

**Space Weather Technical Forecast**

Issued on Saturday, 03 June 2023 at 01:18 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>**

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**Space Weather Forecast Headline: Chance of M-class flares (R1-R2, Minor-Moderate radio blackouts) throughout.**

**Analysis of Space Weather Activity over past 24 hours**

**Solar Activity:** Solar activity has been Moderate, with only a M1.5 flare observed from AR3324 in the north-centre disc at 02/0241UTC. There are eight regions on the disc, with AR3323, the most distinctive, but relatively inactive. AR3319 appears to have also matured and is also showing limited activity. AR3325, just to the south of AR3324 in north-centre disc has evolved quickly and based on current trend could become a significant region. The remaining regions appear stable. No Earth-directed CMEs have been observed on available imagery.

**Solar Wind / Geomagnetic Activity:** Solar winds as observed at L1 have declined from 425km/s to 350km/s as the Earth appears to have exited the high speed stream from coronal hole 08. Density has stayed below average. Total magnetic field strength was weak at below 5nT, with the north-south component varying weakly through the period. Phi angle was negative (towards the Sun) throughout. Geomagnetic activity was Quiet to Unsettled.

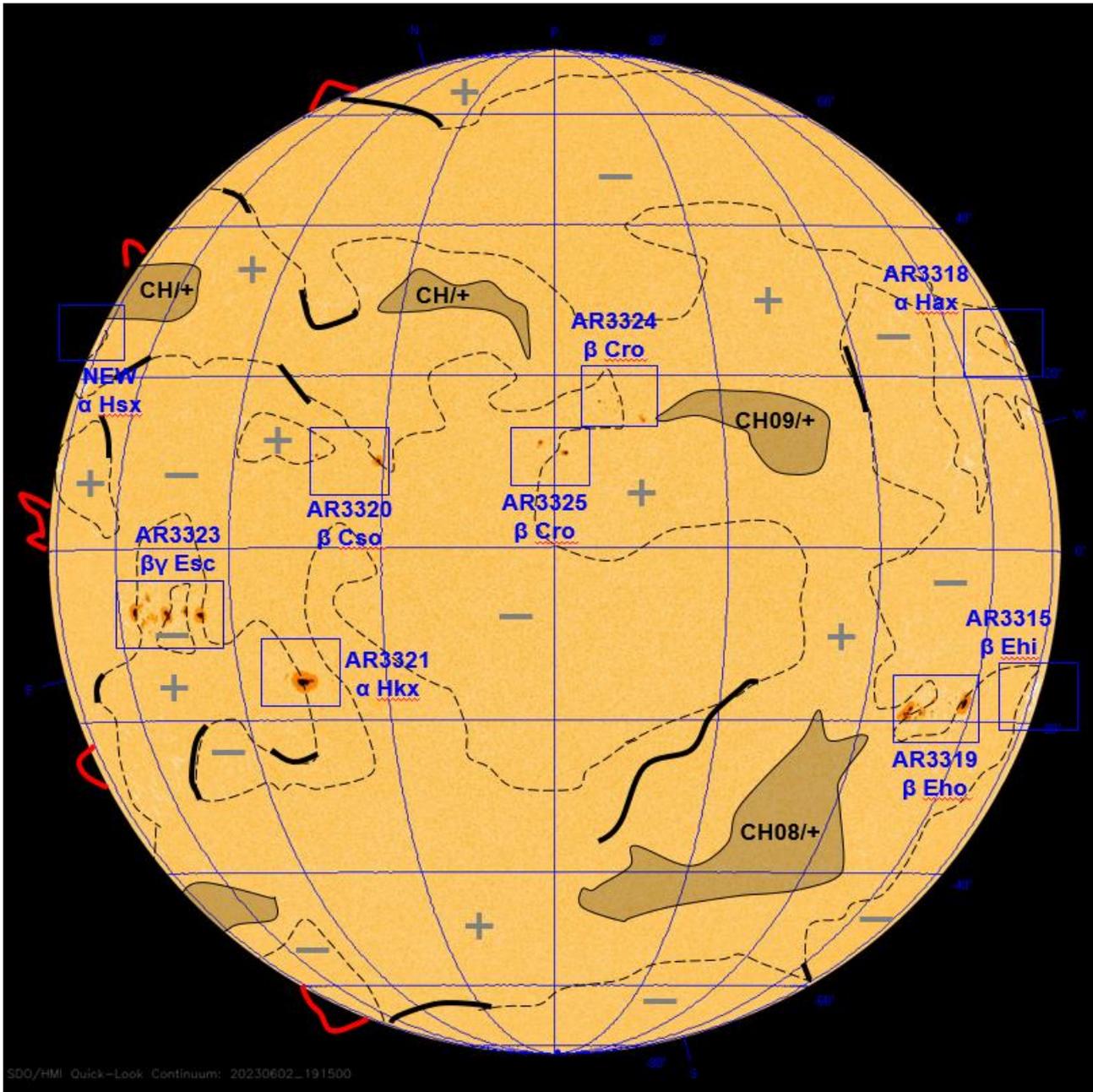
**Energetic Particles / Solar Radiation:** High energy proton flux (greater than 10MeV) has remained at background levels throughout. High energy electron flux (greater than 2MeV) was at background to moderate levels. The associated 24-hour fluence has been below the Active threshold (1e8 integrated pfu) on a steady trend. Electron fluence observed at 03/0000UTC was 4.14e6 integrated pfu.

**Four-Day Space Weather Forecast Summary**

**Solar Activity:** Solar activity is likely to be mainly Moderate due to the two most active regions on the visible disc, one in the southeast and one in the north-centre disc. There is a low risk of High activity being reached, especially from AR3323.

**Solar Wind / Geomagnetic Activity:** No Earth directed CMEs are forecast. Solar wind speeds are forecast to be at mainly ambient levels, but with a possibility of reconnecting to the high speed stream from coronal hole 08 or perhaps coronal hole 09 during 03 and 04 June. Speeds could reach speeds of close to 500km/s due to any high speed stream effects. Mainly Quiet to Unsettled geomagnetic activity with a very slight chance of Active or G1/Minor Storm intervals.

**Energetic Particles / Solar Radiation:** The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, however there is a slight chance of reaching the S1/Minor Storm threshold should any higher energy flares occur. High energy electron flux (greater than 2MeV) is expected to be at mainly background to moderate levels in the absence of significant high confidence increases. Electron fluence is also expected to continue below the threshold.

**Figure 1. Solar Analysis Valid 03/2000UTC.**


**Key:** Filament      , Prominence      , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson  $\alpha$ - $\beta$ - $\beta\gamma$ - $\beta\gamma\delta$  and Zurich-McIntosh Axx etc.

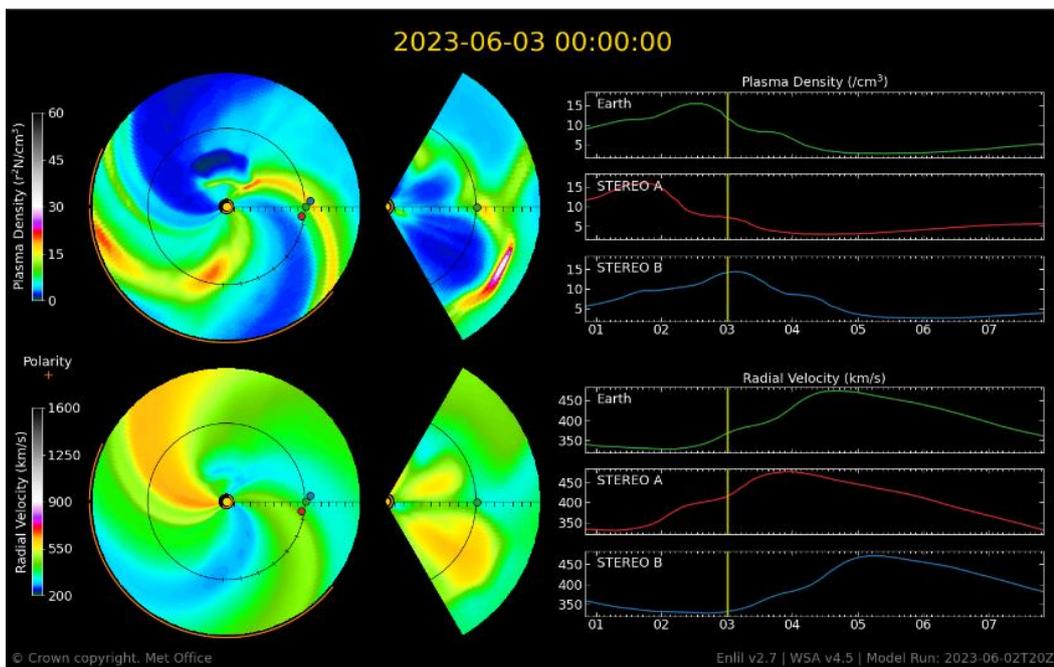
## Geomagnetic Storms:

No Earth-directed CMEs are forecast. Solar winds have shown a steady decline through the last 24 hours, as the Earth apparently moves out of the high speed stream from coronal hole 08. MOSWOC Enlil suggests that the bulk of the high speed stream may pass to the south of the Earth and this may be the reason for an earlier than expected decline. However the hole is consistently evolving, along with coronal hole 09 to the north, so further connections are possible through 03 and 04 June as both coronal holes remain in potentially geoeffective locations.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled, with a slight chance of Active or G1/Minor Storm intervals, should the Earth reconnect with the high speed stream.

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)
			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	10	1	1
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 with the side view on the left indicating the possibility of the high speed stream from coronal hole 08, shown in brighter colours in the bottom right side view, missing the Earth to the south. Interestingly, the high speed stream from coronal hole 08 is shown as missing to the north.



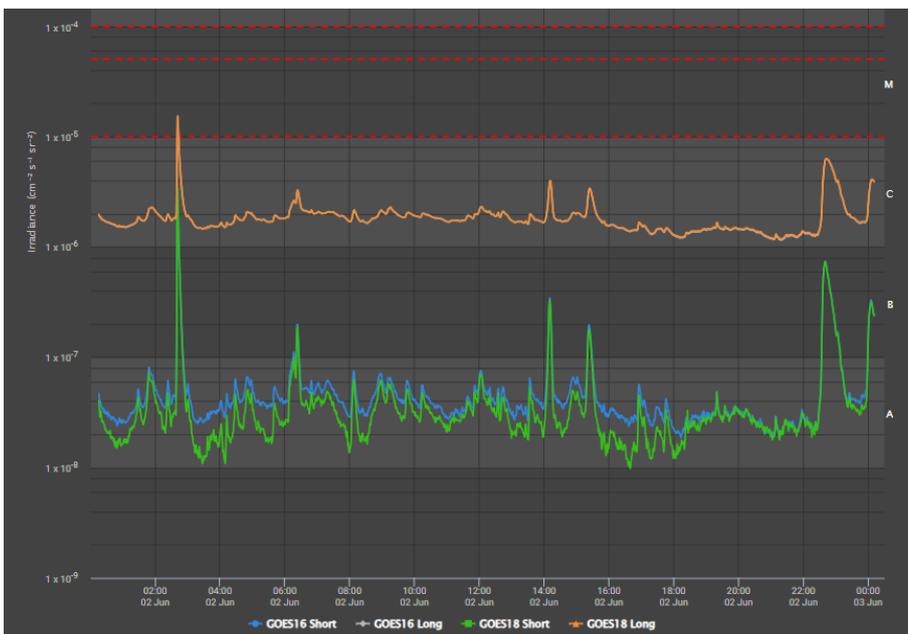
## Radio Blackouts - X-Ray Flares:

There are eight sunspot regions on the visible disc. AR3323 (Esc/ $\beta\gamma$ ) is the most dominant region, with development slowing after a previously rapid increase in complexity. AR3319 (Eho/ $\beta$ ) is also complex, but has been recently inactive along with AR3323. Ex-3311 just beyond the western limb still carries a potential for visible flares. AR3325 in the north-centre disc has been the most active region over the last 24 hours despite a relatively simple appearance, being the source of the only M-class flare. AR3325, to the south of this region, but also in the north-centre disc has evolved quickly over the last 24 hours. A number of new or returning regions are due to rotate onto the disc from the eastern horizon and could affect the flare risk later in the period.

Solar activity is Moderate and is expected to remain Moderate with a slight chance of High activity due to the highly complex regions on the disc.

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: GOES 16 X-ray flux



**Solar Radiation Storms - (High Energy Protons):**

The high energy (greater than 10MeV) proton flux, is at background levels and expected to remain so. A slight chance of S1/Minor Radiation Storms is maintained should any larger flares occur. The greatest risk currently appears to be from AR3319 located in the southwest and is becoming increasingly favourably positioned, but has not produced any recent flare activity.

Radiation Storms	Level (cm <sup>-2</sup> sr <sup>-1</sup> s <sup>-1</sup> )	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	10	10	10	10
Very Active	≥ S3 <sup>*</sup>	No	1	1	1	1

\* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm<sup>-2</sup>sr<sup>-1</sup>s<sup>-1</sup>)

**High Energy Electrons Event (≥ 2MeV):**

High energy electron flux (greater than 2MeV) is expected to remain at mainly background to moderate levels through the period, in the absence of significant modification from solar wind effects. The recent high speed stream appears to have declined towards background, and with no further high speed streams or CMEs expected, there is no clear method for the flux to increase.

Electron fluence is following a steady trend, with this expected to continue in the absence of an increase of flux values.

GEO Electron Environment	Level (cm <sup>-2</sup> sr <sup>-1</sup> day <sup>-1</sup> )	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	≥ 2 MeV ≥ 1x10 <sup>8</sup>	No	1	1	10	10
Very Active	≥ 2 MeV ≥ 1x10 <sup>9</sup>	No	1	1	1	1