Japanese URSI Commission H (Waves in Plasmas)
Activity Report
November 2013 - February 2014

[1] Status of projects related with plasma wave observation

- NICT Science Cloud

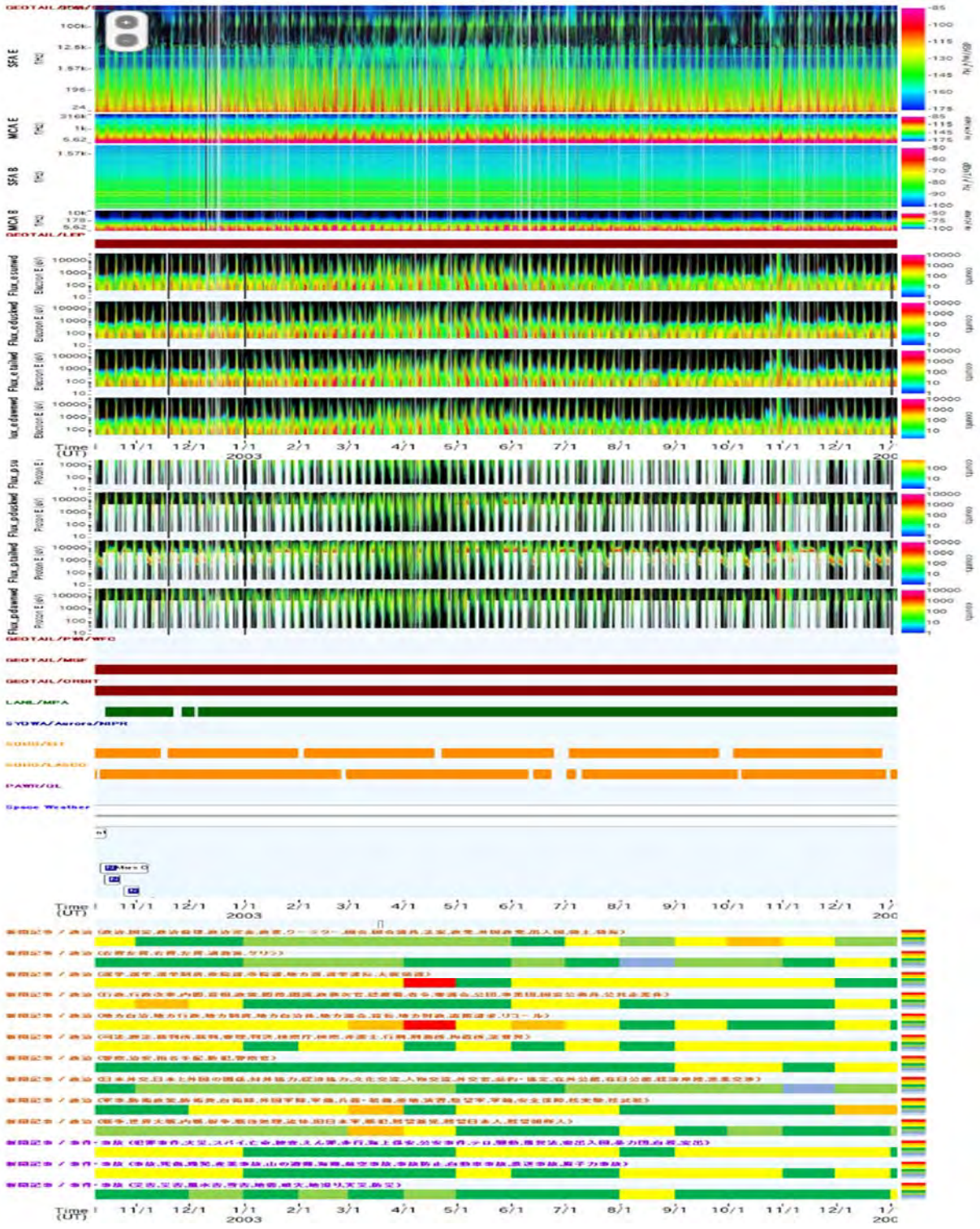
  NICT Science Cloud has been developed for space plasma studies. We have begun to develop a Web application for plasma wave data and other satellite observation data, which is named “STARS touch” (see Figure). This Web application is based on a technique of asynchronous data transfer of graphic files for several types of data plots. The cloud system create a huge number of data plots with various time scale (e.g., from few minutes to few years) for each data-set. Users can preview time-dependent observation data of such multi-time scale plots with easy operations (tap, pinch, drag, flick…). There are 250,000 graphic files for each panel (data) on this application for GEOTAIL satellite. We have a plan to open this Web site by May 2014. (*An example is shown in the next page.*)

[2] Recent Meetings

1. COSPAR Symposium on “Planetary Systems of our Sun and other Stars, and the Future of Space Astronomy”, Bangkok, Thailand, November 11-15, 2013.
2. International CAWSES (Climate and Weather of the Sun-Earth System)-II Symposium, Nagoya, Japan, November 18-22, 2013.
3. 6th VERSIM (VLF/ELF Remote Sensing of the Ionosphere and Magnetosphere) workshop 2014, 20-23 January 2014, University of Otago, Dunedin, New Zealand.

[3] Future Meetings

1. Japan Geoscience Union Meeting 2014, Yokohama, Japan, 28 April – 2 May, 2014.
2. ISRSSP 2014 (Fourth International Symposium on Radio Systems and Space Plasma) , Luxembourg, 26-27, June, 2014.
3. AOGS 2014, Sapporo, Japan, 28 July – 1 August, 2014.
4. The 40th COSPAR Scientific Assembly, Moscow, Russia, 2-10 August, 2014.
5. The 31st URSI GASS, Beijin, China, 16-23 August, 2014.
6. AGU Chapman Conference on "Low Frequency Waves in Space Plasmas", Jeju, Korea, 31 August - 5 September, 2014.
7. Geospace revisited: a Cluster / MAARBLE / Van Allen Probes Conference, Rhodes, Greece, 15-20 September, 2014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[4] Recently Published Papers (November 2013 – February 2014)

1. **M. Ozaki, S. Yagitani, H. Kojima, K. Takahashi, and A. Kitagawa, Current-sensitive CMOS preamplifier for investigating space plasma waves by magnetic search coils, vol.14, no.2, Feb. 2014.**

   In order to considerably reduce circuit resources (mass, volume, and power) for the analog front ends of plasma wave measurement systems, a current-sensitive preamplifier for magnetic search coils (MSCs) is designed with standard 0.25-μm complementary metal-oxide-semiconductor (CMOS) technology. Since the input noise current determines the output noise levels around the resonant frequency of an MSC, a CMOS preamplifier operating with low noise current is suitable when combined with an MSC instead of using bipolar junction transistors. A prototype of the CMOS preamplifier was fabricated on a 1.9×3.3-mm2-silicon chip. The noise equivalent magnetic induction of the CMOS preamplifier combined with a 100-mm-long MSC is 3.5 pT/Hz1/2 at 10 Hz and 30 fT/Hz1/2 at 2 kHz with a power consumption of 4.6 mW for a 3.3-V supply.

2. **Murata, K. T., Watanabe, H., Kasahara, Y., Yagi, D., Kasai, Y., Ishii, S., Yamamoto, K., Kimura, E., Tanaka, M., Tatebe, O., Ukawa, K., Muranaga, K., Suzuki, Y. and Kojima, H., New techniques of high-speed data processing for spacecraft observation data via NICT Science Cloud, IEICE-SANE2013-94, IEICE-113, No. 335, pp. 133-138, 2013.**

   A variety of satellite missions, Earth observations and environments, Space physics and Astrophysics and Commercial uses, are carried out every year. Most of the satellites yield a large-scale data, and high-performance data processing technologies are expected. We have been developing a cloud system (the NICT Science Cloud) for big data analyses of Earth and Space observations via spacecraft. In the present study we propose a new technique to process large-scale data with paying attention to the fact that high-speed I/O (data file read and write) is important compared with data processing itself. We also adopt a task scheduler, the Pwrake, for easy management of parallel data processing. Using a long-time scientific satellite observation data (GEOTAIL satellite), we examine performance of the system on the NICT Science Cloud. We successfully archive high-speed data processing more than 100 times faster than those on traditional

data processing environments. Since the design of the present system is for versatile use, we also discuss how to apply for other satellite missions such as GOSAT satellite, KAGUYA satellite and ISOSIM-L (a radar simulator).

3. **Murata, K. T., Watanabe, H., Ukawa, K., Yamamoto, K. and Zettsu, K., Solar-Terrestrial Physics (STP) database system designed for Linked Open Data and Semantic Web based on RSS1.0 and RDF, 2013 Linked Data in Practice Workshop, Seoul, Korea, Nov. 2013.**

   In many research fields, including the Solar-Terrestrial Physics (STP), it is pointed out that research environment for circulation and utilization of observation data among researchers is insufficient. One of the reasons is that the data formats of observation data are not common. To archive interdisciplinary researches, we need to overcome this circulation and utilization problems. Under such a background, the Solar-Terrestrial data Analysis and Reference System (STARS) has been designed and developed by the authors' group. The STARS has its own database that manages meta-data of satellite and ground-based observation data files. The STARS provides users with cross-over data file search services and download services over the Internet. It is noted that retrieving meta-data from the observation data and registering them to database have been carried out by hand so far in the STARS. It is hard to deal with a huge amount of observation data due to the lack of manpower. We developed an automatic meta-data collection system for the observation data using the STARS RSS (RDF Site Summary) 1.0. Using the RSS1.0 as a meta-data distribution method, the workflow from retrieving meta-data to registering them into the database is automated.

4. **Murata, K. T., Watanabe, H., Zettsu K., Kurosawa, T., Kojima, H., Ukawa, K., Kimura, E., Tatebe, O. and Tanaka, M., A Proposal of High-resolution Data Visualization Synchronized with Semantic Web, SIG-SWO-A1302-01, pp. 1-9, 2013.**

   The NICT Science Cloud is one of the science clouds proposed for development of sciences. A variety of science data are collected and stored in the science cloud to be analyzed interdisciplinary. After the Internet is widely used, new concept and information technology haves shown up; semantic web and linked open data (LOD). These technologies enable information on the Internet machine readable. In many science fields, it is pointed out that the semantic web will play an important role for the interdisciplinary research works. However, there have been

few ideas to be ever proposed as a methodology or roadmap to the interdisciplinary science using semantic web. Herein we present a concept of professional knowledge and academic knowledge following collective knowledge proposed as a Web 2.0. Based on the concept, we design an application for interdisciplinary science.

5. **S. Y. Li, Y. Omura, B. Lembège, X. H. Deng, H. Kojima, Y. Saito, and S. F. Zhang, Geotail observation of counter directed ESWs associated with the separatrix of magnetic reconnection in the near-Earth magnetotail, J. Geophys. Res., 119, doi: 10.1002/2013JA018920, 2014.**

A sub-Alfve´nic jet in the tailward outflow region near the separatrix of the magnetic reconnection is observed by Geotail on 9 February 1995. Several dozens of electrostatic solitary waves/pulses (ESWs) are observed, respectively, on the current sheet-side and the lobe-side of the separatrix. The ESWs on the current sheet-side are of type-B with direction outward (toward to the tailward) while on the lobe-side they are of type-A directed to X-line. The amplitude of ESWs on the current sheet-side is about 6 times more than those on the lobe-side, suggesting that energies flowing outward from the reconnection X-line are much larger than those flowing inward. Moreover, observations show, that electron beams associated with ESWs, which are parallel to the ambient magnetic field, are much stronger on the current sheet-side than on the lobe-side of the separatrix. Furthermore, the direction of the electron beam on the lobe-side of the separatrix is mainly antiparallel to the ambient magnetic field and it is mainly parallel on the current sheet-side. Both are consistent with the propagation of ESWs which is in agreement with the generation mechanism of ESWs, which is suggested to be related to electron beams.