

## Forecasting the risk of single-event upsets (SEUs) on satellites

Space is a harsh environment. Satellites must operate not only in a vacuum but also under extreme temperatures, with the potential of colliding with other satellites or meteorites at speeds of several km/s. They also operate in environments with extremely variable radiation levels. This radiation mainly comes from the Sun, in the form of ultraviolet rays, X-rays and charged particles that continuously reach the Earth as solar wind, or bursts resulting from solar flares and coronal mass ejections. These particles can charge parts of a spacecraft and cause arcing. They can also degrade solar panels, reduce the operational life of satellites and cause SEUs.



In these situations, a satellite's computers can restart, resulting in a loss of data. Fortunately, satellites are built with some resistance to radiation, which is the result of a compromise between using shielding, using components that are resistant to radiation and cost. There is therefore a certain amount of variation among satellites and how sensitive they are to space weather.

The Canadian CASSIOPE satellite, operated by the University of Calgary, carries the Enhanced Polar Outflow Probe (e-POP) suite of scientific instruments to study the ionosphere. It makes ionospheric observation at altitudes ranging from 350 km to 1500 km. It occasionally crosses the South Atlantic Anomaly, a region where the Earth's magnetic field is weaker, reducing its natural shielding effect.

The data on SEUs is difficult to access, and may help overcome the challenges related to managing and predicting SEUs. The [dataset](#) lists a variety of positions, velocities and altitudes of the CASSIOPE spacecraft in UTC time. Some of those are associated with SEUs that have caused CASSIOPE's computers to reset. These data can be combined with other space weather data of your choice to assess and predict the risk of such SEUs occurring. The other data to combine can be found on the [NASA Omniweb](#) database.