THE LATEST ASPECTS OF SEISMO-ELECTROMAGNETIC OBSERVATIONS IN JAPAN

T. Nagao ¹, K. Hattori ², K. Sayanagi ¹, S. Uyeda ¹, and M. Kamogawa ³

¹ Earthquake Prediction Research Center, Tokai University, Shizuoka-shi, Japan
² Marine Biosystems Research Center, Chiba University, Chiba, Japan
³ Department of Physics, Tokyo Gakugei University, Koganei-shi, Tokyo, Japan

ABSTRACT: RIKEN International Frontier Research Group on Earthquakes promoted Seismo-Electromagnetics from 1997 to 2002 as a national project in Japan. Major observations in the research program were DC geoelectric potential changes and ultra low frequency geomagnetic changes. In the measurement of the geoelectric potential changes, the so-called SES, extensively studied by the VAN group in Greece, we tried to reproduce the Greece results in Japan and finally obtained hopeful results. Furthermore, in the summer of 2000, we had intense earthquake swarms and volcanic activities in and around Izu Islands, Japan. Significant anomalous changes in the ultra low frequency range (~0.01Hz) were observed in both geoelectric and geomagnetic fields before the major activity. The spectral intensity of the geoelectric potential difference between some electrodes on Nijima Island and the third principal component of geomagnetic field variations at an array network in Izu Peninsula started to increase from a few months before the onset of the volcano-seismic activity, culminating immediately before near by magnitude 6 class earthquakes. Appearance of similar changes in two different measurement conducted at two far apart sites seems to provide information supporting the reality of preseismic electromagnetic signals. Moreover, our research group is trying the detail observation and clarification of generation mechanism of Lithosphere-Atmosphere-Ionosphere coupling associated with earthquakes.

INTRODUCTION

Thanks to the progress of the digital technology, we now are able to detect a lot of interesting phenomena possibly preceding large earthquakes in various frequencies. Especially, after the devastating Kobe Earthquake in 1995, former Science and Technology Agency (STA, now MEXT) decided to initiate five year programs of RIKEN International Frontier Research Project on Earthquakes and NASDA Earthquake Remote Sensing Frontier Research Project for earthquake prediction research by using electromagnetic methods. Both programs published many high-quality papers. For instance, concerning Kobe Earthquake, observed anomalous electromagnetic phenomena were compiled by Nagao et al. [2002].

The most interesting observational fact in recent years is the existence of the ionospheric anomalies before/during/after the major shallow earthquakes [e.g. Molchanov and Hayakawa, 1998; Liu et al., 2001]. Furthermore, a major progress was made by the detection of significant anomalous changes in the ULF range in both geoelectric and geomagnetic fields before the major volcano-seismic activity in the Izu Island region, Japan in the summer of 2000 [Uyeda et al., 2002]. In this swarm activity we developed a direction finding technique using the array observation of the three-component magnetic data. These are just the results of innovation of the digital technology.

Moreover, the signals of the specific waveforms from the epicentral direction in VLF range are observed several days before impending earthquakes [Asada et al., 2001].

In the VLF range, using a newly designed underground antenna Tsutsui [2002] observed an anomalous signal which probably traveled in the underground wave guide for the first time, which was predicted theoretically more than thirty years ago. The author considers that the new generation of seismo-electromagnetism researches are making an important breakthrough now. At the same time, the researches of the anomalous behaviors of ionosphere related to earthquakes are actively carried out in the LF, VLF and VHF ranges. They are producing the new concept called LAI (Lithosphere-Atmosphere-Ionosphere) coupling hypothesis.

REFERENCES


