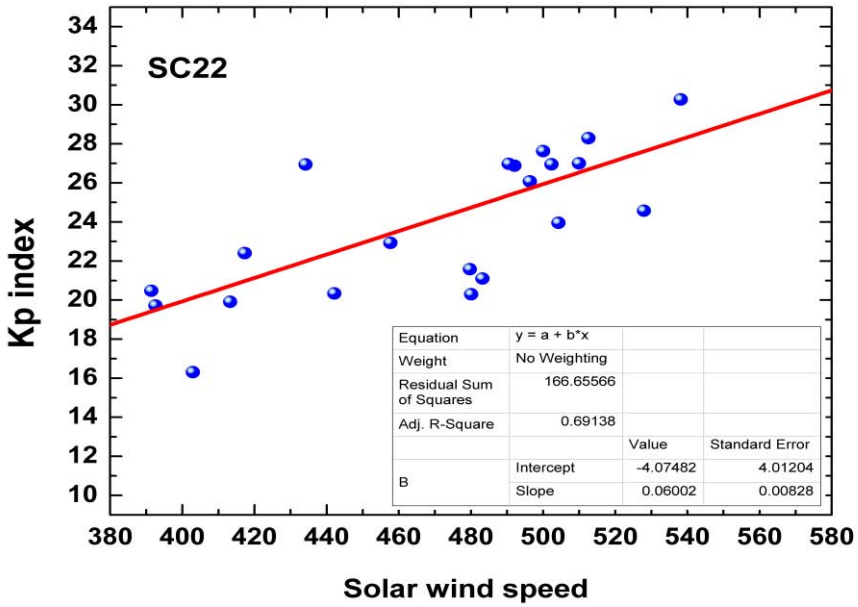

Fig. 3. Kp index as a function of averaged solar wind speed during the descending phase of Solar cycle 22

The main results are shown in Fig. 2–5, where the geomagnetic filed disturbances are presented, as a function of averaged solar wind speed, during the periods of descending solar activity for the last four solar cycles, the maximum of HSS is observed.

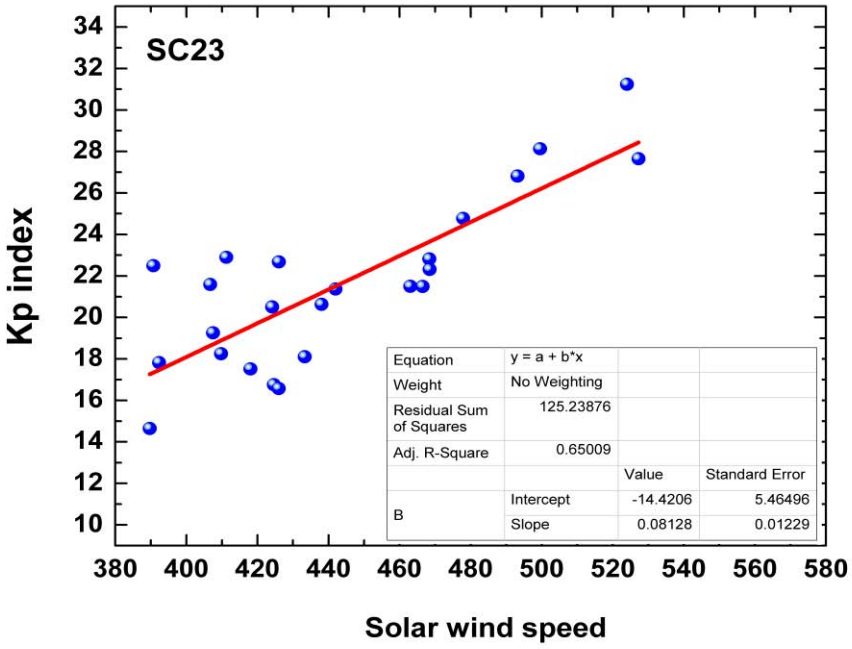

Fig. 4. Kp index as a function of averaged solar wind speed during the descending phase of Solar cycle 23

Conclusion

This study considers the geomagnetic disturbances during the periods of descending solar activity, when HSS occurrences have maximum. The main conclusions are:

- The last Solar cycle 24 is characterized with lowest geomagnetic activity in comparison with the previous cycles during the same cycle periods;
- During the descending phase in SC21 the averaged speed is highest, while in SC 24 is lowest;
- HSS to geomagnetic disturbances during the descending phase in the last four solar cycles is similar.

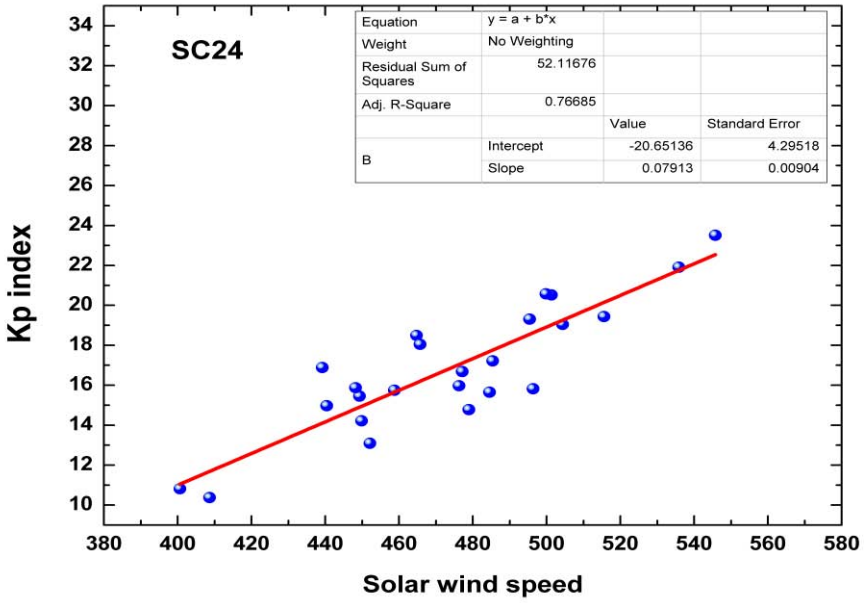

Fig. 5. Kp index as a function of averaged solar wind speed during the descending phase of Solar cycle 24

Acknowledgments

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