

# Atmospheric and Environmental Research

Concern over the potential effects of a space weather event on North America has increased over the past few decades. **Kyle Beatty**, Vice President of the Business Solutions Division at AER and head of the Space Weather Industry Initiative, discusses how the initiative is serving the government and companies in re/insurance, financial services, aerospace and other industries

## To begin, can you explain the rationale behind Atmospheric and Environmental Research (AER) and its core activities?

Since it was founded in 1977, AER has provided leadership in research and development and government services, including work for international space agencies, the US Department of Defense and the National Science Foundation. AER's success has been realised through the quality of its research and its exceptional level of customer service, which is consistently demonstrated through timely and on budget delivery. AER's expertise and intellectual property associated with Earth observation and climate attracted Verisk Analytics (VRSK) to acquire the initiative three years ago. Since its acquisition, AER has been actively partnering with the insurance and financial services industries to apply scientific leadership to address emerging and high-priority issues affecting these markets, including the risks posed by space weather.

## What is the purpose of the Space Weather Industry Initiative? How does it enhance the broad objectives of AER?

AER's Space Weather Industry Initiative was launched in response to demand from insurance companies to have a trusted business partner objectively assess the likelihood and potential severity of extreme space weather events in North America. Carriers approached AER because the problem was known to be highly complex – involving astrophysics, statistical modelling, electrical engineering and actuarial science. Moreover, though, the insurance carriers understood that to be successful the research needed to include partnerships between the scientific, insurance, government and energy communities – each of which are areas where AER has strong partnerships. Original, groundbreaking scientific and engineering research was needed in an applied framework – exactly where AER excels.

## What is meant by the term 'space weather'? How frequent are such events? How do they affect socioeconomic interactions?

Space weather is an upstream cause of the risk that we are focused on. Our industry partners are primarily concerned about the effects of a

space weather event. The specific effect of greatest interest is widespread, long-duration electrical power outage, or 'blackouts'. The question posed to us was how frequent are these events in relation to other risks that the insurance industry has established practices to manage. Questions the market asked us were: 'Is this a 1:100-year event? A 1:200-year event? A 1:1000-year event?'. If an event did occur, they were interested in how severe the losses could be. Their interest was not just the potential of losses to insurance coverages, but the enterprise risk associated with the simultaneous interruption of their operations, potential losses in the financial markets and covered losses. AER's research has determined that the risk of a severe space weather event is equal to or greater than the risk associated with other perils, such as an extreme earthquake. There are well-established precedent events going back thousands of years giving us clarity that this risk needs to be taken seriously.

## Can you explain the multidisciplinary initiative being implemented to assess space weather?

AER quickly discovered that the existing body of academic research was insufficient to assess the frequency and severity of space weather effects. Executing on this project required AER to innovate – an area where we are at our best. It was also clear to us that there was not a single answer to the question – we needed to develop alternative answers that we could 'credibility weigh', resulting in a range of potential results. This approach aligned very well with the interest of our industry partners, who are very comfortable with probabilistic modelling.

AER's contribution to the industry is not simply in the form of a presentation or an academic journal article. AER gives its industry sponsors access to AER's scientists and outside consultants; we provide very detailed technical reports and, perhaps of greatest importance, our sponsors have access to the data to analyse risk to their own portfolios. AER's approach to industry research in this way ensures that our sponsors obtain actionable results and measurable value throughout the duration of the research initiative.

### What is the Carrington Event and how does this provide insight to current understanding?

Prior to AER's research, the Carrington Event was believed to have been the 'worst case' scenario for a space weather event. AER's work has indicated that the 1859 Carrington Event is actually a bit of a misnomer – the severe space weather activity that occurred in 1859 was actually two events that occurred close in time. The first event 'set the stage' for the second to have more severe impacts. The world did not have the same infrastructure as we do today, so the effects were 'felt' on telegraph lines, rather than the electrical grid, however, the currents that were induced are believed to have been strong enough to cause substantial damage to older, unmitigated electrical infrastructure.

### Can you provide an overview of the industries you help to support?

The primary industries that AER serves in addition to governments are re/insurance, financial services, manufacturing and distribution. AER also has clients in energy production, generation, transmission and distribution. In addition to our exceptional research capabilities, AER is privileged to serve as a bridge between these industries, often synthesising proprietary scientific and business data to create solutions that others cannot replicate. These forms of analytics are a key distinguishing factor that AER's clients rely upon.

### What is the Space Environment Effects Tool (SEET) and how does it strengthen the endeavours of different industries?

The SEET software provides modelling of the space environment for satellite mission planners, satellite designers and mission operators interested in understanding space's impact on satellites and their electronic systems. SEET is an add-on software module developed by AER for Analytical Graphics Inc.'s (AGI) Satellite Tool Kit. This product is best described as an illustration of AER's extraordinary knowledge in the space environment. This knowledge base is a key part of the success of our industry initiative. In reference to the insurance marketplace, our SEET product best relates to the specialty insurers that cover satellite payloads from launch to termination of the in-orbit asset. Through our relationships with aerospace companies and our knowledge of particle physics, we can provide unique insights in this area as well.

### You work in partnership with several leading institutions, including the National Oceanic and Atmospheric Administration of America. How does this collaboration help you achieve your goals?

One partnership that is very relevant to our space weather knowledge-base is our longstanding work with the US Air Force Research Laboratory. We also have partnerships with the Space Weather Prediction Center (SWPC), which allow us to be at the cutting-edge of both science and operational response to space weather events. In general, these collaborations ensure that AER's clients will consistently have access to the latest scientific information across a wide range of disciplines, often earlier than the rest of the market.

### In what capacity has your research helped to influence policy at a national and global level?

Our research is beginning to influence the views of governments worldwide regarding mitigation, guided in part by our partners within the re/insurance and financial services sectors. We were honoured to have some of our work discussed at the 3<sup>rd</sup> Annual World Summit on Infrastructure Security at Westminster Palace, in London. We also have had the opportunity recently to present to the Geneva Association, the leading international insurance think tank for strategically important insurance and risk management issues. Each of these forums has initiated the transfer of our leading research into the public policy arena.

### How do you support students of atmospheric science? What advice would you give to those wishing to pursue a career in this field of research?

We strongly support the development of new research talent associated with the observation and modelling of the Earth system. A suggestion I routinely offer is to think early on about how to partner with the private sector, including companies like AER, during their academic studies to transfer their work into application. We consistently find that our clients are looking for us to 'push' them in new directions, however, as a student it is critical to train oneself to do so with foundational knowledge of individual businesses or industry segments. Without this, the innovation cannot successfully transfer into a meaningful industry change. AER provides many students and young scientists with this opportunity to understand the client first, and then work in partnership with companies to move the state of practice toward the state of science.

### What are your hopes for the future of AER?

AER is a company that truly has no equal in the marketplace. Our people are driven by the exceptional quality, exceptional delivery and very clear communication in all of our engagements. I am consistently intellectually stimulated, but moreover, I am excited to see our work put into practice with our government and business customers. I am thrilled to see AER build on its successes to continue to deepen its technical capabilities and broaden the customers it serves across all of the markets we target.

