A new European Union system to forecast space weather has gone live on 1st March 2012. Led by researchers from British Antarctic Survey (BAS), the EUR2.54 million SPACECAST project will provide frequent and reliable web-based forecasts so that satellite operators can take action to protect their satellites from space radiation damage.

Researchers from six European countries, working in partnership with colleagues in the USA and two European companies, use satellite data, ground-based measurements of the Earth’s magnetic field, and computer models to forecast space weather for the region where most satellites orbit the Earth. This is the so-called Van Allen radiation belt – a doughnut-shaped ring of charged particles, trapped within the Earth’s magnetic field that encircles the planet high above the equator.

Space weather is of intense interest to the UK and US governments. Millions of dollars have been lost as a result of large magnetic storms in space causing satellite damage. In 2003, a large magnetic storm caused more than 47 satellites to malfunction, including the total loss of a scientific satellite valued at USD640 million. The largest magnetic storm ever recorded, the Carrington storm of 1859, occurred long before society became reliant on satellites for TV, internet, navigation and telecommunications. If such a super-storm occurred again, the cost could be as high as USD30 billion.

Changes on the sun trigger magnetic storms around the Earth, and during the 11-year sunspot cycle the number of moderate to large magnetic storms varies from about 15 to 60 or more per year. A new sunspot maximum is expected to increase the number of magnetic storms between 2013 and 2015. The new forecast system, which is updated every hour, will help protect satellites used for navigation, telecommunications, remote sensing and other services.

Professor Richard Horne from British Antarctic Survey, who is leading the project, said that the sun is becoming more active again, triggering more geomagnetic storms which generally increase space radiation. These changes are an important part of space weather and are a serious natural hazard. For the first time, it is now possible to forecast radiation levels for a whole range of different orbits, from geostationary to medium Earth orbit where there has been tremendous growth in the number of satellites.

The forecasts are available on the internet and provide a risk index for satellite operators. Satellites continue to operate during space weather events but, given advance warning, operators can reduce the risk of disruption by switching off non-essential systems, re-routing signals and by re-scheduling orbit manoeuvres and software upgrades.

One of the novel features of the forecasts is that space radiation levels are computed from the physics of wave-particle interactions. Observations at British Antarctic Survey’s Halley Research Station, Antarctica, have long shown that special types of very low frequency VLF electromagnetic waves can increase as well as decrease space radiation levels. These variations (or VLF wave measurements) are now incorporated into the forecasting models. Over the next 2 years, SPACECAST will be working on the physics so that the team can improve the forecasts, extend them to the lower energy “seed” electrons, and model solar energetic particle events.