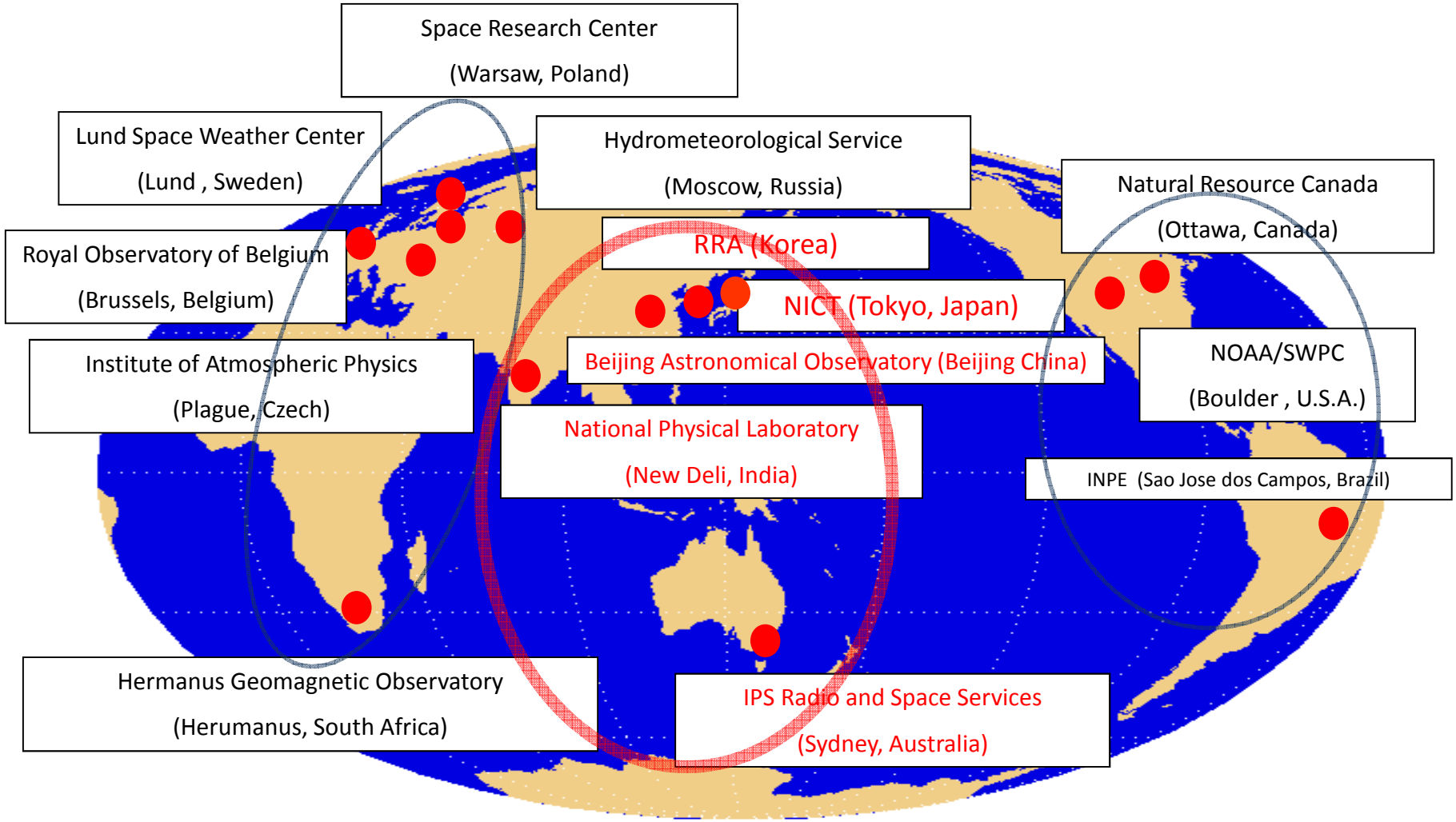
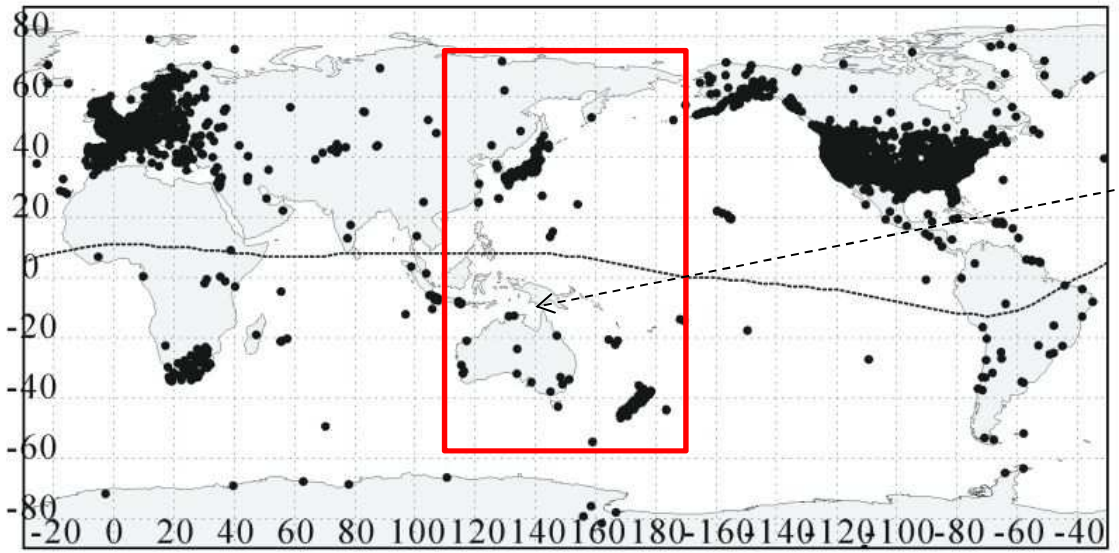
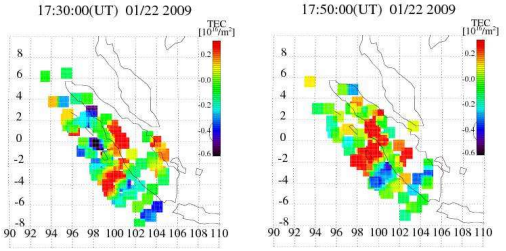
Asia/Oceania Space Weather Alliance (AOSWA)

Space Weather Regional Warning Centers of International Space Environment Service (ISES)





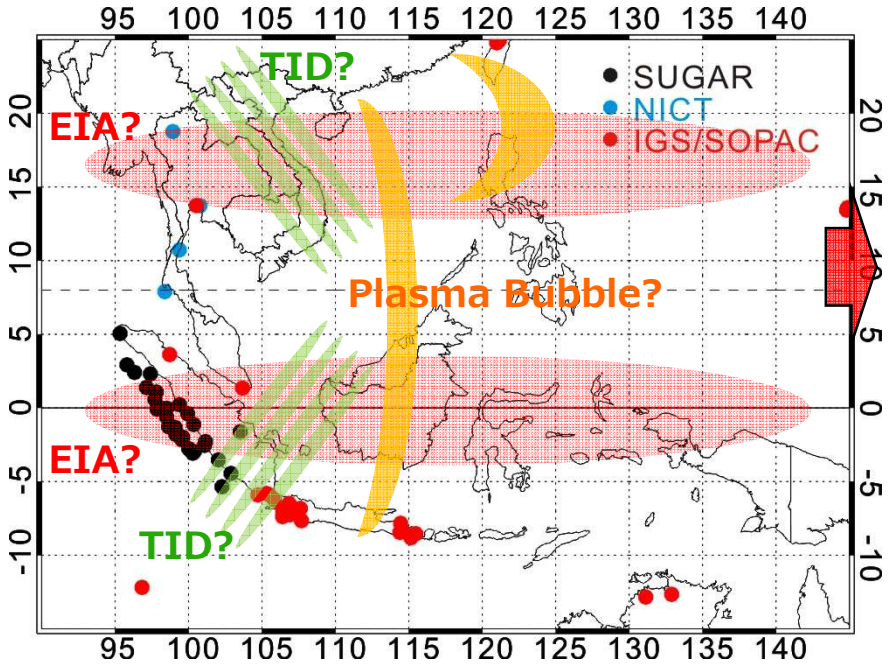
GPS receivers all over the world 5000 receiver data available online



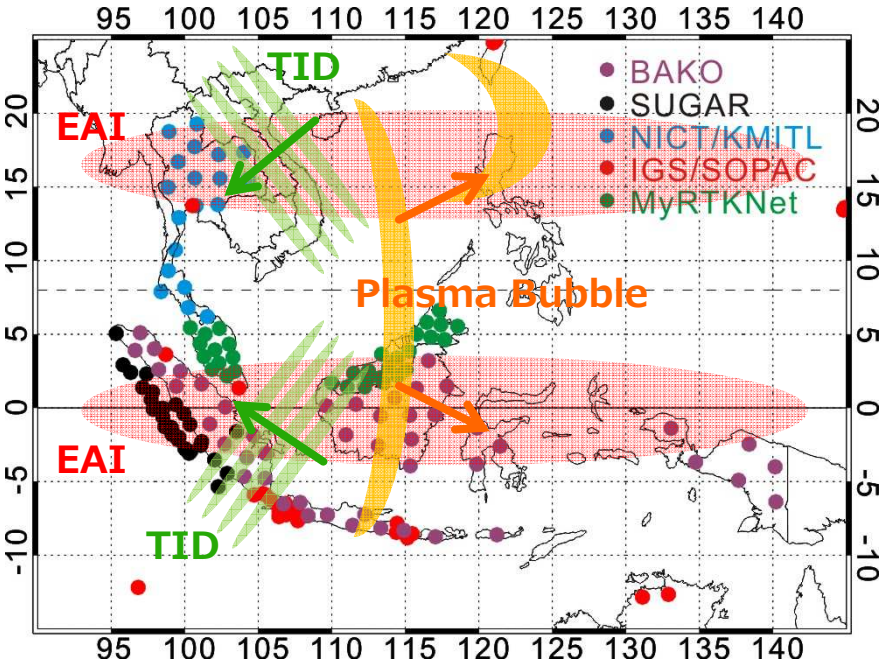
GPS-TEC at Sumatra island

Dense and wide-coverage GPS receiver network can reveal their spatial structures, propagation directions, and temporal evolutions.

Current



Near Future Plan & Vision



The 1st AOSWA Kick-off meeting
12/03/2010 Bandung – Indonesia
Japan, Indonesia, Australia, India, and Malaysia

The main objective of the AOSWA is to make a regional linkage of information of space weather for operations and researches.

AOSWA meetings

2010.12 - LAPAN workshop

- The first kick-off meeting between Japan, Indonesia, Australia, India, and Malaysia

2010.01.2 - SEALION workshop @Thailand

- Indonesia, Vietnam, Taiwan, USA, Brazil, Thailand, Laos, Philippine , China and Japan
- 2nd Kick-off meeting of the AOSWA

2011.04 @NOAA, USA

- Space Weather Workshop @NOAA, USA & ISES meeting 2011
- Local meeting between A-O ISES countries

2011.08 - AOGS @Taiwan

- AOGS; "Collaborative Researches and Operations of Space Weather Forecasting in Asia-Oceania"
- 3rd kick-off meeting of the AOSWA

2012.02 AOSWA 1st Workshop @Chiang Mai, Thailand

- 10 countries, 25 organizations, 77 participants!

2012.08 AOGS2012 @Singapore

- Asia-Oceania Space Weather Alliance: AOSWA session
- AOSWA informal meeting

2013.11 AOSWA 2nd Workshop @Kunming, China

- 11 countries, 29 institutes, 99 participants
- Main theme: space weather research to operations

2015.03 AOSWA 3rd Workshop @Fukuoka, Japan

- 14 countries, 75 participants
- Main theme: promoting international collaboration

2016.10 AOSWA 4th Workshop @Jeju, Korea

- 16 countries, 41 institutes, 131 participants
- Main theme: the risk of space weather, regional action

AOSWA Link

Issue5, March 2015

We hope the AOSWA framework helps our activities for improving space weather activities.

http://aoswa.nict.go.jp/

AOSWA Link

In this Issue...

Your contribution is always welcome!

If you should wish to submit an article, you are greatly appreciated. The articles should be approximately 500 words and contain either figures or pictures. Also it is available for use as a means of spreading information, such as upcoming conference and so on. Your feedback is always welcome.

Contact : sw-project-office@mi.nict.go.jp

KASI's contributions to Space Weather over the past 10 years

Kyungsuk Cho,
Group leader Solar and Space Weather Group,
Korea Astronomy and Space Science Institute, Korea

For the past decade, supported by the Korean government, the solar and space weather group of Korea Astronomy and Space Science Institute (KASI) has been researching towards the prevention of hazardous effects on Korean satellites, the stability of wireless telecommunications, and the safety of polar route aviation. So far, we have collaborated with NJIT and NASA, and established a Space Weather Prediction Center, with which we have been developing a more advanced models for space weather forecasting. Alongside that, we have continued our research on solar activities and the Sun-Earth connection.

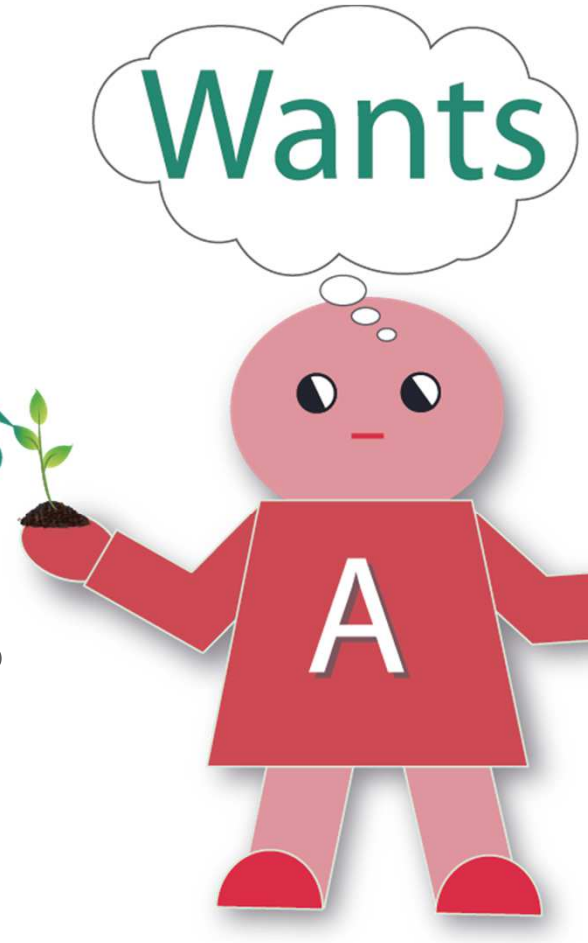
In 2004, KASI initiated a solar project with NJIT, the New Jersey Institute of Technology. The project, consisting of two parts, involved the development of the Korean Solar Radio Burst Locator, Korea's first solar telescope to be able to locate position of radio bursts (KSRBL, Fig1a), and the construction of 1.6 m New Solar Telescope, the world's largest solar optical telescope (NST, Fig1b). The project was completed in early 2009. The KSRBL and NST have been installed the following year at KASI and the Big Bear Solar Observatory respectively. In 2007, the group started a new space weather project to establish a Korean Space Weather Prediction Center (Fig1c). The scope of the project included the extension of the ground observation system, the construction of the space weather database, and the development of prediction models. Through the project, several space weather products have been developed, and forecasting services have been provided to a satisfied domestic clientele such as Korean Air (Fig1d).

In 2010, KASI turned its main scientific focus to space observation. As a part of the efforts, KASI made an agreement with NASA to set up of the data system to store, use, and disseminate the Solar Dynamic Observatory (SDO) data for the Asian region (Fig 1e). The SDO center has three subsystems; the first is the data transfer system (DTS) to transfer SDO data from Stanford University to KASI via the 10 Gbps GLORIAD network. The second is the data archive system (DAS) to archive and manage JP2 data (30 TB since 2010, Sep.) and Fits data (800 TB since 2012, March) of SDO, which was designed in consideration of the compatibility and scalability of the system so that we can extend its capacity and performance at any time by adding more storage and cluster gateway, respectively. We hope that we will be able to provide free and unfettered access to the SDO for the AOSWA community after developing of various applications for data quarry and analysis for space weather. KASI built a 7-meter parabolic antenna in 2012 to receive space weather broadcast data from the Van Allen Probes (VAP) mission (Fig 1f). KASI utilizes the VAP real time data to forecast space weather, protecting national space assets from severe space environment.

KASI pursues international collaborations in hopes of developing the sciences, services, and technologies of space weather. We believe, based on our experiences over the past 10 years, that we may contribute to the future advances of AOSWA.

KASI's instruments for space weather research and forecast

Wants, Seeds and Needs

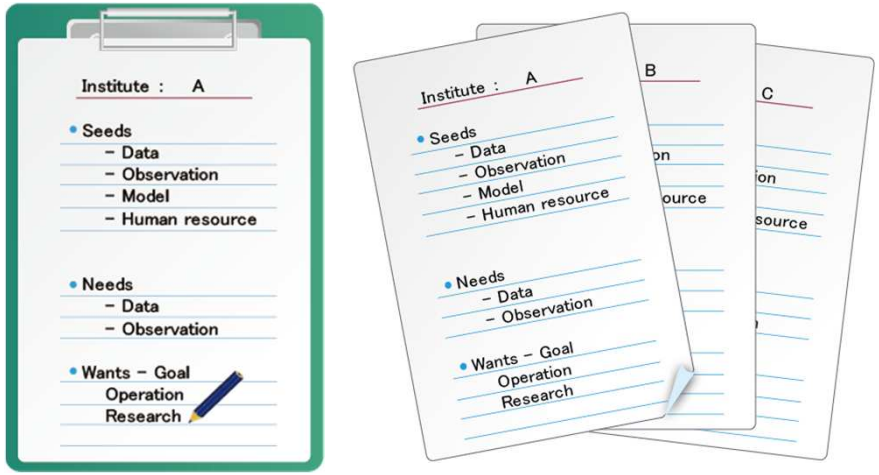


What is aimed at?

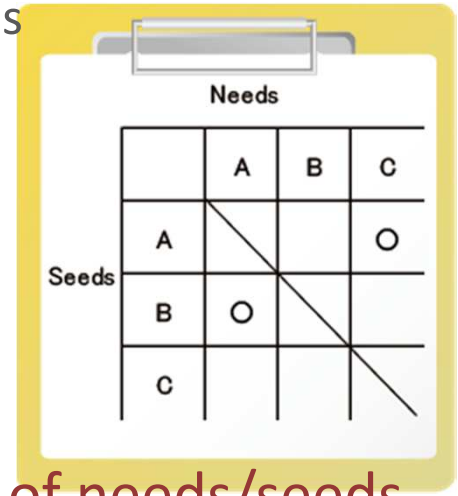
What is the strength/resource?

What is needed?

Questionnaire submitted in advance



On the base of this questionnaire, SOC will prepare the matrix of needs/seeds



Matrix of needs/seeds

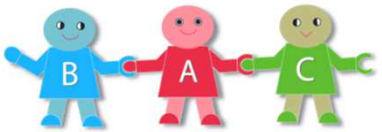
We SOC will send a questioner to invited speakers in which we ask their needs, seeds and wants.
We should prepare some options in each item for answering easily.

Discussion based on the table for “Omiai”

Using this table, each institute has a small meeting with the potentially matching partners.
the meeting time should be limited (15-20 min) SOC keeps the time. Each institute will have three potential partner institutes. In addition they can choose another one which they like.
After the meeting we have plenary meeting for discussing the results.

Introduction of Present status as conclusions

- AOSWA established on 2010 with 5 countries and now has 16 countries, 41 institutes, 131 participants in the 4th workshop held in Jeju, 2016.
- On 2016, LAPAN Indonesia joined ISES as a Regional Warning Center and will host the next AOSWA workshop on 2019.
- Some other countries, for example, Malaysia and Thailand are also interested in operational space weather forecast.
- Now, Asia-Oceania is one of the hottest regions on SWx research.



Activities for Capacity building in NICT

- NICT has been holding “Space Weather Users forum” since 2003.
- Recently we had the forum at the national science museum since 2016.
- In the latest meeting, Three guest speakers presented impressive topics about amateur radio operation, space weather information in ancient documents and space sightseeing. After the forum we had a small tour in the museum for braising space weather exhibition.

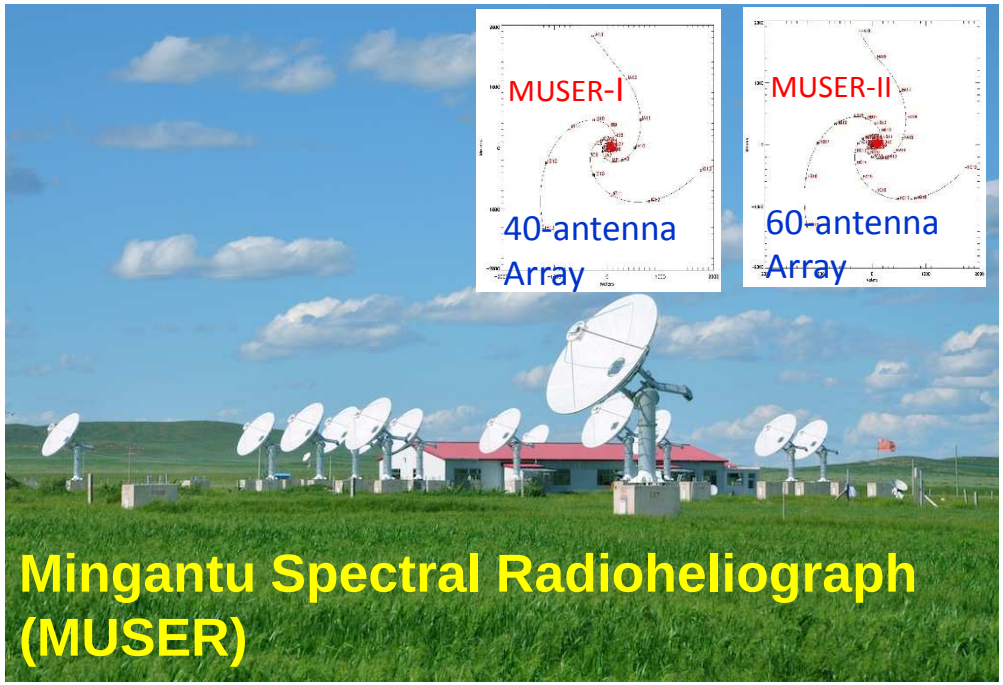
- NICT has a internship fund which pays to students the travel fare to NICT and staying expense.
- In FY2013, we receive two students from Korea for one month (Jan.).
- In FY 2014, we receive one student from Malaysia, and several people will visit from Indonesia on August for few days.
- In FY 2015, we prepare a full program for learning operational space weather forecast and received two students from ANKGASA, Malaysia

Impact of Space Weather on Earth COSPAR Capacity Building Workshop
August 15 – 26, 2016, Paratunka, Kamchatka (Russia)

The workshop on space weather was held at the Institute of Cosmophysical Research and Radio Wave Propagation of the Far Eastern Branch of the Russian Academy of Science (IKIR FEB RAS)

IKIR FEB RAS was presented the methods for system analysis, GPS and low-orbit radiotomography of the ionosphere, radiosounding of the magnetosphere, lidar sounding of the ionosphere. The International Heliophysical Year 2007 facilitated the development of ground observation systems and the coordinated investigation of space weather impacts on the Earth. As a result of international cooperation within the MAGDAS and INTERMAGNET Programmes, observation system complexes were created in the Far East during that time. Analysis of data produced by these observation systems was form a key element of the programme of study proposed.

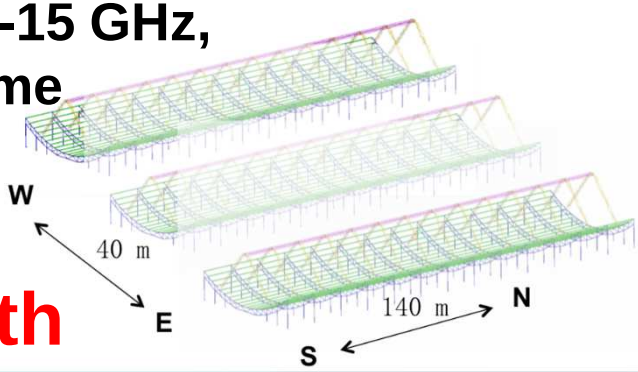
Major Solar Radio Facilities at Mingantu Observing Station, NAOC for Space Weather



Future plans in next 5 years:

- **to build a new array of 100 LPDA + calibration element covering 30-400 MHz.**
- **to build a new 3-station IPS telescope @327/654 MHz: Mingantu IPS Main Station with 3×140 m (NS)×40 m(EW) cylinders; Two sub-stations with ~Φ15m antennas.**

MUSER: Two arrays with 64 channels in 0.4-2.0 GHz & 520 channels in 2.0-15 GHz, space resolution: 1.3″-50″, and time resolution: ~100 ms.



Monitor solar eruptions from the Sun to the Earth

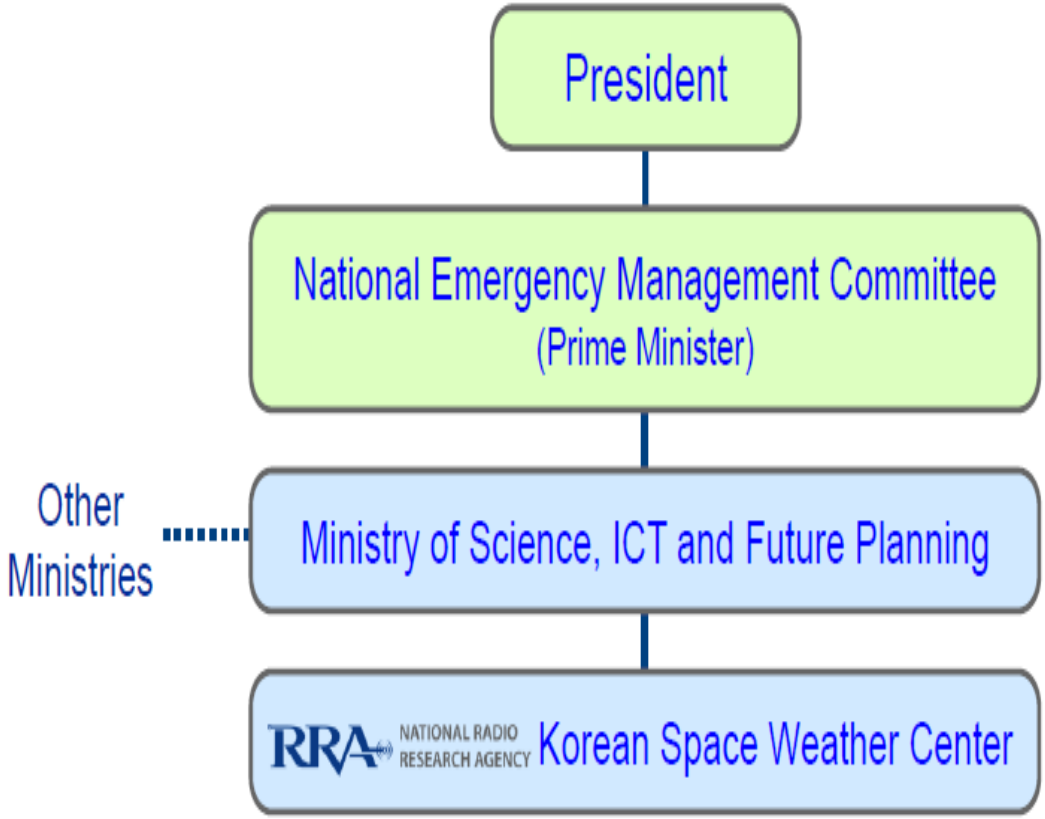
R.O.K. National Preparation
– Standard Manual for Space Weather risk

For more information : Contact to KIC (hangjeongjeon@korea.kr)

Standard Manual
for
Space Weather
Risk

2013.2.

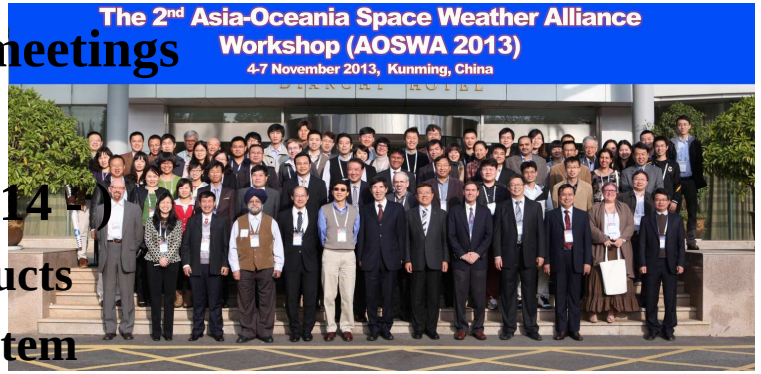
Ministry of Science, ICT and Future Planning



All ministries should follow predefined procedures based on KSWC's SWx information !

China SEPC Activities

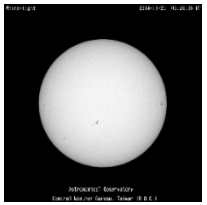
- **Hosted the 2nd AOSWA workshop, attended the others**
- **Attended SWW (USA), ESWW (Europe) meetings**
- **Serving as an ISES AWC**
- **Recent Models, Products, and Services (2014 –)**
  - ✓ **Ionospheric Assimilation Models and Products**
  - ✓ **Operational CME propagation forecast system**
  - ✓ **New Geomagnetic Field Stations and Geomagnetic disturbance nowcast** – K indices for five stations in China
  - ✓ **Forecast Verifications: 3-day forecasts of F10.7 and Ap, CME arrival times, and SPE probability forecasts**
  - ✓ **Space Situation Environmental Awareness System**
  - ✓ **Space Environment Teaching and Practice Software**
  - ✓ **Space Environment Services for China Space Flight Missions**: Tiangong II, Tianzhou I, Dark Matter Particle Explorer (DAMPE), Shijian-10, Quantum Experiments at Space Scale (QUESS), Hard X-ray Modulation Telescope (HXMT)etc
  - ✓ **The Ninth National Symposium on Space Environment and Applications**



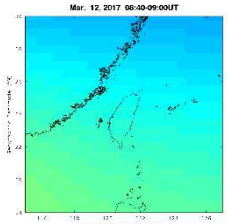
Space Weather Activities at the Central Weather Bureau, Taiwan

http://swoo.cwb.gov.tw/V1/index_Eng.htm

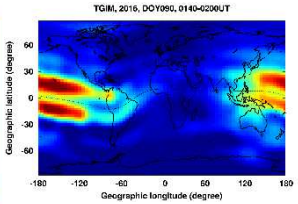
Providing space weather information and global/regional products, as well as conducting outreach education program to introduce space weather and its impacts.



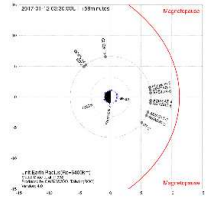
Solar Observation



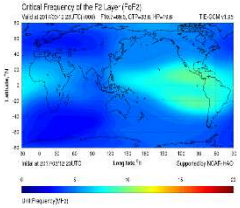
Regional TEC



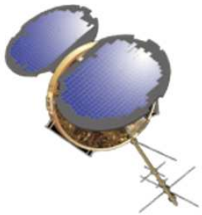
Global TEC Fusion Map



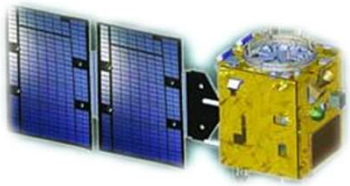
Magnetopause Model



Ionospheric Model



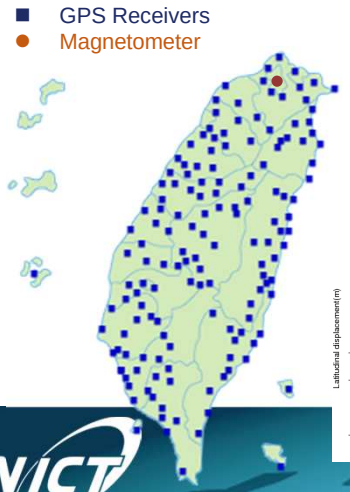
FORMOSAT-3

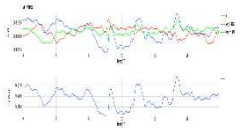


FORMOSAT-7

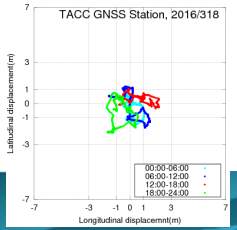
Missions :

- ✓ Ground solar surface and sunspot observation
- ✓ FORMOSAT-3 radio occultation date processing
- ✓ Real-time collecting ground-base GNSS receiver date and producing global/regional TEC map.
- ✓ Constructing near real-time global 3D ionospheric electron density and associated high-level products, hmF2, foF2, NmF2,etc.
- ✓ Developing and maintaining various space weather model.
- ✓ Developing and improving data assimilation system to produce numerical prediction products for ionospheric space weather.
- ✓ Space weather watch, severe event advisories/warnings issuance.
- ✓ Daily updating space weather report and forecast.





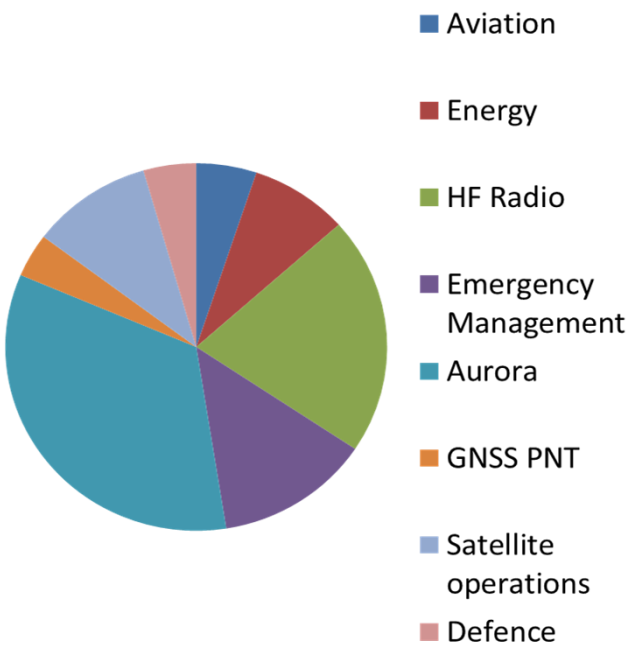
Magnetometer Record



Positioning Error

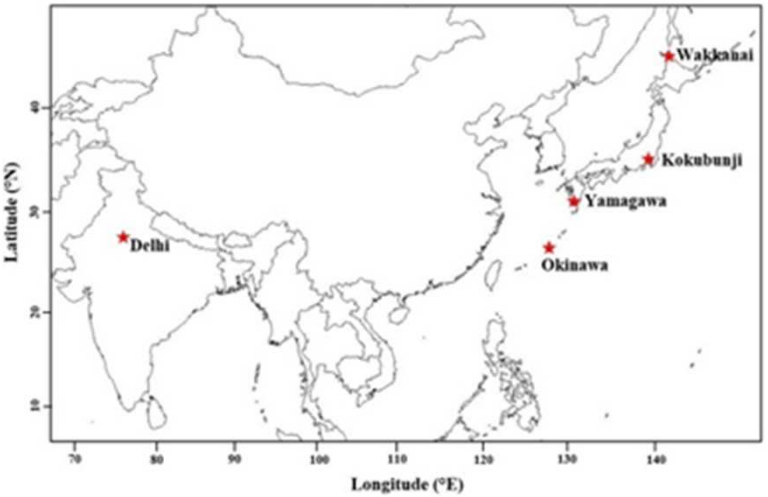
Australian Government
Bureau of Meteorology

SWS continues to engage with industry and the general public. Recent activities include state and national risk assessment scenarios based on extreme space weather events with owners and operators of critical infrastructure. In December 2015, SWS held its inaugural Space Weather Users workshop with over 100 participants from industry and the general public. These will now be a bi-annual event. In November this year, the second workshop will be held following the Australian Space Research Conference (http://swworkshop.sws.bom.gov.au/).

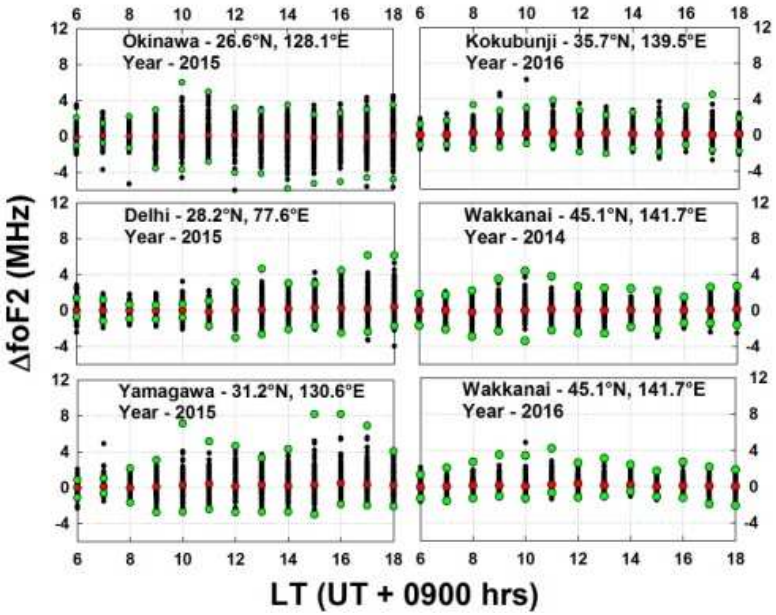


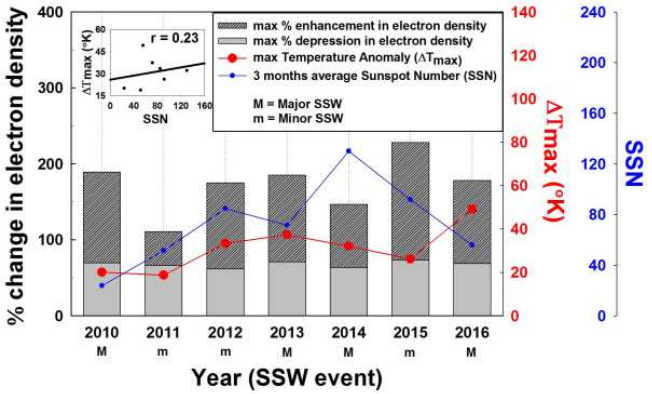
Morphology of Ionospheric F_2 region variability associated with Sudden Stratospheric Warmings

We have analyzed the ionospheric responses to seven SSW events for years 2010 to 2016 using foF_2 covering a broad latitude range from 26.6°N to 45.1°N and longitude range from 77.6°E to 141.7°E across the Asian region to investigate (i) the morphology of these variations across latitudes and longitudes, (ii) the extent of these variabilities, (iii) the new proposed approach of "SSW integrated strength" to characterize SSW by *Vieira et al.* [2017] and (iv) the plausible cause of such atmospheric linkages.



The atmospheric coupling, as seen from the ionospheric responses examined during SSW, seems to be larger during the low and moderate solar activity period in comparison to that during the high solar activity.





The maximum and minimum variation in foF_2 during a period of six months, are largely found to be observed during the SSW period at all the four Japanese stations and at Delhi.

A large variation within enhancement (~117%) in comparison to a quite low and stable variation within depression (~11%) in electron density is observed in our analysis of these seven SSW events. A depression is predominantly seen around and during the SSW peaks during these events.