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When the Sun Strikes: Preparing for the Business Impact of Geomagnetic Storms

Key Takeaways

- Geomagnetic storms can cause major impacts across power, telecoms, aviation, and satellite networks. Yet few organisations currently plan for them with rigour.
- Historically, even moderate space weather events have triggered widespread business impacts from blackouts, satellite loss and GPS disruptions.
- Combining infrastructure resilience, operational preparedness and insurance solutions can help risk managers mitigate business impacts from future storms.

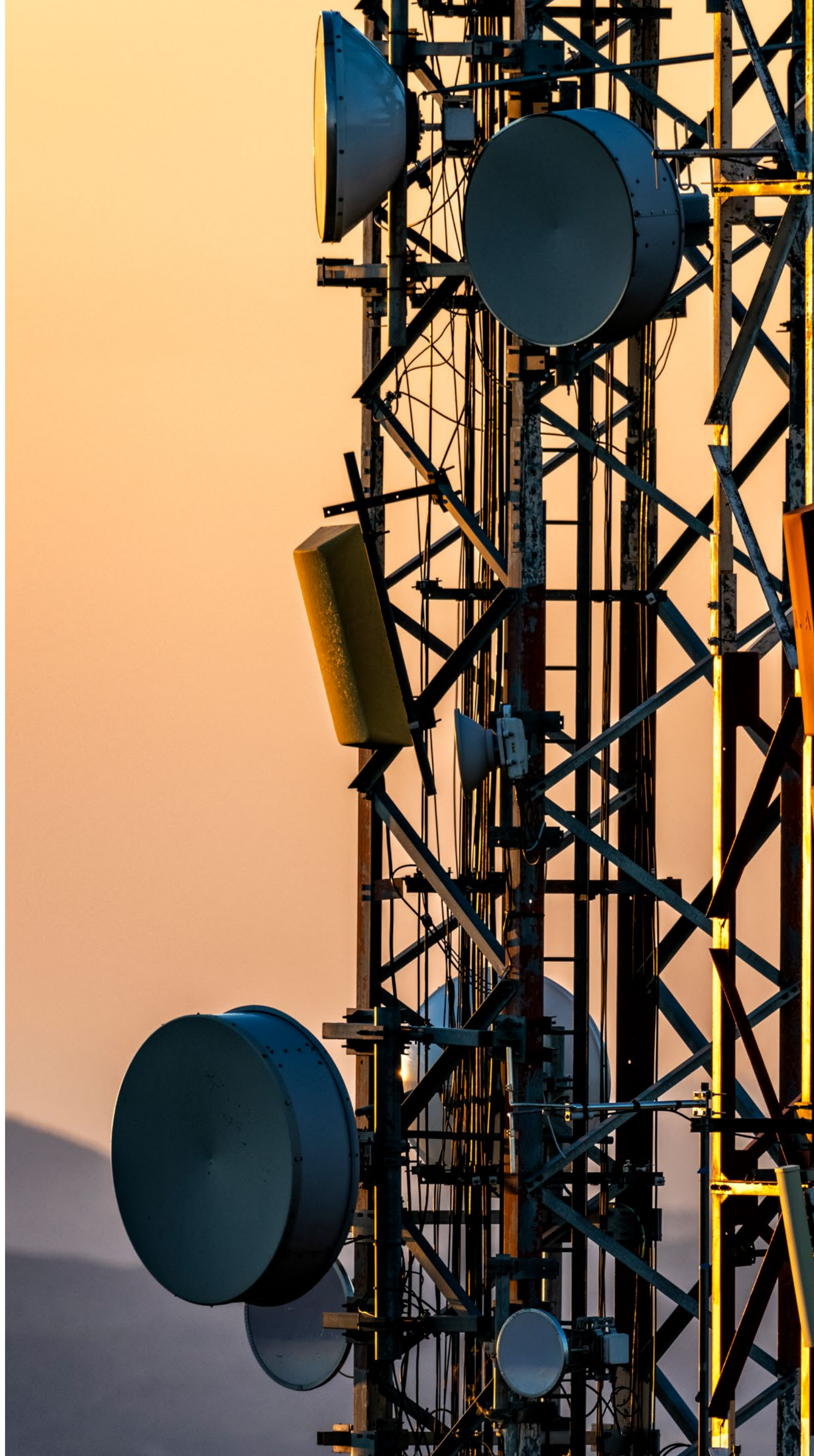
Geomagnetic storms, caused by solar activity such as coronal mass ejections (CMEs), have the potential to disable critical systems including power grids, satellite networks, aviation, communications and cloud-based services. Severe events, combined with the networked nature of business operations and systems in the 21st century, could trigger cascading infrastructure failures across countries and continents, resulting in substantial business impacts that resemble those of a major cyber attack. Despite this, many organisations are unaware of the potential risks and are not adequately prepared for disruption.

Understanding the Risks

Geomagnetic storms originate from heightened solar activity, which follows an approximately 11-year cycle[1] with the current cycle peaking this year (2024-2025).[2] The sun's emissions, and CMEs in particular, interact with the earth's magnetic field to induce electrical currents in grounded infrastructure.[3] This can disrupt systems that underpin global business operations, including high-voltage power grids, satellites, GPS signals, aviation systems and telecommunications. The interconnected nature of these systems mean failure in one domain can rapidly affect others. For example, power outages can disable communications and transport, and satellite signal disruption can interfere with navigation, logistics and financial transactions.[4]

The global economy's growing reliance on cloud computing, autonomous systems, and satellite-based infrastructure has expanded these potential impacts. According to modelling prepared by Lloyds of London in 2024, economic losses from a severe event could reach US$9.1 trillion, representing approximately 1.4% of global GDP. Even in less extreme scenarios, forecasted losses start from US$1.2 trillion.[5]

While these storm incidents are well-documented, forecasting remains imprecise. Space weather monitoring is improving, but organisations may only receive hours of warning before a major event. In this context, preparedness, rather than prediction, is the more practical focus for risk management teams.



[1] Hathaway, D., The Solar Cycle, September 2015
[2] National Weather Service, Hello Solar Cycle 25, accessed June 2025
[3] Boteler, D., Geomagnetic Hazards to Conducting Networks, March 2003
[4] Oughton et al., Quantifying the daily economic impact of extreme space weather due to failure in electricity transmission infrastructure, 2016
[5] Lloyds, Counting the economic cost: How vulnerable could you be?, accessed June 2025

Lessons from the Past

Even in the industrial age, disruption caused by geomagnetic storms was significant. The 1859 Carrington event is the most intense storm on record, producing auroras visible near the equator and sparking fires in telegraph offices as wires overheated.[6] Modern dependence on electricity, digital technologies and automation would likely amplify both damage and business impacts from any similar event if it happens again in the future.

More recently, the 1989 Quebec blackout demonstrated how geomagnetically induced currents (GICs) can destabilise modern power grids. The storm triggered a cascading failure, leaving six million people without power for over nine hours.[7] In 2022, a geomagnetic event resulted in SpaceX losing 38 newly launched Starlink satellites, demonstrating that even moderate storms can pose significant risks.[8]

Impacts for Organisations, Their Stakeholders and Society

The potential consequences of major geomagnetic storms are far-reaching. Simultaneous failures in terrestrial electrical and global satellite systems could lead to cascading impacts across many dimensions of business and society:

Utilities: Widespread blackouts could disable lighting, heating, and essential services. High-voltage transformers are particularly vulnerable and difficult to replace quickly. Water supply and wastewater systems, reliant on electric pumps, would also be disrupted.

Aviation and Transport: Loss of GPS could disrupt flight navigation and air traffic control. Airlines may be forced to reroute flights or delay operations, while ground transport systems could be disabled by power and signal failures.

Telecommunications and Cloud Services: Satellite outages could affect mobile networks and internet access and downtime across cloud services would hinder access to critical systems and data.

Retail and Consumer Services: Electronic payments could fail, limiting access to goods and fuel similar to the CrowdStrike incident in July 2024.

Logistics and Supply Chains: Disruption to satellite navigation would delay freight, shipping and trucking, with ports and warehouses losing visibility of goods in transit.

Financial Markets: Time signal disruptions could misalign trades and destabilise trading platforms, causing markets to experience erratic behaviour or outages which could trigger major, and ongoing, financial losses.

[6] Green, J., Boardsen, S., Science Direct, Duration and extent of the great auroral storm of 185, December 2005
[7] North American Electric Reliability Corporation, Effects of Geomagnetic Disturbances on the Bulk Power System, February 2012
[8] Baruah et al., Wiley Online Library, The Loss of Starlink Satellites in February 2022: How Moderate Geomagnetic Storms Can Adversely Affect Assets in Low-Earth Orbit, April 2024

Preparing a Response to Geomagnetic Activity

These risks from geomagnetic activity are complex and the triggers of such disruption are difficult to forecast. A multi-layered strategy, combining infrastructure adaptation and operational readiness with policy alignment, could help to mitigate against system failures and the widespread impacts of these events.

Infrastructure Protection

Utilities operators can deploy GIC-blocking devices and transformer monitoring systems while investing in rapid replacement protocols for at-risk components to reduce downtime. For example, the Australian Energy Market Operator has implemented a Geomagnetic Disturbance Procedure to protect its power systems during solar events.[9]

For satellite operators, shielding, redundancy, and power-down protocols during solar peaks can reduce exposure. Ground-based backups for GPS, can help maintain navigation continuity.

[9] Australian Energy Market Operator, Power System Security Guidelines, June 2024

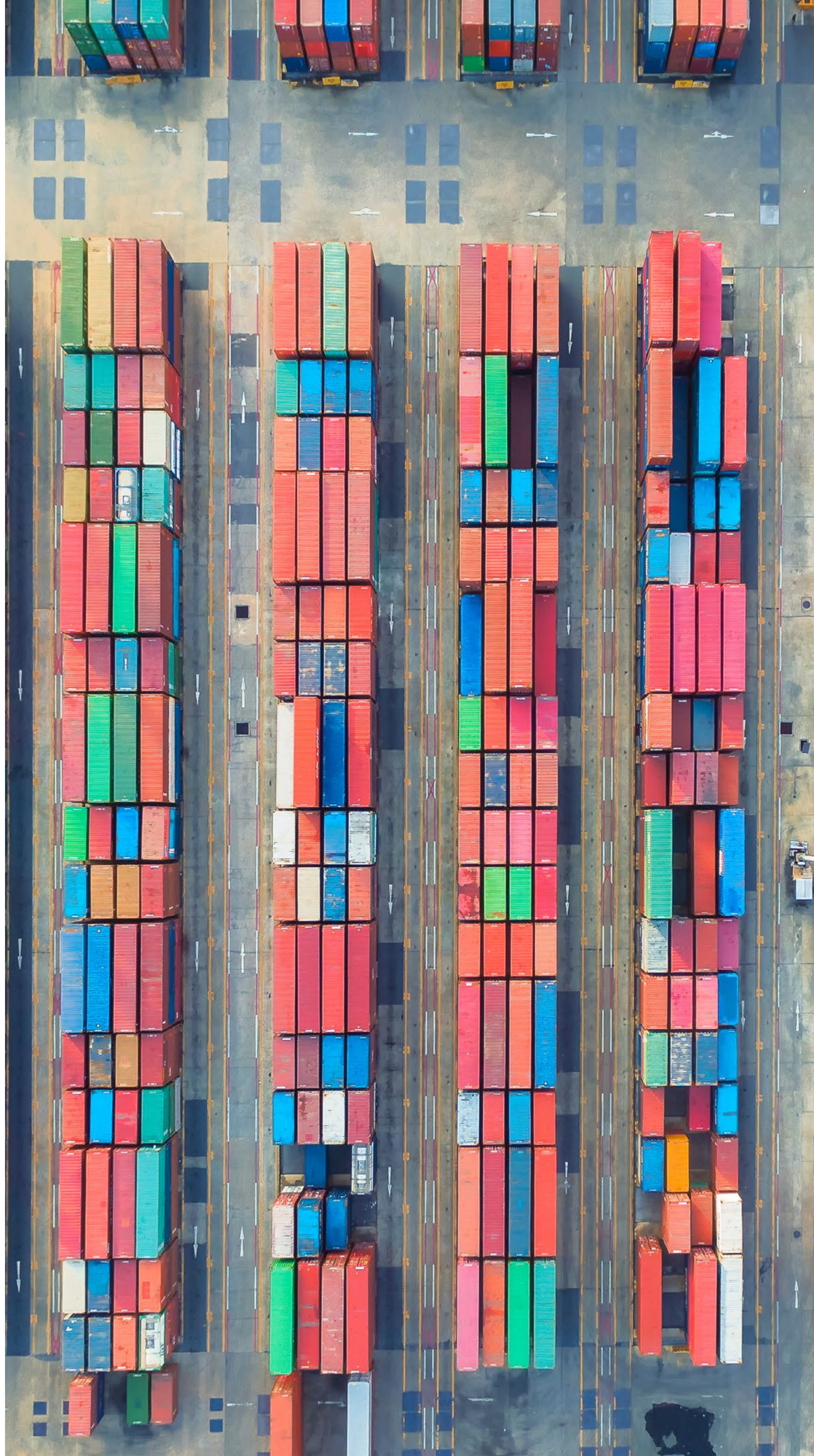
Operational Readiness

Contingency plans are essential. Logistics and supply chain leaders can identify alternate routes, stockpile inventory, localised cloud services and backup generators to ensure critical operations can continue during central outages. Alternative data centres and microgrids can take on additional loads when primary systems fail if capacity allows. Organisations that decentralise their infrastructure and avoid over-concentration of digital services will be better placed to maintain continuity.

Policy and Coordination

Governments and regulators have a vital role to play in strengthening forecasting and legislating for resilience planning, and grid hardening. Organisations can adopt best-practice checklists and protocols, such as those published by University College London and endorsed by space weather experts.

Cross-industry collaboration is equally important. Emergency response, aviation, telecoms and insurance sectors can work together to develop robust response frameworks for high-impact space weather scenarios.



The Role of Insurance

Traditional insurance frameworks may not fully capture the scope of space weather risks. Many Business Interruption policies for example rely on triggers of physical damage which may only be caused indirectly by geomagnetic storms. This creates potential coverage gaps in business interruption and contingent business interruption policies.

Geomagnetic storm impacts can also resemble cyber events, potentially leading to disputes over whether cyber insurance policies apply. This convergence of risks requires careful policy wording and innovative underwriting approaches. There is also a growing need to reassess satellite, aviation, and infrastructure insurance coverage considering new space weather data. As more businesses rely on automated and satellite-connected systems, underwriters may need to adapt their models to price risk and close protection gaps.

Parametric insurance is well matched to damage and business disruption resulting from this type of event. Under these policies, a payout can be made when a predefined index is triggered — such as solar flare intensity — allowing for faster, more transparent claims.

A Risk Worth Planning For

As the current solar cycle peaks, organisations can use this opportunity to reframe their view of space weather impacts on their specific business operations. The impact of past events makes it clear that systemic disruption is a significant risk that businesses need to be prepared for. Exploring cost effective and achievable mitigation options, across infrastructure, operations and insurance should reduce impacts from the next major geomagnetic storm and ensure better business continuity in our connected world.

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Contact Us

James Knight
Head of View of Risk Advisory, Asia Pacific
james.knight1@aon.com

Alec Wild
Senior Catastrophe Research Analyst
alec.wild@aon.com