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Editorial

The Solar Cycle

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The Sun provides variable energetic and magnetic field input to the conditions in the heliosphere which directly affect the magnetosphere. In particular, the Sun's variable magnetic fields constitute a rich source for processes that influence the Earth's upper atmosphere and geomagnetism. The Sun follows a periodic cycle of activity. This cycle, called the solar cycle, has its evident manifestation by the periodic recurrence of sunspots, or darker, relatively cool and strong magnetic regions at the Sun surface. This periodicity was discovered first by Samuel Heinrich Schwabe in 1844 when he observed the variation of the number of sunspots over a seventeen-year period. The solar cycle usually lasts about eleven years on the average, and there is little doubt that it is magnetic in nature and produced by dynamo processes within the Sun. It is believed that the 11-year solar cycle results from generation of strong toroidal magnetic fields in the Sun, with a main period of about 22-years, by combined effects of convection and differential rotation in the Sun.

Although most of the characteristics of the solar cycle have been investigated for many years, we still do not know exactly what causes the 11-year solar cycle. This is one of the most important unsolved problems in solar physics today. Because of the long record of observations, sunspot measurements still constitute a primary source of information to better understand the level and nature of solar activity. Statistical and morphological studies of sunspots have significantly improved our knowledge of this field. Other solar activity indicators including the 10.7 cm radio flux, the total and spectral solar irradiance, the magnetic field, flares and coronal mass ejections, geomagnetic activity, and galactic cosmic ray fluxes have also shown temporal properties related to the solar magnetic activity cycle. While solar flares and coronal mass ejections pose a serious hazard to astronauts, satellites, polar air traffic, electric power grids, and telecommunications facilities on short time-scales ranging from hours to days, the solar radiative output affects planetary and global climate on much longer time-scales (from decades to stellar evolutionary time-scales). We refer the readers to the recent review by David H. Hathaway (solarphysics. livingreviews.org/Articles/lrsp-2010-1/) for more information on the solar cycle.

During the last few decades, technological advances have led to the acquisition of a huge amount of high-quality data on solar magnetic field and solar activity. The development of helioseismology, the technique of studying solar interior through the study of its global oscillations, has led to spectacular success in determining Sun's internal structure and rotation with increasing accuracy.

We invited authors to contribute this special issue of the journal original research articles as well as review articles that can stimulate the continuing efforts to understand the solar cycle and its impact on space weather and global climate. Eleven original research articles were received. All these were peer-reviewed by a minimum of two referees. Eight of them accepted for publications in this special issue. In three of the papers the predictions for the amplitude and duration of cycle 24 were presented, mainly from the statistical analyzes of the sunspot data, and in five papers research on basic property of solar cycle and related topics were presented.

We hope that students and researchers will find this special issue useful. Since the Advance in Astronomy is an open-access journal, all of the papers of this special issue are accessible free of charge to anyone with a computer and an Internet connection.

Acknowledgments

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