Space Weather QUARTERLY

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National Response to a Severe Space Weather Event

Meeting:
U.S.-U.K. Space Weather Workshop

Feature:
Five Centuries of Exploration: From Distant Shores to Distant Planets

Technical:
Evaluation of OVATION Prime as a Forecast Model for Visible Aurorae

Editorial

Small Businesses and Space Weather Products

Small businesses have long been interested in providing space weather services to government and industry. Representatives from many of these entrepreneurial enterprises meet informally at the annual workshop sponsored by NOAA's Space Weather Prediction Center (SWPC). There they have the opportunity to discuss with SWPC leadership the obstacles they face when designing and delivering data and products for use in ground- and space-based technical systems. In April 2011, five of these small businesses formed the American Commercial Space Weather Association (ACSWA), and the importance of this action was commented on in this column (see *Space Weather, 9*, S05002, doi:10.1029/2011SW000692).

In late September 2011, NOAA announced Phase I of its Small Business Innovation Research (SBIR) solicitation for Fiscal Year 2012, which contains a subsection titled "Reducing Impact of Severe Space Weather on Global Positioning Satellite (GPS) Satellite Signal Users." The summary of this subsection begins by stating that the "Nation's critical infrastructure and economy are increasingly dependent on high accuracy GPS positioning, navigation, and timing services" and goes on to note that severe space weather conditions can result in the degradation and/or disruption of GPS signals, causing denial of service to a wide range of users, including those involved in farming, resource exploration, shipping, and various types of transportation. Space Weather has published a number of papers over the past few years that directly address the potential for widespread failure of GPS services as well as the likely causes and consequences of such an event.

SWPC currently has no operational product(s) capable of forecasting ionospheric conditions that might result in a denial of service from GPS. Thus, the solicitation seeks to fund Phase I SBIR activities that will address this lack. Phase I seeks to promote development of concepts and designs that, in Phase II, could become viable products for prediction, now-casting, and detecting disturbances or hazardous conditions in the ionosphere.

This SBIR initiative is a welcome development for the entire field of space weather research and applications. As the formation of the ACSWA demonstrates, there are small enterprises in the United States that are eager to apply fresh thinking, as well as innovative ideas and concepts, to pressing commercial and governmental needs. I look forward to following the progress of the NOAA SBIR program in space weather, and I anticipate that it will be highly successful.

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Space Weather QUARTERLY

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New Award to Recognize Outstanding Research in Space Weather and Nonlinear Waves and Processes

In early 2013, AGU will begin accepting nominations for a new award that recognizes excellence in research involving space weather as well as nonlinear waves and processes.

The award, called the Space Weather and Nonlinear Waves and Processes Prize, will be given every 2 years and will alternate in focus. The first award, to be presented at AGU's 2013 Fall Meeting, will recognize an outstanding contribution to space weather research made by an AGU member; the second award, to be presented in 2015, will recognize a significant contribution to the field of nonlinear waves and processes by an AGU member. AGU's Space Physics and Aeronomy Section and the Nonlinear Geophysics Focus Group, will jointly administer the award.

The prize carries a $10,000 cash award and is funded by Bruce Tsurutani and Olga Verkhoglyadova, both AGU members and scientists at the NASA/California Institute of Technology's Jet Propulsion Laboratory (JPL).

"The vital research being done in the areas of space weather and nonlinear waves and processes has all too often gone unrecognized and unrewarded by the scientific community," Tsurutani said. "These are two emerging areas of science, and we would very much like to support their gaining prominence, both in public awareness and also in recognition. We felt an AGU award would do both of these things at the same time."

"Space Weather and nonlinear wave processes are currently at the forefront of space physics," Verkhoglyadova added. "We hope that this award will help to support and promote research in these fields." Tsurutani explained that hopefully the awards will help the recipients' careers. and, in turn, "will spur them on to even greater discoveries. Perhaps it may even stimulate graduate students to go into these areas," he added.

Tsurutani and Verkhoglyadova were motivated to create the award as a way of giving back to the scientific community and to AGU. An AGU member for nearly 50 years, Tsurutani has been affiliated with JPL since 1972 and is currently a senior research scientist at the laboratory. He served as president of AGU's Space Physics and Aeronomy section from 1990 to 1992 and in 2009 received AGU's John Adam Fleming Medal, given for "original research and technical leadership in geomagnetism, atmospheric electricity, aeronomy, space physics, and related sciences." Before coming to JPL in 2008, Verkhoglyadova worked for 5 years at the Institute for Geophysics and Planetary Physics at the University of California, Riverside. Before that, she was a professor in the Department of Astrophysics and Space Physics at Ukraine's Kiev University, working on the Interball satellite project, a multinational collaboration to study magnetospheric physics, plasma waves and space weather.

> "We hope that this award will help to support and promote research in these fields."

While the first award will be for space weather research, the next award in the prize cycle will highlight nonlinear waves and processes, which are not exclusive to space physics and aeronomy. "This goes to all areas of geophysics. For example, ocean waves become nonlinear as they approach shorelines. An earthquake also is a nonlinear process," explained Tsurutani, who is also an editor of Nonlinear Processes in Geophysics, an open access journal jointly published by AGU and European Geosciences Union.

Nonetheless, he and Verkhoglyadova expect space physics to be well represented in the award's nonlinear geophysics focus. "Most plasma waves that we study are indeed nonlinear," Tsurutani noted, listing phenomena such as magnetosheath lion roars, mirror mode structures, magnetospheric chorus and magnetosonic waves, plasma bubbles in the ionosphere, and interplanetary shocks and Alfvén waves.

This new award strongly supports AGU's mission to promote discovery in the Earth and space sciences for the benefit of humanity, according to Carol Finn, AGU president-elect. "We are extremely grateful to Dr. Tsurutani and Dr. Verkhoglyadova," she noted. "Through their dedication and generosity we are able to recognize the extraordinary contributions of our members and their impact on society."

More details on the award, including nomination criteria, can be found at http://www.agu.org/about/honors/section_fg/joint_pr.shtml.

Mohi Kumar, *AGU Staff Writer*

Citation: Kumar, M. (2012), New award to recognize outstanding research in space weather and nonlinear waves and processes, *Space Weather, 10*, S02013, doi:10.1029/2012SW000776.

Editor's Choice

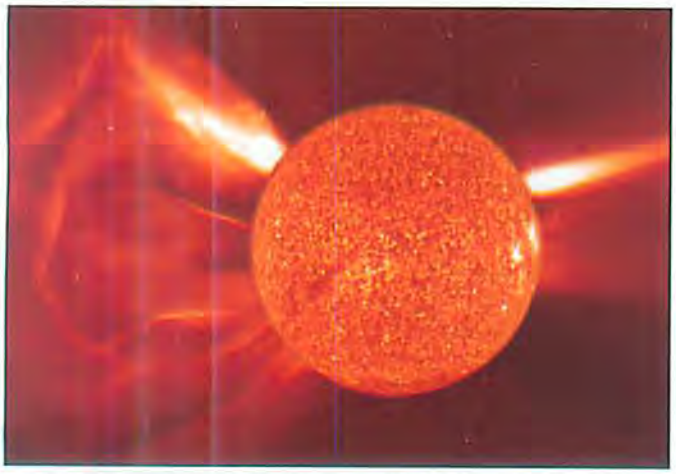
by Howard J. Singer

Selected new articles on the topic of space weather from AGU journals

Predicting Intense Geomagnetic Storms

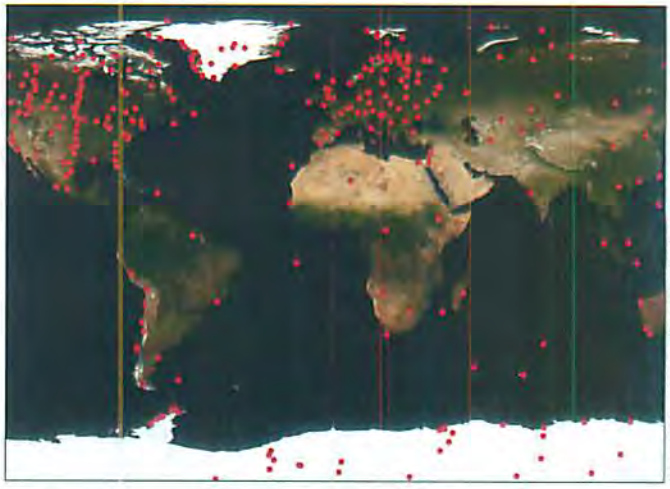
Space weather forecasters are vigilant observers of solar disturbances that might produce extreme geomagnetic storms. Such events can wreak havoc on the power grids, communications systems, and satellites that support our technologically dependent society. Once a solar disturbance, such as a coronal mass ejection (CME), is detected, forecasters must try to predict when it will reach Earth and how severe a disruption it may cause. *Yue and Zong* [2011] have added to forecasters' arsenal of tools by creating a method for categorizing the size of disturbances based on the time history of the solar wind and CME properties (speed, density, and magnetic field) and on the orientation of the solar wind magnetic field relative to the CME shock. Their study, of 280 interplanetary shock events observed between 1998 and 2007, demonstrates that perpendicular shocks create more intense geomagnetic activity than parallel shocks. They also demonstrate that more intense activity results from preconditioning the magnetosphere with southward interplanetary magnetic field in the solar wind and CME sheath region that precedes the CME. While these results are not surprising, they will enable forecasters to use these patterns, together with models and upstream L1 observations, to more accurately predict the size of a geomagnetic disturbance.

Yue, C., and Q. Zong (2011), **Solar wind parameters and geomagnetic indices for four different interplanetary shock/ICME structures,** *J. Geophys. Res., 116,* A12201, doi:10.1029/2011JA017013.



NASA

A bright and expansive coronal mass ejection (CME) unfurled itself on 24 January 2007. As seen in SOHO's LASCO C2 coronagraph, the bright front emerged in the shape of an arc from behind the occulting disk but soon expanded into a ragged, bulbous shape with lots of structural lines inside it.



JESPER GJERLØV, PATRICK NEWELL

SuperMAG is a worldwide collaboration of organizations and national agencies that currently operate more than 300 ground-based magnetometers. Stations are shown in red.

SuperMAG Provides an Improved Auroral Zone Index

For many decades, global indices (such as *Kp, AE,* and *Dst*) derived from ground-based magnetometer observations have been routinely used to characterize the general level of space weather disturbances. As an auroral zone index, *AE* has been useful in identifying substorm onsets related to auroral activity level, geomagnetic variations that can affect power grids, and energetic particle injections in space that can affect spacecraft. Its use is limited, however, by the coarse geographic distribution of about 12 magnetic stations in a narrow high-latitude range covering 360° in longitude. To improve on *AE, Newell and Gjerloev* [2011] construct a new index, the SuperMAG electrojet (SME) index, which uses 100 or more sites from SuperMAG, the worldwide collaboration of organizations and national agencies that operates about 300 ground-based magnetometers. Offering improved spatial coverage, *SME* is better at detecting substorms; more important, Newell and Gjerloev find a strong correlation between the *SME* index and auroral power, even on a 1-minute time scale. They find that 75% of the variance in the nightside auroral power is predicted by using *SME,* a significant improvement over other techniques in use today. The authors also demonstrate a clear geophysical meaning for *SME* that represents the nightside auroral power dominated by the diffuse aurora.

Newell, P. T., and J. W. Gjerloev (2011), **Evaluation of SuperMAG auroral electrojet indices as indicators of substorms and auroral power,** *J. Geophys. Res., 116,* A12211, doi:10.1029/2011JA016779.