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差出人　George Maeda

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* ISWI Newsletter - Vol. 3 No. 103                      21 November 2011 *
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Attachment(s):
(1) "PRELIMINARY ANNOUNCEMENT", 600 KB pdf, 4 pages.
(2) "SERCpamphlet_eng", 2.6 MB pdf, 8 pages.

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:　Re:
:　Preliminary Announcement
:　for the
:　Commemoration of the 10th Anniversary
:　of the
:　Establishment of SERC

Dear ISWI Participant:

SERC (Space Environment Research Center, Kyushu University) will be celebrating its tenth anniversary on 14 March 2012 and an event for that is being planned. The Preliminary Announcement for this event is attached.

Also attached is the 8-page pamphlet of SERC.

It so happens that 14 March is also the birthday of Albert Einstein, who visited Kyushu University in 1922. New information concerning his visit to southern Japan will be released during the event of 14 March 2012.

Cordially and respectfully yours,
:　George Maeda
:　The Editor
:　ISWI Newsletter

This pdf circulated in
Volume 3, Number 103,
on 21 November 2011.

PRELIMINARY ANNOUNCEMENT

for the

# Commemoration of the 10th Anniversary of the Establishment of SERC

(Space Environment Research Center, Kyushu University)

which will take place in Fukuoka, Japan, on 14 March 2012

## *Agenda*

- Commemorate the *10th anniversary of SERC*
- Inaugurate the *International Center for Space Weather Science and Education* (ICSWSE)
- Observe the significance of the *14th of March 2012*

The fundamental purpose of this event is to review where SERC has been, where it is today, and where it plans to go.

## The First Ten Years of SERC (2002-2012)

SERC was established at Kyushu University in 2002 as an *Institute for the Joint Use of Kyushu University* as a collaboration among the Faculty of Mathematics, the Faculty of Engineering Sciences, the Faculty of Engineering, the Faculty of Information Science and Electrical Engineering, and the Faculty of Sciences. It was decided that the first Executive Director of SERC would be Professor Kiyohumi Yumoto.

In the beginning, this Center promoted the diagnosis of the geospace plasma environment and examined the problem of space debris. Additionally, this Center undertook research on electromagnetic disturbances that originated with the Sun. The tools for this research were ground-based magnetometers (to observe the Earth's magnetic field) and radars (to observe the ionosphere). These magnetometers formed a network called CPMN (Circum Pacific Magnetic Network).

Over the past ten years, this Center developed into two main areas of research activities. One was to pursue research on fundamental aspects of plasma physics, which covers space plasmas, fusion plasmas, and industrial applications of plasmas. Additionally, there was a need to develop the mathematical and informatic aspects of plasmas. This entire effort, therefore, was a major inter-disciplinary undertaking inside of Kyushu University.

The other main area of effort at SERC during the past ten years was the deployment of MAGDAS (MAGnetic Data Acquisition System) on a global scale. Unlike the CPMN system, each MAGDAS magnetometer sends its data in real time to SERC for continuous monitoring of the Earth's magnetic field. The first MAGDAS magnetometer started operating at Hualien, Taiwain, in May of 2005. Today there are 63 MAGDAS magnetometers in operation all over the world -- this is an expansion rate of 10 magnetometers per year, or nearly one per month. Thus MAGDAS is *by far* the largest real time magnetometer network in the world. In addition, as part of this real time observation effort, SERC maintains FM-CW radars in Russia, Japan, and the Philippines.

*To summarize the first ten years of SERC:* SERC concentrated on establishing a foundation for research into basic plasma physics and it concentrated on deploying the world's largest real time network of magnetometers. Note that this was mainly a domestic enterprise – to shore up the essential skills and know-how of Japanese scientists and engineers. During the next ten years, SERC will extend this enterprise to a global scale.

## IHY (*International Heliophysical Year,* from 2005 to 2009) and ISWI (*International Space Weather Initiative,* from 2010 to 2012)

[ conducted under the auspices of the United Nations ]

To ensure the success of the MAGDAS Project, SERC became heavily involved with IHY and ISWI, as a major purpose of IHY/ISWI is to get more developing nations involved in space science. Here, MAGDAS contributed enormously – through the installation of instruments in Asia and the Pacific, Africa, and Latin America and the Caribbean. SERC experts have trained local personnel (staff and students) to maintain MAGDAS instruments. SERC invited them to SERC for additional scientific and technical training. For this purpose, SERC conducted MAGDAS schools. Scholarships were provided to MAGDAS hosts so that they were able to attend IHY/ISWI workshops. All these efforts are part of SERC's *Capacity Building* agenda, which is also the agenda of IHY/ISWI.

## The Next Ten Years beyond 2012

During the first ten years, SERC concentrated on two major areas of research activities as outlined above. During the next ten years, SERC will expand to the international stage. Accordingly, SERC will take the initiative on several new international enterprises that are being planned presently. Selected examples (five) are as follows:

1. *The next stage of ISWI.* The first stage of ISWI (2010-2012) will be concluded in 2012. This must be followed up with a new international

program, which is still in the planning stages. SERC intends to take a leading role in the new program.

2. *MAGDAS Schools.* SERC conducted a major MAGDAS School in Nigeria during the summer of 2011 at Redeemer's University near Lagos. The next one is scheduled for Bandung, Indonesia, during the summer of 2012.
3. *Capacity Building.* In support of the **MAGDAS Project**, SERC will continue to push forward with Capacity Building, which involves teaching MAGDAS instrument hosts the skills needed for (1) instrument operation, (2) data analysis, and (3) doing world-class science with the collected MAGDAS data.
4. *Establishment of ICSWSE.* This is the **International Center for Space Weather Science and Education**. Details of this new center are contained in the *Abuja ISWI Resolution,* which was adopted by the participants of the "UN/Nigeria Workshop on ISWI" (October 2011). Here reference is made to the ISWI Newsletter Volume 3, Number 101.
5. *Center of centers.* One role of ICSWSE is to cooperate (in the field of space weather) with the UN-affiliated **Regional Centres for Space Science and Technology Education** (located in Nigeria, Morocco, India, Brazil, and Mexico).

## The Significance of the 14th of March 2012

Albert Einstein (the man who created the Theories of Relativity) was born on 14 March 1879. It is well-known that in 1922 he undertook a tour of Japan with his wife, which included several speaking engagements, including a famous lecture at Kyoto University. But it is not well-known that he also visited Fukuoka and Kitakyushu, and gave a lecture at Kyushu University. During this 14th March 2012 event at SERC, it is being proposed to release some documents (regarding Einstein's visit to Fukuoka in 1922) that have always existed in Japanese, but never in English.

End of Preliminary Announcement.

Written by K. Yumoto, H. Haubold, and G. Maeda

on 21 November 2011.

Kyushu University | Space Environment Research Center

As the Humanosphere expands to the altitude of some tens of thousand km in the 21st century, or in other words, to the region in which the geomagnetic field is dominant (Geospace), serious concern about possible disasters to the spacecraft and to the body of astronauts has emerged, such as cosmic rays coming from solar flare, electromagnetic disturbance caused by magnetic storms arising in the geospace, and further, space debris (or cosmic dust). These radiations, electromagnetic disturbances, and fluctuations in the space debri environment are regarded as the elements of the "space weather." It is an urgent task to implement international collaboration to clarify the mechanisms of the space weather and to realize the space weather forecast.

Space Environment Research Center was established in Kyushu University in 2002 as an Institute for the Joint Use of Kyushu University through the collaboration among the Faculty of Mathematics, the Faculty of Engineering Sciences, the Faculty of Engineering, the Faculty of Information Science and Electrical Engineering, and the Faculty of Sciences.

This center promotes the diagnosis of geospace plasma environment and the research of electromagnetic disturbances to occur and propagate, utilizing the ground magnetic field observation network (MAGDAS) and the ionosphere radar observation network that have been developed at approximately 50 points in the world, mainly located in the Circum-pan Pacific region.

It also presses ahead with most creative research themes in the world such as: the reproduction of geospace environment in laboratories using a plasma generator; simulation of distributed and diffused space debris that the humankind has released in the geospace environment until today; and the reproduction of physical phenomena in the solar-terrestrial system combined region through the simulation of global magnetohydrodynamics (MHD). As an information service of the center, we put a massive amount of data into the database in order to contribute to joint research, and the students and staffers also try to provide open information about the situation of daily space weather to the public on the Web site, "Space Weather Nowcasting" based on the data coming from satellites that monitor the solar-terrestrial system and from ground network observations.

It is expected that those research and education activities will positively lead to development of space hazard forecast systems and fostering of space weather forecasters in the future.

Space Environment Research Center

Exective Director, Prof. Kiyohumi YUMOTO

# Creation of New Geospace Environment Science



## Contents of research

○ Creation of interdisciplinary geospace environment science and basic research of space weather forecast and space debris warning.

• Space weather forecast; Notifying in advance the effects of solar radiations and increase of abnormal current in the geospace based on the observations of the whole region from the sun to the geospace.

• Space debris warning; Foretelling the tracked debris, which would collide with any spacecrafts or would fall into the atmosphere, by analyzing the trajectory of the space debris.

## (1) Social background

○ Since the latter half of the 20th century, the development and utilization of the space have brought various, enormous amounts of information, obtained by communication, broadcasting, meteorology observation and GPS positioning satellites. Such information now constitutes a kind of infrastructure essential for daily life.

○ In the "Geospace", congestion of satellites for practical use set off abnormal increase of space hazards, cause by radiation particles and fluctuation of electromagnetic fields during solar flare and huge magnetic storm, and further, collision with space debris which would break application satellites and damage astronauts. Such space hazards occur so frequently that it is becoming a serious social problem.

○ Urgent matters are to minimize such space hazards and to secure peaceful and safe infrastructure.

## (2) Trend of Research

### Related to space weather

The "Scientific Committee On Solar-Terrestrial Physics (SCOSTEP)" of the International Council for Science (ICSU) is now conducting an international collaboration research project, "Climate and Weather of the Sun-Earth System (CAWSES)", taking the term of five years from 2004, for the time being.

International Polar Year, (IPY-4) and International Heliophysical Year (IHY) programs are also carried out in 2007-2009. Furthermore in the U. S.,NASA is now formulating a Living With Star (LWS) plan to launch a satellite into the plasma acceleration region of the radiation belt in 2011 in conjunction with the Japanese ground-satellite observations.

### Related to space debris

The Committee On the Peaceful Uses of Outer Space (COPUOS) of the U. N. created international guidelines to stipulate measures for reducing space debris and methods of safe control thereof, aiming to realize the Agreement 2005. The "Inter-Agency space Debris coordination Committee (IADC)" organizes discussion to prepare a draft plan, defining:

① Device not to release space debris from the first stage of design;

② Safe landing onto the ocean of satellites that have completed the life of 2000 km or less;

③ Avoidance of collision of geostationary orbital satellite with other satellites, and;

④ Full use of fuel at the end of operation.

Upon the preparation of the guidelines, discussion will be made over surveillance of space debris and a framework of forecasting and warning possible collision.

## (3) Roles of center

1. Research observations for forecasting geospace environment changes (space weather) using an advanced worldwide ground network system

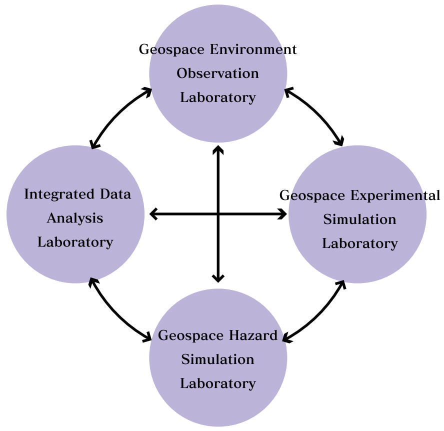
2. Development of space debri observation system, research on numerical analysis and warning by using space debris distribution map

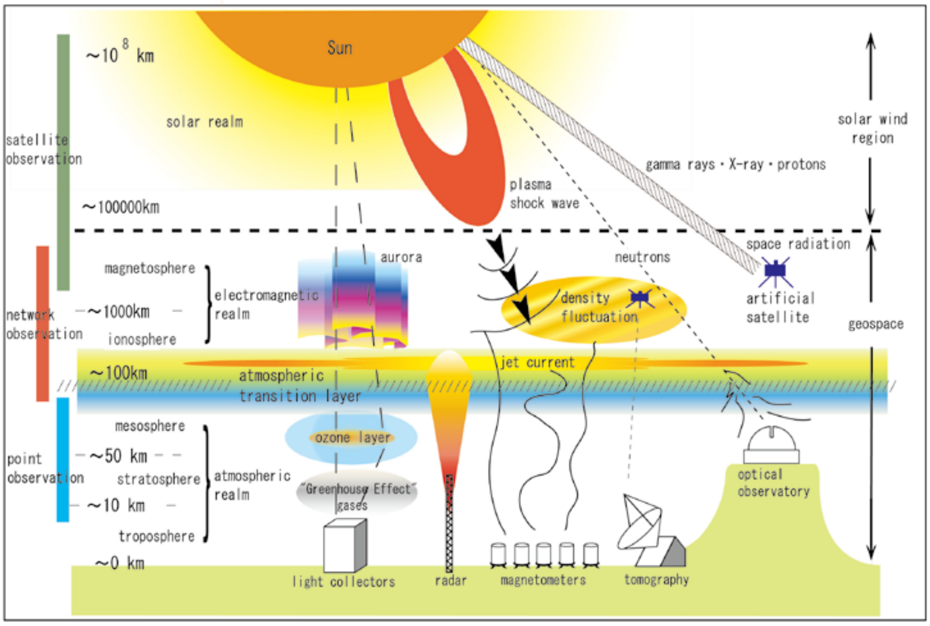
3. Simulation of geospace environment plasma by experimental laboratory and research for establishing various measurement methods

4. Creation of new physics for complex and compound systems on the basis of synthetic 4D (time and space) data and theorical analysis of geospace phenomena

5. Contributions to the society and a service to the public, by establishing space weather forecasting and space debris warning.

### Organization of Space Environment Research Center




## (4) Contributions of research fruit to the society

○ Construction of future space hazard forecasting system and fostering of space weather forecasters

○ Creation of new medicinal and biological fields including geomagnetic physiology and astrobiology

○ Promotion of research and development for national infrastructure and initiation of various new industries that are involved in the use of space

### What is geospace?

The space ranging from the solar surface to the earth's surface consists of three spheres: the heliosphere dominated by solar wind, the magnetosphere, plasmasphere and ionosphere filled with the geomagnetic fields and ionized plasma, and the atmosphere filled with neutral particles.

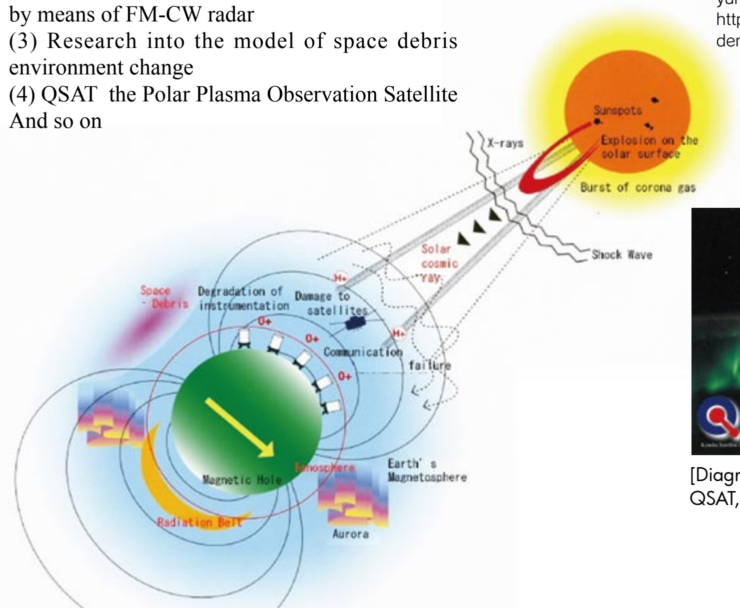
A geospace generally refers to the region ranging from the earth's surface to the magnetopause.

# The influence of the sun and space debris on the Humanosphere and its forecasting.

Geospace Environment Observation Laboratory

## Contents of research

(1) Research into the electromagnetic field of space and the earth based on observations with the MAGDAS/CPMN (MAGnetic Data Acquisition System/Circum-pan Pacific Magnetometer Network)
(2) Observational research of fluctuating electric field in the ionosphere by means of FM-CW radar
(3) Research into the model of space debris environment change
(4) QSAT the Polar Plasma Observation Satellite
And so on




[Left diagram]
Outer space around the earth (geospace)

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[Diagram above]
QSAT, the Polar Plasma Observation Satellite

[Right diagram]
Simulation of space debris distribution

# The microcosmic laboratory to simulate various phenomena in the solar-terrestrial system.

Geospace Experimental Simulation Laboratory

## Contents of research

(1) Introduction of the method to measure super high density plasma
(2) Development of accuracy-guaranteed calculation method and large-scale simulation
(3) Approach with the introduced multi-dimensional mathematical analysis

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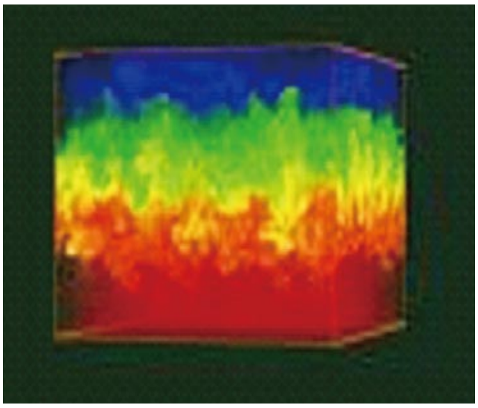
[Diagram above]
Formation of structure and scale-to-scale bonding

[Diagram below]
High-density plasma generator



[Right diagram]
Turbulent flow and instability

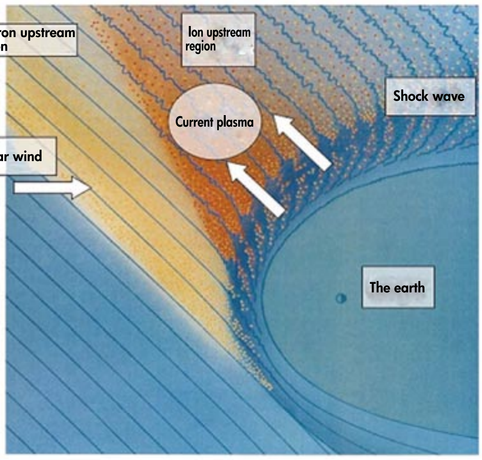
# Integration of a massive amount of data and a numerical analysis to elucidate the solar-terrestrial system

Integrated Data Analysis Laboratory

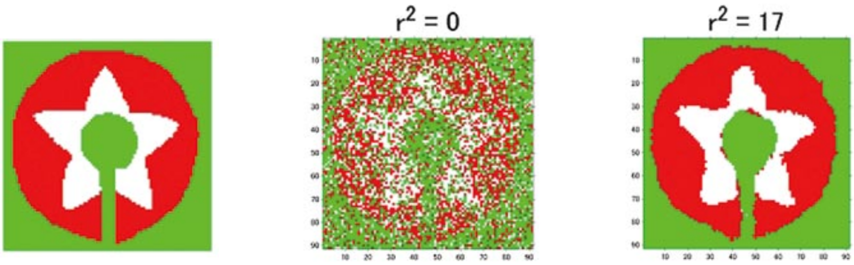
## Contents of research

(1) To deal with various images on solar surface and earth's surface a methodology of pixel discrimination by means of multi-spectral image is suggested from the viewpoint of statistical learning theory. Research is conducted into the asymptotic theory

(2) A numerical model for upstream region of magnetosphere shock wave




[Right diagram]
Conceptual diagram for upstream region of magnetosphere shock wave




[Right diagram]
Pixel discrimination methodology: one by one from the left
True image
Discrimination not using space discrimination
Discrimination using space discrimination

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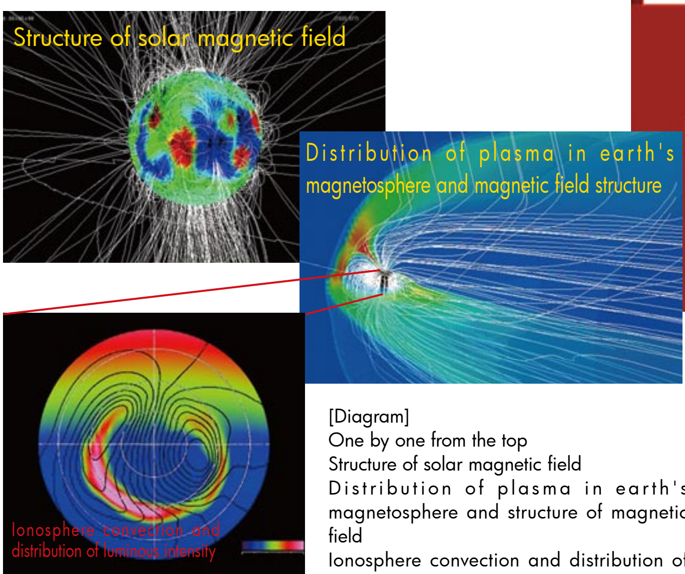
# Development of investigational research into forecast of space hazards

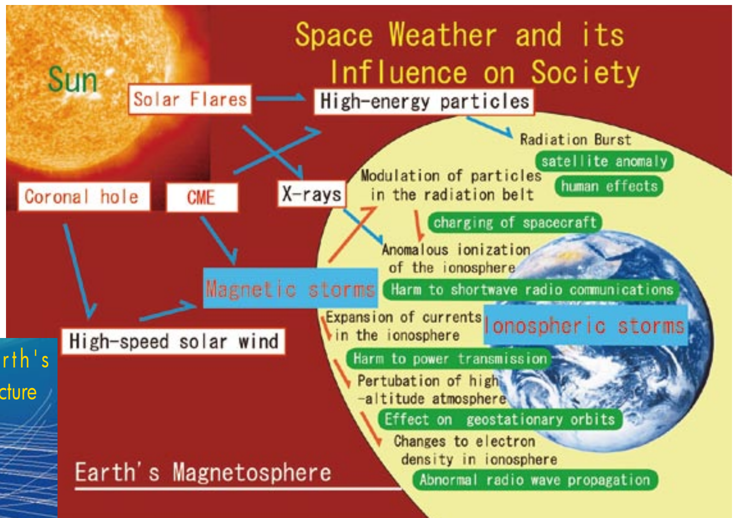
Geospace Hazard Simulation Laboratory

## Contents of research

(1) Simulation of the solar-terrestrial system
(2) Simulation of planetary atmosphere
(3) A model for forecasting space weather in low-latitude regions
(4) Global simulation of energetic particles




[Diagram]
One by one from the top
Structure of solar magnetic field
Distribution of plasma in earth's magnetosphere and structure of magnetic field
Ionosphere convection and distribution of luminous intensity

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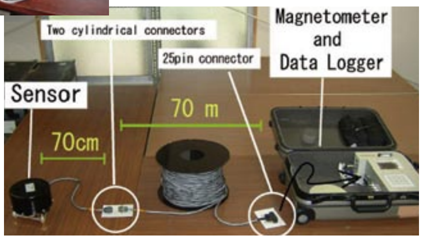
# Topics

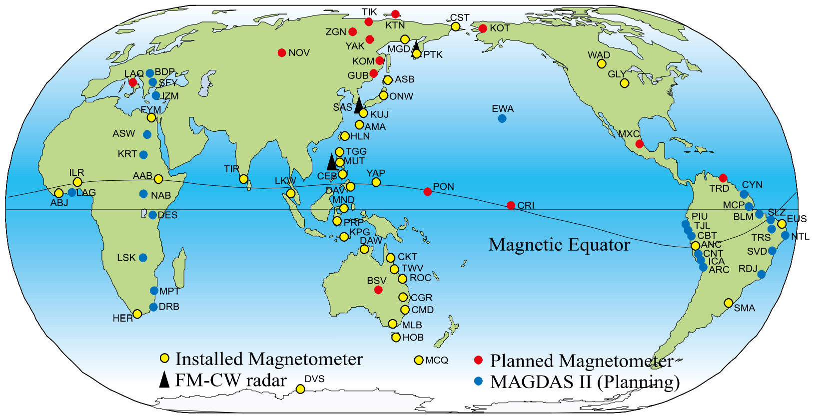
## Worldwide MAGDAS observation network

Space Environment Research Center can obtain real-time data from magnetic field observations and FM-CW radar ionosphere observation through the MAGDAS Circum-pan Pacific Magnetometer Network (MAGDAS/CPMN) linked to 50 places in the world. SERC promotes the study of observation and forecast of electromagnetic plasma environment in the geospace, and discloses the information to minimize spacecraft disasters, and thus it contributes to the construction of Sustainable Humanosphere



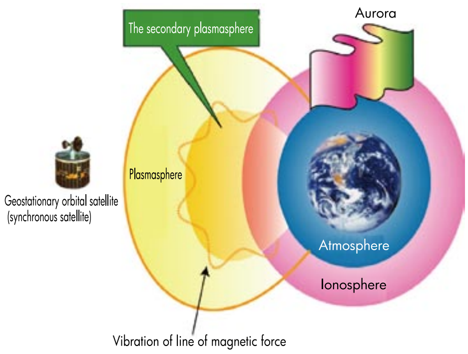

MAGDAS/CPMN

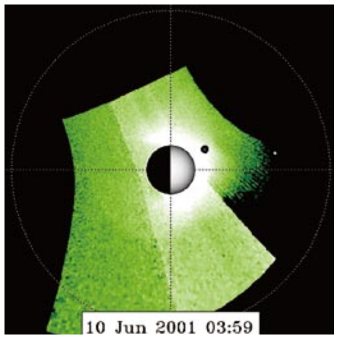
(MAGnetic Data Acqusition System/Circum-pan Pacific Magnetometer Network)




## Diagnosis of geospace plasma density by the MAGDAS data

The magnetic field data obtained by ground observations involve the phenomenon called magnetic field line resonance. From that phenomenon, we can estimate the mass density of magnetospheric plasma along the line of magnetic force at the ground observation point. From the MAGDAS/CPMN data, we can perform continuous remote sensing of magnetospheric plasma mass density and comparison with the plasmasphere image pickup by an extreme ultraviolet (EUV) observation of the IMAGE satellite. The great magnetic storm in the geospace is also the subject for our research.

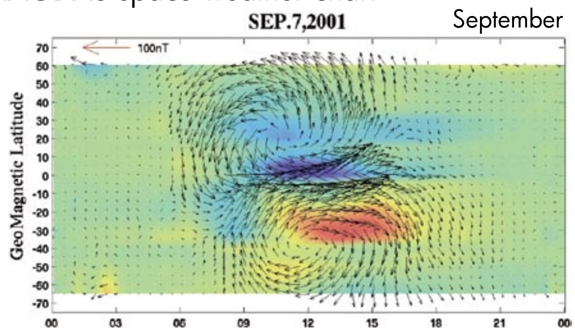



## The ionospheric Sq current systems, determined from the MAGDAS data

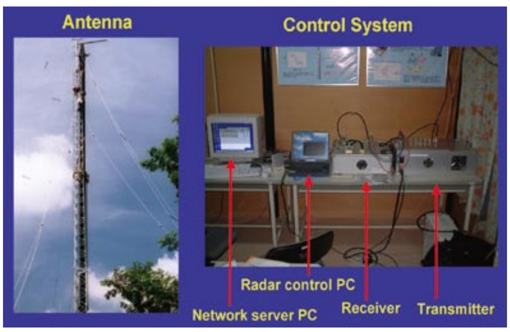
The right diagram indicates the geospace 3D current pattern projected to the 100km altitude of ionospheric layer. Equivalent Sq current patterns at the time of magnetic calm and at the time of disturbance such as magnetic storm will allow us to use as the "Weather Chart" in the space weather forecast.

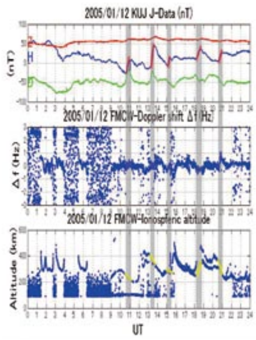
MAGDAS space weather chart

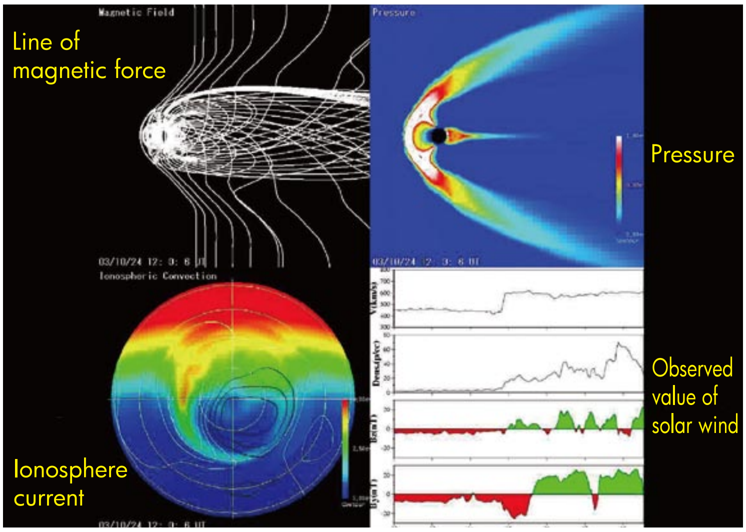



## FM-CW radar for measurement of the electric fields in the ionosphere

An FM-CW radar was installed at Sasaguri located near the 210-degree magnetic meridian of the MAGDAS network in order to elucidate the process of propagation of ionospheric electric fields. Global electromagnetic field disturbance will be analyzed by comparison of the electric field fluctuation in the ionosphere with the ground magnetic field fluctuation.






## Real time simulation of geospace environment

A real-time simulation system of geospace environment was completed under the cooperative development with the National Institute of Information and Communications (NiCT). The solar wind parameters (velocity, density and magnetic field; see the diagram bottom left) observed by the ACE satellite located at the Lagrange stationary point upstream of the solar wind at 240 Re from the earth were entered as the boundary and initial values, and then we successfully managed to make real-time simulation of the line of magnetic force in the earth's magnetosphere (see the diagram top left), the pressure (see the diagram top right), and further, the global current pattern (see the diagram bottom left) flowing in the ionosphere, which has contributed to the creation of the "Space Weather Forecasting" by the Space Environment Research Center.

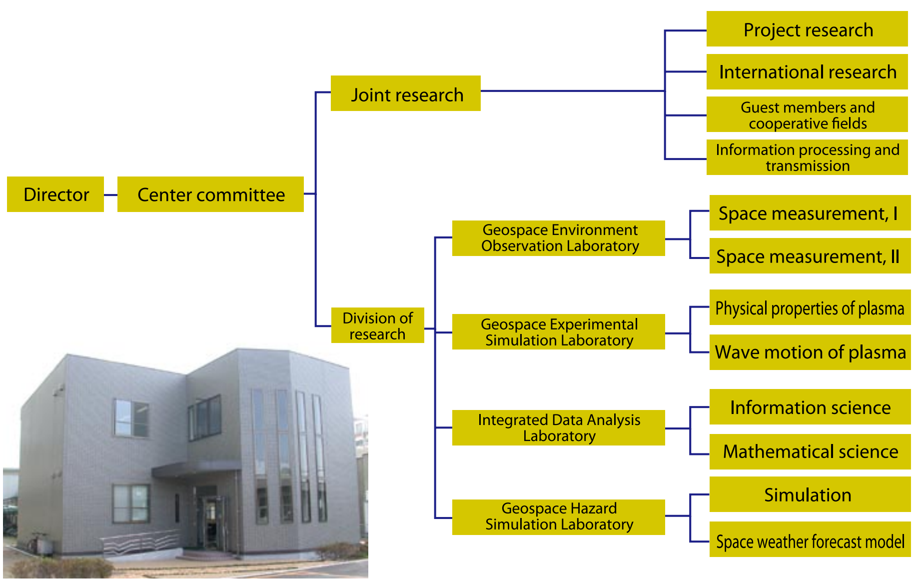
## Research and education of space weather forecasting

This center daily monitors various observation data (both satellite and ground observation) obtained in the region from the sun to the ground.

The relationship between the radiations, mass ejection, solar wind velocity etc. from the sun and the various disturbance phenomena in the geospace are described in the "Space Weather Nowcasting". Those data are finally publicized in the summary report on the web site (http://www.serc.kyushu-u.ac.jp). A number of students from the graduate schools of the associated disciplines participate in the discussion.

They can deepen their experience of various observation data, the way of how to evaluated the data, and the knowledge about actual phenomena,which helps them grow to experts of geospace environment science as well as space weather forecaster.

## Organization of Space Environment Research Center

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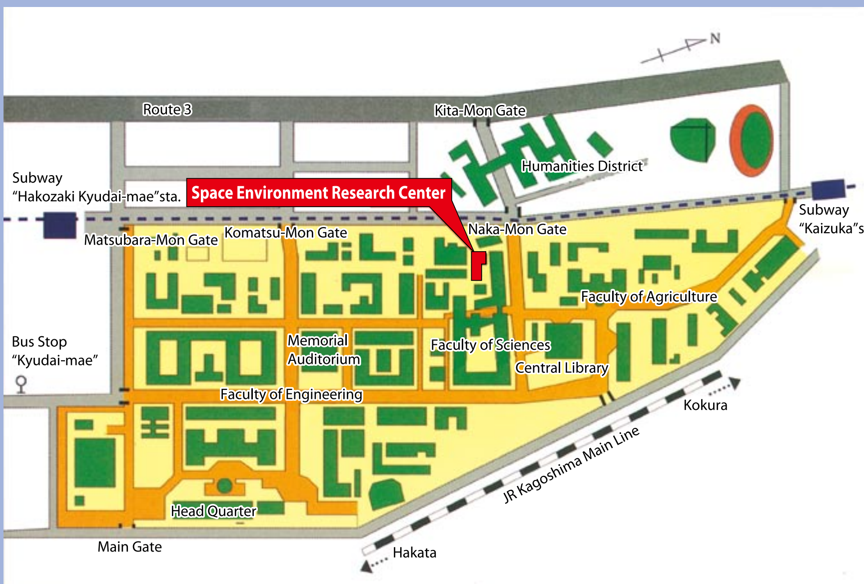


ACCESS

| ■ From Hakata station |
|---|
| 【Subway】<br>Take a train bound for Meinohama → Transfer at Nakasu-Kawabata station → Get off at Hakozaki Kyudai-mae station. |
| 【Bus】<br>Take a bus from"Hakata Center Biru-mae" (E9) → Get off at"Kyudai-mae". Or,take a bus from Hakata-eki Koutsu Center(29) → Get off at "Kyudai Kitamon". → Get off at Hakozaki |
| 【JR】<br>station(kagoshima main line) → Walk for about 10-15 minutes. |
| **■ From Fukuoka Airport** |
| 【Subway】<br>Take a train bound for Meinohama → Transfer at Nakasu-Kawabata station → Get off at Hakozaki Kyudai-mae station. |
| **■ From Tenjin** |
| 【Subway】<br>Take a train bound for Kaizuka → Get off at Hakozaki Kyudai-mae station. |
| 【Bus】<br>Take a bus from Tenjin"Yubinkyoku-mae" (18-A,23,or18-B,4,22,24) → Get off at "Kyudai Kitamon". Or,take a bus from Tenjin"Daiwashouken-mae" (1,59,59-1,61,62) → Get off at "Kyudai-mae". |

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