Solar Shield: Update and Path Forward

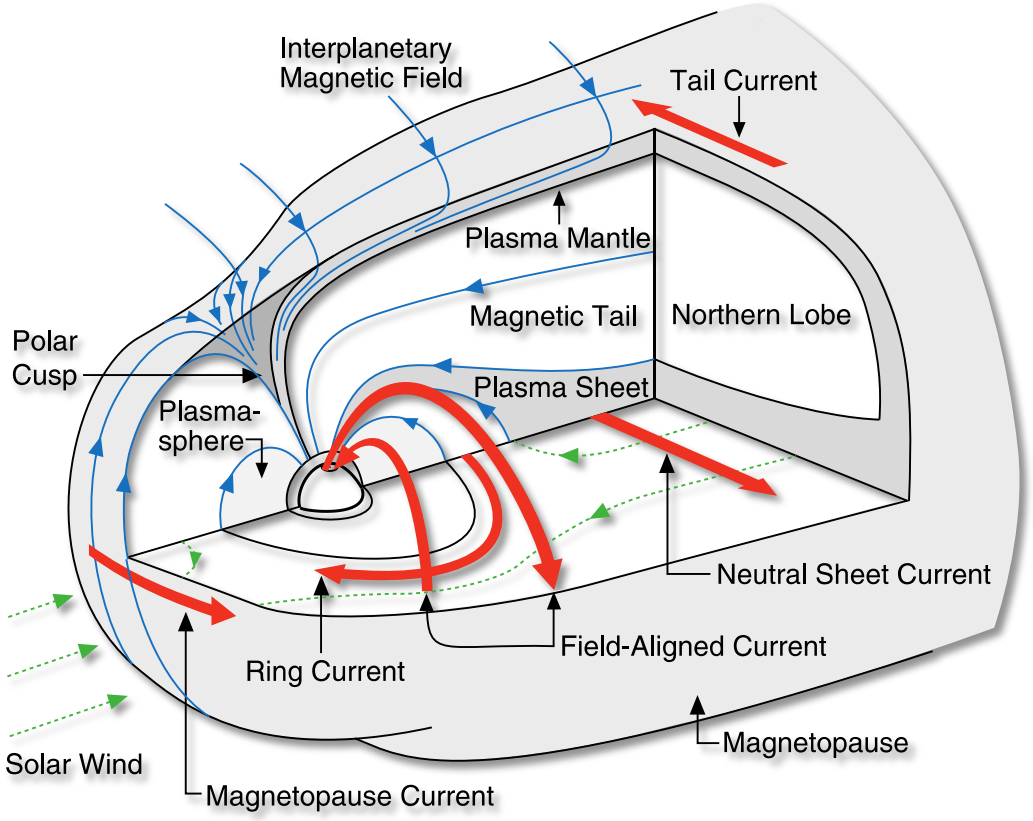
A. Pulkkinen (NASA GSFC), S. Mahmood (DHS S&T), C. Ngwira (CUA), C. Balch (NOAA SWPC), S. Habib (NASA GSFC), F. Policelli (NASA GSFC), R. Lordan (EPRI), D. Fugate (ERM), W. Jacobs (ERM)

Contents

- Background.
- “Old” Solar Shield project.
- What was missing?
- “Extended” Solar Shield project.
- Initial results.

Background

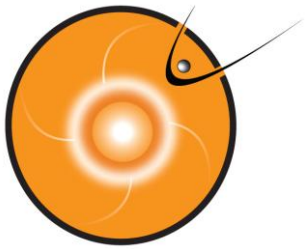
- If you are interested in forecasting GIC, you need to capture the physics of near-space electric current systems.



Credit: Russell, C. (IEEE Trans. on Plasma Science, 2000)

Background

- The key idea of our research-based GIC forecasting project(s) is to utilize the latest greatest space science modeling capacity available at Community Coordinated Modeling Center (CCMC).

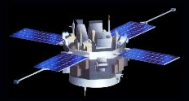


We thank all the organizations having their models hosted at CCMC → critical for these types of efforts

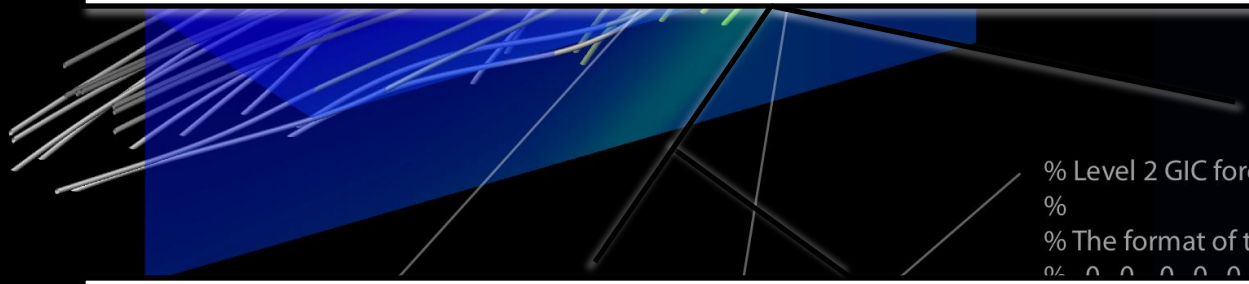
“Old” Solar Shield project

- NASA-EPRI-ERM project supported by NASA Applied Sciences Program 2007-2010.
- Check http://ccmc.gsfc.nasa.gov/Solar_Shield for details and documentation.

Lagrange 1 observations used as boundary conditions for magnetospheric MHD. NASA's ACE data used.

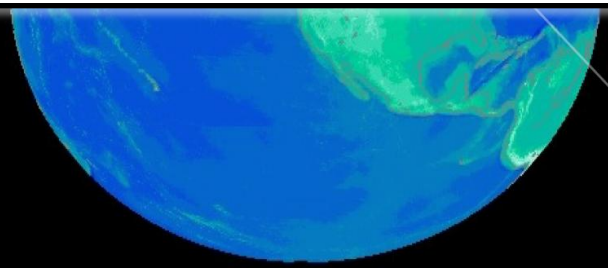


Magnetospheric MHD output used to drive geomagnetic induction and GIC code providing GIC at individual nodes of the power grid. GIC forecast file is generated.



% Level 2 GIC forecast produced by REALTIMEGIC_LEVEL2
%
% The format of the data is as follows:

Magnetospheric MHD model used to model the magnetospheric-ionospheric dynamics. Computations carried out at the Community Coordinated Modeling Center.



2008 03 19 11 06 31	-0.02	0.00	0.04	0.00
2008 03 19 11 08 31	0.00	0.00	0.01	0.00
2008 03 19 11 10 31	0.01	0.00	-0.03	0.00
2008 03 19 11 12 31	0.00	0.00	0.02	0.00
2008 03 19 11 14 31	0.02	0.00	0.04	0.00
2008 03 19 11 16 31	-0.00	0.00	-0.05	0.00
2008 03 19 11 18 31	-0.01	0.00	-0.07	0.00
2008 03 19 11 20 31	0.03	0.00	0.00	0.00

What was missing?

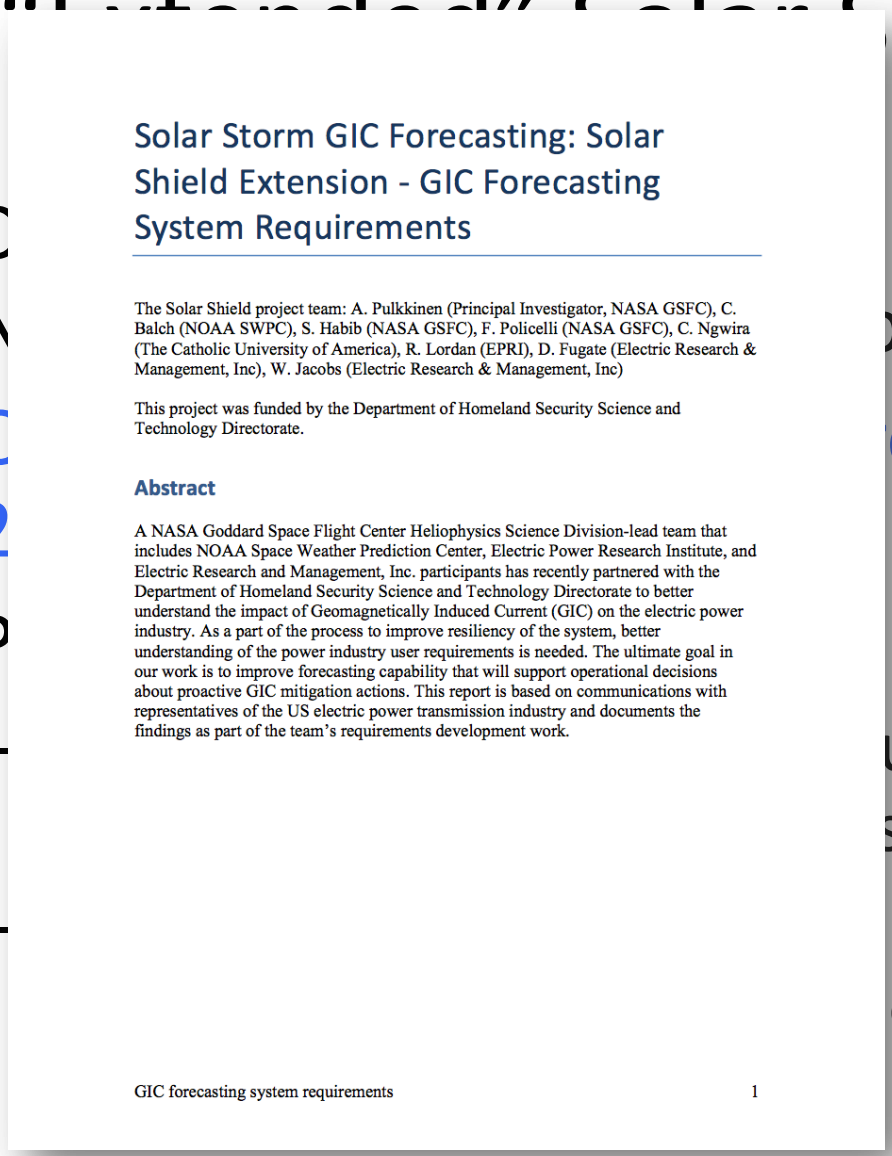
- Only high-latitude locations addressed in Level 2.

We want to address these two with DHS in the “Extended” Solar Shield project

- Low “technological/applications readiness level.” (TRL/ARL 4-5)

“Extended” Solar Shield project

- D (S&T) sponsored N oject 2014-2016.
- C oject was May 15, 2
- P
  - ument developed in stry. Ask for a copy!
  - mpleted and real-time ed.



Solar Storm GIC Forecasting: Solar Shield Extension - GIC Forecasting System Requirements

The Solar Shield project team: A. Pulkkinen (Principal Investigator, NASA GSFC), C. Balch (NOAA SWPC), S. Habib (NASA GSFC), F. Policelli (NASA GSFC), C. Ngwira (The Catholic University of America), R. Lordan (EPRI), D. Fugate (Electric Research & Management, Inc), W. Jacobs (Electric Research & Management, Inc)

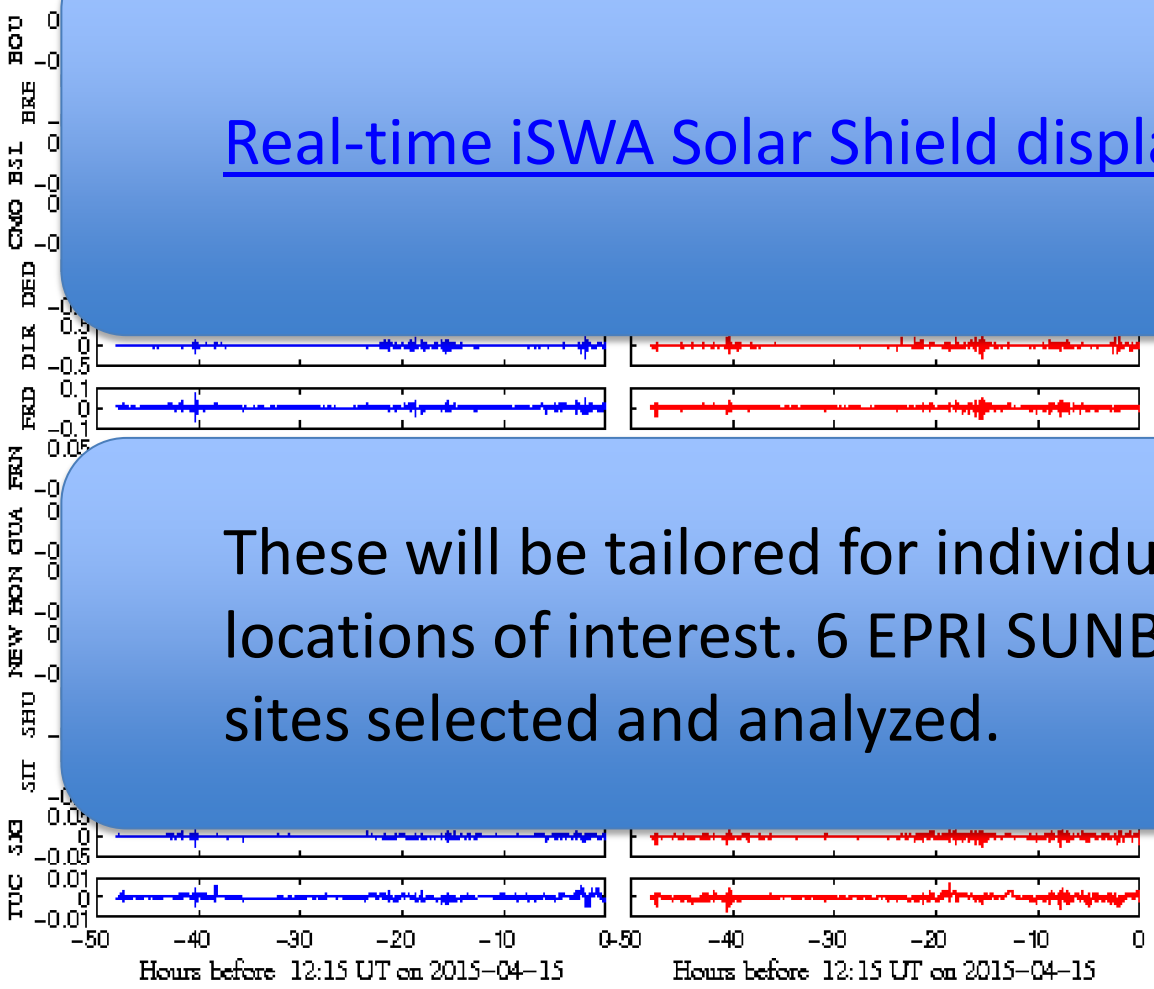
This project was funded by the Department of Homeland Security Science and Technology Directorate.

Abstract

A NASA Goddard Space Flight Center Heliophysics Science Division-lead team that includes NOAA Space Weather Prediction Center, Electric Power Research Institute, and Electric Research and Management, Inc. participants has recently partnered with the Department of Homeland Security Science and Technology Directorate to better understand the impact of Geomagnetically Induced Current (GIC) on the electric power industry. As a part of the process to improve resiliency of the system, better understanding of the power industry user requirements is needed. The ultimate goal in our work is to improve forecasting capability that will support operational decisions about proactive GIC mitigation actions. This report is based on communications with representatives of the US electric power transmission industry and documents the findings as part of the team’s requirements development work.

GIC forecasting system requirements 1

Initial real-time computations



[Real-time iSWA Solar Shield display]

These will be tailored for individual locations of interest. 6 EPRI SUNBURST sites selected and analyzed.

Summary

- We at NASA GSFC are working with DHS S&T, NOAA, EPRI and ERM to develop the next generation prototype “Extended Solar Shield” GIC forecasting system.
- Stay tuned for updates!