



## Long range pre-seismic geomagnetic effect related to M9 Great Tohoku earthquake on 11 March 2011

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It is supposed that prior to a large earthquake its foci may send through the Earth crust long-range effect of strain-related to transient signals, sometimes strong, but more often very weak and fleeting. Passing through the crust, these signals give rise to geomagnetic variations which are propagated over a wide range of frequencies. Consequently, in this paper, we retrospectively analyzed the geomagnetic data collected at three observatories placed in Japan (Memambetsu, Kakioka) and Romania (Provita de Sus), to confirm same pre-seismic anomalous geomagnetic effect related to the M9 Great Tohoku earthquake occurred on March 11, 2011. The daily mean distributions of the geomagnetic parameter  $B_{zn} = B_z/B_{perp}$  (where:  $B_z$  is vertical component of the geomagnetic field;  $B_{perp}$  is geomagnetic component perpendicular to the strike orientation) and its standard deviation (SD) are performed in the frequency range (0.001Hz to 0.016Hz), by using the FFT band-pass filter analysis. After analyzing the pre-seismic anomalous values obtained at Memambetsu, Kakioka and Provita de Sus observatories, applying a standardized random variable equation, a pre-seismic peak greater than 2.5SD related to the M9 Tohoku earthquake was identified on 5-6 February 2011. The lead time is 32 days before the M9 Tohoku earthquake occurrence. The final conclusion is that the area of precursor detection, under favorable conditions, could be extended to considerable distances from the epicenter of large earthquake.