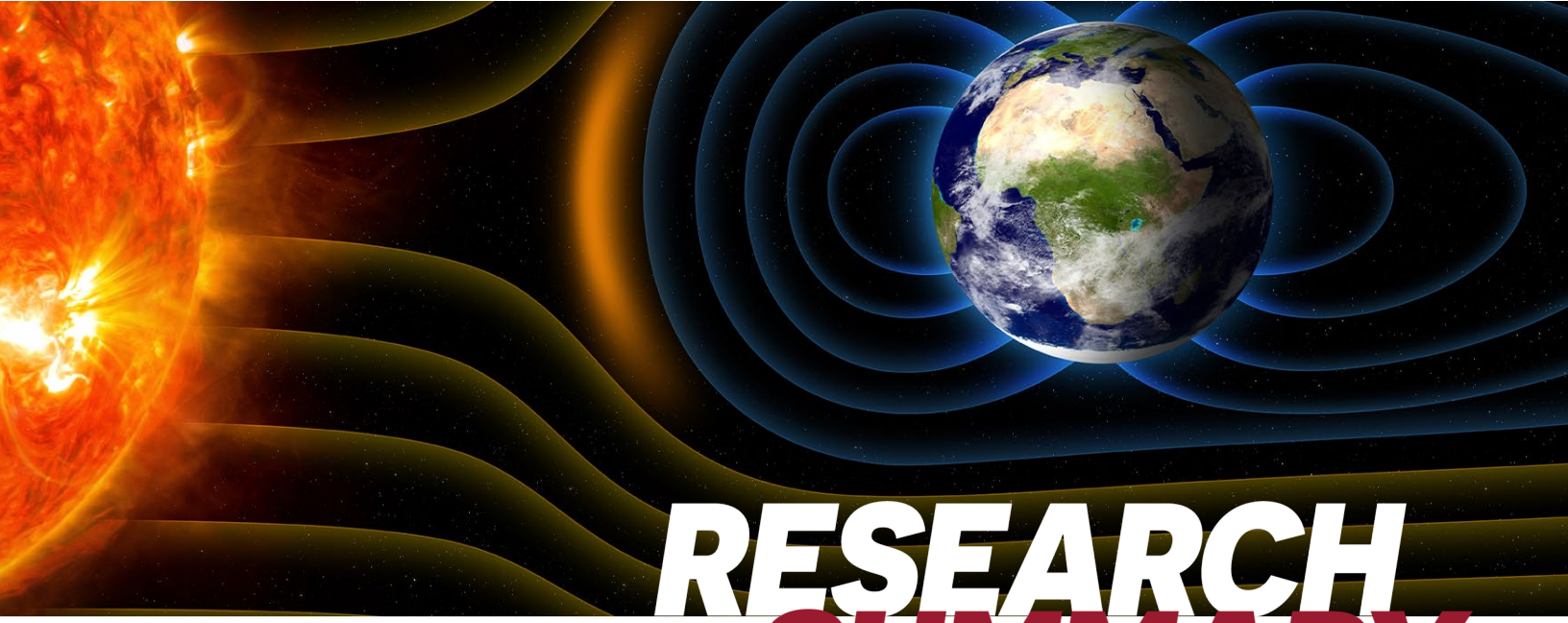

RESEARCH SUMMARY

Revisions to NOAA's Space Weather Scales

For more than 26 years, the National Oceanic and Atmospheric Administration (NOAA) has applied scales for communicating space weather conditions and their effects on people and infrastructure. Yet over time, forecasting capabilities and user needs have changed. This summary reports on how IDA is helping the agency revise its space weather scales.

Solar storms and geomagnetic disturbances can disrupt the power grid, communications, navigation, and satellite operations posing significant risks to government and commercial sectors. Since 1999, NOAA has applied the Space Weather Scales (SWS) to convey current and future space weather conditions and their impact on systems and people. Stakeholders worldwide use SWS to initiate hazard preparedness, mitigate operations, inform irregularities attribution and research activities.

However, many changes have occurred over the past 26 years warranting revisions for SWS. The space weather user base has expanded to include government leadership, such as policymakers at the Department of Homeland Security and NASA, and growing end-user communities, including power grid, aviation and satellite sectors. Finally, operational end-users have called for greater geographic specificity with scales, forecasts and products to inform the various sectors in different regions about predicted impacts of severe space weather events.

Due to these shifts, NOAA's Space Weather Prediction Center (SWPC) contacted IDA's Science and Technology Policy Institute to assist in revising SWS. The results of these potential revisions are presented in a report by IDA researchers: Project Leader Asha Balakrishnan, Daniel Pechkis, Katherine Ross and Erin Saybolt.

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The IDA team reviewed three SWS metrics: Geomagnetic Storm Scale (G-scale), Solar Radiation Storm Scale (S-scale) and Radio Blackouts Scale (R-scale). The G-scale measures global geomagnetic activity caused by solar wind and coronal mass ejections from the sun. The S-scale measures energetic proton flux, which is associated with the magnitude of a solar radiation storm. The R-scale measures x-ray flux from solar flares that correspond to the strength of radio interference on the Earth's sunlit side. The scales are useful in giving different user communities a heads up that a space weather event is ensuing. For some sectors, the scale levels are part of their operational procedures.

Although space weather is global in scope, the effects are experienced at a local level and the audience for SWS is diverse. For these reasons, users may experience different effects from space weather events; the actual impacts are based on external factors that are not well known to SWPC and vary by sector and system.

To assess these scales, IDA researchers interviewed a variety of stakeholder groups, including end-user community sectors, the U.S. government, academia, the Space Weather Advisory Group, meteorologists and the international community. The researchers facilitated input from nearly 500 people through over 170 engagements, focusing on questions about the benefits and uses of the scales, but the key question STPI researchers focused on was: How should the scales change?

IDA found a consensus among stakeholders that adjusting the G-scale, particularly the G-5 level, could make it more actionable for users. The G-scale is the most well-known and widely used scale, and users wanted to have greater fidelity at the upper end of the G-scale at levels 5 and beyond. Users requested that SWPC clarify the S-scale since users frequently misinterpret what it means for health effects on aviation passengers and crews. As for the R-scale, stakeholders requested that SWPC rename it to more accurately reflect the disturbances it causes. Stakeholders also highlighted the need for SWPC to use a different letter to represent the R-scale. This would eliminate confusion between it and the S-scale, as "R" is often associated with radiation. Suggested scale revisions could be addressed through sector tailored products and services to note the unique impacts they face during an extreme space weather event.

Overall, IDA found that the scales should continue to be based on observed and measured phenomena; however, SWPC could work to improve communicating potential effects for key sectors. This is achievable through collaborative data collection and information sharing with sectors and international partners.

This summary represents IDA Product 3003755.

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