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Space-time structure of the 2003 geomagnetic jerk at Mid-Eastern Asia

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The 2003 jerk has an abrupt change in the geomagnetic secular variation (SV), and was recognized as a local phenomenon of internal origin from the satellite observations (Olsen and Mandea, 2007). Notable strength of the 2003 jerk is located at Mid-Eastern Asia. The temporal and spatial features at this area are important to resolve the Earth's core fluid flow dynamics at local scale (e.g. Wardinski et al., 2008). We investigate the temporal-spatial development of the 2003 jerk in more detail at Mid-Eastern Asia with the ground-based observations and CHAOS-3 core field model.

We select the data in the international geomagnetic quiet days to calculate the monthly means. In order to reduce the influence of the external field, we adopt a function comprising the terms associated with the indices of the geomagnetic activity, and the terms of the periodic signals on the observatory monthly means data (Stewart and Whaler, 1992). We then use an empirical AR-2 model to represent the internal field signals in the observatory data. The extreme detection is applied to identify the jerk in the SV time series. The onset time and the strength of the 2003 jerk are obtained through the detection for geomagnetic field component, X, Y and Z. The maximum of the strength of the 2003 jerk is located under the Indian mainland. The onset time of this jerk propagates approximately southeastward. Two jerks in 2001 and 2003 for the Z component are further compared and they are confirmed as independent processes. We suggest the jerk in 2001 identical to the well known 1999 jerk in Europe (Mandea et al., 2000). Our results reveal the fine structures of the 2003 jerk that corroborate the conclusions in previous studies. The larger scale time-spatial structure given by the AR-2 model constructed from ground observatory data (monthly values) is consistent with the results from the CHAOS-3 model. This structure can be applied for further inversion of the local core surface fluid flow motions.

Reference

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