

Examination of local geomagnetic jerks using wavelet analysis

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Wavelet analysis can be used to identify singular behavior in time-series by using an appropriate analyzing wavelet. Detection of geomagnetic jerks, sudden variation of secular acceleration of the geomagnetic field components, has been tried using third time-derivative of a Gaussian as the analyzing wavelet and it has been confirmed that geomagnetic jerks occurred globally around 1968 and 1978 (Alexandrescu et al., 1995). Location of extrema lines of the wavelet transform in the time-dilation diagram and the absolute value of the wavelet transform along the extrema lines, ridge functions, were used to identify the geomagnetic jerks and to discuss regularity of them.

Observation of geomagnetic field using satellites allowed identifying local geomagnetic jerks of 2003 and 2007 (e.g. Chulliat et al., 2010), whose signatures are seen strongly in south Atlantic region in secular acceleration map. We attempted to analyze the two local geomagnetic jerks by applying a wavelet analysis on time series of magnetic field at geomagnetic observatories. The analyzing wavelet is the same as that used by Alexandrescu et al. (1995). The two local geomagnetic jerks were successfully identified in wavelet transform at Mbour (MBO, Senegal), but only the one around 2007 was identified in that at Chambon la Foret (CLF, France). The global jerks and local jerk around 2003 at MBO showed similar regularity. However, the regularity of the local jerk around 2007 at MBO and CLF is higher than that of the other jerks. These results might imply that the generation mechanism of the local geomagnetic jerk around 2007 is different from those occurred globally around 1969 and 1978 and locally around 2003.

Reference:

Alexsandrescu, M. et al., 1995, JGR, 100, 12,557-12,572.

Chulliat, A. et al., 2010, GRL, 37, L0730.