

## Geomagnetic detection of the sectorial solar magnetic field and the historical peculiarity of minimum 23-24

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Analysis is made of the geomagnetic-activity aa index covering solar cycle 11 to the beginning of 24, 1868-2011. Autocorrelation shows 27.0-d recurrent geomagnetic activity that is well-known to be prominent during solar-cycle minima; some minima also exhibit a smaller amount of 13.5-d recurrence. Previous work has shown that the recent solar minimum 23-24 exhibited 9.0 and 6.7-d recurrence in geomagnetic and heliospheric data, but those recurrence intervals were not prominently present during the preceding minima 21-22 and 22-23. Using annual-averages and solar-cycle averages of autocorrelations of the historical aa data, we put these observations into a long-term perspective: none of the 12 minima preceding 23-24 exhibited prominent 9.0 and 6.7-d aa recurrence. We show that the detection of these recurrence intervals can be traced to an unusual combination of sectorial spherical-harmonic structure in the solar magnetic field and anomalously low sunspot number. We speculate that 9.0 and 6.7-d recurrence is related to transient large-scale, low-latitude organization of the solar dynamo, such as seen in some numerical simulations.

Keywords: Geomagnetism, Magnetic observatory, Recurrent geomagnetic activity, Solar-terrestrial interaction, Solar wind, Solar dynamo