

THE LATEST ASPECTS OF GEOELECTRIC POTENTIAL DIFFERENCE MEASUREMENTS IN JAPAN AND FUTURE DIRECTION OF INTERNATIONAL CO-OPERATION IN THE SEISMO-VOLCANIC ELECTROMAGNETIC STUDY

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The importance of short-term earthquake prediction has become ever more evident through the tragic experiences like the 1995 Kobe disaster. Recently, the existence of electromagnetic precursory phenomena related to earthquakes have been reported by various research groups ([1], [2], [3], [4]). Recognizing the importance of this new move, we consider that obtaining complete scientific understanding of the electromagnetic phenomena in the earth's crust is an indispensable step for the achievement of short-term earthquake prediction.

The RIKEN International Frontier Research Group on Earthquakes, which was started in 1997 as a five year national program, views the earthquakes as large scale fracture phenomena in the earth's crust and aims to achieve a thorough and comprehensive scientific understanding of the geo-electromagnetic variations reported as promising precursors, through cooperation with the leading scientists of the world.

The DC geoelectric potential changes, the so called SES, have been extensively studied by the VAN group in Greece. Their results are highly promising but are still in controversy. There are basic unsolved problems in this method, including the possible SES generation and transmission mechanisms. We started our project first to check if SES really exists and can be observed in Japan also. This required extensive installation of observing stations. We have constructed about 40 DC stations in Japan. Anomalous DC changes have been observed before six EQs and before/during the recent seismo-volcanic activity in the Izu island region.

In the summer of 2000, we had intense earthquake swarms and volcanic activities in and around Izu islands including Miyakejima Island (Fig. 1). These activities were located in the area covered by our DC and ULF remote stations. The seismic activity started on June 26 beneath Miyakejima Island and followed by volcanic eruption. These intense seismic activities continued about three months and not yet completely terminated even now. One of our DC geoelectric potential monitoring stations in Niijima Island recorded SES activity type signals. It started at the end of April 2000 and lasted to the end of August. Especially, from June 27 to 30, intense spiky signals continued almost whole day long. Concerning ULF magnetic data, a magnetic array, which consists of 'three' three-component magnetic sensors with inter sensor distance of about 5km, in Izu Peninsula was operating. After removing artificial and natural noises, ULF magnetic anomaly showed very similar temporal changes to what we observed electrically at Niijima Island (Fig.2). In the presentation, we also would like to introduce rather new approach to measure large scale electric and magnetic fields using the facility of electric company's power lines, etc.

Furthermore, to promote international co-operation and collaboration between individuals and research

groups, on observations and research into electric and magnetic effects associated with earthquakes and volcanoes, a new Inter-association working group has recently been established in the International Union of Geodesy and Geophysics (IUGG). One of the most important issues of this working group is to clarify Lithosphere-Atmosphere-Ionosphere coupling associated with earthquakes. Therefore, the working group plans to closely co-operate with URSI. The existence of seisomo-electromagnetic phenomena is no doubt. Now is the time to clarify the generation mechanism of the effects through truly interdisciplinary collaboration.

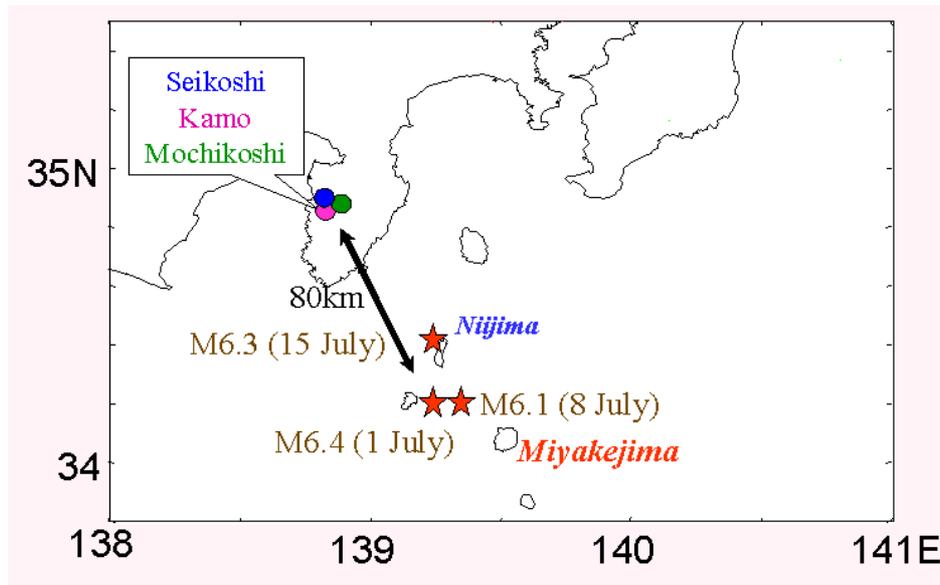


Figure 1 Index map of the Izu island region, Japan.

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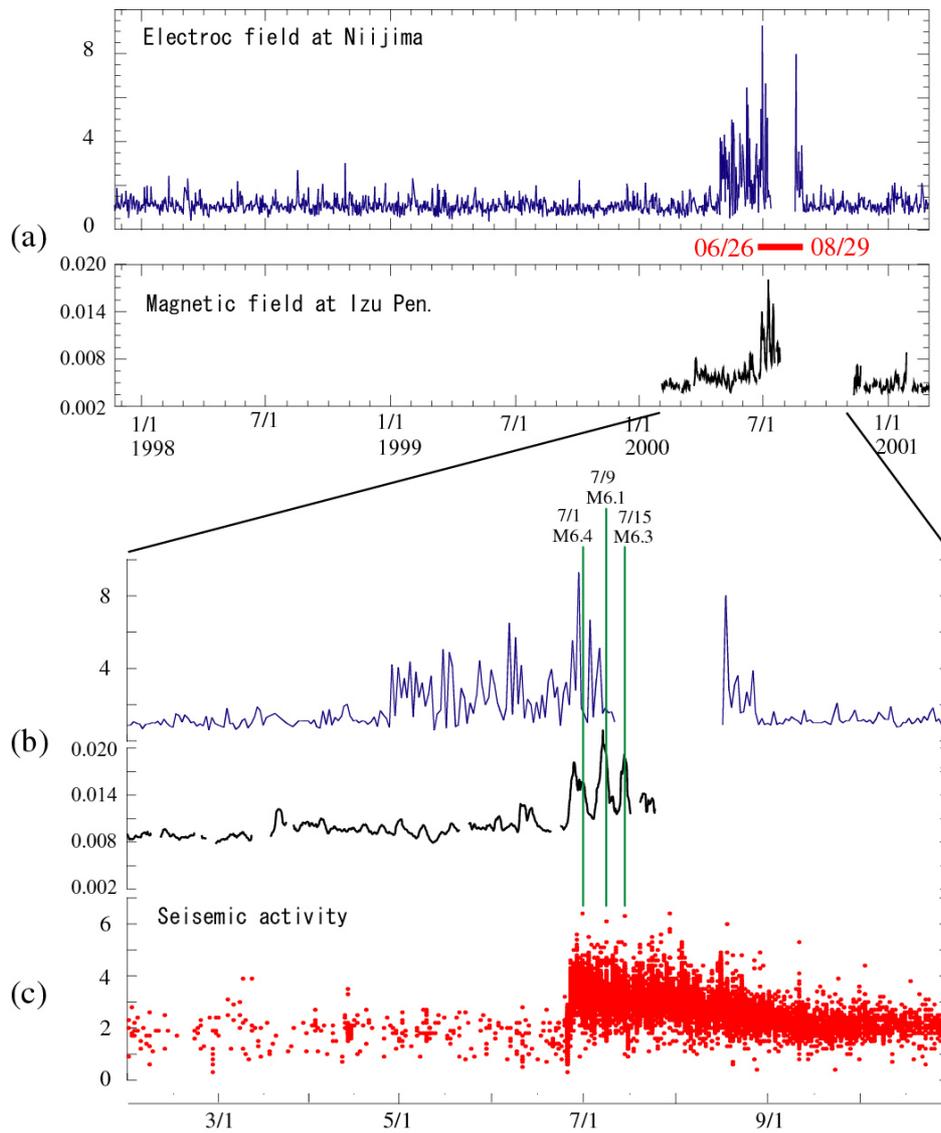


Figure 2: Time change of the 0.01 Hz spectral intensity ratio (blue) of geoelectric potential difference at Niijima and of the nighttime third principal component at 0.01 Hz of the geomagnetic field at Izu array station (black). Lack of data was due to system failure in July and August. a) For three year period, b) For January-October, 2000. Three $M > 6$ earthquakes in July are indicated by vertical green lines. c) Seismicity of the Izu Island region (red dots).