
Space Weather Technical Forecast

Issued on Wednesday, 28 June 2023 at 13:22 Local

This technical 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: Moderate solar activity likely. Chance of Active fluence likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with two M-class flares observed from the vicinity of AR3340 in the northwestern quadrant. The strongest of these flares was an M1.9 at 28/0844UTC, although it does not appear to have generated a CME. AR3354 in the northeast quadrant has rapidly evolved into a Beta-Delta region, with the delta spot contained within the central part of this increasingly compact region. A CME which left the northeast of the Sun late on 27 June from the vicinity of AR3354 is forecast to glance the Earth on 01 July, but with low confidence. The remaining seven sunspot regions do not currently pose a risk of significant flare activity.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, appears to have stabilised at around 450km/s after following a declining trend from 500km/s. Density has been around average throughout. Total magnetic field strength was weak, with the north-south component, Bz, varying weakly. Phi angle was predominantly negative (towards the Sun). Geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as observed by GOES16, was at background levels. High energy electron flux (greater than 2MeV), as observed by GOES16, reached high levels at the diurnal maximum with a peak value of 2110pfu at 27/1625 UTC. The associated 24-hour fluence rose during the day but was still below Active, with an observed value of 6.23e7 integrated pfu at 28/0000UTC.

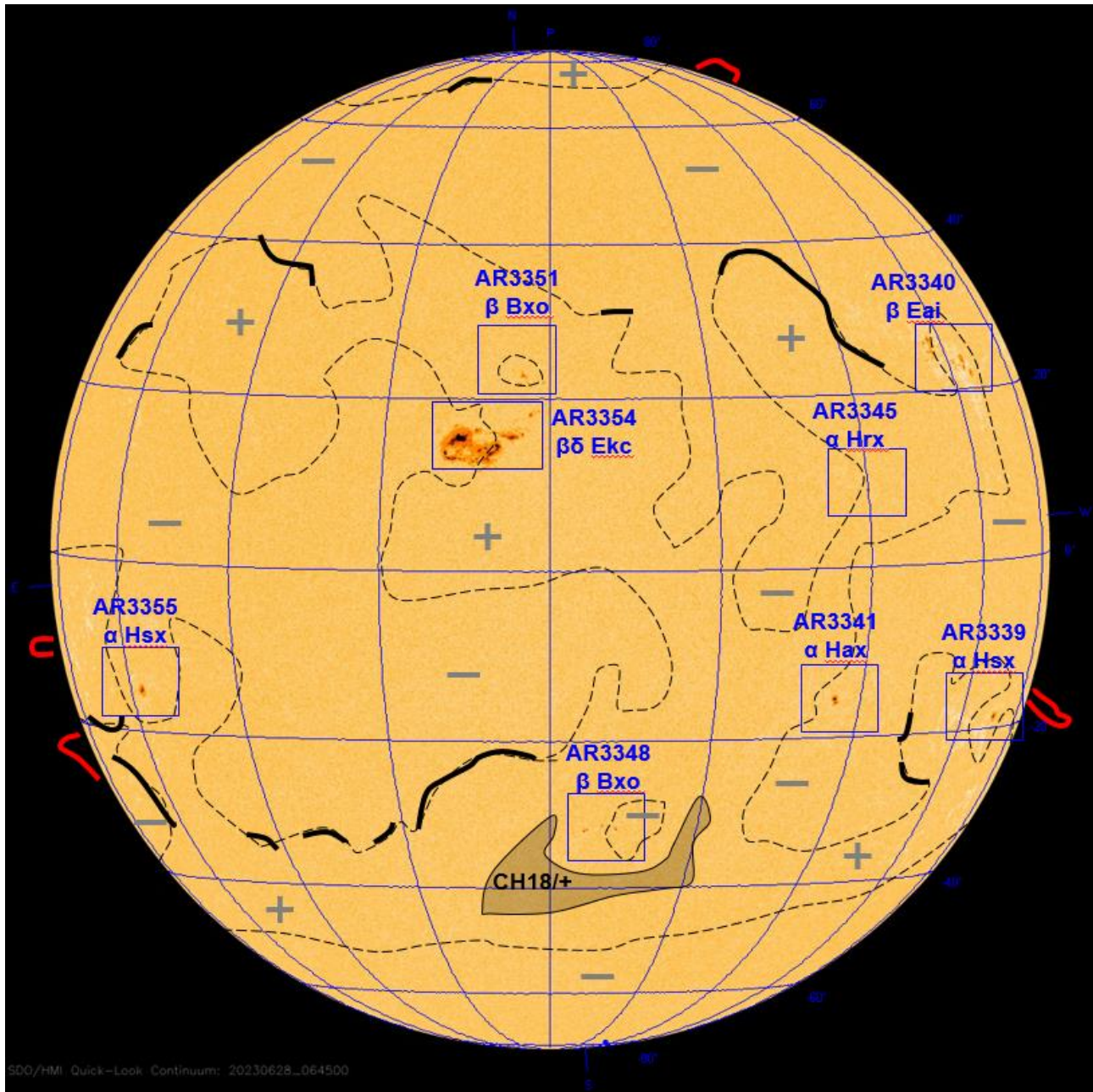
Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low to Moderate, with a slight but increasing chance of X-class flares, mainly from AR3354.

Solar Wind / Geomagnetic Activity: A CME which left the Sun on 27 June may glance the Earth on 01 July, but with low confidence. Solar wind speeds are expected to be relatively muted in the absence of any forecast high speed streams. Geomagnetic activity is forecast to be Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is most likely to remain at background levels but with a slight chance of reaching the S1/Minor Storm level, mainly due to AR3354 and AR3340. High energy electron flux (greater than 2MeV) is likely to continue to peak at high levels at the diurnal maxima in the coming days but possibly with a declining peak. There is a chance of Active (1e8 integrated pfu) fluence through this period.

Figure 1. Solar Analysis Valid 28/0800UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

A CME which left the northeast quadrant of the Sun on 27 June may glance the Earth on 01 July, but this is low confidence, with a range of arrivals between 30 June and 02 July possible.

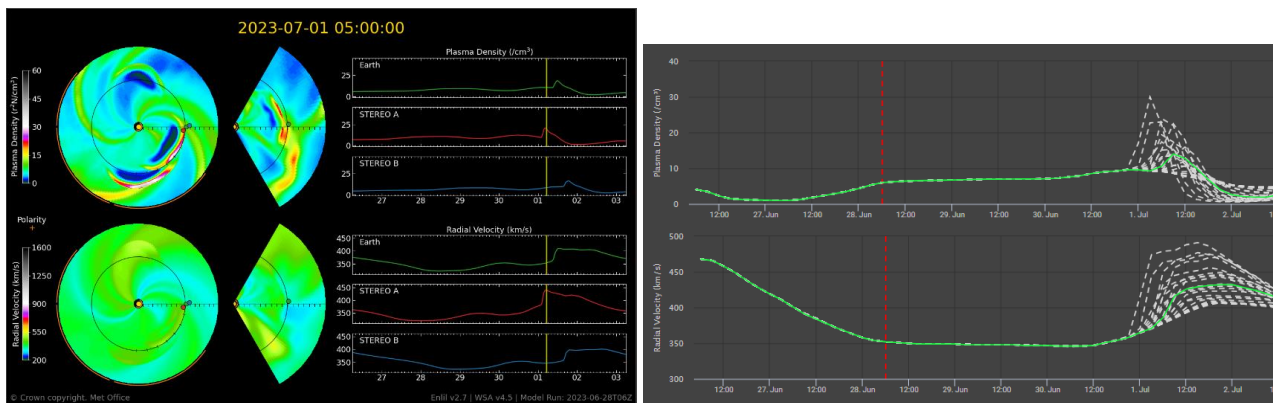
Solar wind speeds have declined to 450km/s and appear to have stabilised at this speed.

Recurrent coronal hole 18 is unlikely to become geoeffective, as it is a weakening feature with only limited effects on Earth during the previous rotation. No further coronal holes are discernible on satellite imagery.

Geomagnetic activity is expected to be mainly Quiet to Unsettled, with a very slight chance of G1/Minor Storms due to the low confidence CME glance.

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	1	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil and MOSWOC Enlil ensemble forecast, showing the possible CME glance on 01 July.



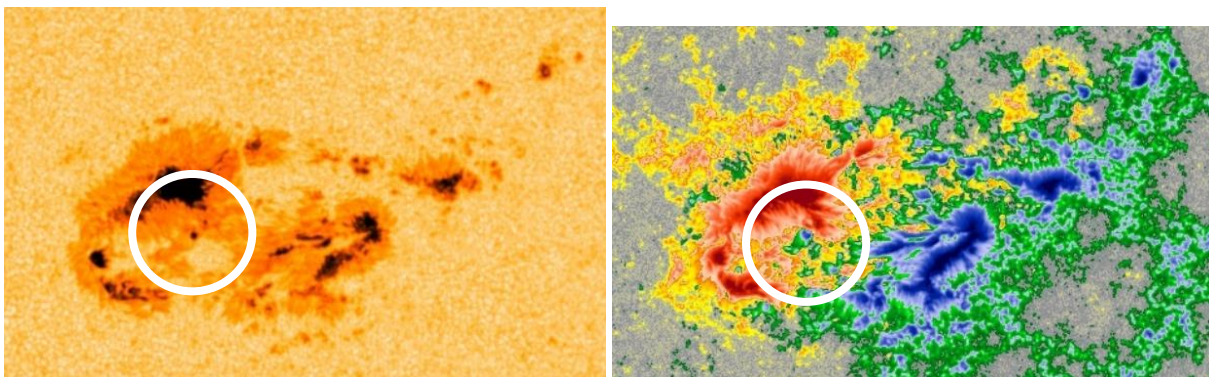
Radio Blackouts - X-Ray Flares:

Solar activity has been Moderate, with two M-class flares observed from the vicinity of AR3340. This appears to be a fading region, but this appearance could be due to the location close to the northwestern limb. AR3354 in the northeast is the most rapidly evolving region and has developed a central, weak delta spot as the whole region becomes more compact. This region contains enough indicative flux to produce X-class flares and will be monitored closely. The remaining regions are all relatively simple and inactive.

Solar activity is expected to be mainly Low to Moderate with a slight chance of X-class 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	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: AR3354 (Ekc/beta-Delta) with the central weak delta spot indicated.



Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux, as observed by GOES16, is at background levels and is most likely to remain so throughout the period. However there is a slight chance of reaching the S1/Minor Storm threshold, mainly due to AR3354 and AR3340. AR3354 in particular has developed rapidly and is the reason for the increase in the probability of radiation storms as it moves towards the western hemisphere.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	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	$\geq \text{S1}$	No	10	10	10	10
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2MeV) has oscillated between moderate and high levels through the last 24 hours, but the second high peak is lower than the one on 27 June, suggesting early indications of a declining peak. Despite this being too early to suggest a downward trend, the lack of significant solar wind inputs suggests this is the more likely trend. The forecast CME at the end of the period is unlikely to be a significant factor in enhancement of electron counts.

Electron fluence increases have slowed, with a reduced risk of reaching the Active threshold during the forecast period.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	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	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	40	40	40	40
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1