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Variations of altitude observed on the occasion of the Tohoku Earthaquake (M=9.0) occurred on March 11, 2011 – Further results and Validation

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Since October 1, 2010 a GPS receiver is into operation at Tokai (Japan) in an experiment on Neutrino Physics (T2K). An evident decrease in the altitude appeared from the beginning of March 2011, so that a possible GPS precursor of the Tohoku earthquake seemed to be observed.
In order to investigate in details this possibility we analyzed the GPS data collected during 2011 by GEONet (GPS Earth Observation Network). This is the nation wide GPS array of Japan and consists of 1240 permanent stations. Preliminary results of the analysis [1] show four different behaviours, in particular ten days before the earthquake some possible anomalous variation appeared. This behaviour was revealed in some stations of the network located mainly near the epicentral area.
Funther Analysis have been performed in order to confirm hourly behavior of the GPS station altitude. PSI (Persistent Scatterer Interferometry) technique has been used in order to validate GPS data. PSI is the most advanced class of differential interferometric Synthetic Aperture Radar techniques (DINSAR). This technique makes use of a multi-image processing method which is able to detect millimetric terrain motion phenomena. Two stack of 21 COSMO-SkyMed Stripmap-Himage data have been used in order to perform PSI Analysis.
Clear variations of altitude were revealed by the GPS data on the occasion of the Tohoku earthquake. The co-seismic and post-seismic ones represent a very known phenomenon also taking into account the very large magnitude of the earthquake. The possible variations starting around ten days before the earthquake seem to confirm the observation in the T2K Neutrino experiment and they can represent short term precursors of the earthquake.
In order to confirm this possibility more detailed studies have been conducted using hourly data. The possibility that they are produced by some variations in the ground (producing AGW) cannot be excluded.

Acknowledgements
COSMO-SkyMed images were provided by ASI - CIDOT

[1] Milillo, P.; Vespe, F.; Maggipinto, T.; Schiavulli, L.; Ligonzo, T.; Biagi, P. F.. Variation of altitude observed on the occasion of the Tohoku Earthquake occurred on March 11, 2011, OSP Award NH section.