

QUARTERLY REPORT ON PAST SPACE WEATHER

Q4 2022

1.10.2022 – 31.12.2022

SUNSPOT NUMBERS

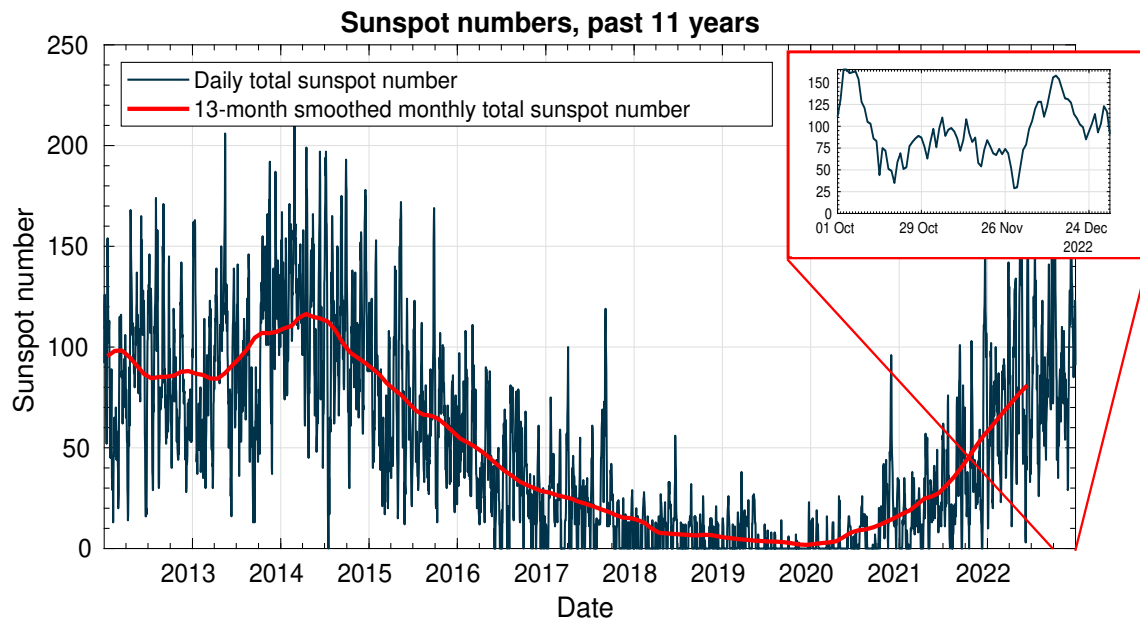


Figure 1: Sunspot numbers for the past 11 years and the last quarter. (Data from SILSO)

FLARES

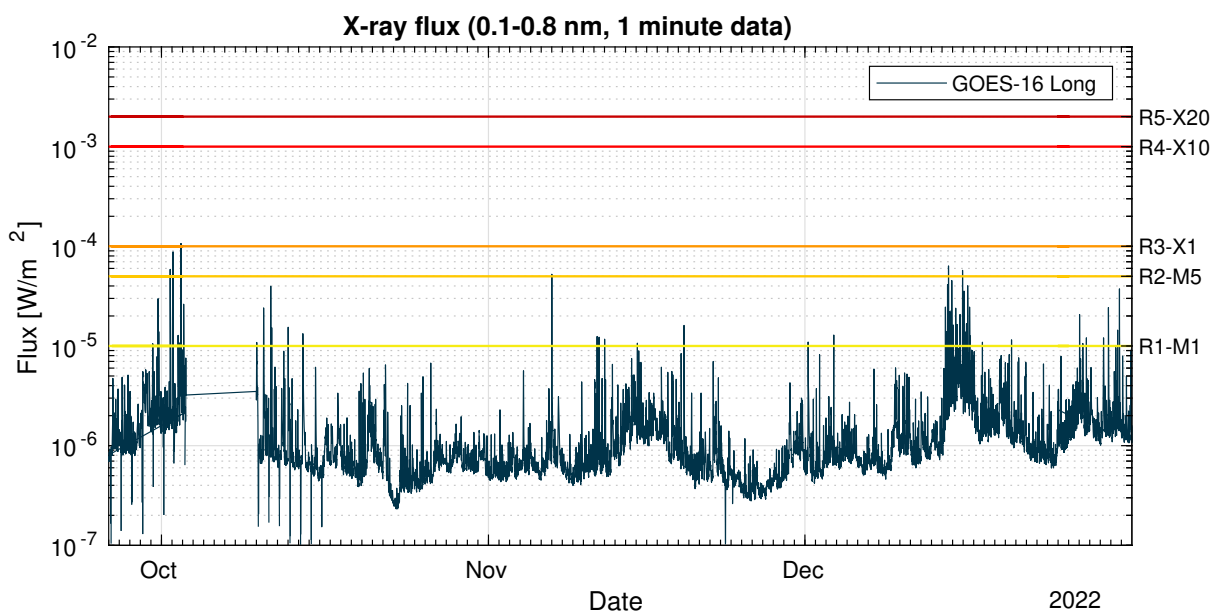


Figure 2: GOES X-ray flux (GOES – SWPC/NOAA) together with the NOAA Space weather scale thresholds for radio blackouts. (For more information on the NOAA Space Weather Scales, see <https://www.swpc.noaa.gov/noaa-scales-explanation>)

SOLAR ENERGETIC PARTICLES

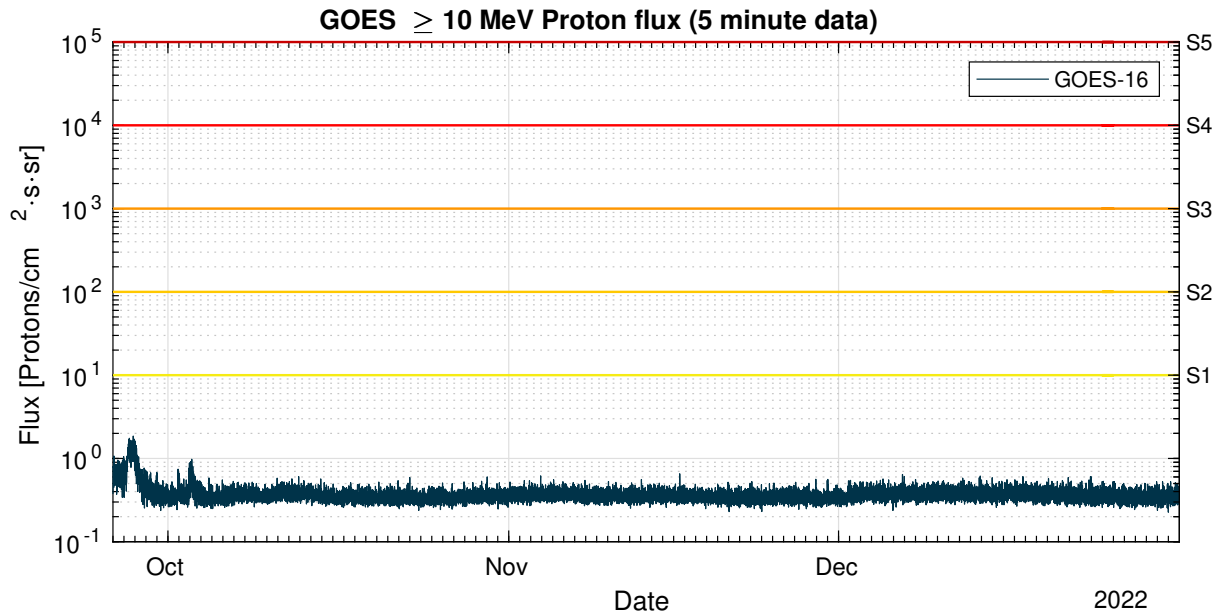


Figure 3: GOES proton flux (GOES - SWPC/NOAA) together with the NOAA Space weather scale thresholds for Solar Radiation Storms. (For more information on the NOAA Space Weather Scales, see <https://www.swpc.noaa.gov/noaa-scales-explanation>)

SOLAR WIND

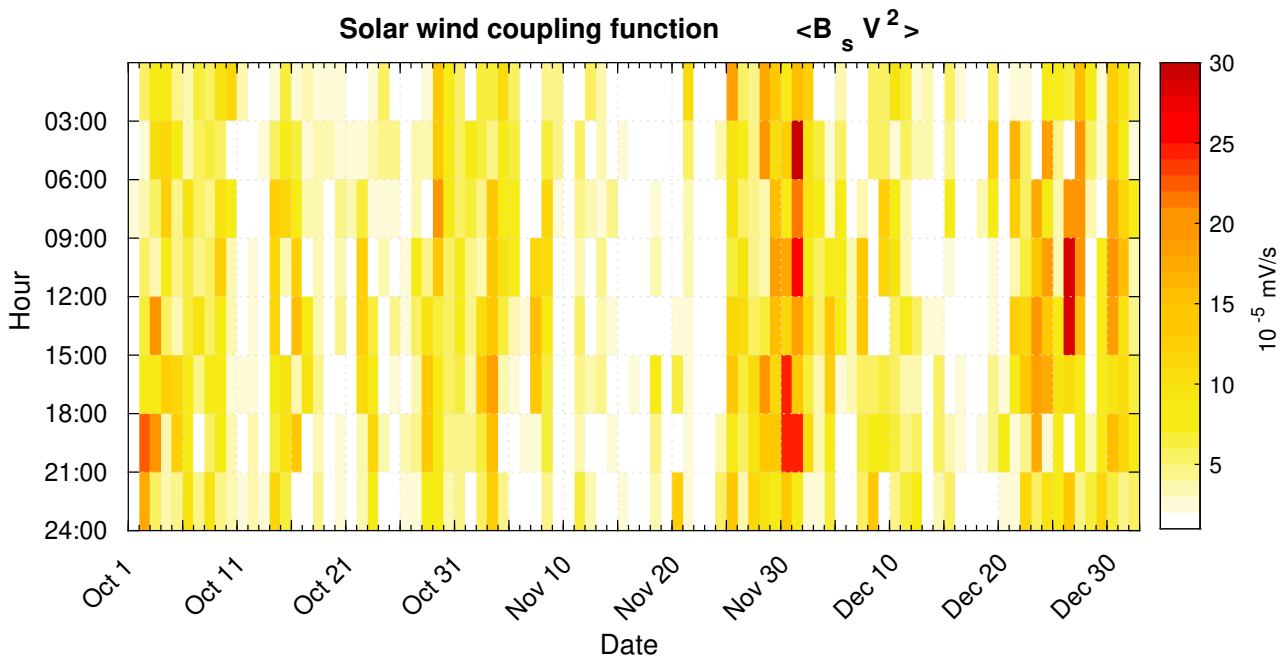


Figure 4: 3-hourly mean values of the Solar wind coupling function $\langle B_s V^2 \rangle$ based on ACE data. (NOAA/SWPC)

GEOMAGNETIC CONDITIONS

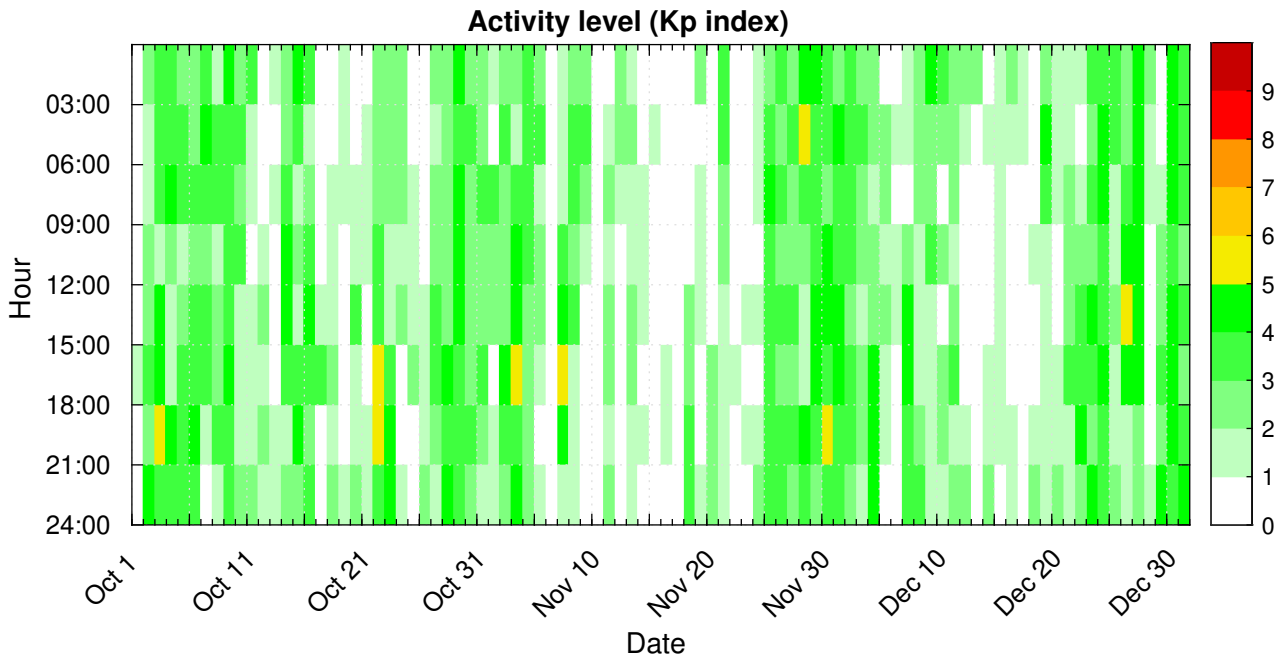


Figure 5: Kp index. (Data from GFZ Potsdam.)

CORONAL MASS EJECTIONS AND HIGH-SPEED STREAMS

A list of high-speed streams (HSS) and coronal mass ejections (CMEs) that caused a global geomagnetic disturbance of minor storm (Kp 5) or higher are listed in the table below. The listed date is the first day of the geomagnetic disturbance where the Kp index crossed the threshold for a minor storm. The maximum Kp is the maximum Kp index value caused by the HSS or CME.

Table 1: Major geoeffective coronal mass ejections (CMEs) and high-speed streams (HSS)

Date	Type	Storm level	Max Kp
03. October 2022	HSS	Minor	5.67
22. October 2022	HSS	Minor	5.33
03. November 2022	HSE	Minor	5.0
07. November 2022	HSS	Minor	5.0
28. November 2022	HSS	Minor	5.33
30. November 2022	HSS	Minor	5.33
26. December 2022	CME?	Minor	5.67

(Source: Solar Influences Data analysis Center – RWC Belgium and GFZ Potsdam)



ACKNOWLEDGEMENTS

Data from:

SILSO - <http://www.sidc.be/silso/>

GOES - <https://www.ngdc.noaa.gov/stp/satellite/goes/index.html>

DONKI - <https://kauai.ccmc.gsfc.nasa.gov/DONKI/>

DSCOVER/ACE – NASA/NOAA /SWCP - <https://www.ngdc.noaa.gov/dscovr/portal/index.html#/>

GFZ Potsdam - <https://www.gfz-potsdam.de/en/kp-index/>