Extreme Value Theory Applied to the AA Index

Si Chen (1,2,3), Lihui Chai (1,2,3), Yong Wei (1,2,3)

(1) Key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China. , (2) College of Earth and Planetary Sciences, University of Chinese Academy of Sciences, Beijing, China., (3) Institutions of Earth Science, Chinese Academy of Sciences, Beijing, China.

The global or local temporal variation of the geomagnetic field can be collectively referred to as geomagnetic activity. The strength of geomagnetic activity is generally described by geomagnetic index. Geomagnetic storm is a violent global geomagnetic disturbance phenomenon, which is one of the main causes of space disaster, ground power system failure and low latitude aurora. With the development of international space industry, geomagnetic storm prediction research become more and more important. In this paper, the probability of extreme magnetic storms is studied by using the extreme value theory, which helps us estimate the frequency of space disaster events and low latitude aurora. Furthermore, the extreme value theory also gives us a hand to know about ancient auroral events. In this study, the aa index we use is from 1844 to 2016(9-24 solar cycles). We used the extreme value theory to calculate the probability of the extreme space weather events. It is found that the probability of the extreme magnetic storm event is significantly higher than the previous estimates. The results show that the extreme geomagnetic storms that causes damage to the high-latitude power system and satellite disconnection hundreds of years, and it is recommended that appropriate precautions should be taken. The probability of an extreme magnetic storm that causes low latitude aurora is about hundreds of years, which coincides with the auroral records recorded in ancient Chinese and Korean ancient books.