

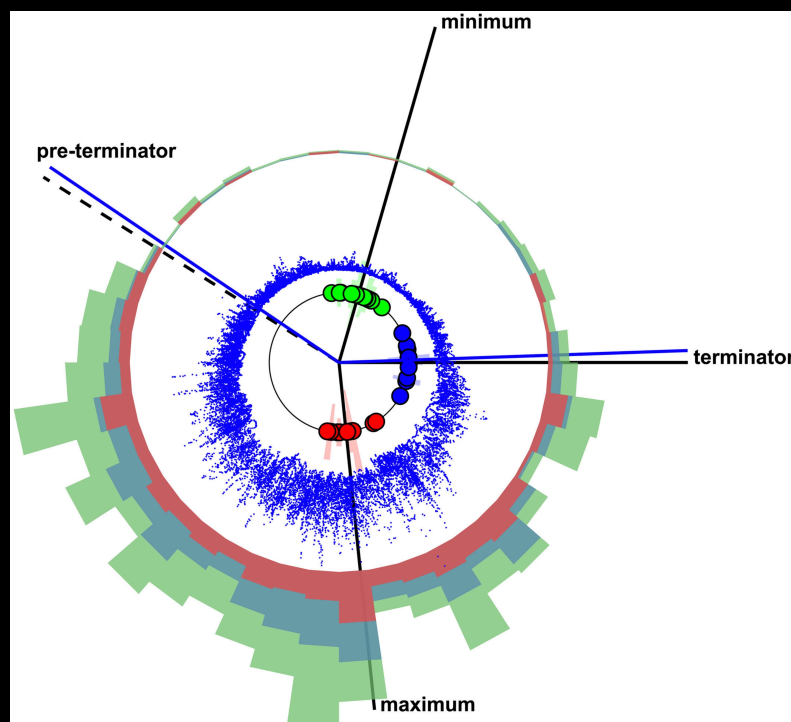


# A New Clock for Solar Storms



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Extreme space weather events can significantly impact systems such as satellites, communications systems, power distribution and aviation. These events are driven by solar activity which is known to have an irregular but roughly 11-year cycle. By using 200 years of sunspot observations (18 solar cycles) and 150 years of geomagnetic space storm observations, researchers at the University of Warwick, Goddard Space Flight Center and the High Altitude Observatory created a novel 'sun clock'.



The aligned solar cycles are wrapped around a circle to create a clock with time running clockwise. The blue points inside show solar activity measured in radio emission. The red, blue and green histograms represent strong, medium and weaker solar flares. Green and red dots show the minima and maxima of the cycles. The blue dots indicate the terminators, or ends of the last sunspot cycle.

The researchers created the clock using a technique known as the Hilbert transform, which was used to convert the linear observations of past solar cycles onto a circle, stretching or compressing the years as necessary to fit a standard 11 year timeframe.

- By devising this new 'sun clock', researchers have found that the switch on and off of periods of high solar activity are quite sharp and are **predictable**.
- Whilst extreme events can happen at any time, they are far less likely to occur in the quiet interval.
- Most flares are not at solar maximum, but afterward.

The clock will help determine more precisely when the risk for solar storms is highest and help to plan the impacts of space weather on infrastructure.

- The next switch on of activity may be imminent, and the Sun is currently coming out of the period of solar minimum (the end of solar cycle 24).
- As we enter solar cycle 25, the next 2–3 years will see the sun move towards sunspot maximum, and then 3-4 more years before the sharp switch-off.
- When the post-maximum switch-off occurs in 2027, **Solar Orbiter** will be making its first high latitude pass, capturing this moment.