

# Report

*Installation of GEON*  
*(Global ELF Observation Network)*  
*at Kuju MAGDAS Station*  
*of Kyushu University*

by

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The main objective of GEON is to carry out continuously the measurement of electromagnetic waves in the extra low frequency (ELF) range of 1-100Hz excited by lightning discharges and to monitor global lightning activities. Using the ELF waveform data obtained by GEON, it is possible to estimate global occurrence locations and rates of lightning discharges and to deduce the charge moment changes, which is a proxy of the discharge energy. From the ELF waveform data, it is also possible to deduce a discharge current of lightnings, which occur within a few thousand kilometers from the GEON site. This innovative technique is a really powerful tool to monitor the lightning current, which will be a substitute for a huge and expensive Rogowskii coil measurement system.

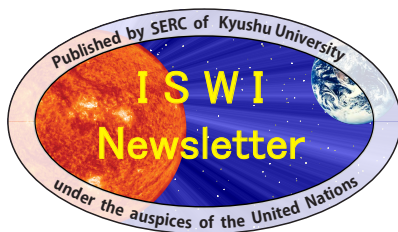
An ELF observation system consists of two horizontal orthogonal induction magnetometers, a main amplifier, a data recording system, and a GPS receiver. This

system was first developed by a group of researchers in Hokkaido University and was installed at Syowa station in Antarctica in February 2000. After this success, the same observation system was also installed at Onagawa station in Japan, Kiruna in Sweden, and Santa Cruz in California, USA. In order to measure discharge current of lightnings occurring in Japan, one more GEON station was needed in western part of Japan. Thus, one more ELF observation system was produced and installed at Kuju MAGDAS station under the inter-university collaboration led by Dr. Mitsuteru Sato, Dr. Fuminori Tsuchiya and Dr. Akimasa Yoshikawa.

Recent studies suggest that the global lightning activities and global cloud coverage are closely correlated. Based on the GEON observations, it is identified that global lightning activities has a periodic variation with ~27days periodicity, which is same as the periodicity of the solar rotation. By measuring the global lightning activities, the missing link of the Sun-Earth connection might be discovered.

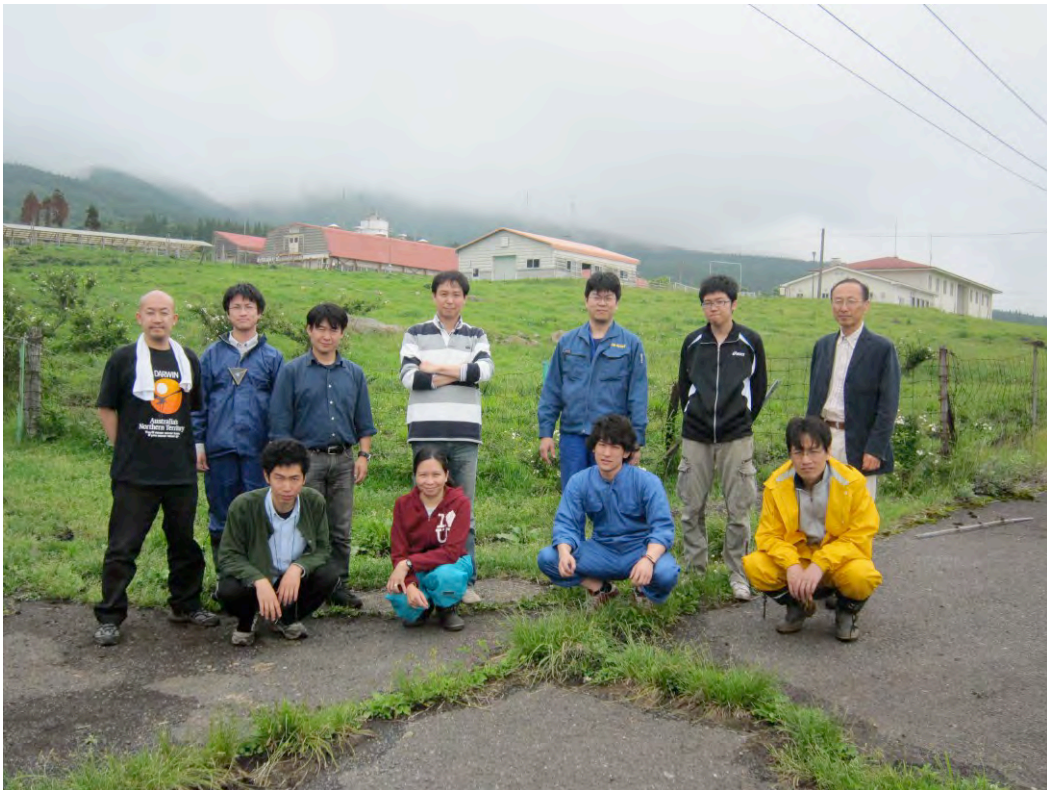
*The following pages are photos of this installation, which are numbered as:*

-1-      -2-      -3-      -4-



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# COLLABORATIVE INTER-UNIVERSITY INSTALLATION OF INDUCTION MAGNETOMETER AT KUJU STATION IN JAPAN ON 2<sup>ND</sup> - 4<sup>TH</sup> JUNE 2013



Back row from left: S. Abe,<sup>4</sup> S. Sato,<sup>2</sup> T. Uozumi,<sup>4</sup> A. Yoshikawa,<sup>4</sup> M. Sato,<sup>1</sup> O. Ogushi,<sup>4</sup> and N. Honma<sup>3</sup>  
Front row from left: S. Imajo,<sup>4</sup> M.G. Cardinal,<sup>4</sup> Mihara,<sup>1</sup> F. Tsuchiya,<sup>2</sup> and M. Iwaki<sup>4</sup>

<sup>1</sup>Hokkaido University

<sup>2</sup>Tohoku University

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<sup>4</sup>Kyushu University

2<sup>ND</sup> JUNE 2013



Instrument packages were unpacked, the GPS and induction magnetometer sensors were temporarily installed and initial data monitoring were conducted on the first day.

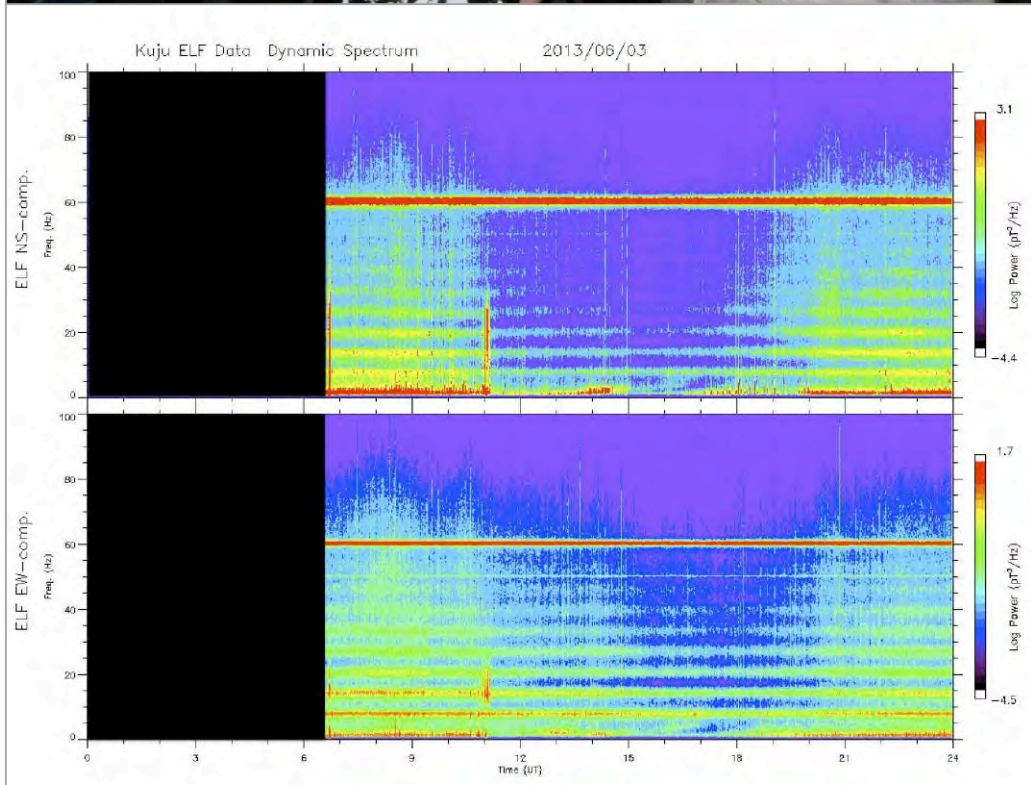


3<sup>RD</sup> JUNE 2013



On the second day, the sensor and GPS cables were covered with vinyl flexi tubes. After the sensors were installed and buried, the data recording was started.

4<sup>TH</sup> JUNE 2013



On the last day, Dr. Sato gave some instructions on how to do the maintenance once a year (top). A sample of the induction magnetometer data at Kuju station (bottom).