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A coupling between geometry of the main geomagnetic field tectonic margins and seismicity

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Integrated studies involving geomagnetism, geodynamics, and seismology are essential for advances in understanding the Earth dynamics. This work presents recent results based of the International Geomagnetic Reference Field (IGRF-10) model, Digital Tectonic Activity Map (DTAM-1), and the global seismological catalogue (173477 events for 1973-2010 with $\geq$4.5). It will be shown that:

1. The geometry of the main geomagnetic field controls a spatial distribution of seismicity around the globe. This becomes apparent when geomagnetic field components are analyzed using the geocentric solar magnetospheric (GSM) coordinate system. Earthquakes prefer occur in the regions where geomagnetic Z_GSM component reaches large positive value, that takes place at low and middle latitudes. In the areas of strongest seismicity, that takes place at low and mid latitudes in the eastern hemisphere, the Z_GSM values are largest compared to all other regions of the planet. The possible maximal magnitude of earthquake (Mmax) has a linear dependence on the logarithm of absolute Z_GSM value in the epicenter in the moment of earthquake occurrence.
2. There is a geomagnetic conjugacy between certain tectonic structures. In particular, the middle ocean ridges located in the southern hemisphere along the boundary of the Antarctic tectonic plate are magnetically conjugate with the areas of junction of continental orogens and platforms in the northern hemisphere. Close magnetic conjugacy exists between southern boundary of the Nazca tectonic plate and northern boundaries of the Cocos and Caribbean plates.
3. Variations in the total strength of the main geomagnetic field could be associated, to some extent, with the earthquake occurrence. In particular, the IGRF-10 model shows that in the area of the major 2004 Sumatra earthquake (epicenter 3.3N; 95.98E), the strength of the main geomagnetic field steadily increased from $\sim$ 41338 nT in 1980 to $\sim$ 41855 nT in 2004 with a mean change per year of about 21.6 nT. After the M=9.1 earthquake on December 26 2004, an increase in the geomagnetic field in this area slowed down: from 2005 to 2010, the mean change in geomagnetic field was only 4.7 nT per year. Another example, in the area of a major M=8.0 earthquake in 1995 (epicenter 19.060N; 104.210W) in the Mexican Manzanillo region, the strength of the main geomagnetic field systematically decreased from $\sim$ 42369 nT in 1980 to $\sim$ 41695 nT in 1994 with the mean change of about - 48.1 nT per year. After the earthquake on October 9 1995, the decrease in geomagnetic field speeded up, and from 1995 to 2010, the mean change per year was -77.1 nT.

Possible reasons for the observed effects and future research directions in this area will be discussed.