Significant space weather events

Descriptive Occurrence Statistics

Geomagnetic Storms (ASWAS / NOAA G-scale)

How often?

- 22 G5-level storms over the last 8 solar cycles (~90 years)
- **~3 G5-level storms per 11-year solar cycle on average**
- No G5-level storms in the previous solar cycle
- The last G5-level storm occurred in October 2003

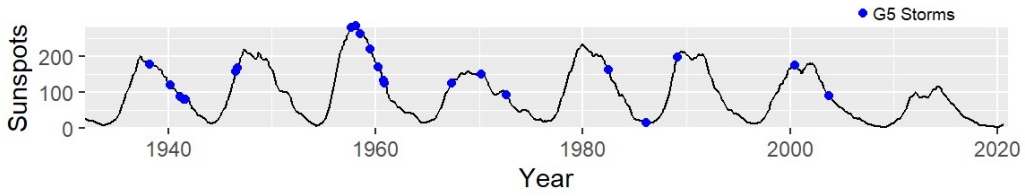

Figure 1. 22 G5-level geomagnetic storms occurred over the last 8 solar cycles (~90 years).

When in the Solar Activity Cycle?

- Predominantly in the "descending phase" of the solar activity cycle (ie after solar maximum).

  Context: The Sun is currently in the "ascending phase", with the next solar maximum expected 2025. G5 level storms can still occur at all phases of the solar cycle (for example, an event in 1986 occurred at solar minimum)

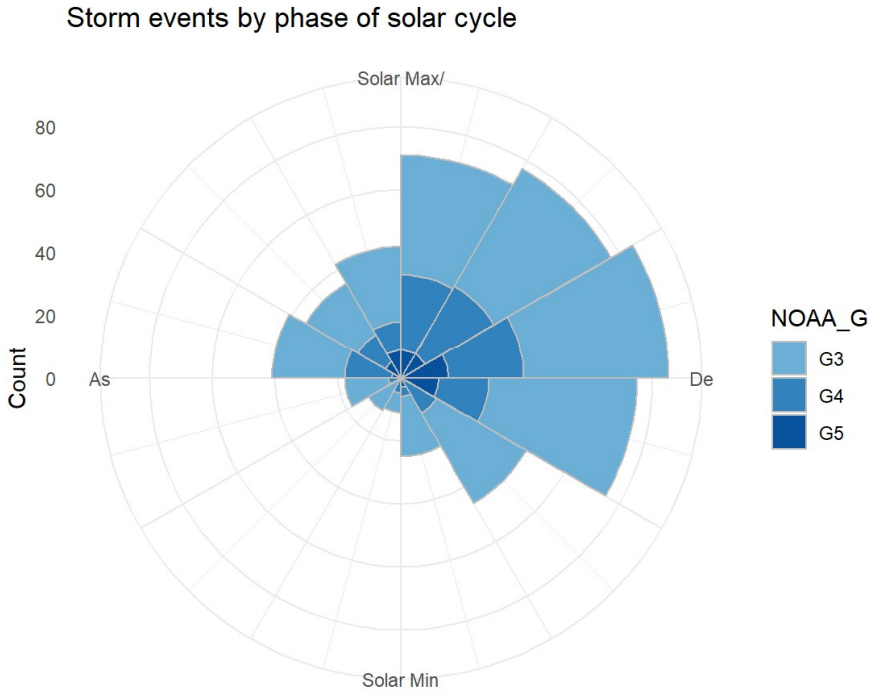

Figure 2. Clock plot histogram of geomagnetic storm occurrence. Solar Maximum is at the top, Solar Minimum at the bottom, Descending phase on the right. Significant geomagnetic storms (G4 / G5) occur preferentially in the Descending phase after solar maximum, but G5 events can occur at all phases of the solar cycle.

Radiation Events (ASWAS / NOAA S-scale)

How Often?

- No S5-level radiation storms since satellite observations commenced
- 8 S4-level radiation storms over the last 4 solar cycles (~45 years)
- **~3 S4-level radiation storms per 11-year solar cycle on average**
- Last S4-level solar radiation storm occurred in October 2003

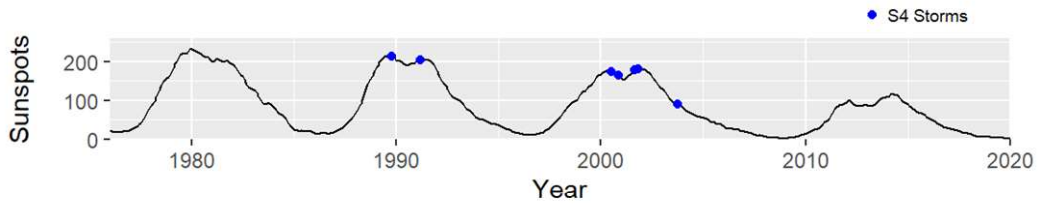

Figure 3. S4 storms over the last 4 solar cycles (~45 years). There have been no recorded S5 events since satellite monitoring began.

When in the Solar Activity Cycle?

- Predominantly around solar maximum.

Context: The Sun is currently in the "ascending phase", with the next solar maximum expected 2025. The occurrence rate of significant radiation storms is expected to increase over the next 2-4 years. Smaller solar cycles (such as the previous cycle) may produce less (and less intense) radiation storms; The current solar cycle is predicted to be relatively small.

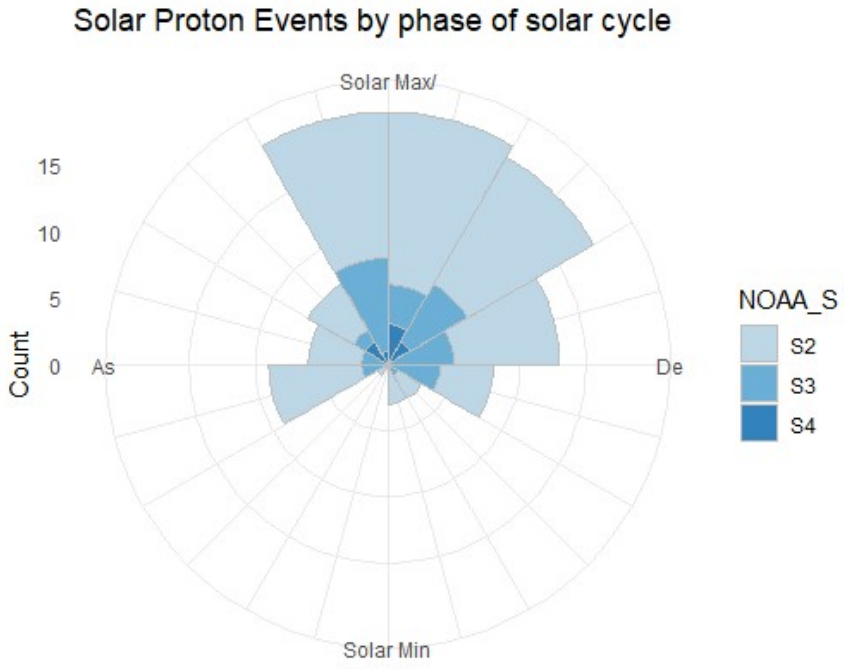

Figure 4. Clock plot histogram of geomagnetic storm occurrence. Solar Maximum is at the top, Solar Minimum at the bottom, Descending phase on the right. Significant solar radiation storms (S4) occur preferentially near solar maximum.

Radio Blackout Events (ASWAS / NOAA R-scale)

How Often?

- 5 R4/R5 radio blackout events over the last two solar cycles (~25 years),
- **~2-3 R4 or R5-level events per 11-year solar cycle on average**
- Last R5-level event (X28) was in November 2003.

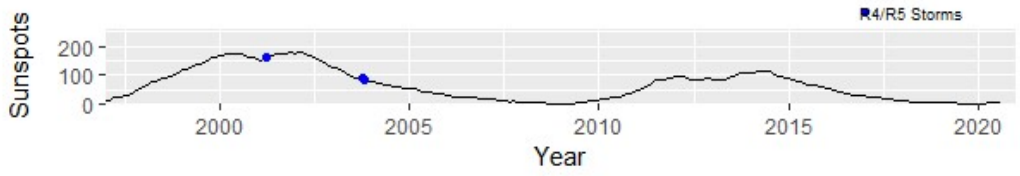

Figure 5. R4 / R5 radio blackout events over the last 2 solar cycles (~25 years).

When in the Solar Activity Cycle?

- Predominantly around solar maximum.

Context: The Sun is currently in the "ascending phase", with the next solar maximum expected 2025. The occurrence rate of significant radio blackout events is expected to increase over the next 2-4 years. There is evidence that smaller solar cycles (such as the previous cycle) produce less (and less intense) radio blackout events. The current solar cycle is predicted to be relatively small.

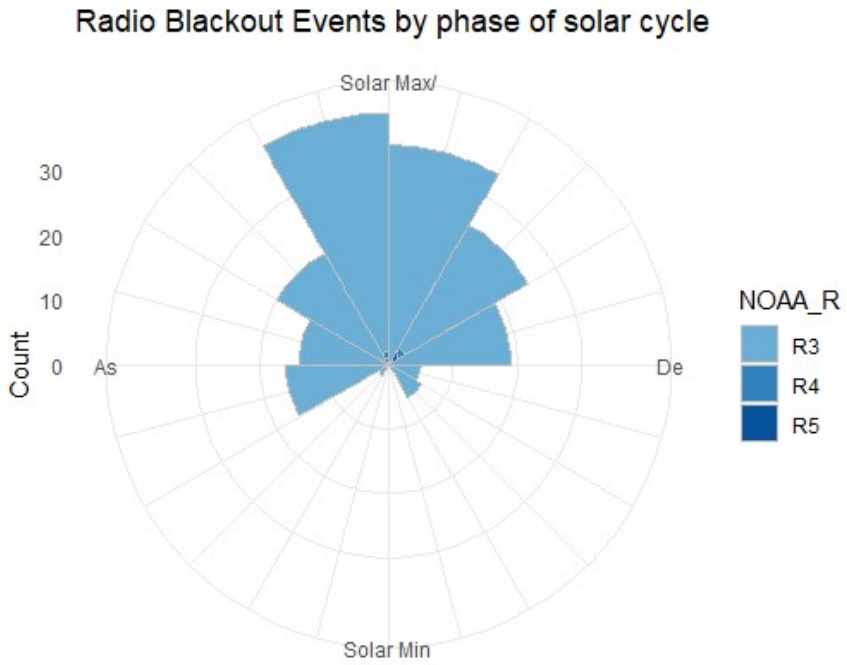

Figure 6. Clock plot histogram of radio blackout event occurrence. Solar Maximum is at the top, Solar Minimum at the bottom, Descending phase on the right. Significant radio blackout events (R4 / R5) occur preferentially near solar maximum.

Event Frequency Table

Table 1. Estimated frequency of significant space weather events at each level of the ASWAS scale (1-5)

Level	*Geomagnetic (G)*	*Radiation (S)*	*Radio Blackout (R)*
	Events / cycle	Events / cycle	Events / cycle
5	3	<1	<1
4	20	3	2
3	40	10	80
2	90	20	110
1	130	40	840

- Note these may differ from the event frequencies reported for the NOAA scales due to different event identification criteria (particularly the G-scale).

Full descriptive Statistics at:
http://web.sws.bom.gov.au/~mterkil/SpaceWeatherEvent_SummaryStats.html