

17 November 2018, Magnetically Speaking an Exceptionally Quiet Day

Whitham D. Reeve

1. Magnetogram

One indication that a sunspot cycle is approaching its minimum is the steady reduction in geomagnetic activity over time. The magnetogram for Anchorage, Alaska on 17 November illustrates this point for cycle 24 (figure 1). This is the first time in almost 10 years of monitoring Earth's magnetic field that I have seen a zero K-index for a 24 h period. I discuss the K-index and additional details below.

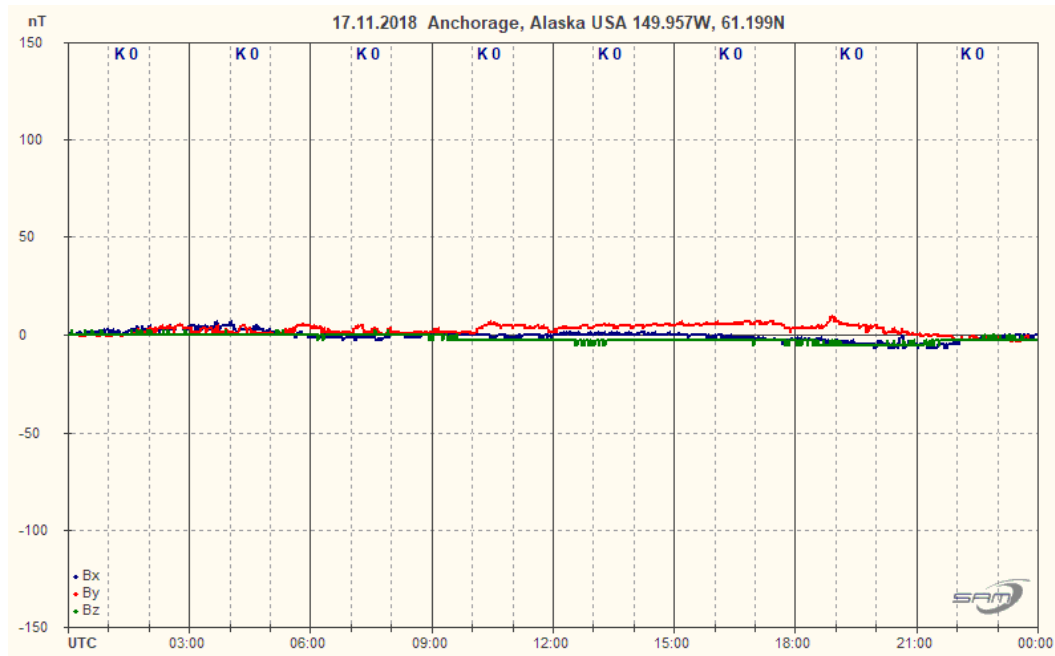


Figure 1 ~ Magnetogram for 17 November 2018 recorded at Anchorage, Alaska using the SAM-III 3-axis magnetometer. Recording a K-index of 0 for a 24 h period indicates very quiet magnetic conditions. The magnetogram is normalized at midnight, thus the scale indicates relative magnetic induction variations.

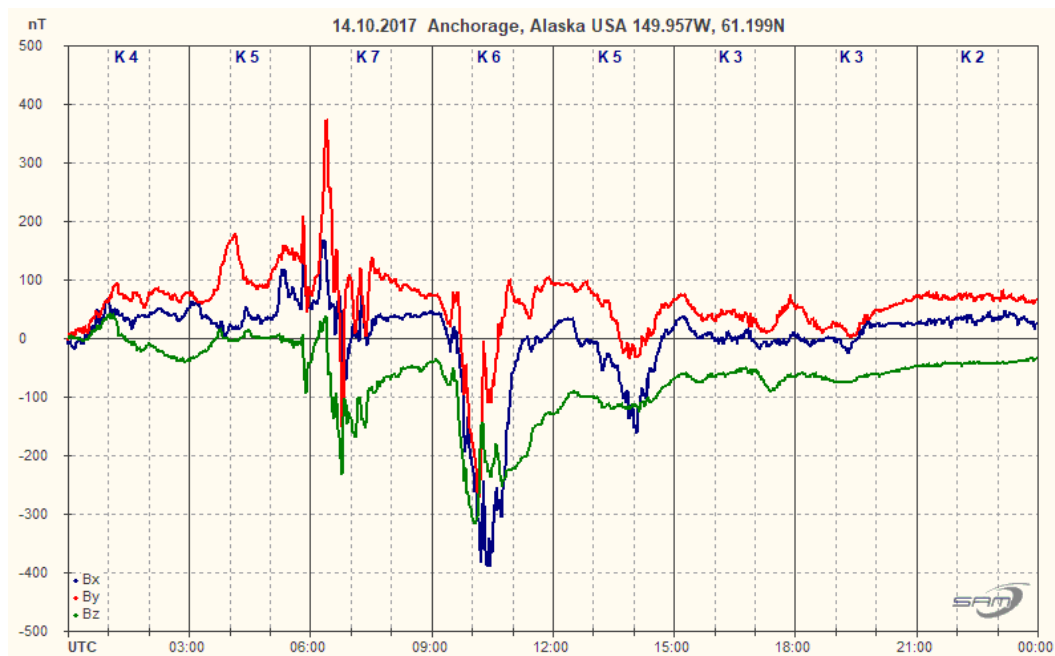


Figure 2 ~ Magnetogram for 14 October 2017 for comparison with above. This was a magnetically active day. It was caused by a combination of southward Bz component in the interplanetary magnetic field along with the influence of a coronal hole high-speed stream. Note the scale compared to the quiet day.

Geomagnetic variations are naturally larger at higher latitudes, so it is notable when the magnetogram at Anchorage, which is at 61° north latitude, varies only slightly. For comparison, the magnetogram for a magnetically active day is shown for 14 October 2017, one year earlier (figure 2). The latter observation was reported in more detail in [Reeve17](#).

Magnetic variations often are measured in terms of the K-index, and, as previously mentioned, on 17 November the K-index at Anchorage remained at zero (K0) for the entire 24 h period. The K-index is a quasi-logarithmic scale used to quantify the peak variations in the magnetic field during three hour intervals (synoptic periods). It was conceived by J. Bartels in 1939 [Bartels39]. The K-index ranges from 0 (very quiet) to 9 (very active) with K5 and higher indicating magnetic storm conditions.

The K-index is calculated at professional observatories from the horizontal component (vector sum of east-west, B_y , and north-south, B_x , components) of Earth's magnetic field. However, the SAM-III magnetometer used in Anchorage calculates the index separately for each of the three axes, B_x , B_y and B_z (vertical). The SAM-III system used to produce the magnetograms shown here is setup to display the highest K-index value of the three axes.

2. Polar Diagram

The SAM magnetometer also can display a polar diagram, which shows the two horizontal field vector components B_x and B_y (figure 2). For comparison, the polar diagram is shown for a magnetically active day as above (figure 3).

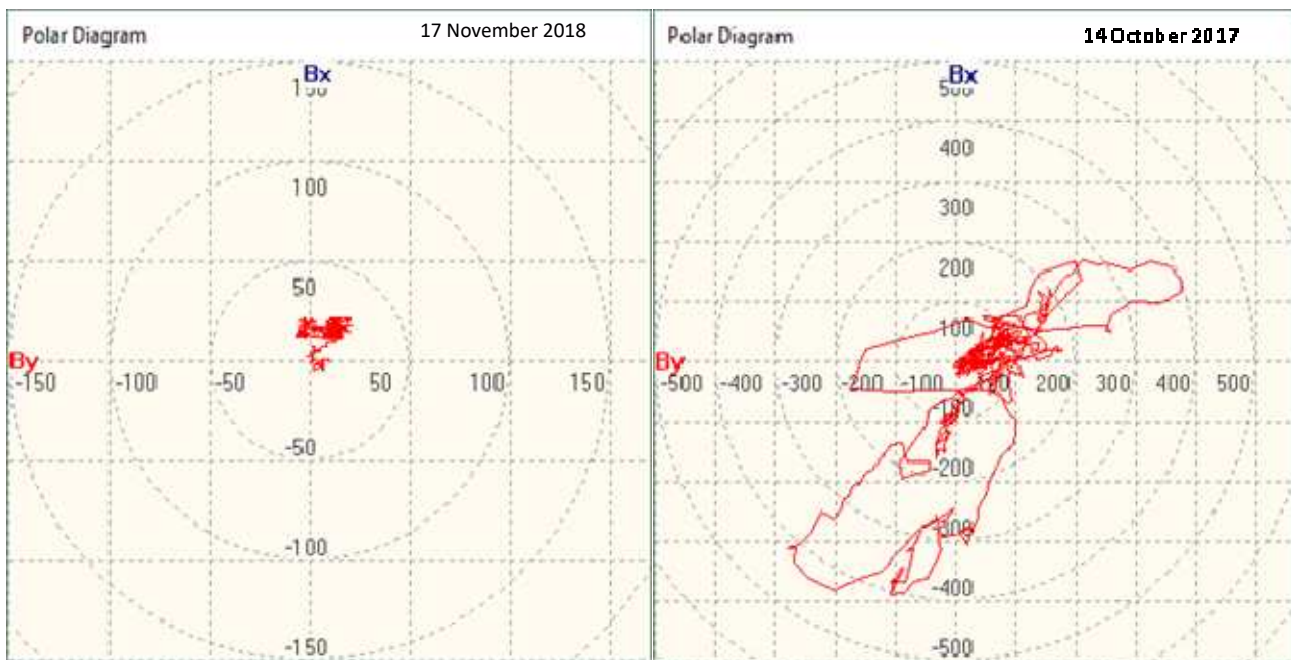


Figure 3 ~ Polar Diagrams for 17 November 2018 and 14 October 2017 showing the values for B_x and B_y throughout the 24 h period. Note scale differences.

3. Discussion

Space Weather Prediction Center simply reported for 17 November “*The geomagnetic field was quiet under a nominal solar wind regime.*”{SWPC} As of this writing, the sunspot cycle minimum has not yet arrived but it is not far away. Readers wishing to learn more about the relationship between geomagnetic activity and the sunspot cycle can download the **Geomagnetism Tutorial** at {Reeve15}.

4. References & Weblinks

- [Bartels39] J. Bartels, N. Heck, H. Johnston, The Three-Hour-Range Index Measuring Geomagnetic Activity, Terrestrial Magnetism and Atmospheric Electricity, Vol. 44, No. 4, Pg 411–454, 1939
- {Reeve15} Reeve, W., Geomagnetism Tutorial, 2015. This document may be downloaded at:
<http://www.reeve.com/Documents/SAM/GeomagnetismTutorial.pdf>
- {Reeve17} Reeve, W., Observations of Geomagnetic Storm Conditions at Anchorage, Alaska on 14 October 2017, Radio-Astronomy, November-December 2017, Society of Amateur Radio Astronomers. Paper may be downloaded: at
http://www.reeve.com/Documents/Articles%20Papers/Observations/Reeve_Mag_CHHSS_14Oct2017.pdf
- {SWPC} Forecast Discussion, 17 November 2018, 1230 UTC:
ftp://ftp.swpc.noaa.gov/pub/forecasts/discussion/11171230forecast_discussion.txt