The relationship between the 2011 Tohoku mega earthquake and geomagnetic field variations in Japan

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On 11 March 2011 at 05:46:23 UTC, a mega earthquake with magnitude 9.0 (The 2011 Tohoku Earthquake; 38.322N, 142.369E) has occurred at a depth of about 24 km near the east coast of Honshu Island, Japan as a result of a thrust faulting on or near the subduction plate boundary between the Pacific and North American plates. Geomagnetic data from MAGDAS network and the Geospatial Information Authority of Japan (GSI) have been analyzed to examine the occurrence of any anomalous signature related to the 2011 Tohoku earthquake on the geomagnetic field measurements in Japan. The results indicate long-term geomagnetic field variations before the 2011 Tohoku mega earthquake; which started from 2005-2006. An increase of about 5 nT in the total geomagnetic field intensity was observed starting from 2009 in the vicinity of the epicenter compared with other reference stations. Moreover, the ratio of annual range of the Z- to H-components daily variations started to decrease from 2005-2006 near the epicenter up to the occurrence of the Tohoku EQ. Concerning the ULF emissions; the polarization ratio (Z/H) of the Pc 3 amplitude started to decrease (near the epicenter) a few weeks before the occurrence of the 2011 Tohoku EQ.