What do we know of Space Climate from Geomagnetic Activity?

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Geomagnetic activity forms one of the most reliable and versatile ways to study the long-term change in the Sun and heliosphere, i.e., Space climate. Continuous measurements of geomagnetic activity exist since the mid-19th century, covering nearly 170 years. In addition to the long-term trend, geomagnetic activity depicts persistent patterns and periodicities, the most dominant of which are the solar cycle variation and the semiannual variation. Other significant periodicities include the annual variation, 1.3-1.8-year variation and the 22-year variation. All these variations reflect some fundamental properties of the Sun and the Sun-Earth connection. Interestingly, although some of these patterns are known for nearly 150 years, they are properly appreciated and understood only since recently. In this contribution I review the principles and status of the traditional and new indices of geomagnetic activity, discuss the present understanding of the various systematic patterns depicted by geomagnetic activity, including the centennial change of geomagnetic activity and its implications about the long-term change of the Sun.