Seismo-electromagnetic anomalies in ELF range observed by an induction magnetometer in Kuju

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Seismo-electromagnetic anomalies have been observed in a lot of frequency ranges, from the ultra-low frequency (ULF) range to the very-high frequency (VHF) range. These ranges include the extremely-low frequency (ELF) range, which covers 3 to 300Hz. In the ELF range, there exist a phenomenon called Schumann Resonance, where electromagnetic waves excited by lightning resonate in the cavity between the earth's surface and ionosphere in ELF range, especially at 8Hz, 14Hz and 20Hz. However there also exist some reports [e.g., Ohta et al., 2005] which report that some ELF waves are excited before earthquakes and the excited waves differ from the ones caused by lightning; these waves before earthquakes may be seismo-electromagnetic anomalies.

The International Center for Space Weather Science and Education has an induction magnetometer, which can detect magnetic variations in ELF range. The purpose of this study is to use this magnetometer and determine whether or not there are seismo-electromagnetic anomalies in the ELF range before, during and/or after earthquakes by power spectral analyses of the magnetic-field data obtained from the induction magnetometer in Kuju.

The examined earthquakes took place in the years 2003-2011.Since the distance between epicenter and station and the magnitude of the earthquake might be related to the magnetic variation, we examined near (distance between epicenter and station shorter than 100km) and large (magnitude larger than 4.0) earthquakes. Among them, here we present a 4.8-magnitude earthquake which occurred on May 13, 2010 in Oita prefecture. We compared the spectrograms of three different intervals: One interval is from one month before to one month after the earthquake (4/14-6/10); the other two intervals are a few months before (1/22- 3/19) and a few months after (6/29-8/24) the earthquake when there were no earthquakes with distance nearer than 100km and magnitudes larger than 4.0. As a result, we found no significant magnetic variations in the earthquake interval (4/14-6/10). On the other hand, there were magnetic variations before the earthquake (1/22-3/19). It might be the effect of another earthquake which occurred on Feb. 21, 2010 and had the depth of 10km (because the distance was 123km, this event had not been included in our original event list). The depth of the earthquake which occurred on May 13th, 2010 was 104km. Thus, the depth of earthquake might be related to the magnetic variation. To check this possibility, earthquakes with the depth shallower than 100km will be selected and examined. Details will be discussed at the SGEPSS meeting.