

Simulating Space Weather Extremes Workshop: Summary

Overview

We propose a three-day workshop that will bring new understanding to the complex sun-to-power grid system by converging the range of communities that are involved. The novel workshop will bring together the myriad disciplines to identify the research & development and operational gaps and to propose solutions for those gaps. We will structure the convergence through a space weather-to-power grid 'simulation game,' a low-risk, cost-effective environment to unite researchers, decision-makers, and operators to assess the preparedness for threats and hazards posed by space weather on the electric power grid.

The central goal of this workshop is to emerge the research and development gaps that arise from a holistic view of the sun-to-power grid system. A natural outcome of the convergent approach, the workshop will also advance the connection between research and operations (i.e., research-to-operations-to-research, R2O2R), responding to the recently reaffirmed and reinvigorated National Space Weather Strategy and Action Plan (NSW-SAP). A secondary outcome of this workshop will be to make recommendations to guide R2O2R for the space weather-to-power grid system.

Intellectual Merit

The workshop will create a greater awareness of the preparedness of the space weather-to-power grid community to respond to extreme space weather. The simulation game will reveal the existing communication and tools that facilitate information flow, and, importantly, the gaps therein. Synthesis activities will promote new recommendations to guide the science and operations communities, feeding directly into direction-setting documents such as the Heliophysics Decadal Survey and operations manuals for power grid engineers. System-building will crystallize the relationships that are developed during the convergence workshop and lay the foundation for the tools that respond to the new knowledge generated during the simulation game and synthesis.

Overall, the workshop will strengthen the development of a space weather-to-power grid Open Knowledge Network (OKN) that will help reimagine grid resilience by integrating data from diverse fields openly and in a usable manner and connecting the traditionally disparate communities. One of the most important, and oft ignored, intellectual outcomes of the workshop will be the 'social' component, better connecting the disparate communities.

Broader Impact

The workshop will embrace a diverse community; diverse in discipline, in sector of society (i.e., across academia, industry, and the public sector), and in representation (we will place special emphasis on under-represented early career scientists). It will integrate research scientists with operators and data scientists. The workshop will be designed to promote education and knowledge exchange between diverse scientific and technical communities. In this way, we will deliver new linkages between the electric power grid industry, ground-based geoscience, space weather, and Heliophysics domains. The result will be a new convergent community and a more resilient power grid to power society that is able to fully take advantage of innovation and assets from different fields such as space science and computer science. Ultimately, it will be a guide for achieving one of the NSF's Big Ideas: convergence.

We will also contribute to the creation of a data literate workforce in accordance with NSF's Harnessing the Data Revolution Big Idea. The workshop will help train a number of early career, postdoctoral, and graduate students on a variety of important modern tools in an environment representative of future trends - cutting across disciplines with data science skills.

Finally, our efforts will feed into existing NSF-funded activities such as the SuperDARN, SuperMAG, and Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) and will interface with several existing convergent science efforts.