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STRATEGIC PLAN FOR SPACE WEATHER

National/regional strategic plans for space weather:

KMA space weather service, status and future plans

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Summary and Purpose of Document

KMA has begun the space weather service to the public since April, 2012. KMA space weather service targets 1) the support of satellite operation, 2) the support of aviation, and 3) the ionospheric dynamics. KMA proceeds with three major projects to build the infrastructure supporting the space weather operation, which is mainly focused on three KMA service targets.

This document reports on the status and the future plans of KMA space weather projects.

APPENDIX KASI Solar Observational Systems

DISCUSSION

1. INTRODUCTION

1.1 Background

KMA revised the Korean weather act to include the space weather associated act in September 2011 and have the mandate to provide space weather information of its long-/short-term prediction and alert to the public. Accordingly, KMA has started the space weather service to the public in April 2012. Three major projects have been initiated to improve the space weather service: “to build the observation system”, “to develop the prediction model” and “to build the space weather service system”.

1.2 Scope of the document

In this report, we introduce the status and the future plans of KMA’s space weather program. The ground observation system of the representative space weather research institute, the Korea Astronomy and Space science Institute (KASI) is described in the appendix.

2. RECENT DEVELOPMENTS

2.1 GNSS data utilization

KMA received the ground-based GNSS data from 87 Korea GNSS ground stations in 2011. More GNSS stations were added for a total number of 115 in 2012, including 9 IGS sites near the Korean peninsula. KMA has been producing TEC and PWV information over Korea every hour using GNSS station data.

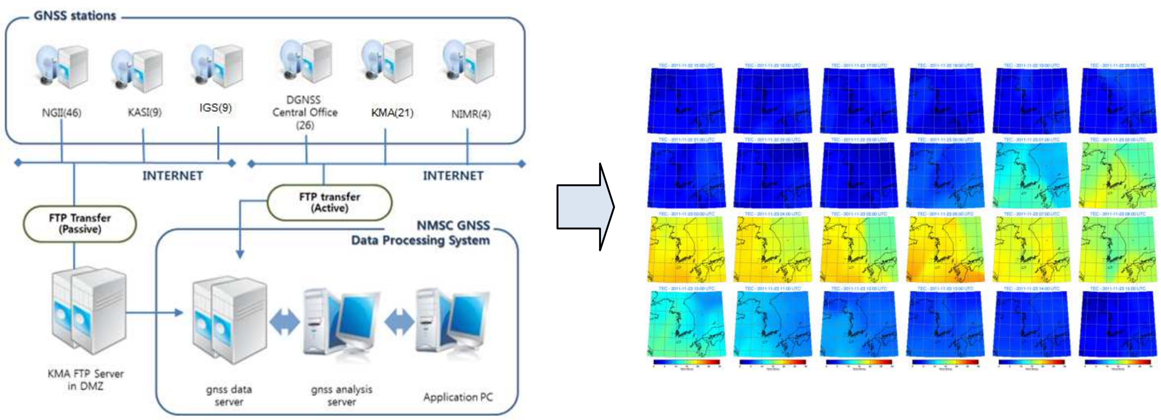

Fig. 1 KMA GNSS data processing system (Left) and TEC map over Korea (Right)

2.2 Space Weather Analysis system

The KMA space weather analysis system is under development. Some functions of the system like CME analysis system based on the coronagraph images of SOHO, STEREO-A/-B and shock arrival time based on the STOA-II model are ready to operate. (See Fig.2).

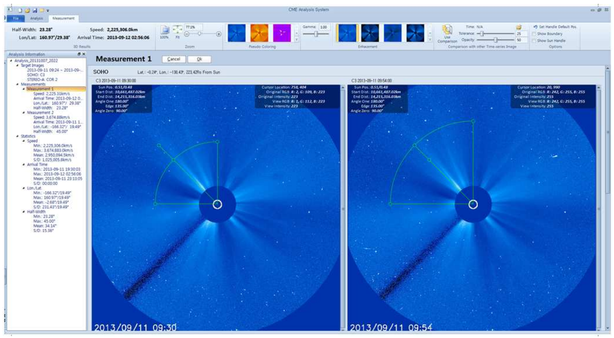

Fig. 2 Coronagraph image based CME analysis system

2.3 Space weather service

KMA has begun the space weather service for the satellite operation, aviation and the ionosphere condition. The daily space weather information through the homepage (http://swfc.kma.go.kr) is provided and the space weather alert is issued as any extreme events occur (See Fig. 3).
To improve the space weather service, new KMA integrated space weather operation system is planned. New integrated space weather operation system includes the data acquisition of space-/ground-based observation data, space environment monitoring, event analysis, model operation and issuing the daily log and alerts.

Fig. 3: Space weather information homepage

3. FUTURE PLANS

3.1 Model development

KMA has developed the space weather prediction model from the Sun and the interplanetary system to near Earth region of magnetosphere and ionosphere. Currently prototypes of the models are running in the testbed. Most of model will be operated in real-time and its results will be released to the public by the end of 2014.

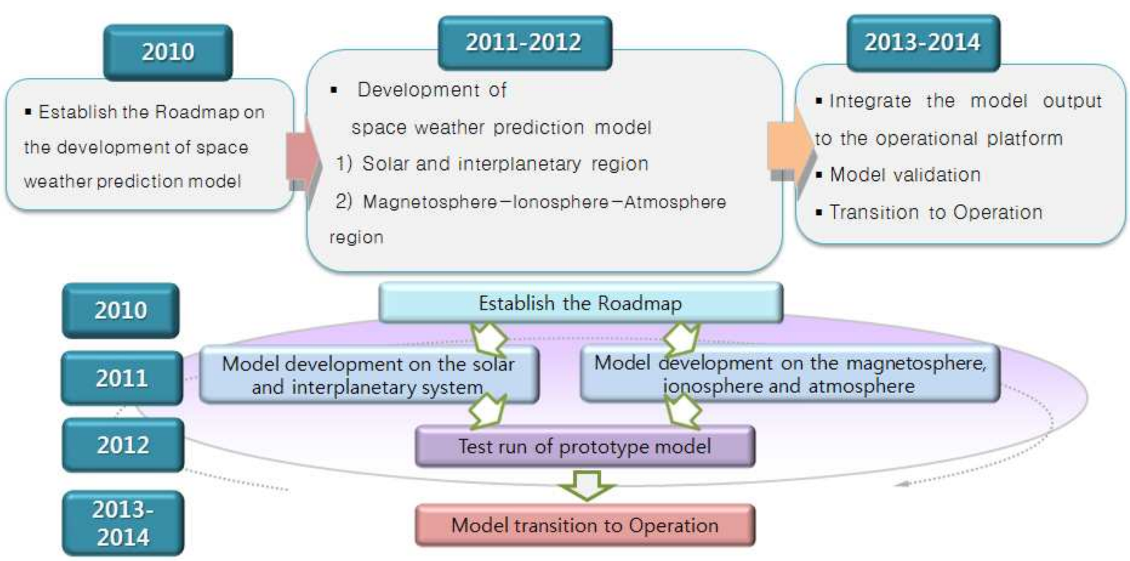

Fig. 4 KMA Model development plan

3.2 GEO-KOMPSAT-2A Space Weather Mission

KMA is planning the follow-on geostationary meteorological satellite (GEO-KOMPSAT-2A) to continue the COMS's meteorological mission. In addition to meteorological mission, GEO-KOMPSAT-2A satellite will carry on the payload for space environmental monitor. The space weather mission of GEO-KOMPSAT-2A consists of 1) medium energy particle detector, 2) magnetometer, and 3) satellite charging monitor. The mission requirement of measurement and resolution are as follows:

Sensor	Requirements
Medium energy Particle Detector	- Electron(/Ion) energy range : ~50keV ~ 2 MeV - Angular Resolution (pitch angle): 60° at least
Magnetometer	- Measurement range : ± 300nT (in 3 axes) - Field resolution : 1nT at least (on orbit)
Satellite Charging Monitor	- Current range: ± 3pA/cm^2 - Measurement resolution : 0.01pA/cm^2

4. ISSUES, CHALLENGES OR OPPORTUNITIES

4.1 Contingency plan on the possible gap of Coronagraph image

To secure the lead time is important. For the case of satellite operators, there's some required time to make any decision when any severe space weather information is given. Without coronagraph, it's really hard to secure the leading time for the severe space weather alert.

4.2 Challenges and opportunities

Up to now, most of the space weather work has been done more on the research side. International cooperation is more important in the space weather field than in the weather society to transfer the research product to operation. It is expected that ICTSW plays a key role for that. "How to prepare the countermeasure on the possible data gap of coronagraph" is the challenge topic to be discussed during ICTSW.

KASI Solar Observational Systems

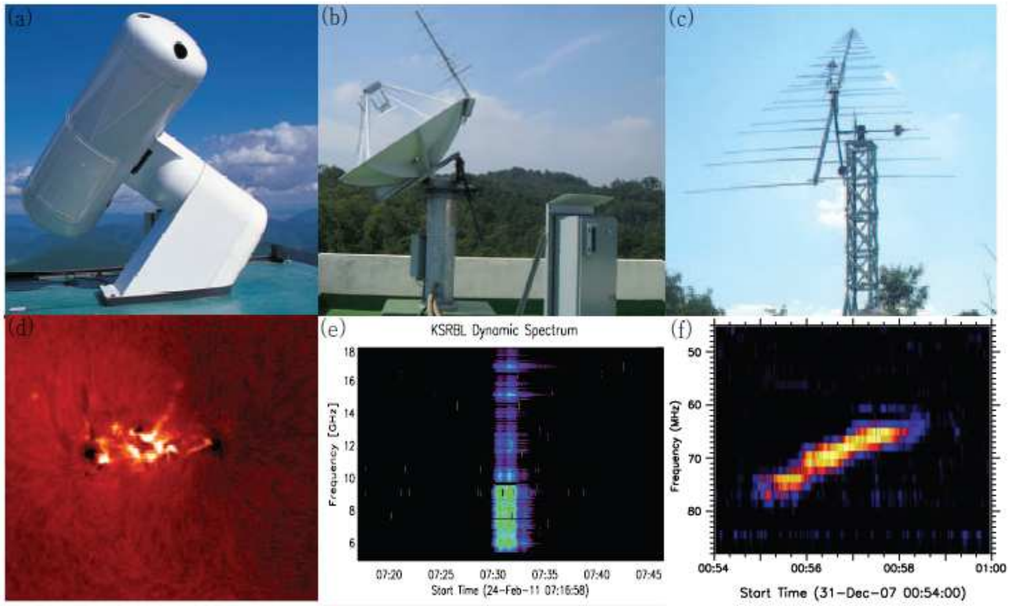

Figure 1. Representative solar observational systems and data in Korea. (a) Solar Flare Telescope (SOFT), (b) Korean Solar Radio Burst Locator (KSRBL), (c) e-CALLISTO, (d) Hα flare observed by SOFT on 15 Feb. 2011, (e) Solar radio burst observed on 24 Feb. 2011 by KSRBL, and (f) type II radio burst observed on 31 Dec. 2007 by e-CALLISTO.

Figure 1 shows KASI ground observation systems in Korea such as Solar Flare Telescope (SOFT), Korean Solar Radio Burst Locator (KSRBL), and e-CALLISTO. SOFT is the first research-oriented solar observing facility in Korea that was installed at the top of the Bohyun Mountain in 1995. The SOFT was originally designed for the observations of solar active regions as a 4-channel instrument including white light and H-alpha observing systems, a vector magnetogram (VMG) and a longitudinal magnetogram (LMG). In 2006, an H-alpha full-disk monitoring system for the observations of the chromosphere was added to the SOFT. KASI has two solar radio observation systems. One is the Korean Solar Radio Burst Locator (KSRBL), a single dish radio spectrograph with broadband frequency range (0.5 - 18GHz). The KSRBL was developed in collaboration with New Jersey Institute of Technology (NJIT) and was installed at KASI in August, 2009. It has a unique capability to locate the position of a burst within 2 arcmin and record the spectra of solar microwave bursts with high time (1 sec) and frequency resolution (1MHz). In lower frequency range, there is the e-CALLISTO (Earth-wide, Compact Astronomical Low-frequency, Low-cost Instrument for Spectroscopy in Transportable Observatories), which is a global network of frequency-agile radio spectrometers that was constructed in a collaboration between ETHZ of Switzerland and KASI as a part of IHY 2007 (International Heliophysical Year) activity. The e-CALLISTO is monitoring the solar radio bursts in frequency range between 45MHz and 870MHz and is usually used for studying type II solar radio bursts. The e-CALLISTO and KSRBL will be used for studying solar eruptions and monitoring solar radio bursts which can disturb many kinds of high-tech radio instruments such as cellular phone, GPS, and radar.