

# System and service for management of space weather risk in Korea

2020. 2. 4.



Ministry of Science, ICT and Future Planning  
National Radio Research Agency

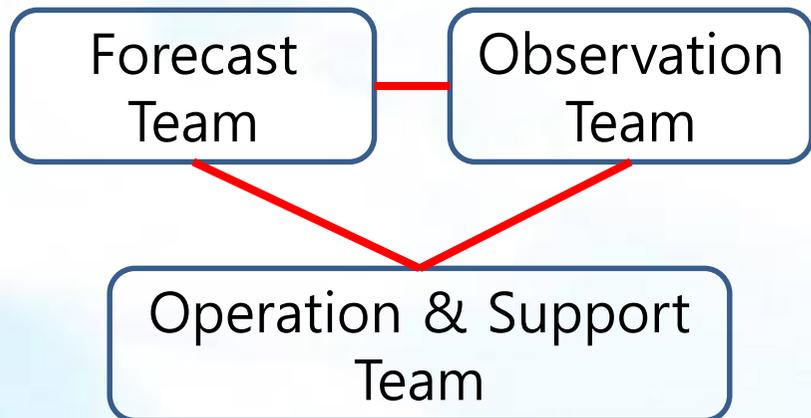
Korean Space  
Weather Center

**YUN, JONG-YEON**

# KSWC Overview

- The **primary action agency** of emergency measure to severe SWx, and the **RWC Korea** as a member of ISES (International Space Environment Service)

**KSWC** KOREAN SPACE WEATHER CENTER



2011

ISES  
Regional Warning Center



2012

Member of ICTSW  
ITP – SWISS Feb. 2017



2014

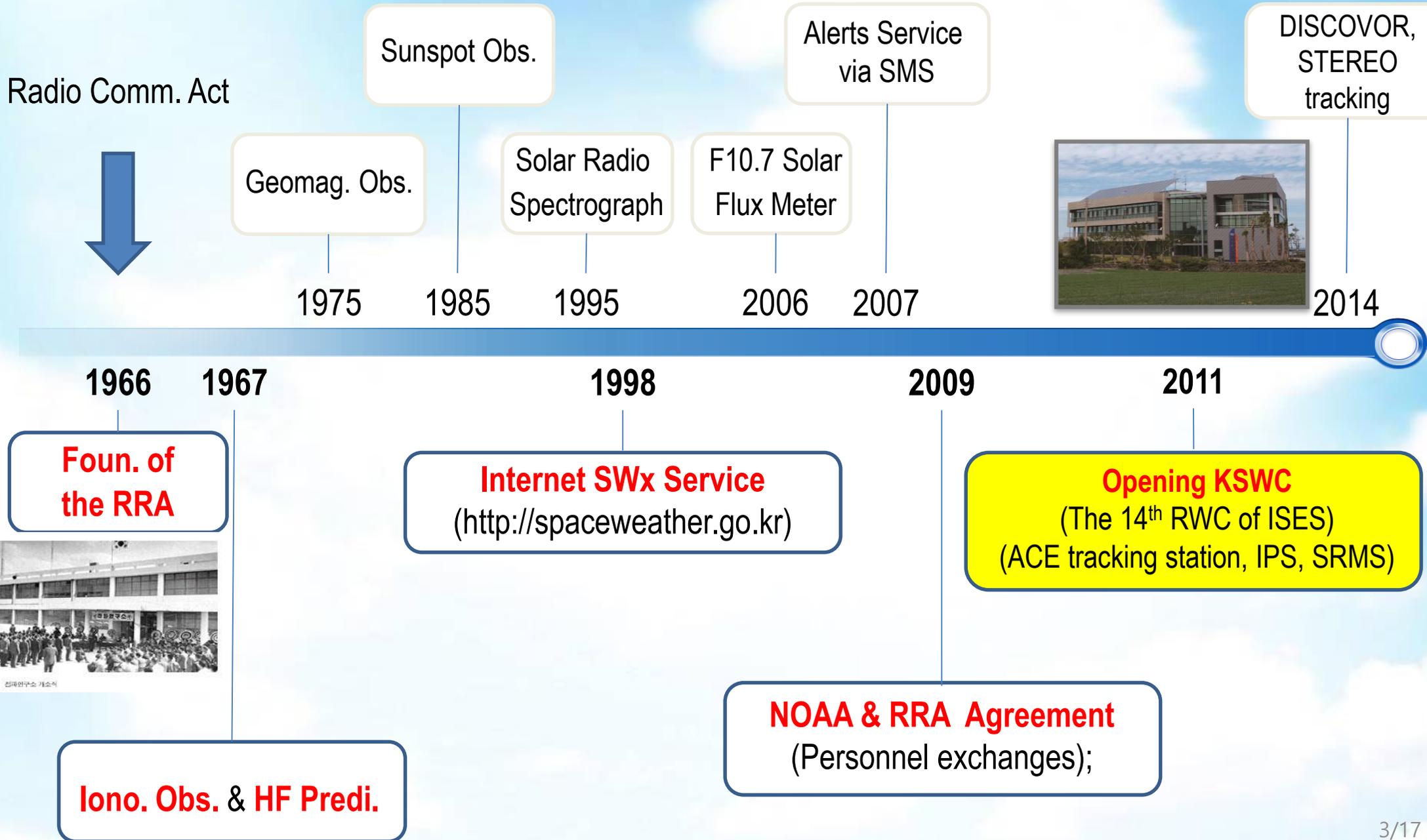
Delegate for Space Weather



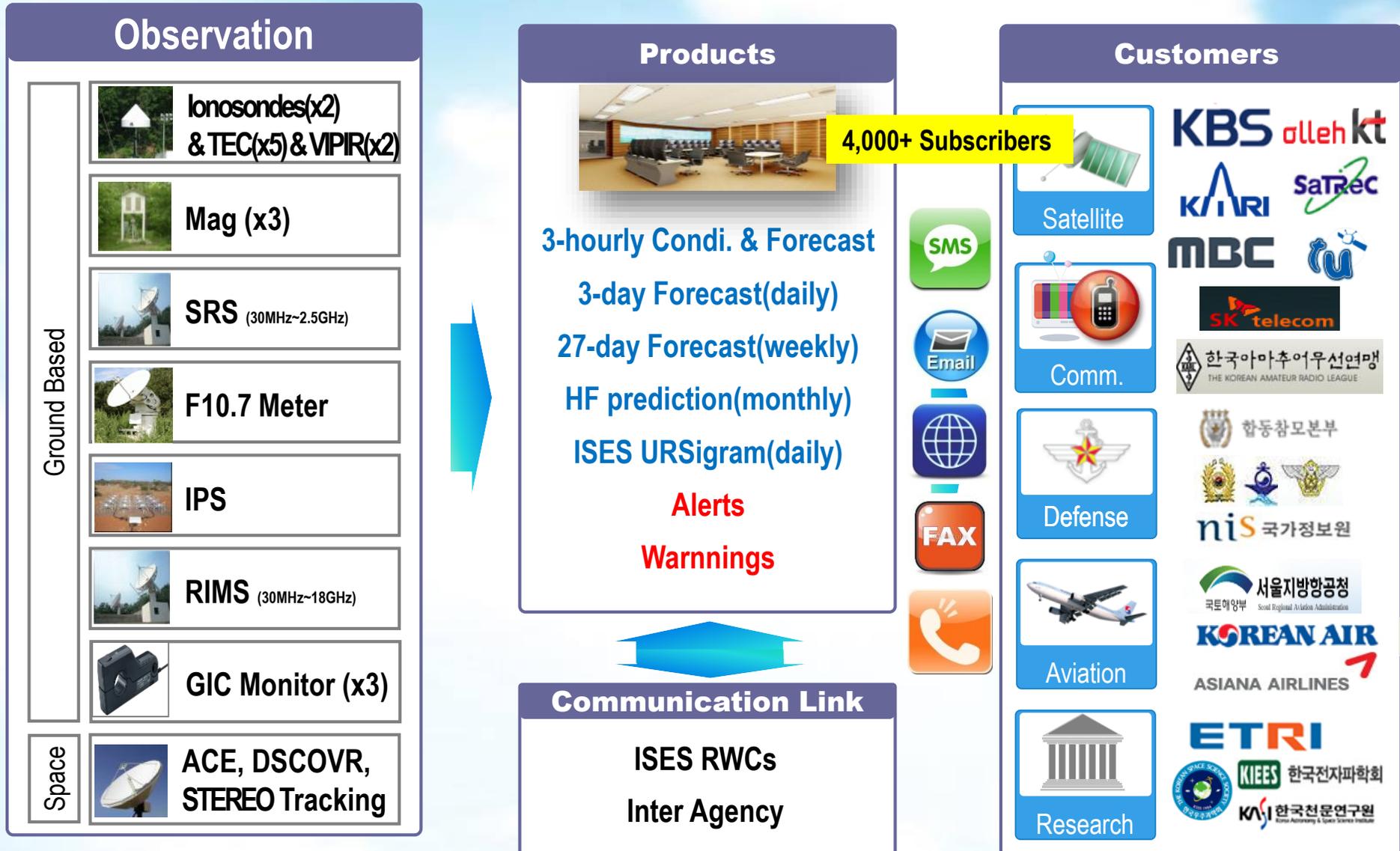
1980S~

Leading Agency of ROK

# History & Origin of KSWC



# Operational Flow



# Observation Networks in Korea



# Forecasting Office

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WEATHER CENTER**

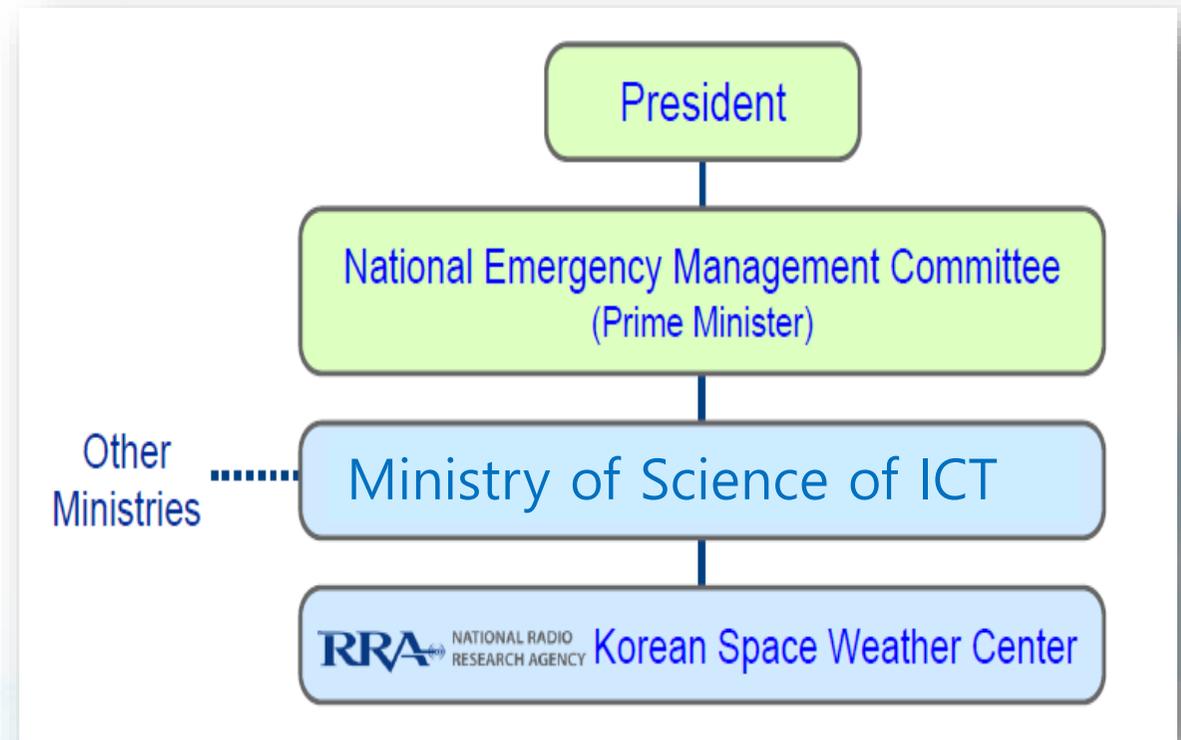


**Disaster  
ACT**

**Standard Manual  
for  
Space Weather Risk**

**2013.2.**

**Radio  
Wave  
ACT**



**All ministries followed predefined procedures based on KSWC's SWx information !**

# Policy - SWx Disaster Management

- ✓ We take actions according to NOAA SWx scales
- ✓ If level 3+ event occurs, we provide the press release for public

<b>R.S.G.</b> <b>NOAA Scales</b>	1	Send alert messages (SMS/email/fax, automatic)	<i>KSWC level</i>	
	2			
	3	Notify to key customers (phone call, forecaster)  Status updates at website	Report to the Ministry  Press release	<i>Ministry level</i>
	4	Notify to related Ministries (Defense, Transport, Communication, Energy, Meteorological, Security...)	Issue a national space weather disaster alert (by Space Weather Disaster Management Manual)	<i>National level</i>
	5			

# Migration to Customer Oriented Services

Alerts & Warnings  
 for Global Disturbance



Customized Alerts & Warnings  
 to Each Customer

### Ionospheric Disturbance Effect Prediction

### Solar Radio Noise Effect Prediction

### Solar Activity Prediction using Image Processing

### GEO Satellite Environment

### Comic radiation Prediction Model

2017-06-17 11:00 (KST), 2017-06-17 02:00 (UTC)

우주전파센터

Alerts & Forecasts | Forecast Model | Real Time Data | Space Weather a... | Instru...



The Sun now

1 day Forecasts | 3 day Forecasts | Monthly Radio Wave

### Forecast condition

Date updated 2017.06.16, KST

#### Radio Blackouts

	0-24hr	24-48hr	48-72hr
R1 - R2	1%	1%	1%
R3 or higher	1%	1%	1%

#### Solar Radiation Storms

	0-24hr	24-48hr	48-72hr
S1 - S2	1%	1%	1%
S3 or higher	1%	1%	1%

#### Geomagnetic Storms

	0-24hr	24-48hr	48-72hr
G1 - G2	50%	50%	50%
G3 or higher	10%	10%	1%

Notice

지자기교란 관측에 대한 조별 크리... 2017-06-16 09:00

지자기교란 : ...

지자기교란 : ...

HOME | FAQ | SITE MAP | KOREAN

2017-06-17 11:07 (KST)  
2017-06-17 02:07 (UTC)

Alerts & Forecasts | Forecast Models | Real Time Data | Space Weather | Instruments | About the Center

Home > Forecast Model > ASSA

## ASSA

Automatic Solar Synoptic Analyzer

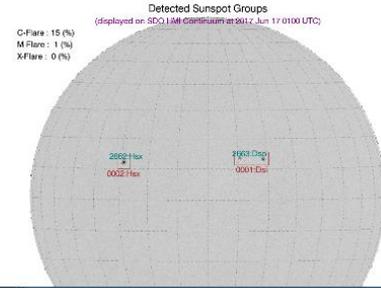
Font Size + - Print

ASSA Sunspot | Flare Forecast (24H) | Flare Forecast (12H) | CH effect | ASSA Filament

- ASSA
  - Wireless-SNR
  - Automatic CME analysis model
  - Satellite Drag Model
  - 3D Solar Active Region Monitor
  - Prediction of long-term solar activity at 2.8GHz
  - Displaying automatically CME type detection using observed solar radio flux data
- Detection of Sunspot Groups, Coronal Holes, Filaments
  - SDO HMI, AIA data and ground-based H-alpha data are used
  - Morphological feature detection and estimation of necessary quantitative parameters by various image processing techniques
  - McIntosh and Wilson Magnetic Classification results are automatically generated
  - Update Period: 1 hour

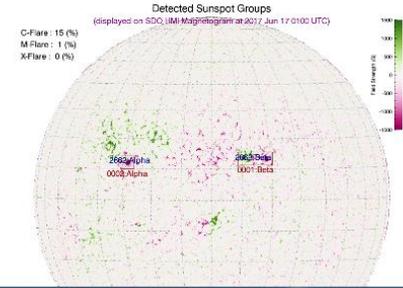
Detected Sunspot Groups  
(displayed on SDO/HMI Continuum at 2017 Jun 17 0100 UTC)

C-Flare: 15 (%)  
M-Flare: 1 (%)  
X-Flare: 0 (%)



Detected Sunspot Groups  
(displayed on SDO/HMI Magnetogram at 2017 Jun 17 0100 UTC)

C-Flare: 15 (%)  
M-Flare: 1 (%)  
X-Flare: 0 (%)



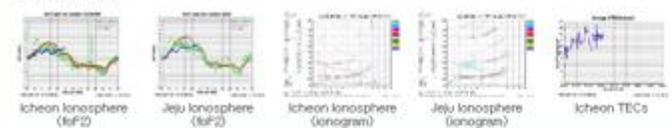
Observation Data | Go

Space Weather Report | Go

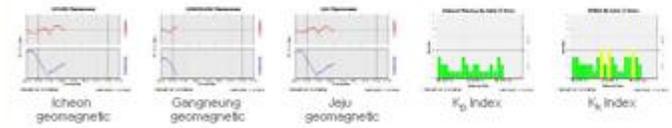
### Real time data

Click the image

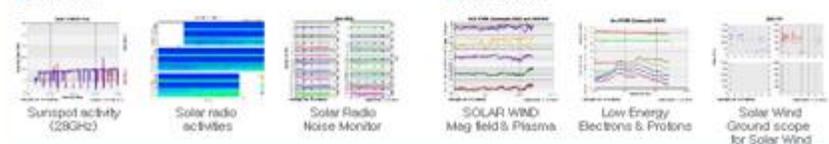
#### Ionosphere



#### Geomagnetic activity

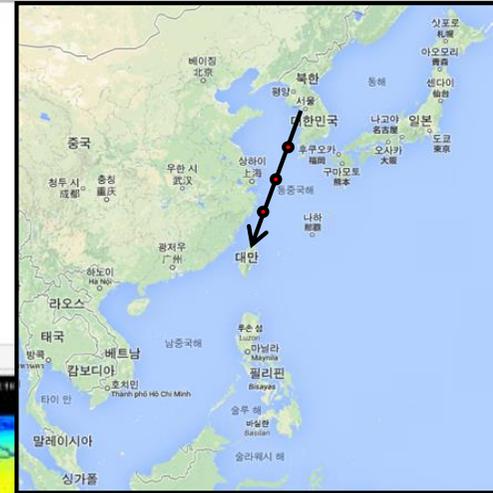


#### The Sun

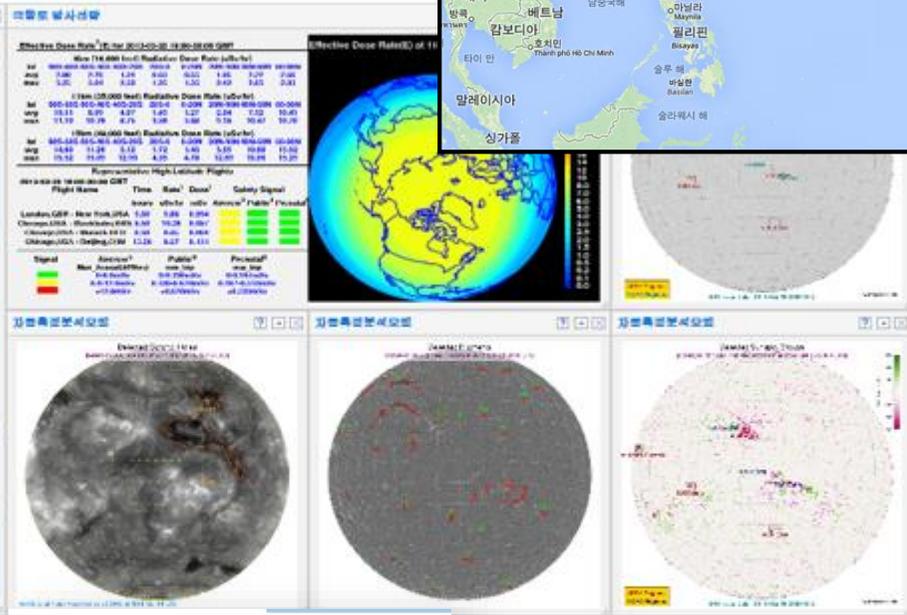


#### Solar Wind

# Customer Oriented Web Services

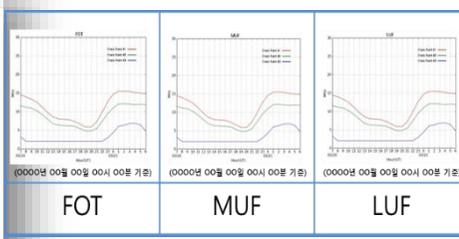
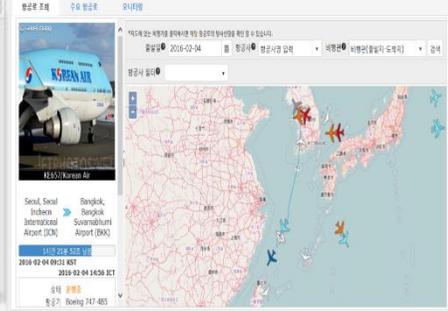


The screenshot shows the 'Aviation' section of the website. It features a navigation menu with 'Alerts & Forecasts', 'Forecast Models', 'Real Time Data', 'Space Weather', 'Instruments', and 'About the Center'. The main content area is titled 'Aviation' and 'Provide forecast service related to Aviation'. It includes logos for 'KOREAN AIR', 'EASTAR JET', and 't'way 티웨이항공', each with a 'Flight Radiation Service' button. There are also buttons for '우주전파환경 정보' and '극항로우주전파환경'.

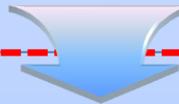


## Customer Services

- Satellite
- Aviation
- navigation
- Electric Power
- radio
- defense



# R & D - SW Forecast Models

	<b>R</b> adio Blackouts	<b>S</b> olar Radiation Storms	<b>G</b> eomagnetic Storms
Forecast Model	- <b>ASSA</b> (Automatic Solar Synoptic Analyzer)	- <b>Solar Proton Event Prediction</b>	- <b>Enlil, IPS, IPS-driven Enlil</b>
Function	Identify solar active regions, filament channels and coronal holes	Predict the intensity and occurrence of the solar radiation storm	Calculate geo-effectiveness of solar wind using IPS data & Coronagraph
<b>Upgrade Plan (Future)</b>	 <ul style="list-style-type: none"> <li>+ Tracing filaments using SDO 304</li> <li>+ Analyzing the magnetic field configuration of sunspots</li> </ul>	 <ul style="list-style-type: none"> <li>+ Predicting the peak time and the end time of the solar proton event</li> </ul>	 <ul style="list-style-type: none"> <li>+ CME analysis improvement using data of STEREO and L5 satellite</li> <li>+ Predicting IMF Bz</li> <li>+ Automatic CME analysis</li> </ul>

# R & D - SW Effect Analysis Models

	Satellite	Aviation	Navigation	Power Grid	Comm.
<b>Analysis Model</b>	- DREAM	- SAFE	- GNSS signal monitoring analysis	- GIC measurement	- Real time HF Mapping
<b>Function</b>	Calculate high energy particles on the radiation belts	Calculate cosmic radiation does during aviation flight	Monitor GNSS signal status according to solar activity	Measure GIC induced by Space Weather disturbance	Predict usable HF based on ionospheric assimilation
<b>Upgrade Plan (Future)</b>	+predict electron density distributions for 3 days using deep-learning	+predict cosmic radiation doses on flight routes		+predict GIC and K index for 3 days in Korea	+accuracy improvement using portable observational devices for ionosphere

# Activities for ionosphere research

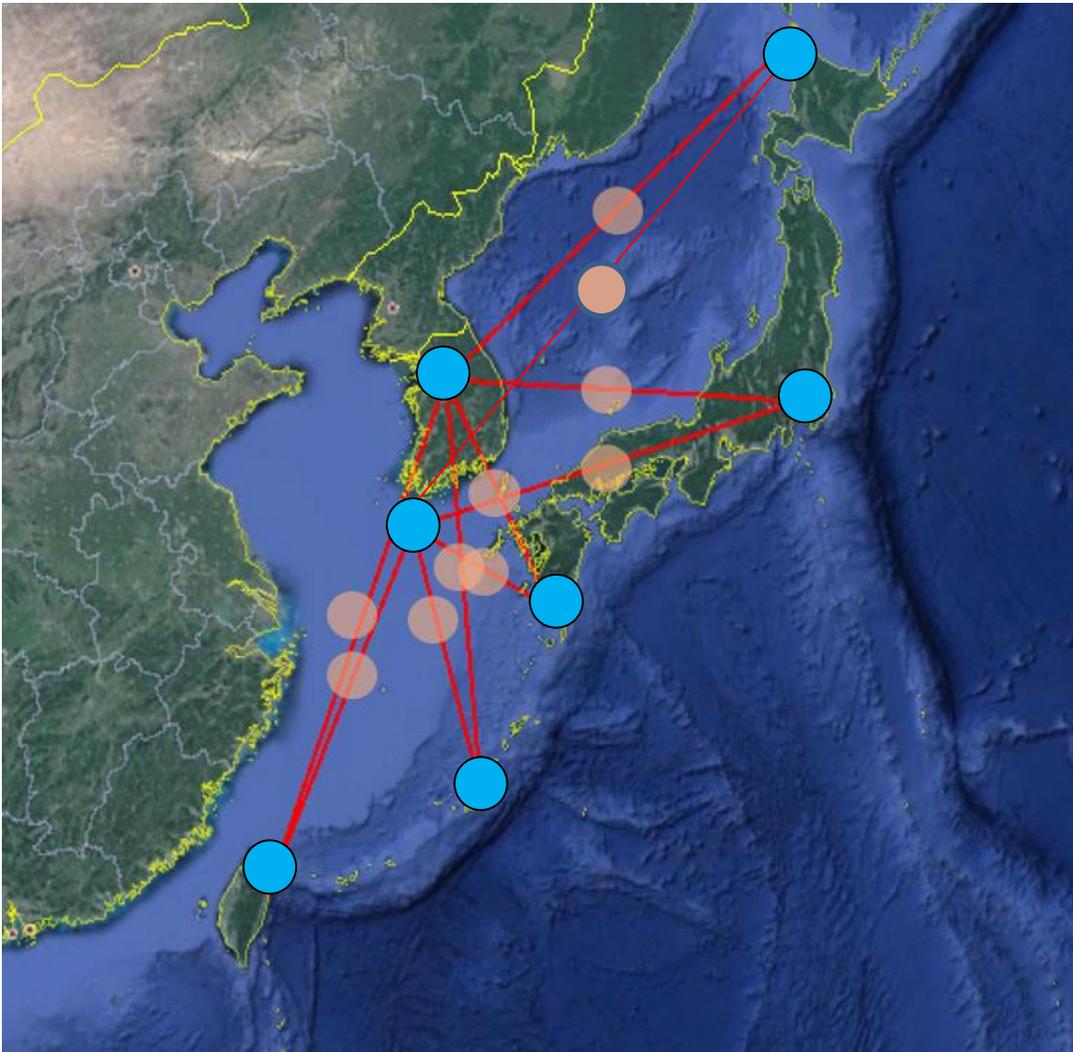
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Ionospheric  
joint  
observation

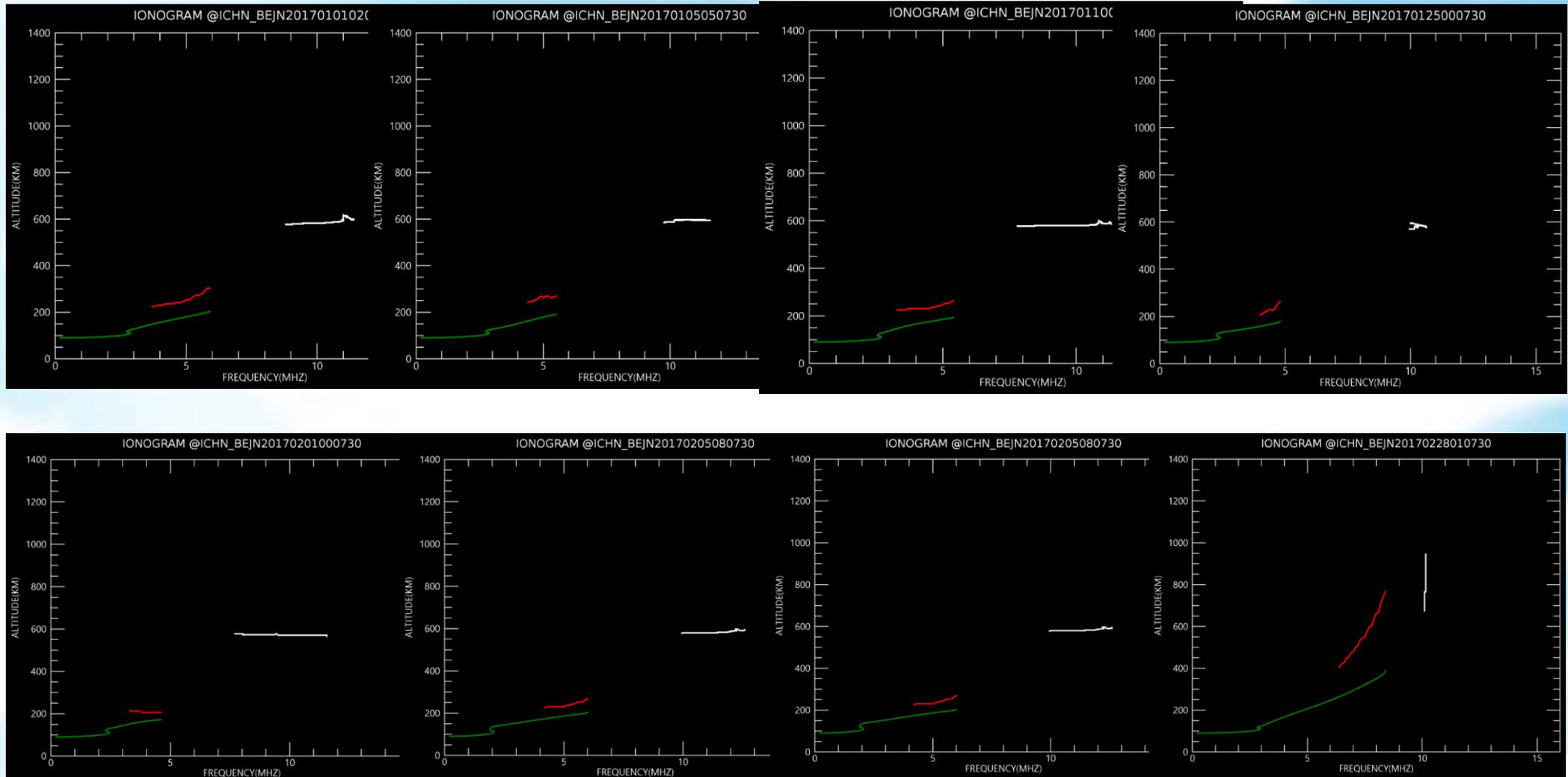
Ionospheric  
prediction  
model

# Ionospheric joint observation



- ✓ Progress of Joint Observation of East Asia Ionosphere and MOU
- ✓ Expansion of ionospheric observation area through Oblique sites
- ✓ Use the VIPIR system
- ✓ Vertical Sites ●  
+ Oblique Sites on the sea ●

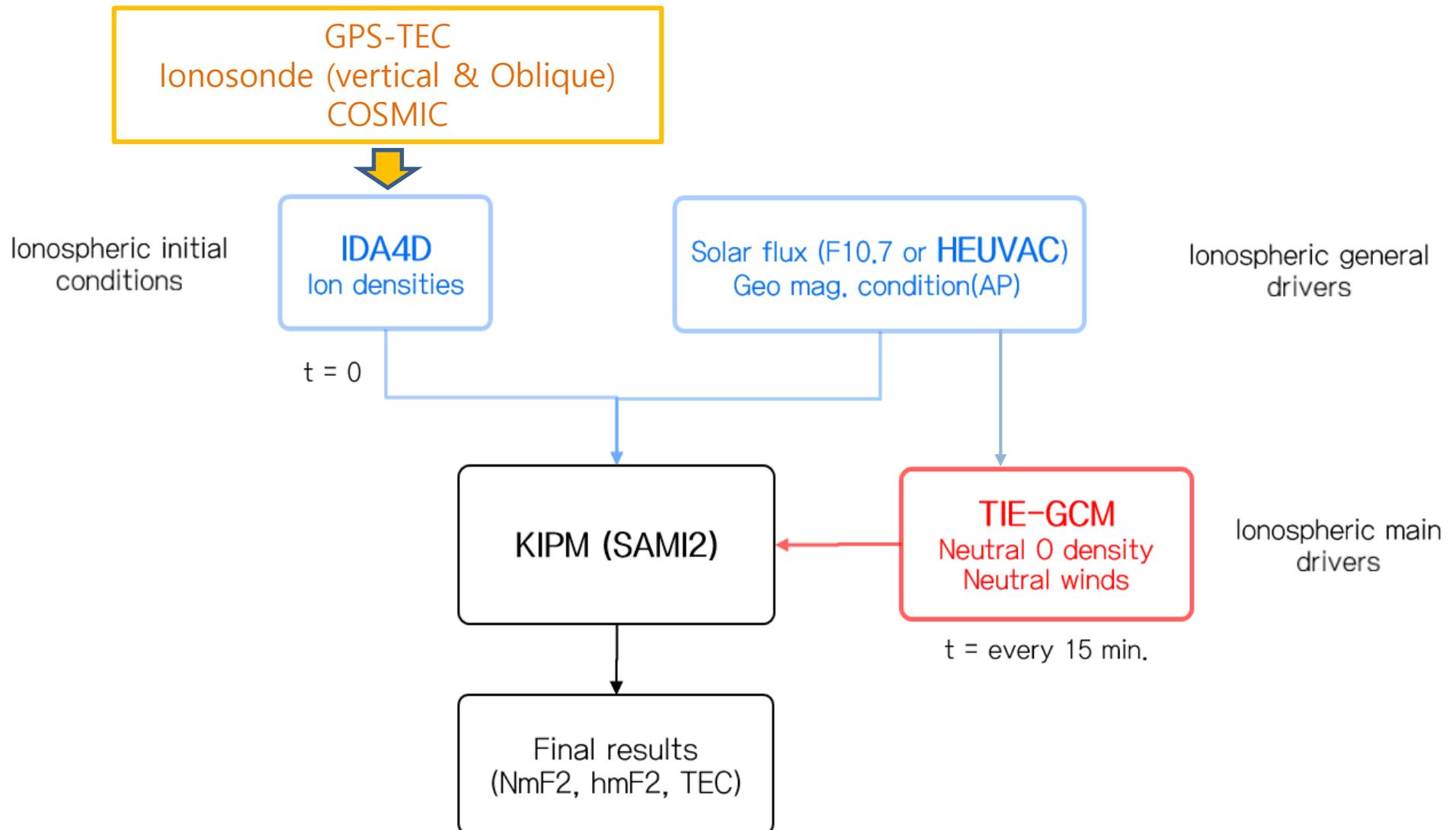
# Oblique to Vertical



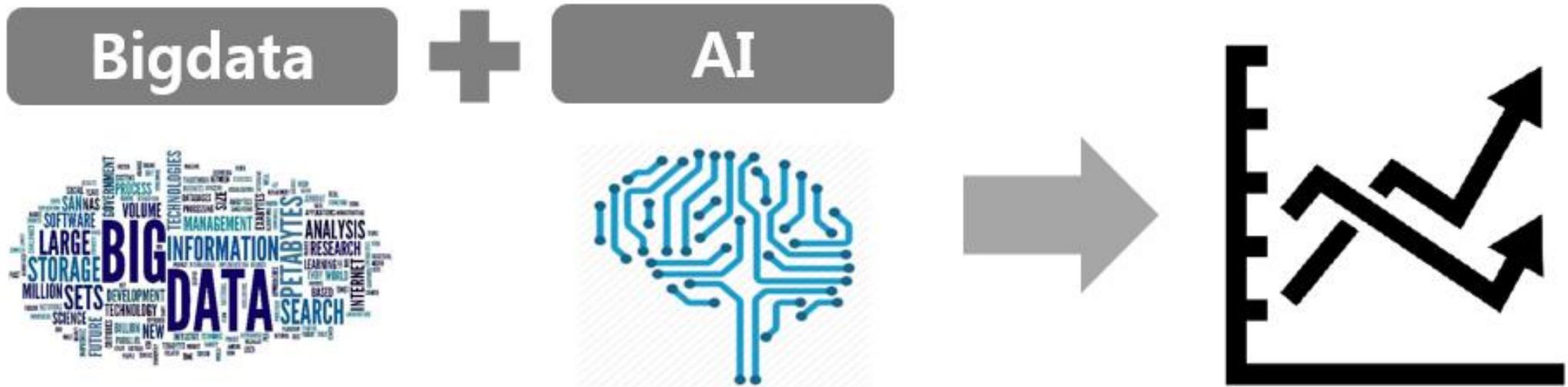
- White line : extracted data from oblique sounding data
- Red line : translated data from oblique to vertical
- Green line : scaled data

# Ionospheric Prediction Model

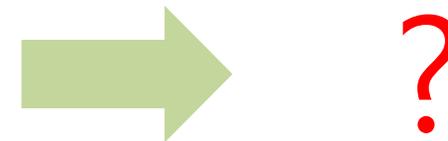
Final concept of KIPM (Korean Ionospheric Prediction Model)



# Big data & AI system construction



2020 : hardware + Infrastructure  
2021 : Software + Applications



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# Thank you!



[www.facebook.com/rwcjeju](http://www.facebook.com/rwcjeju)



[App : RRA Space Weather](#)



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