

Space Weather Forecast

Issued on Monday, 06 December 2021 at 13:10 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Numerous Coronal Mass Ejection (CME) candidates in period - awaiting confirming satellite imagery for analysis. Slight chance of G1/Minor Geomagnetic Storms day 4 (Thursday 09 December) from one such event.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity reverted to low over the past 24 hours, with occasional small common-class flares emanating from two main sources. The first of these sources produced two main common-class flares: these are probably attributable to a developing sunspot region over the western horizon of the sun (i.e. on the far side), with the flares detectable at Earth for the ejecta they have thrown high into the sun's outer regions. The second flare from this region was overlaid by several more impulsive small common-class flares - this a result of growth in the sole remaining front-sided sunspot in the southeast of the sun. This one remaining sunspot underwent a brief growth phase, however this receded as the 24-hour period ended.

The period was also characterised by a series of potential 'filament lift-offs' - where arcs of plasma can leave the sun as CMEs. The first of these was a large event that occurred at the very start of the reporting period, visible in ground-based observatory imagery. The second was faint, but also just visible in the southeast quarter of the sun, 05/1900-060200UTC, of a similar apparent size as the earlier filament. Finally, the third candidate was small but more pronounced, occurring 06/0600-0800UTC. This again was centred on the southeastern quarter of the facing side.

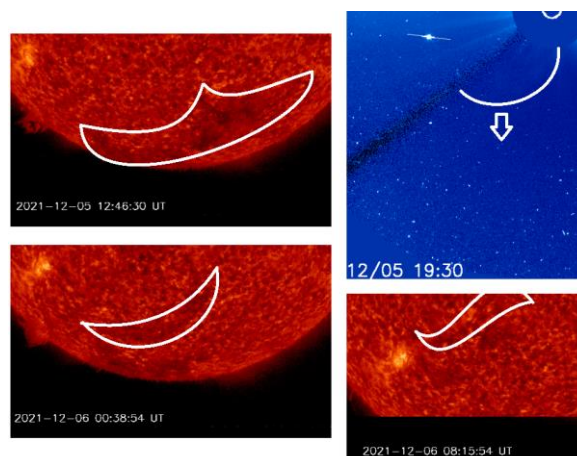


Figure 1: False-colour extreme UV satellite imagery of three possible 'filament lift offs' (possible CME-causing events – the orange/red images). The uppermost has been tentatively correlated with a false-colour visible image of the resulting CME in the first case (top). This event has a suggested most likely arrival as a glancing blow at Earth around 09/1800UTC, with a 20% chance of minor geomagnetic storm G1 as a result.

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Satellite imagery to determine any CMEs for the period is relatively scant, with the added complication of the common-class flare generating region behind the western solar horizon producing some non-Earth directed CMEs. At present, available imagery only hints at any CME from the first of the three events, but this will be updated in due course should thoughts on this change.

All considered, as with the previous issue of this guidance, the only 'confirmed' CME produced is that linked to the initial large filament described above at around 05/1200-1330. This is weak and low confidence in its attribution, but carries a potential Earth-directed component arriving 09/1800UTC +/-9 hours.

Solar Wind / Geomagnetic Activity: The solar wind was at slightly elevated levels likely due to the fast wind from a 'coronal hole'. A weak decreasing tendency then became evident through the UTC morning of Monday 06 December, with a late resurgence perhaps signalling the tail end of recent 'coronal hole' influence. Both the number of particles comprising the wind and their associated magnetic field were slightly above normal background but with a decreasing tendency with time. Resultant geomagnetic activity was generally quiet - well below Minor Geomagnetic Storm G1 throughout.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be low, with the chance of further notable X-ray flares from behind the sun's western horizon now significantly decreased, leaving one small current front-sided sunspot.

Solar Wind / Geomagnetic Activity: There are two potentially Earth-directed CMEs in the forecast, as well as two further candidates (from recent 'disappearing filaments') awaiting imagery.

The first CME in the forecast is from a filament eruption on Friday 03 December, scheduled to pass the radius of Earth's orbit as a near-miss of Earth on Tuesday 07 December. A placeholder 5% risk of G1 is included as a result. The second CME is a faint emission from a 'filament eruption' on Sunday 05 December, and is expected to arrive day 4 (Thursday 09 December) at 09/1800UTC +/-9 hours, but again confidence is low due to limited imagery for analysis.

In terms of the unperturbed solar wind, the current fast wind is expected to ease from day 2 onward (Tuesday 07 December), before a further fast wind enhancement is also possible towards the end of day 4 (Thursday 09 December). All considered, there is a Slight Chance of G1 on day two from the probable near miss from the 03 December CME, with the period rounded out by a 20% Chance of G1 should the 05 December CME materialise.

Energetic Particles / Solar Radiation: No solar radiation storms are expected.

Geomagnetic Storms:

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	5	1	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)