

1st International School on Equatorial  
Atmosphere 2019  
Auditorium LAPAN Bandung – Indonesia  
March 18-22, 2019  
超高層大気長期変動の全地球上空プラットフォーム  
Inter-university Upper atmosphere Global Observing Network

## Lessons 7 and 8: IUGONET data analysis for promotion of atmospheric science

Institute for Space-Earth Environmental Research (ISEE),  
Nagoya University

## 1. Introduction

- An overview of the IUGONET project
- Characteristics of IUGONET Type-A and SPEDAS

## 2. How to use IUGONET Type-A

- Access to IUGONET Type-A
- How to search the data information you want to know  
(ex. Equatorial Atmosphere Radar, MF/Meter radar,...)
- Exercise (15 – 20 minutes)

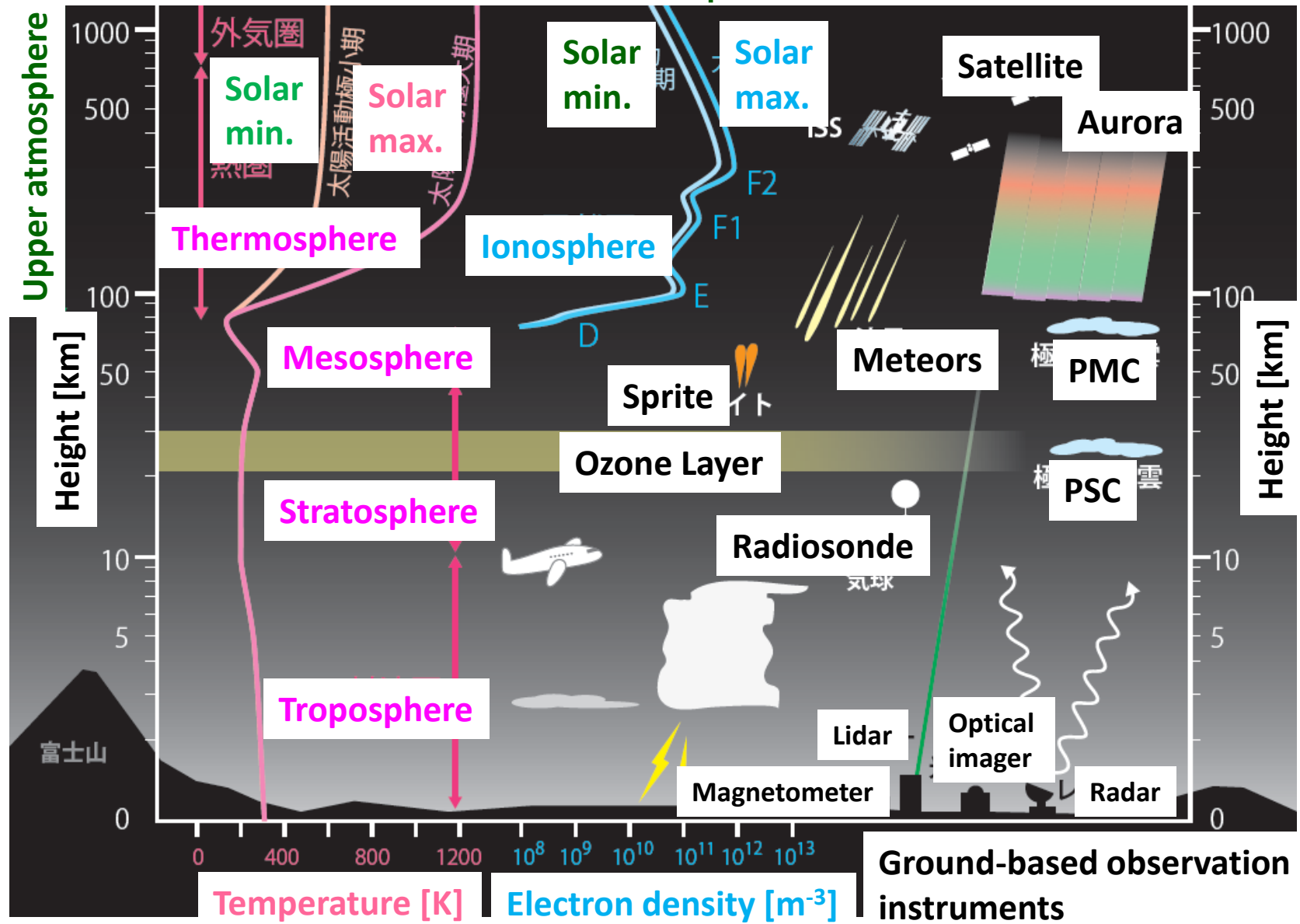
## 3. How to use SPEDAS with an aid of IUGONET Type-A

- Installation of SPEDAS to your own PC
- Data load, plot, save of image and postscript files, advanced data analysis  
(average, filter, FFT, wavelet etc)
- Exercise (30 minutes) (ex. EAR/MU, MF/meteor, radiosonde,...)

## 4. Summary and conclusion

- Future plan of the IUGONET project (international collaboration, SPEDAS for MATLAB)

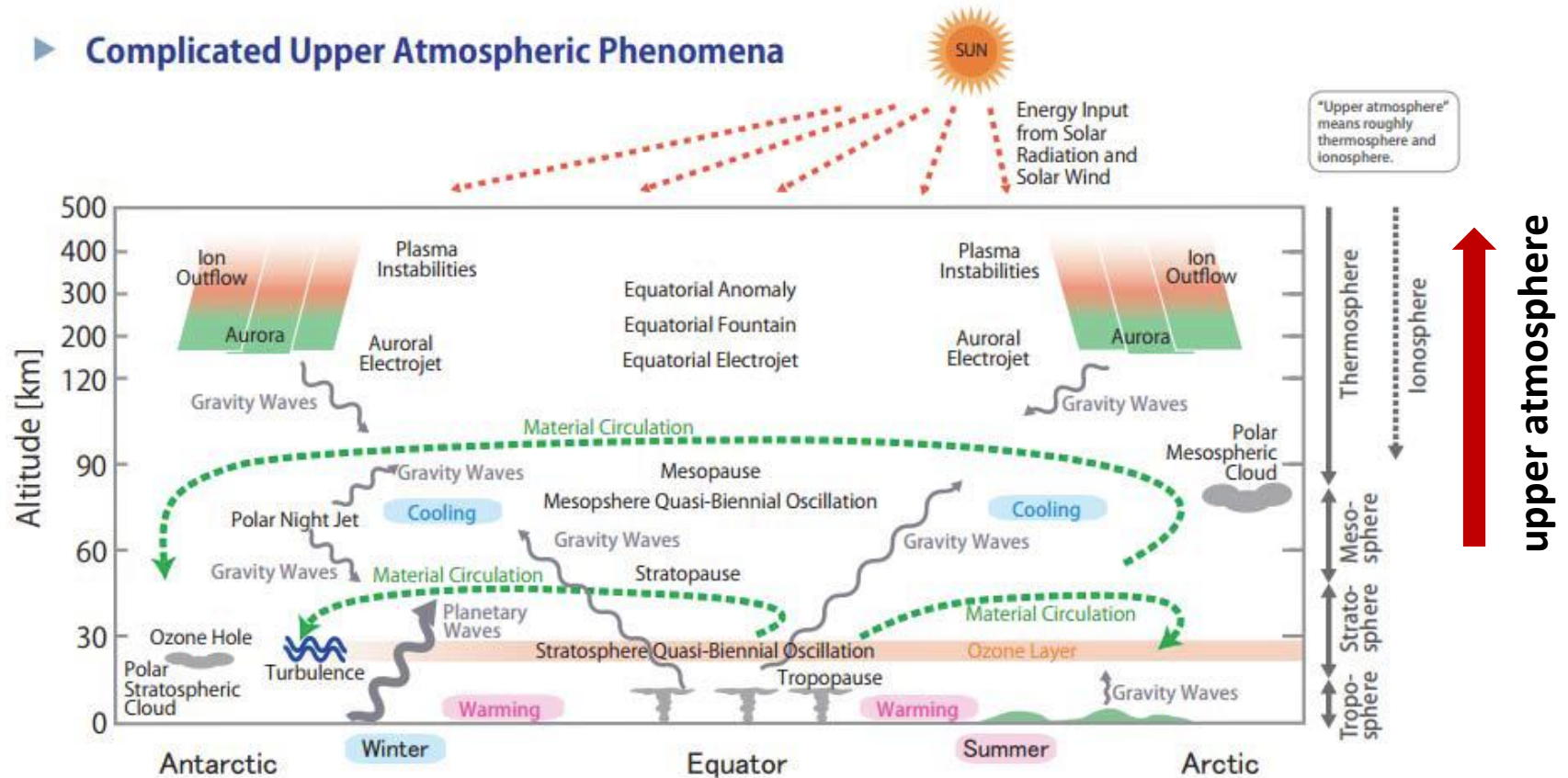
## 1.1 Structure of the Earth's atmosphere



# 1. Introduction

## 1.2 Coupling process in the solar-terrestrial system

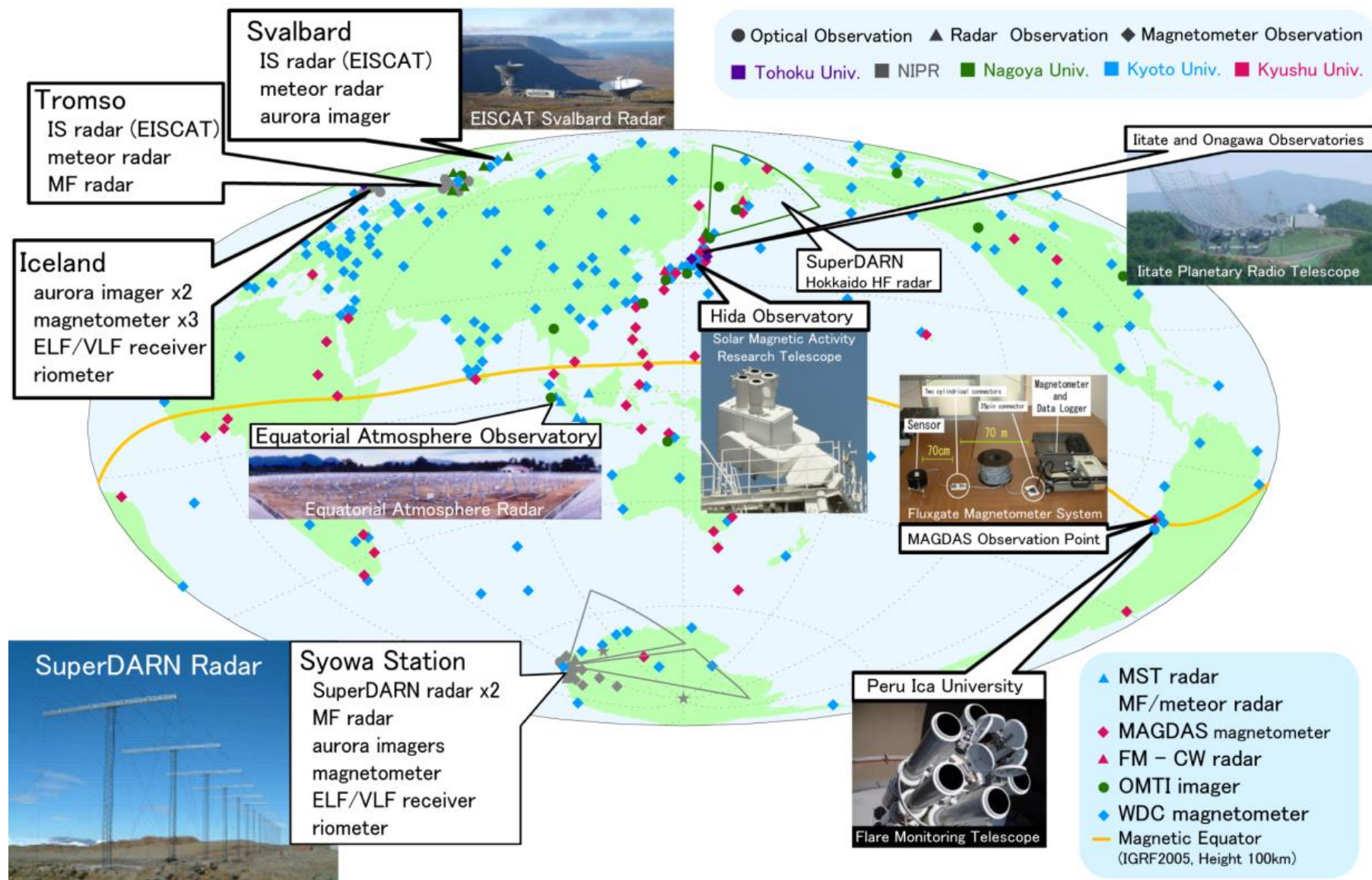
### ► Complicated Upper Atmospheric Phenomena



The upper atmosphere are influenced by both solar activity and atmospheric waves propagating upward from the lower atmosphere. **To understand the generation mechanism of upper atmospheric variations, we need to perform an integrated analysis with different types of atmospheric observation data.**



## 1.3 Global observation network



**Various kinds of ground-based observation data taken by different techniques cover a wide region from both the poles to equator and from the troposphere to solar surface.**

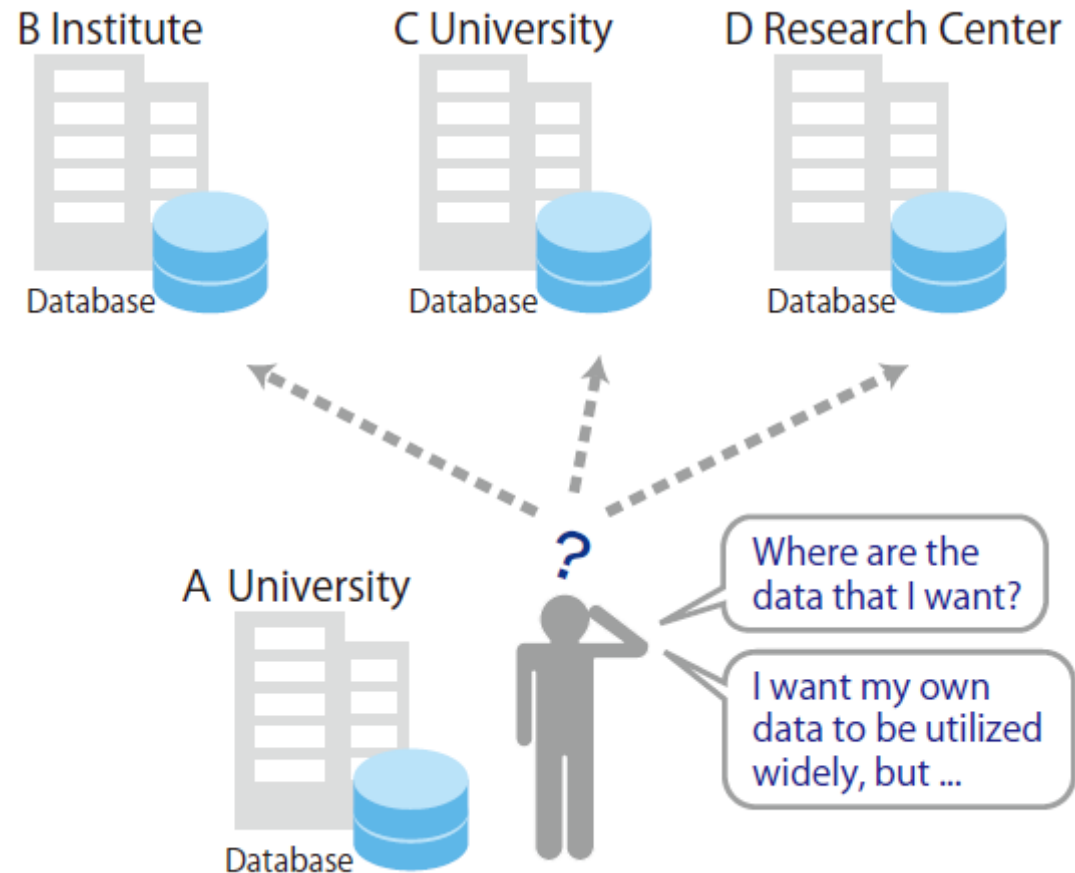
## 1.5 Major problems of openness of observation data

Each research group has its own observation database.

Most observation data are used only in a particular institute or domain, and **some data remain undisclosed.**

**Much time and troublesome procedures are required for external researchers to access databases of observation data.**

Interdisciplinary research requiring various observation data is inhibited.

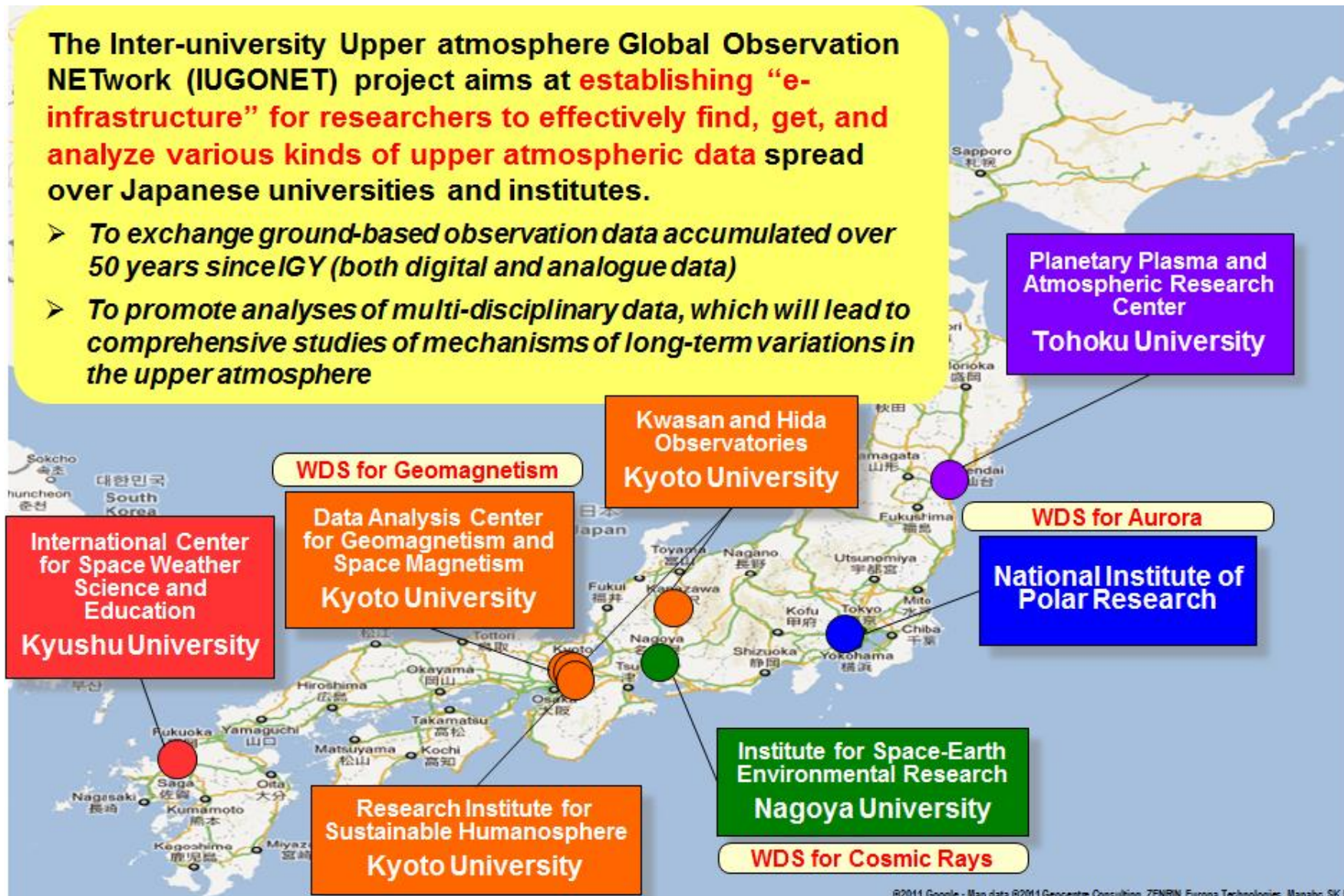




## 1.6 The IUGONET project and its objectives

The Inter-university Upper atmosphere Global Observation NETwork (IUGONET) project aims at **establishing “e-infrastructure”** for researchers to effectively find, get, and analyze various kinds of upper atmospheric data spread over Japanese universities and institutes.

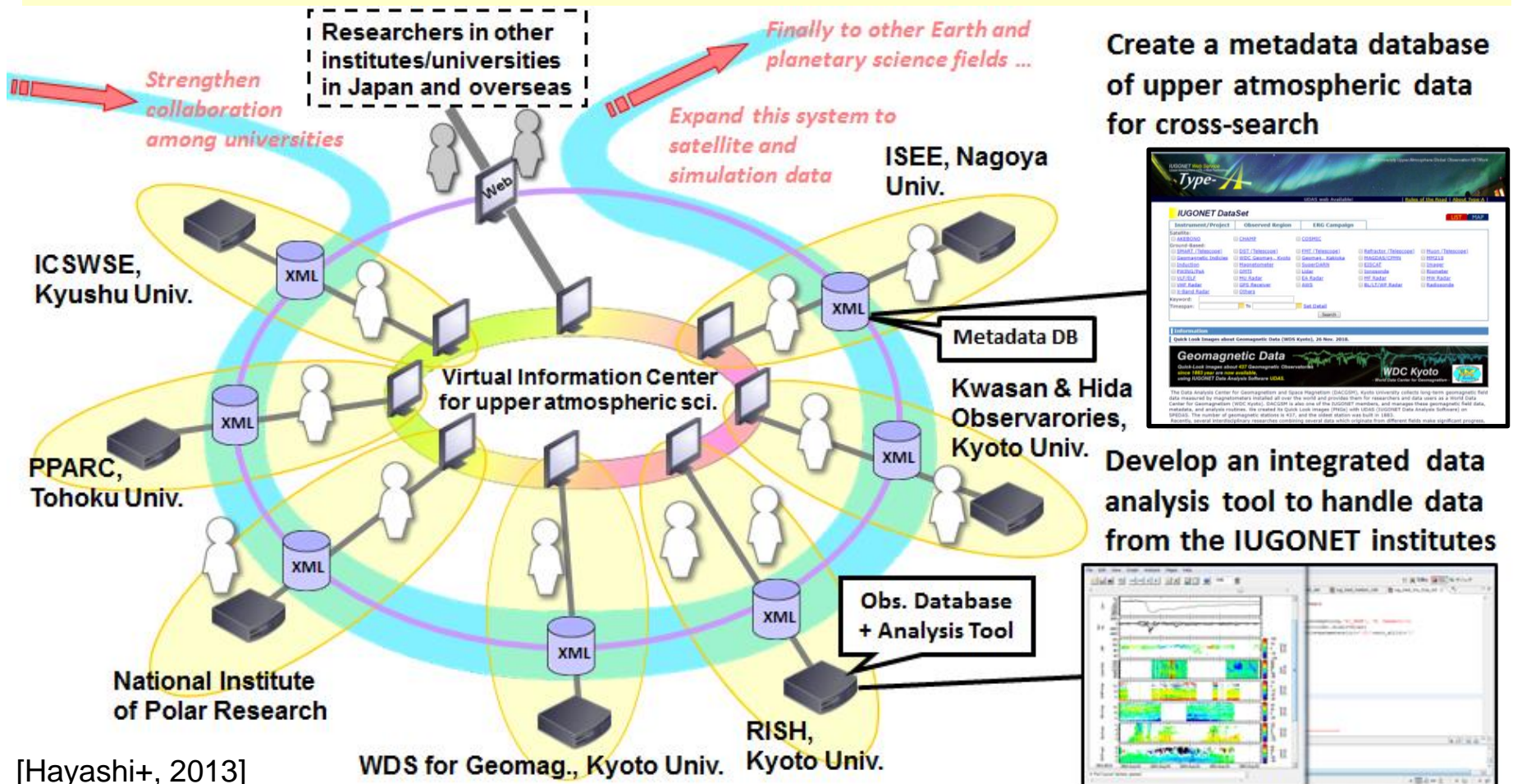
- To exchange ground-based observation data accumulated over 50 years since IGY (both digital and analogue data)
- To promote analyses of multi-disciplinary data, which will lead to comprehensive studies of mechanisms of long-term variations in the upper atmosphere





## 1.7 An overview of the IUGONET project

In order to promote an interdisciplinary study of coupling processes in solar-terrestrial system, we need **to establish a database of data information (metadata) on ground-based observation data for cross-search and to develop an integrated data analysis tool.**



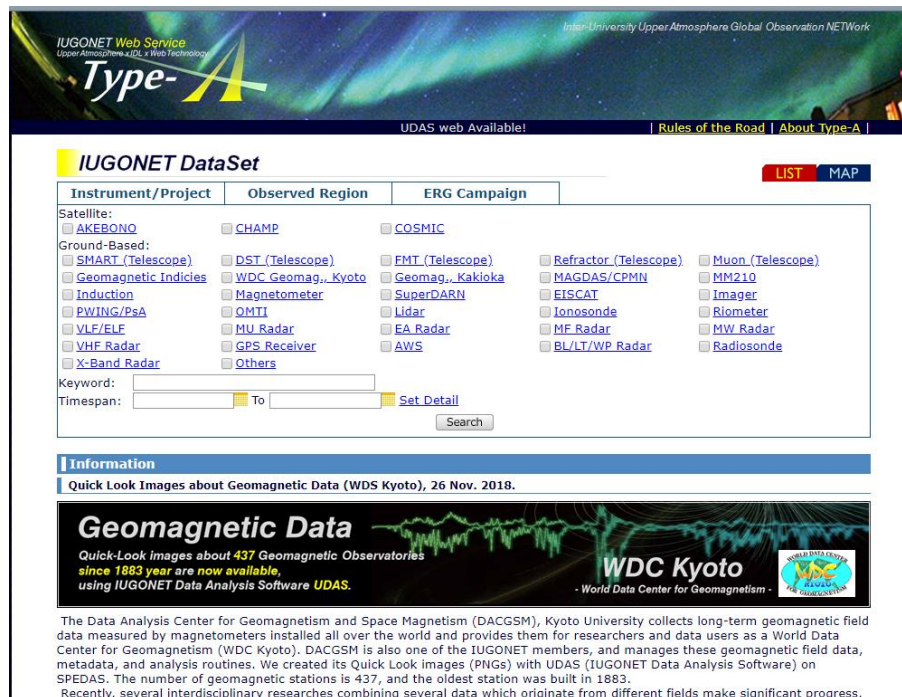
## 1.8 IUGONET products (IUGONET Type-A and UDAS)

### IUGONET web-service

To cross-search various kinds of ground-based solar and earth's atmospheric observation data.

### iUgonet Data Analysis Software (UDAS)

Integrated data analysis tool to handle various kinds of observation data provided by the IUGONET institutes.



**IUGONET Web Service Type-A**  
Upper Atmosphere & IOL X Web Technology  
Inter-University Upper Atmosphere Global Observation NETWork

UDAS web Available! | Rules of the Road | About Type-A |

**IUGONET DataSet**

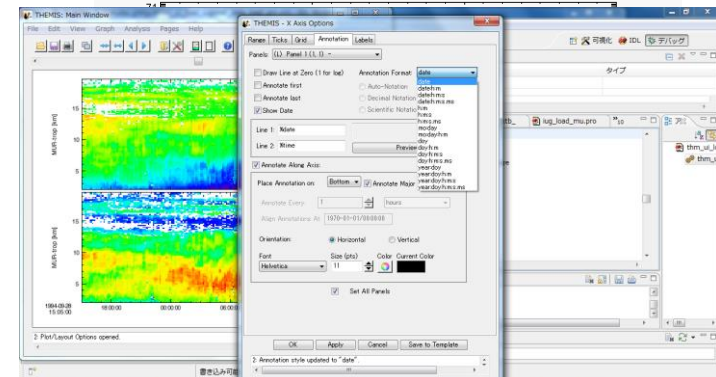
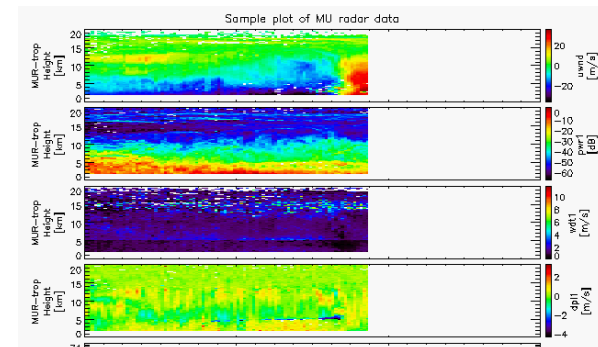
Instrument/Project	Observed Region	ERG Campaign
Satellite: <input type="checkbox"/> AKEBONO	<input type="checkbox"/> CHAMP	<input type="checkbox"/> COSMIC
Ground-Based: <input type="checkbox"/> SMART (Telescope) <input type="checkbox"/> Geomagnetic Indices <input type="checkbox"/> Induction <input type="checkbox"/> PWING/PsA <input type="checkbox"/> VLF/ELF <input type="checkbox"/> VHF Radar <input type="checkbox"/> X-Band Radar	<input type="checkbox"/> DST (Telescope) <input type="checkbox"/> WDC Geomag., Kyoto <input type="checkbox"/> Magnetometer <input type="checkbox"/> QMTI <input type="checkbox"/> MF Radar <input type="checkbox"/> GPS Receiver <input type="checkbox"/> Others	<input type="checkbox"/> FMT (Telescope) <input type="checkbox"/> Geomag., Kakioka <input type="checkbox"/> SuperDARN <input type="checkbox"/> Lidar <input type="checkbox"/> FA Radar <input type="checkbox"/> AWS <input type="checkbox"/> Refractor (Telescope) <input type="checkbox"/> MAGDAS/CPMN <input type="checkbox"/> EISCAT <input type="checkbox"/> Ionosonde <input type="checkbox"/> MF Radar <input type="checkbox"/> BL/LT/WP Radar <input type="checkbox"/> Muon (Telescope) <input type="checkbox"/> MM210 <input type="checkbox"/> Imager <input type="checkbox"/> Riometer <input type="checkbox"/> MW Radar <input type="checkbox"/> Radiosonde

Keyword:   
Timespan:  To  [Set Detail](#) [Search](#)

**Information**  
Quick Look Images about Geomagnetic Data (WDS Kyoto), 26 Nov. 2018.

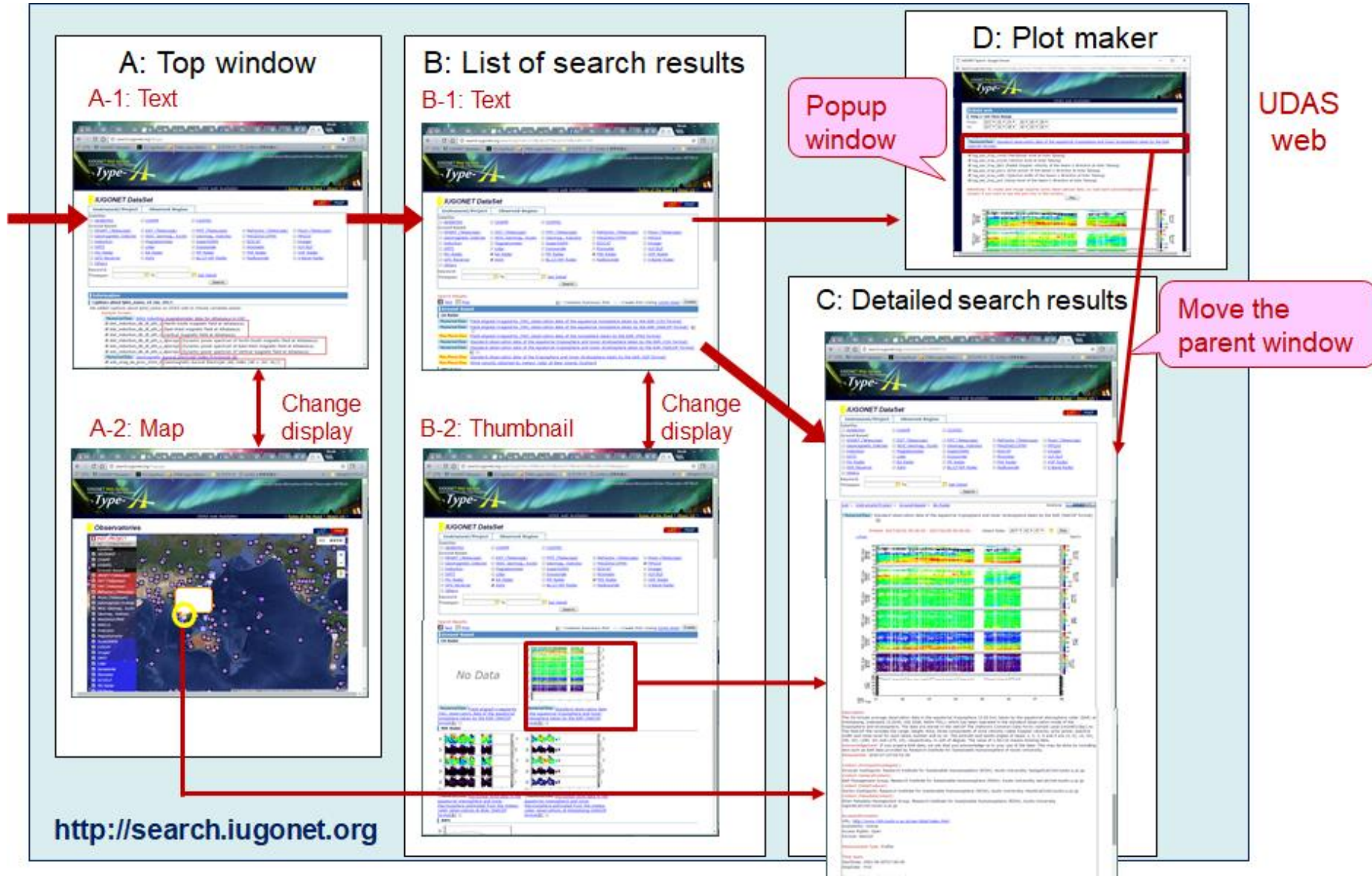
**Geomagnetic Data**  
Quick-Look images about 437 Geomagnetic Observatories since 1883 year are now available, using IUGONET Data Analysis Software UDAS.

The Data Analysis Center for Geomagnetism and Space Magnetism (DACS), Kyoto University collects long-term geomagnetic field data measured by magnetometers installed all over the world and provides them for researchers and data users as a World Data Center for Geomagnetism (WDC Kyoto). DACS is also one of the IUGONET members, and manages these geomagnetic field data, metadata, and analysis routines. We created its Quick Look images (PNGs) with UDAS (IUGONET Data Analysis Software) on SPEDAS. The number of geomagnetic stations is 437, and the oldest station was built in 1883. Recently, several interdisciplinary researches combining several data which originate from different fields make significant progress,





## 1.9 Structure of IUGONET Type-A



## 1.10 What can you learn from IUGONET Type-A?

- Basic information of observation data you want to know

Observation site, method (instrument), period, observed region, data format, data policy, person

→ **These become basic material when you write scientific paper.**

- Quick look (QL) plot of observation data related to category and keywords

→ The Q plots displayed in IUGONET Type-A has **a common time interval of 1, 3, and 7 days** for the data you can plot with SPEDAS.

**Because their time axes are the same, you can easily compare different types of observation data (ex. neutral wind, solar wind, geomagnetic field) and may find new relationship between the phenomena observed in the different atmospheric layers.**

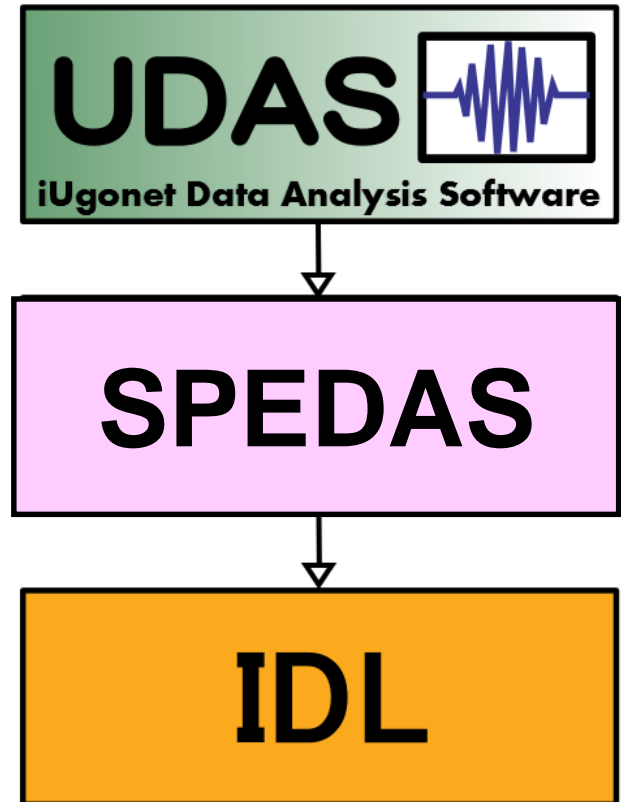
- How to create time-series plots of observation data with SPEDAS

→ **You can easily make several line or contour plots of solar and atmospheric data at anytime and anywhere by yourself.**

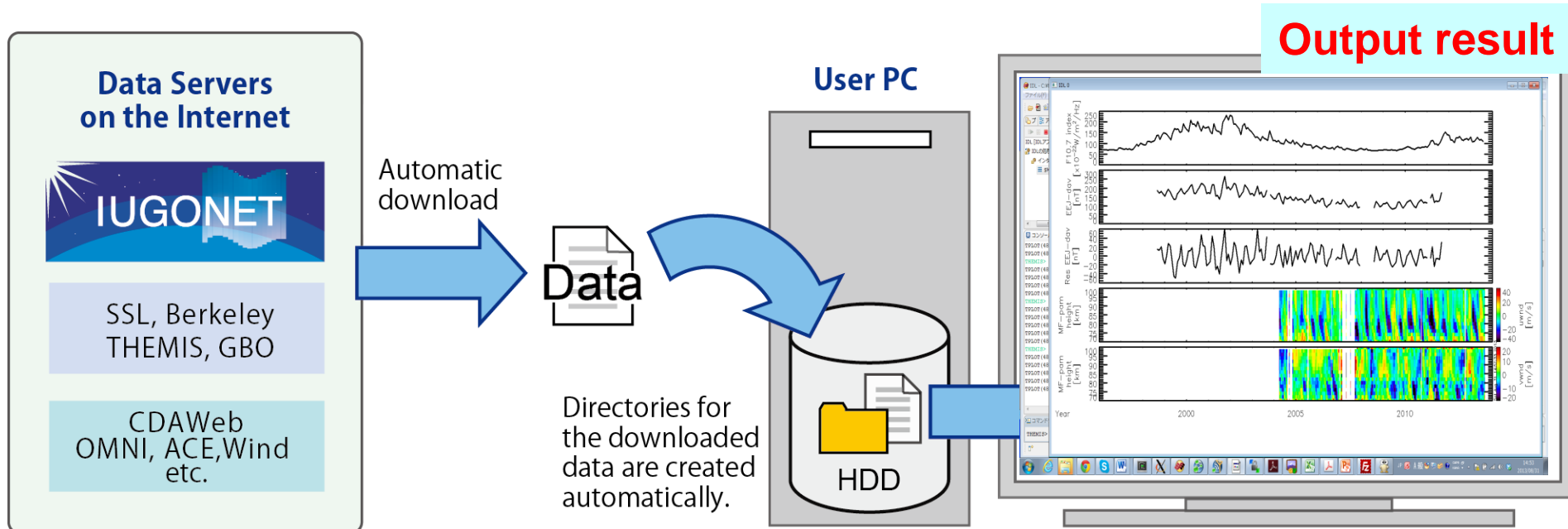


## 1.11 Analysis software: SPEDAS

- The IUGONET Data Analysis Software (UDAS) is the plug-in software for Space Physics Environment Data Analysis System (SPEDAS), formerly known as THEMIS Data Analysis Software suite (TDAS)
- The IUGONET data (e.g., geomagnetic data, aurora data, radar data, and so forth) and many satellite mission data (THEMIS, GOES, WIND, and ACE) can be handled.
- It is possible to use many routines to visualize and analyze time series data.
- It accesses the IUGONET data through the Internet, and then the data are automatically downloaded onto the user's computer



## 1.12 Characteristics of SPEDAS



Data can be easily plotted, for example, by only three basis commands with the SPEDAS-CUI tool.

- |                         |                                     |
|-------------------------|-------------------------------------|
| 1. Set a time period    | <code>timespan, 'yyyy-mm-dd'</code> |
| 2. Load *** data        | <code>iug_load_***</code>           |
| 3. Plot the loaded data | <code>tplot, +++</code>             |

In case of the GUI tool, only a few simple clicks of your mouse are required to procedure the same plot as that created by the above command with the CUI tool.

## 1.13 Datasets to handle with SPEDAS

### SPEDAS

#### Satellite

ACE, DISCOVER, WIND

--- Interplanetary

ERG, FAST, GOES, MMS, RBSP, THEMIS

--- Magnetosphere

ICON, POES --- Ionosphere

COSMIC, CHAMP --- Atmosphere

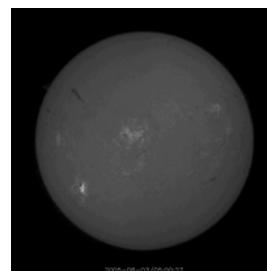
MAVEN --- Mars

#### Ground/Model

ERG, IUGONET

--- Solar telescope, Radar, Imager,  
Ionosonde, Magnetometer, AWS,  
Riometer, SuperDARN, GPS, Kyushu GCM

Sun



Space



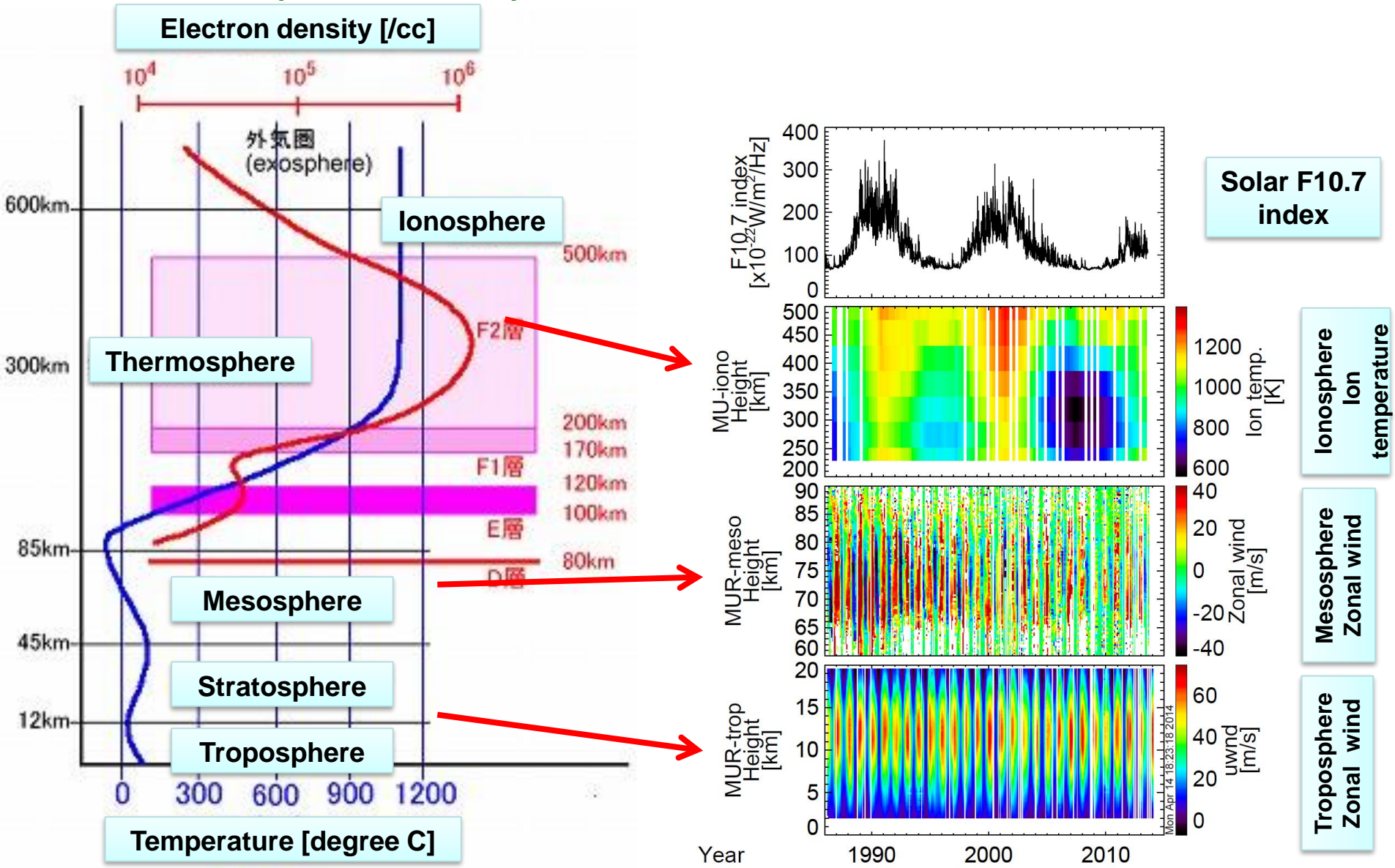
Integrated data  
analysis



Earth's  
atmosphere

IUGONET observatories

## 1.14 Example of data plot with SPEDAS





## 1.15 Executable file of SPEDAS-GUI

We built the SPEDAS executive file working on [IDL Virtual Machine](#).

You can use the SPEDAS (with only GUI) without any IDL licenses. You can get the executable file from the SPEDAS website.

If you don't have an IDL license

SPEDAS is free software but if you do not have an IDL license, then you cannot use the IDL command line, and hence the options:

1. Download the SPEDAS executable (for Linux, MacOS, or Windows), or
2. Download the SPEDAS save file (for Solaris or other operating systems).

Download the SPEDAS executables, Version 3.1.1 (October 2018, minor refresh)

Note: In January 2019, we created new executable files (spedas version 3.1.1). However, the only change is the correction of the IDL license. For users without IDL licenses, you can use the SPEDAS 3.1.1 executable files for Linux, Windows, and MacOS, which do not require an IDL license.

- \* SPEDAS 3.1.1, Windows 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~55 MB) [Download](#)
- \* SPEDAS 3.1.1, MacOS 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~70 MB) [Download](#)
- \* SPEDAS 3.1.1, Linux 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~70 MB) [Download](#)
- \* SPEDAS 3.1.1, Linux 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 7.6 (~70 MB) - includes Geopack 7.6 [Download](#)

This release contains everything you need, including the IDL VM, the Geopack DLM and the CDF DLM. You just have to run the SPEDAS executable.

Download the SPEDAS save file, Version 3.1.1 (October 2018, minor refresh)

Note: In January 2019, we created a new save file (spedas version 3.1.1). However, the only change is the correction of the IDL license. The SPEDAS save file requires the run-time IDL Virtual Machine (VM) [which](#) has to be downloaded for free from [Hinode](#).

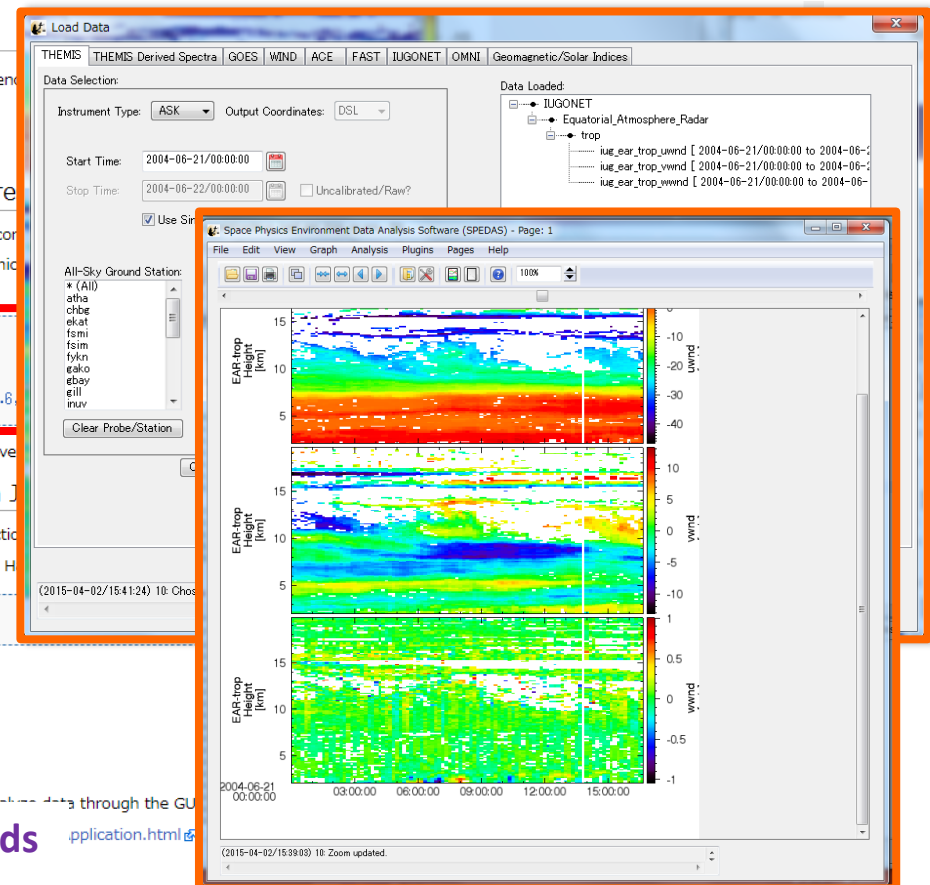
- \* SPEDAS 3.1.1, IDL Savefile (20 MB) [Download](#)

To run SPEDAS using the IDL virtual machine,

1. start the IDL virtual machine executable
2. click through the splash screen to get to the file selection dialog
3. navigate to the SPEDAS installation
4. go into the thm\_gui\_new directory and click on thm\_gui.sav

This should bring up the main screen of the SPEDAS GUI. From this point you should be able to load, plot and analyze data through the GUI.

[http://spedas.org/wiki/index.php?title=Downloads\\_and\\_Installation](http://spedas.org/wiki/index.php?title=Downloads_and_Installation)



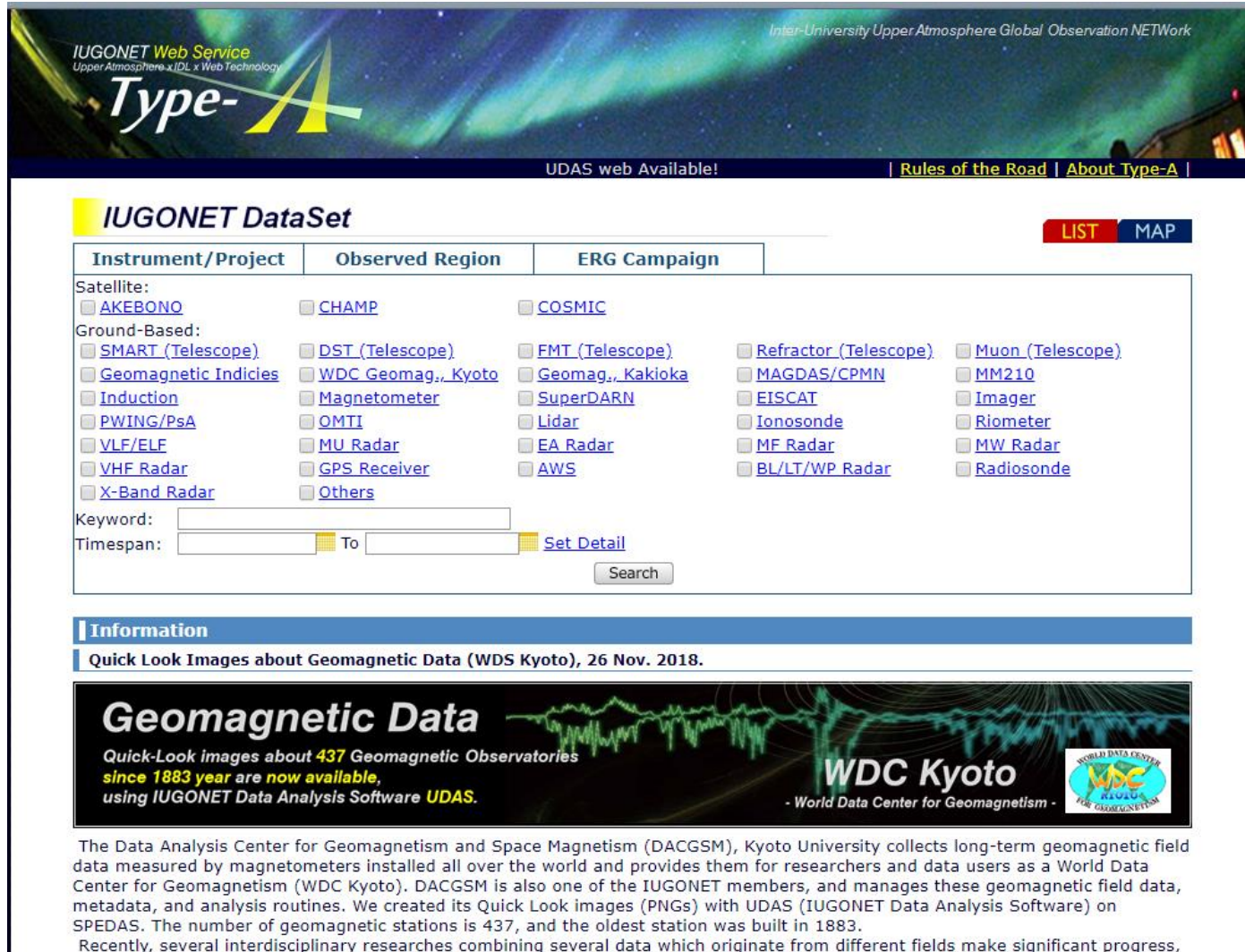
## Section 2

How to use a database of  
data information for solar  
and atmospheric data  
(IUGONET Type-A)

## 2. How to use IUGONET Type-A

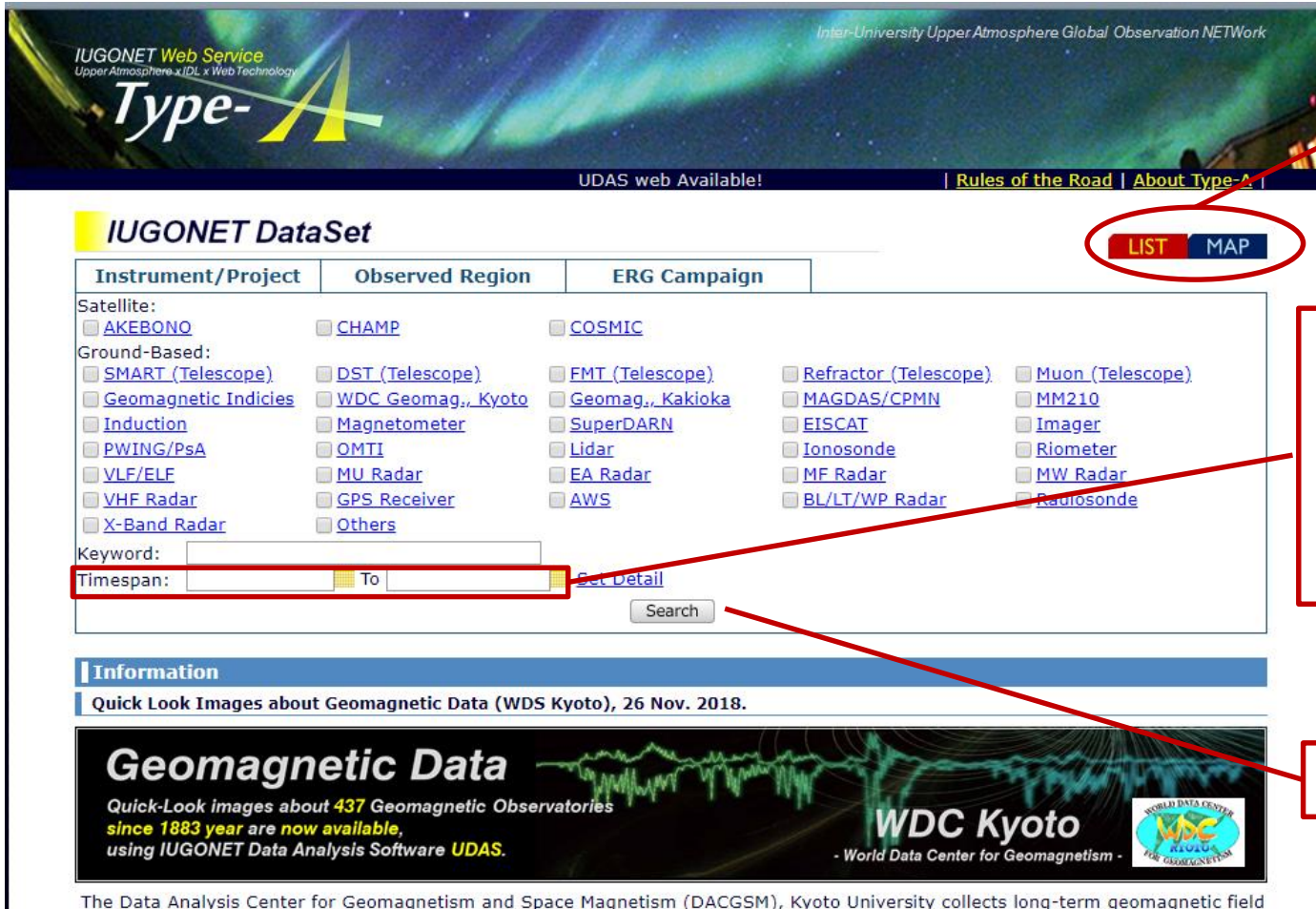
### 2.1 Access to IUGONET Type-A (<http://search.iugonet.org>)

Please access IUGONET Type-A from Internet browser with your own PC.



The screenshot shows the IUGONET Type-A web interface. At the top, there is a banner with the IUGONET logo and the text "Inter-University Upper Atmosphere Global Observation NETWork". Below the banner, there is a navigation bar with "UDAS web Available!" and links for "Rules of the Road" and "About Type-A". The main content area is titled "IUGONET DataSet" and features a "LIST" button and a "MAP" button. Below this, there is a table with three columns: "Instrument/Project", "Observed Region", and "ERG Campaign". The table lists various instruments and projects, including satellite-based (AKEBONO, CHAMP, COSMIC) and ground-based (SMART, Geomagnetic Indices, Induction, PWING/PsA, VLF/ELF, VHF Radar, X-Band Radar, DST, WDC Geomag., Kyoto, Magnetometer, OMTI, MU Radar, GPS Receiver, Others, FMT, Geomag., Kakioka, SuperDARN, Lidar, EA Radar, AWS, Refractor, Telescope, MAGDAS/CPMN, EISCAT, Ionosonde, MF Radar, BL/LT/WP Radar, Muon, Telescope, MM210, Imager, Riometer, MW Radar, Radiosonde). Below the table, there is a "Keyword:" field and a "Timespan:" field with "To" and "Set Detail" buttons. A "Search" button is also present. Below the search area, there is an "Information" section with a link to "Quick Look Images about Geomagnetic Data (WDC Kyoto), 26 Nov. 2018." The "Quick Look Images" section features a banner with the text "Geomagnetic Data" and "Quick-Look images about 437 Geomagnetic Observatories since 1883 year are now available, using IUGONET Data Analysis Software UDAS." Below the banner, there is a paragraph about the Data Analysis Center for Geomagnetism and Space Magnetism (DACGSM) at Kyoto University, which collects long-term geomagnetic field data and provides it for researchers and data users as a World Data Center for Geomagnetism (WDC Kyoto). The paragraph also mentions that DACGSM is one of the IUGONET members and manages these geomagnetic field data, metadata, and analysis routines. It states that they created their Quick Look Images (PNGs) with UDAS (IUGONET Data Analysis Software) on SPEDAS. The number of geomagnetic stations is 437, and the oldest station was built in 1883. Finally, it mentions that recently, several interdisciplinary researches combining several data which originate from different fields make significant progress.

## 2.2 Search data on the top window (list search)



**IUGONET Web Service**  
Upper Atmosphere xIDL x Web Technology  
**Type-A**

Inter-University Upper Atmosphere Global Observation NETWORK

UDAS web Available! | [Rules of the Road](#) | [About Type-A](#)

**IUGONET DataSet**

Instrument/Project | Observed Region | ERG Campaign

Satellite:  
☐ [AKEBONO](#)    ☐ [CHAMP](#)    ☐ [COSMIC](#)

Ground-Based:  
☐ [SMART \(Telescope\)](#)    ☐ [DST \(Telescope\)](#)    ☐ [FMT \(Telescope\)](#)    ☐ [Refractor \(Telescope\)](#)    ☐ [Muon \(Telescope\)](#)  
☐ [Geomagnetic Indices](#)    ☐ [WDC Geomag., Kyoto](#)    ☐ [Geomag., Kakioka](#)    ☐ [MAGDAS/CPMN](#)    ☐ [MM210](#)  
☐ [Induction](#)    ☐ [Magnetometer](#)    ☐ [SuperDARN](#)    ☐ [EISCAT](#)    ☐ [Imager](#)  
☐ [PWING/PsA](#)    ☐ [OMTI](#)    ☐ [Lidar](#)    ☐ [Ionosonde](#)    ☐ [Riometer](#)  
☐ [VLF/ELF](#)    ☐ [MU Radar](#)    ☐ [EA Radar](#)    ☐ [MF Radar](#)    ☐ [MW Radar](#)  
☐ [VHF Radar](#)    ☐ [GPS Receiver](#)    ☐ [AWS](#)    ☐ [BL/LT/WP Radar](#)    ☐ [Radioonde](#)  
☐ [X-Band Radar](#)    ☐ [Others](#)

Keyword:

Timespan:  To  [Get Detail](#)

**Information**  
Quick Look Images about Geomagnetic Data (WDS Kyoto), 26 Nov. 2018.

**Geomagnetic Data**  
Quick-Look images about 437 Geomagnetic Observatories since 1883 year are now available, using IUGONET Data Analysis Software UDAS.

**WDC Kyoto**  
- World Data Center for Geomagnetism -

The Data Analysis Center for Geomagnetism and Space Magnetism (DACGSM), Kyoto University collects long-term geomagnetic field

Exchange the list search into map search

Input a timespan you want to search the data  
**2012/03/04 (from)**  
**2012/03/10 (to)**

Click "search" button

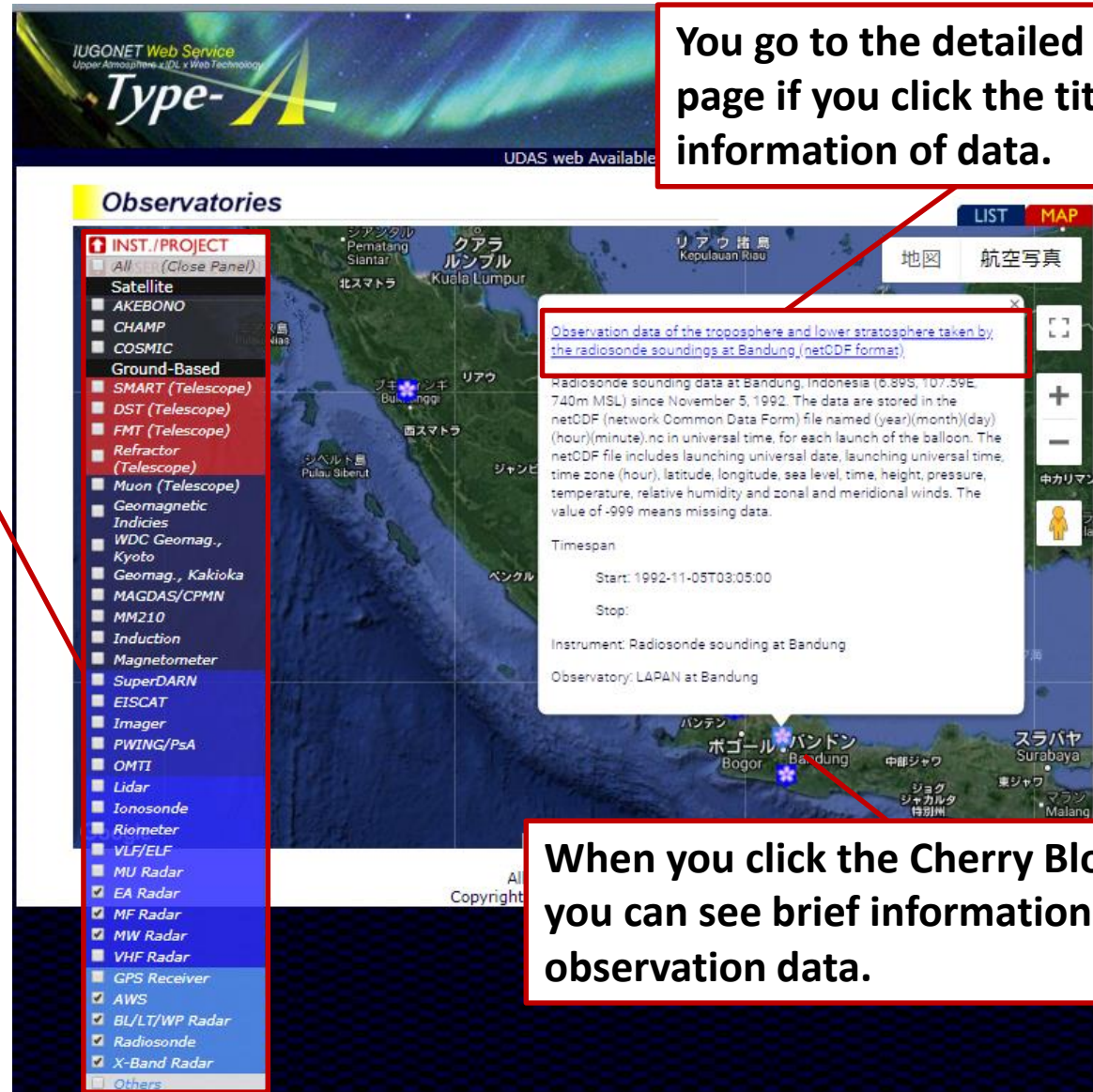
You can restrict the search results by selecting the related instrument/project or inputting the keyword related to the data you want to know.



## 2. How to use IUGONET Type-A

### 2.2 Search data on the top window (map search)

The default is selected all the instruments. If you specify them, you exclude the check "All" and include the check for each instrument you want to know.



The screenshot displays the IUGONET Web Service interface. The top header shows "IUGONET Web Service" and "Type-A". Below the header, there's a "Observatories" section with a list of instruments. The "INST./PROJECT" dropdown is set to "All". The instrument list includes various categories like Satellite, Ground-Based, and Radar, with many items checked. A map of Southeast Asia is shown, with a red dot indicating the location of Bandung, Indonesia. A pop-up window displays detailed information about the radiosonde sounding data at Bandung, including the start and stop times, instrument type, and observatory name.

**Observatories**

**INST./PROJECT**

All (Close Panel)

Satellite

- ☐ AKEBONO
- ☐ CHAMP
- ☐ COSMIC

Ground-Based

- ☐ SMART (Telescope)
- ☐ DST (Telescope)
- ☐ FMT (Telescope)
- ☐ Refractor (Telescope)
- ☐ Muon (Telescope)
- ☐ Geomagnetic Indices
- ☐ WDC Geomag., Kyoto
- ☐ Geomag., Kakioka
- ☐ MAGDAS/CPMN
- ☐ MM210
- ☐ Induction
- ☐ Magnetometer
- ☐ SuperDARN
- ☐ EISCAT
- ☐ Imager
- ☐ PWING/PsA
- ☐ OMTI
- ☐ Lidar
- ☐ Ionosonde
- ☐ Riometer
- ☐ VLF/ELF
- ☐ MU Radar
- ☒ EA Radar
- ☒ MF Radar
- ☒ MW Radar
- ☐ VHF Radar
- ☐ GPS Receiver
- ☒ AWS
- ☒ BL/LT/WP Radar
- ☒ Radiosonde
- ☒ X-Band Radar
- ☐ Others

**Observation date of the troposphere and lower stratosphere taken by the radiosonde soundings at Bandung (netCDF format).**

Radiosonde sounding data at Bandung, Indonesia (0.895, 107.59E, 740m MSL) since November 5, 1992. The data are stored in the netCDF (network Common Data Form) file named (year)(month)(day) (hour)(minute).nc in universal time, for each launch of the balloon. The netCDF file includes launching universal date, launching universal time, time zone (hour), latitude, longitude, sea level, time, height, pressure, temperature, relative humidity and zonal and meridional winds. The value of -999 means missing data.

Timespan

Start: 1992-11-05T03:05:00

Stop:

Instrument: Radiosonde sounding at Bandung

Observatory: LAPAN at Bandung

You go to the detailed search page if you click the title of information of data.

When you click the Cherry Blossoms, you can see brief information of the observation data.

## 2.3 Search results (text)



**IUGONET DataSet**

[LIST](#) [MAP](#)

Instrument/Project	Observed Region	ERG Campaign
<b>Satellite:</b> <input type="checkbox"/> <a href="#">AKEBONO</a> <input type="checkbox"/> <a href="#">CHAMP</a> <input type="checkbox"/> <a href="#">COSMIC</a>		
<b>Ground-Based:</b> <input type="checkbox"/> <a href="#">SMART (Telescope)</a> <input type="checkbox"/> <a href="#">DST (Telescope)</a> <input type="checkbox"/> <a href="#">FMT (Telescope)</a> <input type="checkbox"/> <a href="#">Refractor (Telescope)</a> <input type="checkbox"/> <a href="#">Muon (Telescope)</a> <input type="checkbox"/> <a href="#">Geomagnetic Indices</a> <input type="checkbox"/> <a href="#">WDC Geomag., Kyoto</a> <input type="checkbox"/> <a href="#">Geomag., Kakioka</a> <input type="checkbox"/> <a href="#">MAGDAS/CPMN</a> <input type="checkbox"/> <a href="#">MM210</a> <input type="checkbox"/> <a href="#">Induction</a> <input type="checkbox"/> <a href="#">Magnetometer</a> <input type="checkbox"/> <a href="#">SuperDARN</a> <input type="checkbox"/> <a href="#">EISCAT</a> <input type="checkbox"/> <a href="#">Imager</a> <input type="checkbox"/> <a href="#">PWING/PsA</a> <input type="checkbox"/> <a href="#">OMTI</a> <input type="checkbox"/> <a href="#">Lidar</a> <input type="checkbox"/> <a href="#">Ionosonde</a> <input type="checkbox"/> <a href="#">Riometer</a> <input type="checkbox"/> <a href="#">VLF/ELF</a> <input type="checkbox"/> <a href="#">MU Radar</a> <input checked="" type="checkbox"/> <a href="#">EA Radar</a> <input type="checkbox"/> <a href="#">MF Radar</a> <input type="checkbox"/> <a href="#">MW Radar</a> <input type="checkbox"/> <a href="#">VHF Radar</a> <input type="checkbox"/> <a href="#">GPS Receiver</a> <input type="checkbox"/> <a href="#">AWS</a> <input type="checkbox"/> <a href="#">BL/LT/WP Radar</a> <input type="checkbox"/> <a href="#">Radiosonde</a> <input type="checkbox"/> <a href="#">X-Band Radar</a> <input type="checkbox"/> <a href="#">Others</a>		
Keyword: <input type="text"/> Timespan: <input type="text" value="2012/03/04"/> To <input type="text" value="2012/03/10"/> <a href="#">Set Detail</a> <input type="button" value="Search"/>		

You can exchange text into QL plot displays.  
If you click "Plot", you can find the QL plots of each dataset.

Search Results:

☒ Text ☐ Plot

☒ Contains Summary Plot ☐ Create Plot (Using UDAS-Web)

Satellite	
<b>AKEBONO</b>	
Numerical Data	<a href="#">Observation data from VLF/MCA onboard Akebono</a>
<b>COSMIC</b>	
Numerical Data	<a href="#">COSMIC full spectrum inversion (FSI) data (netCDF)</a>
Plot/Movie Data	<a href="#">COSMIC full spectrum inversion (FSI) data (PNG)</a> <input checked="" type="checkbox"/>
Plot/Movie Data	<a href="#">Global distribution of dry air temperature at 15 km derived from the COSMIC full spectrum inversion (FSI) data (PNG)</a>
Plot/Movie Data	<a href="#">Global distribution of dry air temperature variance in a height range of 10 - 30 km derived from the COSMIC full spectrum inversion (FSI) data (PNG)</a>
Ground-Based	
<b>SMART (Telescope)</b>	
Plot/Movie Data	<a href="#">Quick-look images of SMART/T3 H-alpha and continuum partial-region solar images</a> <input checked="" type="checkbox"/>
Numerical Data	<a href="#">SMART/T1 H-alpha full-disk solar images</a>
Plot/Movie Data	<a href="#">SMART/T1 H-alpha full-disk solar images in JPEG format</a> <input checked="" type="checkbox"/>
Numerical Data	<a href="#">SMART/T3 H-alpha and continuum partial-region solar images</a>
Plot/Movie Data	<a href="#">SMART H-alpha movies of representative solar prominence eruptions and flares</a>
<b>DST (Telescope)</b>	
Numerical Data	<a href="#">DST/H-alpha multi-wavelength partial solar images with the KODAK CCD</a>
Plot/Movie Data	<a href="#">DST/H-alpha partial solar quick-look images</a> <input checked="" type="checkbox"/>
Numerical Data	<a href="#">DST solar spectrum data with spectrographs</a>
Plot/Movie Data	<a href="#">DST Spectroheliograph quick-look images</a>

List of the search results you want to know.  
If you click the title of each dataset, you go to the detailed search page.

## 2.4 Search results (plot)



**IUGONET DataSet**

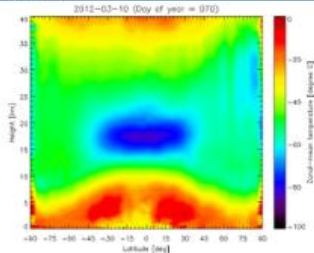
[LIST](#) [MAP](#)

Instrument/Project	Observed Region	ERG Campaign
<b>Satellite:</b> <input type="checkbox"/> <a href="#">AKEBONO</a> <input type="checkbox"/> <a href="#">CHAMP</a> <input type="checkbox"/> <a href="#">COSMIC</a>		
<b>Ground-Based:</b> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">SMART (Telescope)</a>  <input type="checkbox"/> <a href="#">Geomagnetic Indices</a>  <input type="checkbox"/> <a href="#">Induction</a>  <input type="checkbox"/> <a href="#">PWING/PsA</a>  <input type="checkbox"/> <a href="#">VLF/ELF</a>  <input type="checkbox"/> <a href="#">VHF Radar</a>  <input type="checkbox"/> <a href="#">X-Band Radar</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">DST (Telescope)</a>  <input type="checkbox"/> <a href="#">WDC Geomag., Kyoto</a>  <input type="checkbox"/> <a href="#">Magnetometer</a>  <input type="checkbox"/> <a href="#">OMTI</a>  <input type="checkbox"/> <a href="#">MU Radar</a>  <input type="checkbox"/> <a href="#">GPS Receiver</a>  <input type="checkbox"/> <a href="#">Others</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">FMT (Telescope)</a>  <input type="checkbox"/> <a href="#">Geomag., Kakioka</a>  <input type="checkbox"/> <a href="#">SuperDARN</a>  <input type="checkbox"/> <a href="#">Lidar</a>  <input type="checkbox"/> <a href="#">EA Radar</a>  <input type="checkbox"/> <a href="#">AWS</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">Refractor (Telescope)</a>  <input type="checkbox"/> <a href="#">MAGDAS/CPMN</a>  <input type="checkbox"/> <a href="#">EISCAT</a>  <input type="checkbox"/> <a href="#">Ionosonde</a>  <input type="checkbox"/> <a href="#">MF Radar</a>  <input type="checkbox"/> <a href="#">BL/LT/WP Radar</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">Muon (Telescope)</a>  <input type="checkbox"/> <a href="#">MM210</a>  <input type="checkbox"/> <a href="#">Imager</a>  <input type="checkbox"/> <a href="#">Riometer</a>  <input type="checkbox"/> <a href="#">MW Radar</a>  <input type="checkbox"/> <a href="#">Radiosonde</a> </div> </div>		
Keyword: <input type="text"/> Timespan: <input type="text" value="2012/03/04"/> To <input type="text" value="2012/03/10"/> <a href="#">Set Detail</a> <input type="button" value="Search"/>		

You can select three kinds of time range (1, 3, and 7 days).  
The default is 7 days.

Search Results: ☒ Contains Summary Plot ☐ Create Plot (Using UDAS-Web) [Create](#)  
[Text](#) [Plot](#) [<Prev](#) Numerical: 2012/03/04 00:00:00 - 2012/03/11 00:00:00, Plot/Movie: 2012/03/10 Timespan: 1 3 7 [Next>](#)

**Satellite**  
**COSMIC**



Temperature profile obtained from the COSMIC RO data.

[Plot/Movie Data](#) [COSMIC full spectrum inversion \(FSI\) data \(PNG\)](#) ☒

**Ground-Based**  
**SMART (Telescope)**

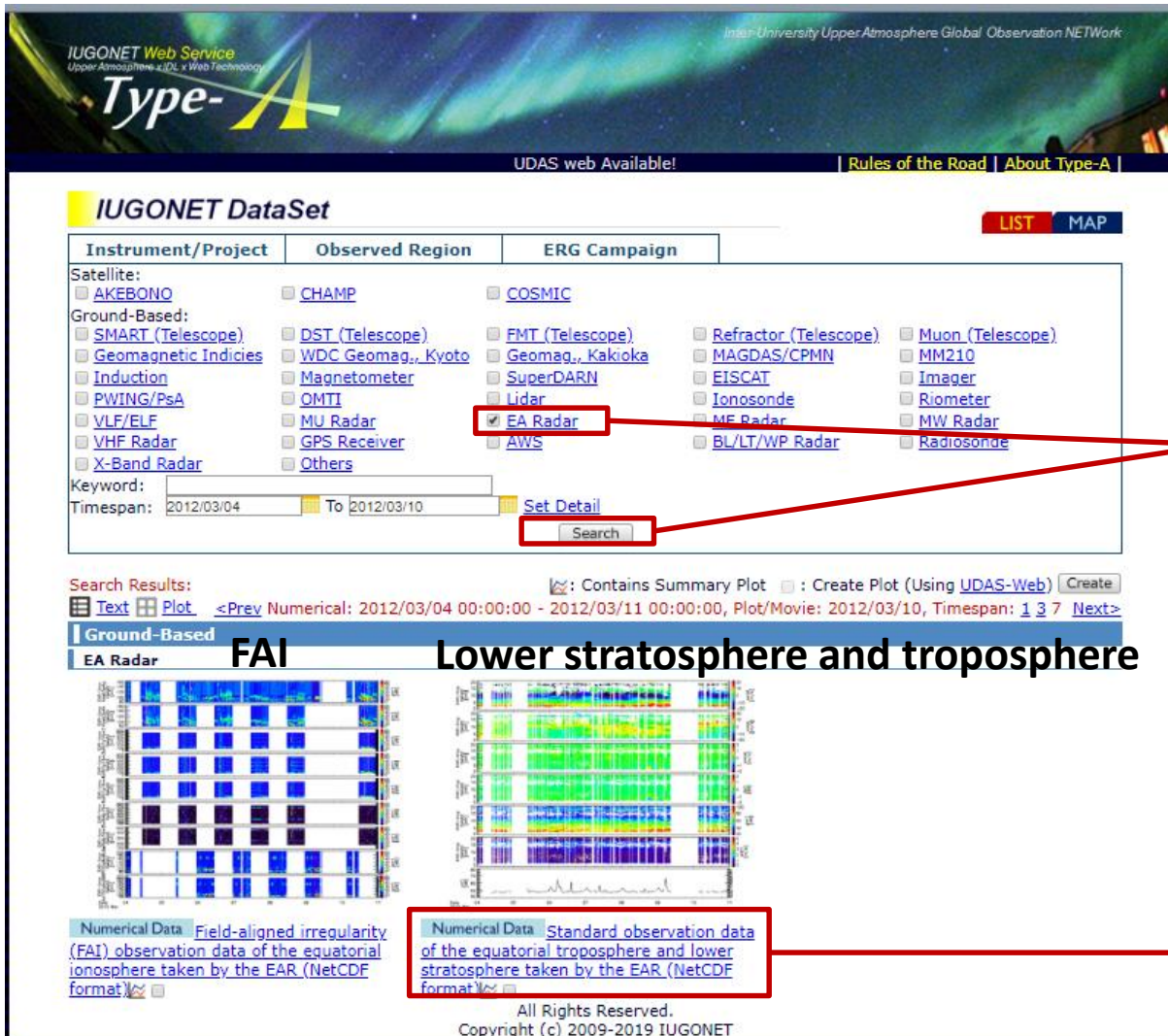


Solar surface image obtained from the solar telescope.

The start time of the QL plots corresponds to that of timespan you specify.



## 2.4 Search results (plot) (specify EAR)



**IUGONET Web Service**  
Upper Atmosphere & Ionosphere Web Technology  
**Type-A**  
Inter-University Upper Atmosphere Global Observation NETWork

UDAS web Available! | Rules of the Road | About Type-A

**IUGONET DataSet** LIST MAP

Instrument/Project	Observed Region	ERG Campaign
Satellite: <input type="checkbox"/> AKEBONO	<input type="checkbox"/> CHAMP	<input type="checkbox"/> COSMIC
Ground-Based: <input type="checkbox"/> SMART (Telescope) <input type="checkbox"/> Geomagnetic Indices <input type="checkbox"/> Induction <input type="checkbox"/> PWING/PsA <input type="checkbox"/> VLF/ELF <input type="checkbox"/> VHF Radar <input type="checkbox"/> X-Band Radar	<input type="checkbox"/> DST (Telescope) <input type="checkbox"/> WDC Geomag., Kyoto <input type="checkbox"/> Magnetometer <input type="checkbox"/> OMTI <input type="checkbox"/> MU Radar <input type="checkbox"/> GPS Receiver <input type="checkbox"/> Others	<input type="checkbox"/> FMT (Telescope) <input type="checkbox"/> Geomag., Kakioka <input type="checkbox"/> SuperDARN <input type="checkbox"/> Lidar <input checked="" type="checkbox"/> EA Radar <input type="checkbox"/> AWS
		<input type="checkbox"/> Refractor (Telescope) <input type="checkbox"/> MAGDAS/CPMN <input type="checkbox"/> EISCAT <input type="checkbox"/> Ionosonde <input type="checkbox"/> MF Radar <input type="checkbox"/> BL/LT/WP Radar
		<input type="checkbox"/> Muon (Telescope) <input type="checkbox"/> MM210 <input type="checkbox"/> Imager <input type="checkbox"/> Riometer <input type="checkbox"/> MW Radar <input type="checkbox"/> Radiosonde

Keyword:   
Timespan: 2012/03/04 To 2012/03/10 [Set Detail](#)

Search Results: ☒ Contains Summary Plot ☐ Create Plot (Using UDAS-Web)   
  [<Prev](#) Numerical: 2012/03/04 00:00:00 - 2012/03/11 00:00:00, Plot/Movie: 2012/03/10, Timespan: 1 3 7 [Next>](#)

**Ground-Based** **FAI** **Lower stratosphere and troposphere**

**EA Radar**

Numerical Data [Field-aligned irregularity \(FAI\) observation data of the equatorial ionosphere taken by the EAR \(NetCDF format\)](#) ☐

Numerical Data [Standard observation data of the equatorial troposphere and lower stratosphere taken by the EAR \(NetCDF format\)](#) ☐

All Rights Reserved.  
Copyright (c) 2009-2019 IUGONET

If you click the check box of “EA Radar” and click “search” button, the QL plots of FAI and lower stratosphere and troposphere data taken by EAR appear as shown in the left figure.

If you click the title of dataset, you go to the detailed search result.

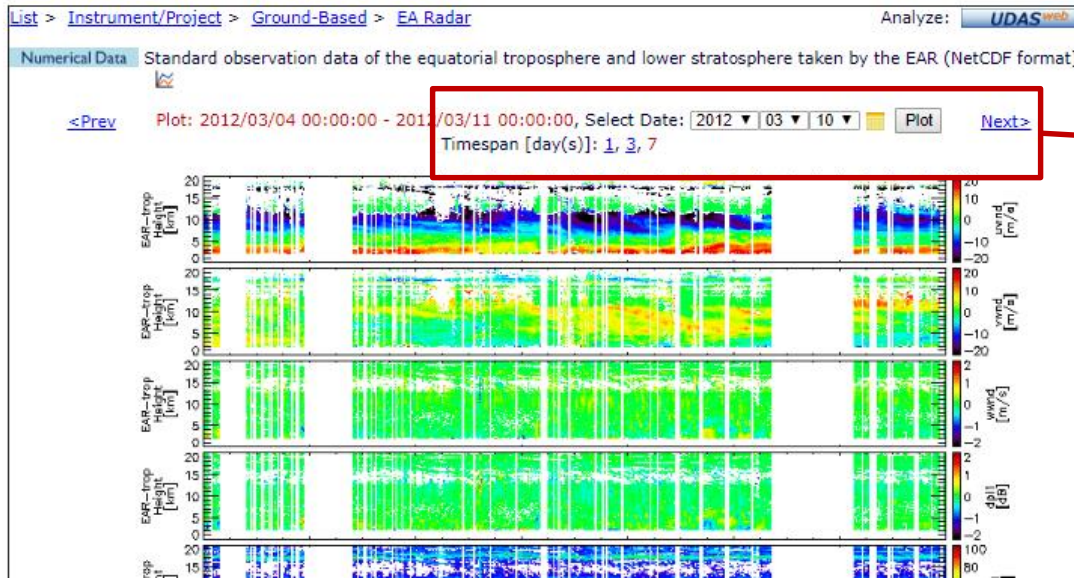


## 2.5 Detailed search results



### IUGONET DataSet

Instrument/Project	Observed Region	ERG Campaign
<b>Satellite:</b> <input type="checkbox"/> <a href="#">AKEBONO</a> <input type="checkbox"/> <a href="#">CHAMP</a> <input type="checkbox"/> <a href="#">COSMIC</a>		
<b>Ground-Based:</b> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">SMART (Telescope)</a>  <input type="checkbox"/> <a href="#">Geomagnetic Indices</a>  <input type="checkbox"/> <a href="#">Induction</a>  <input type="checkbox"/> <a href="#">PWING/PsA</a>  <input type="checkbox"/> <a href="#">VLF/ELF</a>  <input type="checkbox"/> <a href="#">VHF Radar</a>  <input type="checkbox"/> <a href="#">X-Band Radar</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">DST (Telescope)</a>  <input type="checkbox"/> <a href="#">WDC Geomag., Kyoto</a>  <input type="checkbox"/> <a href="#">Magnetometer</a>  <input type="checkbox"/> <a href="#">OMTI</a>  <input type="checkbox"/> <a href="#">MU Radar</a>  <input type="checkbox"/> <a href="#">GPS Receiver</a>  <input type="checkbox"/> <a href="#">Others</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">FMT (Telescope)</a>  <input type="checkbox"/> <a href="#">Geomag., Kakioka</a>  <input type="checkbox"/> <a href="#">SuperDARN</a>  <input type="checkbox"/> <a href="#">Lidar</a>  <input type="checkbox"/> <a href="#">EA Radar</a>  <input type="checkbox"/> <a href="#">AWS</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">Refractor (Telescope)</a>  <input type="checkbox"/> <a href="#">MAGDAS/CPMN</a>  <input type="checkbox"/> <a href="#">EISCAT</a>  <input type="checkbox"/> <a href="#">Ionosonde</a>  <input type="checkbox"/> <a href="#">MF Radar</a>  <input type="checkbox"/> <a href="#">BL/LT/WP Radar</a> </div> <div style="width: 33%;"> <input type="checkbox"/> <a href="#">Muon (Telescope)</a>  <input type="checkbox"/> <a href="#">MM210</a>  <input type="checkbox"/> <a href="#">Imager</a>  <input type="checkbox"/> <a href="#">Riometer</a>  <input type="checkbox"/> <a href="#">MW Radar</a>  <input type="checkbox"/> <a href="#">Radiosonde</a> </div> </div>		
Keyword: <input type="text"/> Timespan: <input type="text"/> To <input type="text"/> <a href="#">Set Detail</a> <input type="button" value="Search"/>		



From the detailed search results, you can know valuable information of the data you want to know.

You can change the start time of QL plot and time intervals (1, 3, or 7 days).



Scroll down

### 2.5 Detailed search results

#### Description:

The 10-minute average observation data in the equatorial troposphere (2-20 km) taken by the equatorial atmosphere radar (EAR) at Kototabang, Indonesia (0.203S, 100.320E, 865m MSL), which has been operated in the standard observation mode of the troposphere and stratosphere. The data are stored in the netCDF file (Network Common Data Form) named (year)(month)(day).nc. The NetCDF file includes the range, height, time, three components of wind velocity, radial Doppler velocity, echo power, spectral width and noise level for each beam number and so on. The azimuth and zenith angles of beam 1, 2, 3, 4 and 5 are (0, 0), (0, 10), (90, 10), (180, 10) and (270, 10), respectively, in unit of degree. The value of 1.0e+10 means missing data.

**Acknowledgement:** If you acquire EAR data, we ask that you acknowledge us in your use of the data. This may be done by including text such as EAR data provided by Research Institute for Sustainable Humanosphere of Kyoto University.

**ReleaseDate:** 2016-07-21T16:51:00

#### Contact (PrincipalInvestigator):

Hirokyu Hashiguchi, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, hasiguti(at)rish.kyoto-u.ac.jp

#### Contact (GeneralContact):

EAR Management Group, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, ear(at)rish.kyoto-u.ac.jp

#### Contact (DataProducer):

Noriko Hashiguchi, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, nhashi(at)rish.kyoto-u.ac.jp

#### Contact (MetadataContact):

RISH Metadata Management Group, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, iugonet(at)rish.kyoto-u.ac.jp

#### AccessInformation:

**URL:** <http://www.rish.kyoto-u.ac.jp/ear/data/index.html>

**Availability:** Online

**Access Rights:** Open

**Format:** NetCDF

**Measurement Type:** Profile

#### Time Span:

**StartDate:** 2001-06-20T17:00:00

**StopDate:** -P1D

**Observed Region:** Earth.NearSurface.Atmosphere

**Observed Region:** Earth.NearSurface.Troposphere

**Observed Region:** Earth.NearSurface.Stratosphere

**Observed Region:** Earth.NearSurface.EquatorialRegion

**Keywords:** EARTH SCIENCE Atmosphere Atmospheric Winds Wind Profiles

#### Instrument:

**Name:** Equatorial Atmosphere Radar (EAR)

**Description:** Equatorial Atmosphere Radar (EAR) is a large Doppler radar built for atmospheric observation at the equator in West Sumatra, Indonesia (0.20S, 100.32E, 865m MSL). The construction was completed in March 2001, with collaboration between RISH, Kyoto University and the National Institute of Aeronautics and Space of Indonesia (LAPAN) of Indonesia. The EAR has a circular antenna array of approximately 110 m in diameter, which consists of 560 three-element Yagis. It is an active phased array system with each Yagi driven by a solid-state transceiver module. This system configuration makes it possible to direct the antenna beam by electronic control up to 5000 times per second. The EAR transmits an intense radio wave of 47 MHz to the sky and receives extremely weak echoes scattered back by atmospheric turbulence. It can observe winds and turbulence in the altitude range from 2 km to 20 km (troposphere and lower stratosphere). It can also observe echoes from ionospheric irregularities at heights more than 30 km.

#### Contact (PrincipalInvestigator):

Hirokyu Hashiguchi, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, hasiguti(at)rish.kyoto-u.ac.jp

#### Contact (GeneralContact):

EAR Management Group, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, ear(at)rish.kyoto-u.ac.jp

#### Contact (MetadataContact):

RISH Metadata Management Group, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, iugonet(at)rish.kyoto-u.ac.jp

#### Data description

**This information is very helpful for writing scientific papers.**

#### Data use policy

#### Contact person

**From this information, you can easily contact the data PIs.**

#### Information of instrument

**This description is also very helpful for writing scientific papers.**

**Scroll down**

## 2.5 Detailed search results

### Observatory:

**Name:** Equatorial Atmosphere observatory at Kototabang

**Description:** The Equatorial Atmosphere observatory at Kototabang is located at the equator in West Sumatra, Indonesia (0.20S, 100.32E, 865m MSL). In this site, various kinds of instruments (for example, boundary layer radar (BLR), equatorial atmosphere radar (EAR) and meteor wind (MW) radar) have been installed, which measure the equatorial atmosphere including the troposphere, lower stratosphere, upper mesosphere, thermosphere and ionosphere.

### Contact (MetadataContact):

RISH Metadata Management Group, Research Institute for Sustainable Humanosphere (RISH), Kyoto University, iugonet(at)rish.kyoto-u.ac.jp

### Location:

**ObservatoryRegion:** Earth.Surface

**CoordinateSystemName:** WGS84

**Latitude:** -0.204

**Longitude:** 100.320

### Observed Data:

#### How to Plot (SPEDAS-CUI #Basic):

```
DL> thm_init
THEMIS> timespan, ['2012-03-04 00:00:00', '2012-03-11 00:00:00']
THEMIS> iug_load_ear, datatype = 'troposphere'
THEMIS> tplot, ['iug_ear_trop_uwnd', 'iug_ear_trop_vwnd', 'iug_ear_trop_wwnd', 'iug_ear_trop_dpl1', 'iug_ear_trop_pwr1', 'iug_ear_trop_wdt1', 'iug_ear_trop_pn1']
```

#### How to Plot (SPEDAS-CUI #Advanced [\*Quick-Look was created with this command]):

```
DL> thm_init
THEMIS> timespan, ['2012-03-04 00:00:00', '2012-03-11 00:00:00']
THEMIS> iug_load_ear, datatype = 'troposphere'
THEMIS> ylim, 'iug_ear_trop_uwnd', 0, 20
THEMIS> ylim, 'iug_ear_trop_vwnd', 0, 20
THEMIS> ylim, 'iug_ear_trop_wwnd', 0, 20
THEMIS> ylim, 'iug_ear_trop_dpl1', 0, 20
THEMIS> ylim, 'iug_ear_trop_pwr1', 0, 20
THEMIS> ylim, 'iug_ear_trop_wdt1', 0, 20
THEMIS> ylim, 'iug_ear_trop_pn1', 40, 80
THEMIS> zlim, 'iug_ear_trop_uwnd', -20, 20
THEMIS> zlim, 'iug_ear_trop_vwnd', -20, 20
THEMIS> zlim, 'iug_ear_trop_wwnd', -2, 2
THEMIS> zlim, 'iug_ear_trop_dpl1', -2, 2
THEMIS> zlim, 'iug_ear_trop_pwr1', 20, 100
THEMIS> zlim, 'iug_ear_trop_wdt1', 0, 5
THEMIS> tplot_options, 'region', [0.05, 0, 1, 1]
THEMIS> tplot, ['iug_ear_trop_uwnd', 'iug_ear_trop_vwnd', 'iug_ear_trop_wwnd', 'iug_ear_trop_dpl1', 'iug_ear_trop_pwr1', 'iug_ear_trop_wdt1', 'iug_ear_trop_pn1']
```

#### How to Plot (SPEDAS-GUI):

```
Step 1: Start SPEDAS GUI Program.
Step 2: Choose [FILE] -> [Load Data].
Step 3: Choose [IUGONET] Tab.
Step 4: Uncheck 'Use Single Day'.
Step 5: Set Start Time: '2012-03-04 00:00:00' and Stop Time: '2012-03-11 00:00:00'.
Step 6: Choose Instrument Type: 'Equatorial_Atmosphere_Radar'.
Step 7: Choose Data Type: 'troposphere', Site or parameter(s)-1: '*(all)' and parameter(s)-2:
Step 8: 'uwnd', 'vwnd', 'wwnd', 'pwr1', 'wdt1', 'dpl1', 'pn1'.
Step 9: Push [->] button. (Please wait a few minutes).
Step 10: Push [Done] button.
Step 11: Choose [Graph] -> [Plot Layout Options].
```

### Information of observatory

**This information is very helpful for writing scientific papers.**

### Information of basic commands of SPEDAS (CUI)

**Load and plot the data.**

### Information of advanced commands of SPEDAS

**Customize the data plot, and conduct the advanced analysis.**

### Information of flow chart of SPEDAS (GUI)

**Load, and plot the data.**

## 2. How to use IUGONET Type-A

### 2.6 Exercise (2.2~2.5 items)

#### Let's try IUGONET Type-A

You try to search various kinds of ground-based observation data related to equatorial atmosphere with IUGONET Type-A.

For example, **automatic weather station (AWS), wind profiler radar, EAR, radiosonde** etc.

If you have some time, please try to search other datasets (solar, geomagnetic field, ionospheric plasma, air glow etc.)

Time limit: 15 – 20 minutes

If you have any questions and suggestions on this exercise and IUGONET Type-A, please let me know them.



# Section 3

## How to use an integrated data analysis software: SPEDAS

### 3.0 Contents in this section

- **To Learn a basic use of SPEDAS-GUI**
  - 1. Start of the GUI tool**
  - 2. Load data**
  - 3. Plot loaded data**
  - 4. Output the plot image file**
  - 5. Save the loaded data**
  - 6. Save the working contents**
  - 7. Customize the plot**
  - 8. Simple data analysis (average, filter, FFT, wavelet etc.)**
- **Data set**
  - **EAR, meteor/MF radar, radiosonde, AWS, WPR etc.**
  - **Various kinds of upper atmospheric data from IUGONET**

## 3.1 Download and installation of SPEDAS GUI tool

### 1. Access the SPEDAS homepage

**[http://spedas.org/wiki/index.php?title=Downloads\\_and\\_Installation](http://spedas.org/wiki/index.php?title=Downloads_and_Installation)**

#### If you don't have an IDL license

SPEDAS is free software but if you do not have an IDL license, then you cannot use the IDL command line, and hence neither the SPEDAS command line tools. You can still use the SPEDAS GUI, and you have two options:

1. Download the SPEDAS executable (for Linux, MacOS, or Windows), or
2. Download the SPEDAS save file (for Solaris or other operating systems).

#### Download the SPEDAS executables, Version 3.1.1 (October 2018, minor refresh January 2019)

Note: In January 2019, we created new executable files (spedas version 3.1.1). However, the only change is the correction of a single bug in the executables, the underlying pedas code remains that of October 2018. For users without IDL licenses, you can use the SPEDAS 3.1.1 executable files for Linux, Windows, and MacOS, which allow access to the Graphical User Interface capabilities of SPEDAS, with no additional IDL license required.

- \* SPEDAS 3.1.1, Windows 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~55 MB) [⬇](#)
- \* SPEDAS 3.1.1, MacOS 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~70 MB) [⬇](#)
- \* SPEDAS 3.1.1, Linux 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 10.5 (~70 MB) [⬇](#)
- \* SPEDAS 3.1.1, Linux 64bit executable with IDL 8.5.1, CDF 3.6.3.1, Geopack 7.6 (~70 MB) - includes Geopack 7.6, for older Linux machines that have problems with Geopack 9.4 [⬇](#)

This release contains everything you need, including the IDL VM, the Geopack DLM and the CDF DLM. You just have to unzip the file and run the executable and the SPEDAS GUI will appear.

#### Download the SPEDAS save file, Version 3.1.1 (October 2018, minor refresh January 2019)

Note: In January 2019, we created a new save file (spedas version 3.1.1). However, the only change is the correction of a single bug, the underlying pedas code remains that of October 2018.

The SPEDAS save file requires the run-time [IDL Virtual Machine \(VM\)](#) [⬇](#) which has to be downloaded for free from H

- \* SPEDAS 3.1.1, IDL Savefile (20 MB) [⬇](#)

To run SPEDAS using the IDL virtual machine,

1. start the IDL virtual machine executable
2. click through the splash screen to get to the file selection dialog
3. navigate to the SPEDAS installation
4. go into the thm\_gui\_new directory and click on thm\_gui.sav

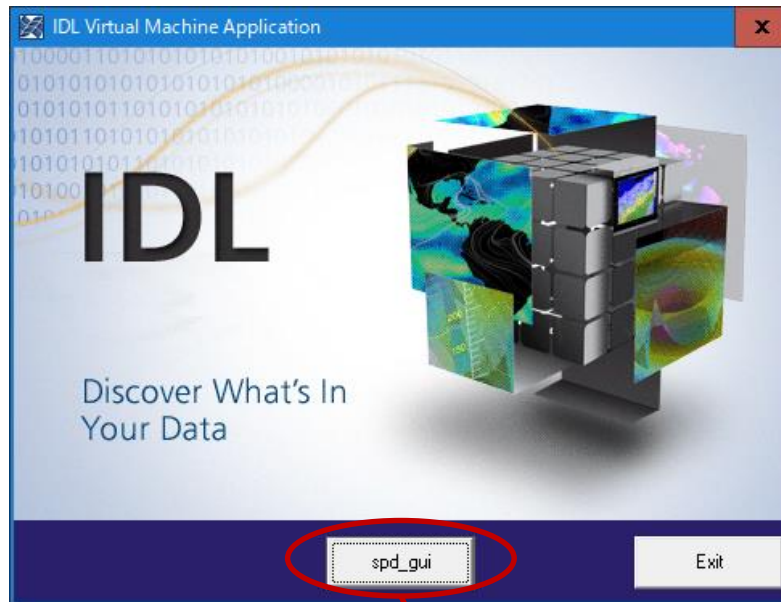
This should bring up the main screen of the SPEDAS GUI. From this point you should be able to load, plot, and anal

Further information for loading IDL save files can be found here: <http://harrisgeospatial.com/docs/StartingVirtualMachineApplication.html> [⬇](#)

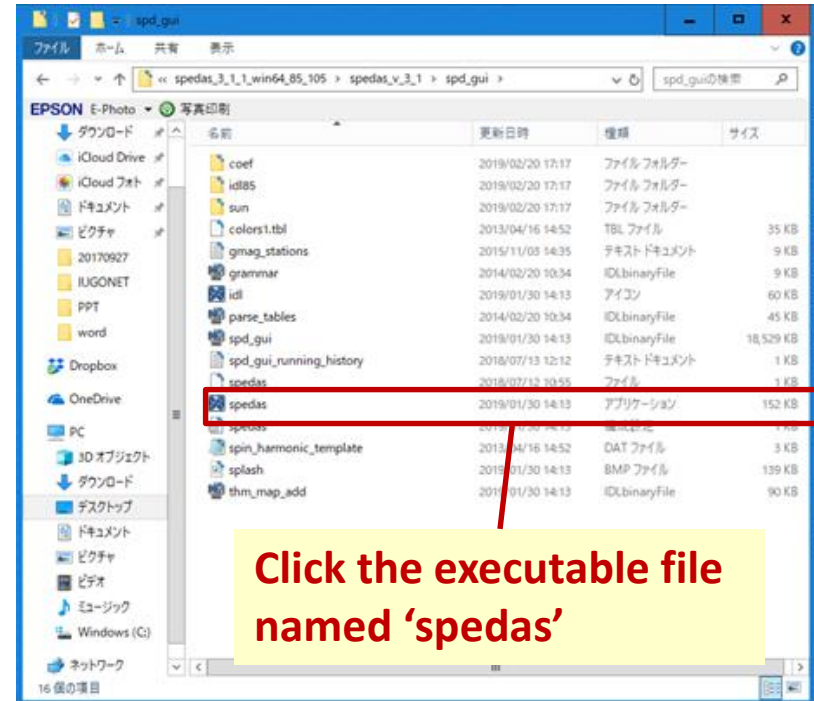
**2. Click the proper link for your OS.  
The compressed executable file will  
be downloaded in several seconds  
or minutes.**

## 3.2 Start of SPEDAS GUI tool

- [1] Unzip the downloaded zip file.
- [2] Click the executable file named 'spedas' stored in the directory 'spd\_gui'.



Click the icon 'spd\_gui'.

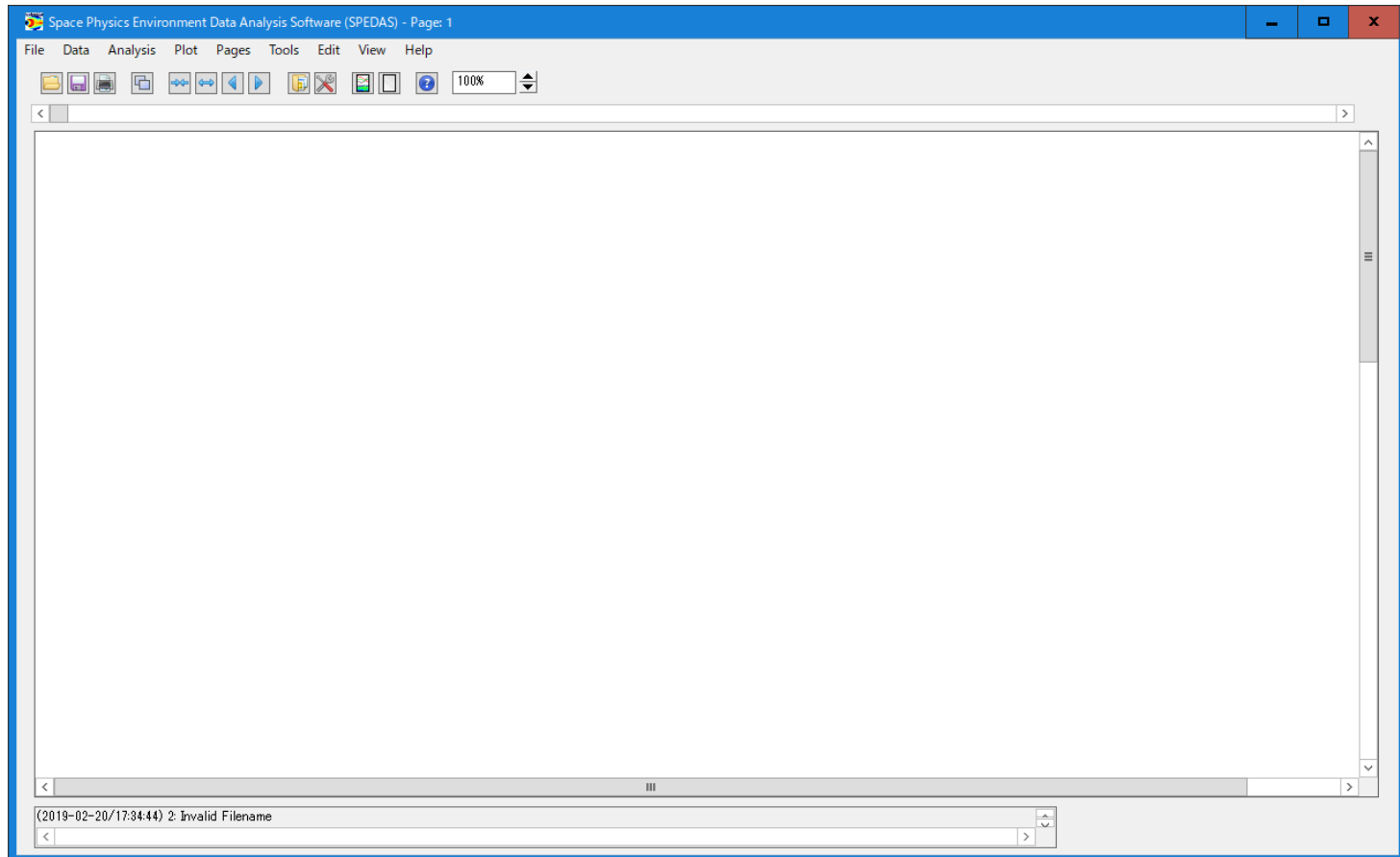


- [3] Because the IDL Virtual Machine window appears on your PC, you should click the icon 'spd\_gui'.



## 3.3 Start of SPEDAS GUI tool

Does this window appear ?



**If the SPEDAS GUI starts normally, this window appears immediately.**

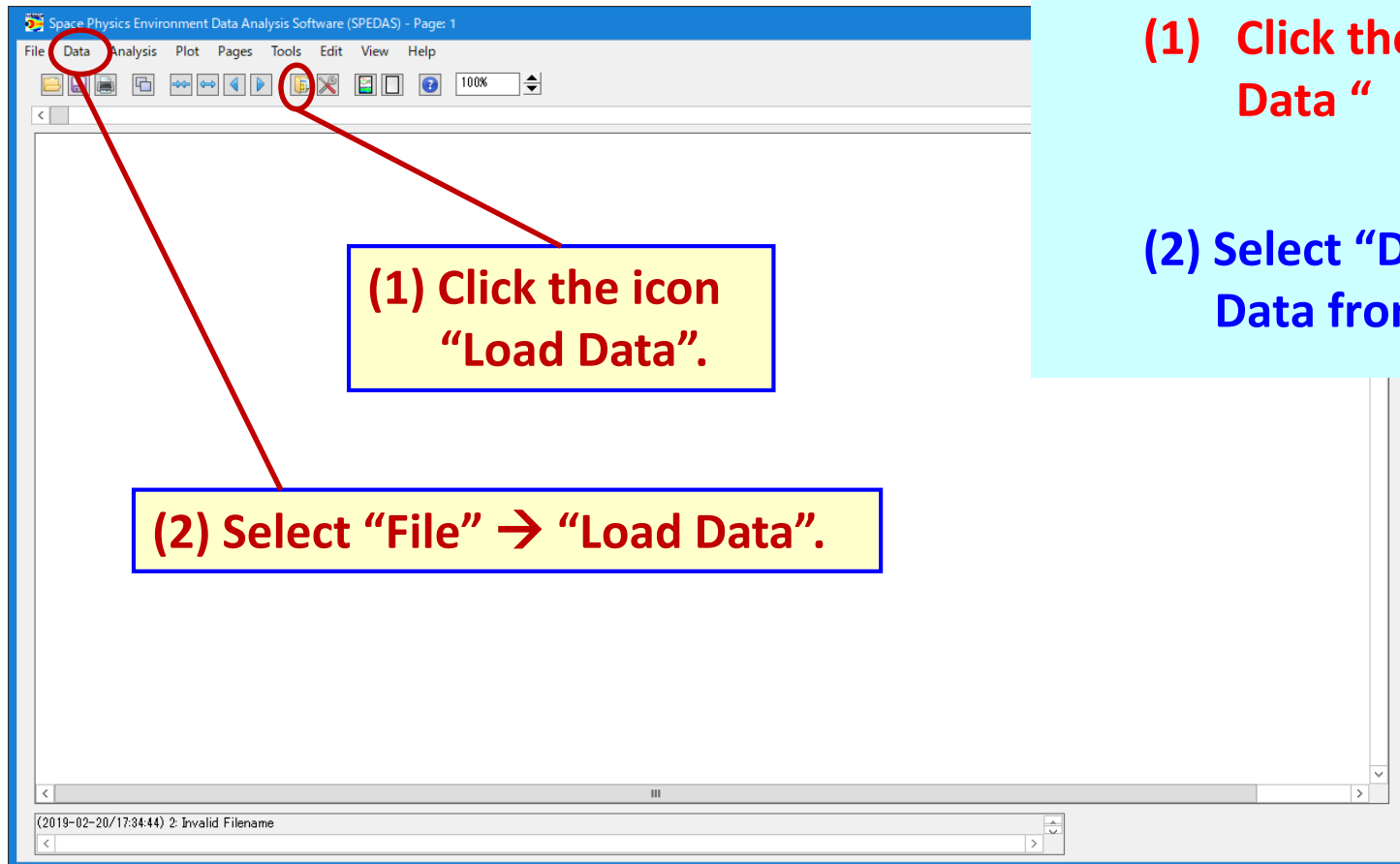
### 3.4 Load and plot the EAR data

**You can create the plots of the EAR data through only 12 steps!**

1. Start SPEDAS GUI Program.
2. Choose [Data] -> [Load Data from Plug-in].
3. Choose [IUGONET] Tab.
4. Uncheck 'Use Single Day'.
5. Set Start Time: '2012-03-04 00:00:00' and Stop Time: '2012-03-11 00:00:00'.
6. Choose Instrument Type: 'Equatorial\_Atmosphere\_Radar'.
7. Choose Data Type: 'troposphere', Site or parameter(s)-1: '\* (all)' and parameter(s)-2: 'uwnd', 'vwnd', 'wwnd', 'pwr1', 'wdt1', 'dpl1', 'pn1'.
8. Push [->] button. (Please wait a few minutes).
9. Push [Done] button.
10. Choose [Plot] -> [Plot Layout Options].
11. Choose 'iug\_ear\_trop\_uwnd', 'iug\_ear\_trop\_vwnd', 'iug\_ear\_trop\_wwnd', 'iug\_ear\_trop\_dpl1', 'iug\_ear\_trop\_pwr1', 'iug\_ear\_trop\_wdt1', 'iug\_ear\_trop\_pn1' and push [Line->] button.
12. Push [OK] button.

**From: IUGONET Type-A**  
**<http://search.iugonet.org/metadata/001/00000155>**

## 3.4 Load and plot the EAR data



[4] Start of Load Data Window with the following method.

**(1) Click the icon "Load Data"**

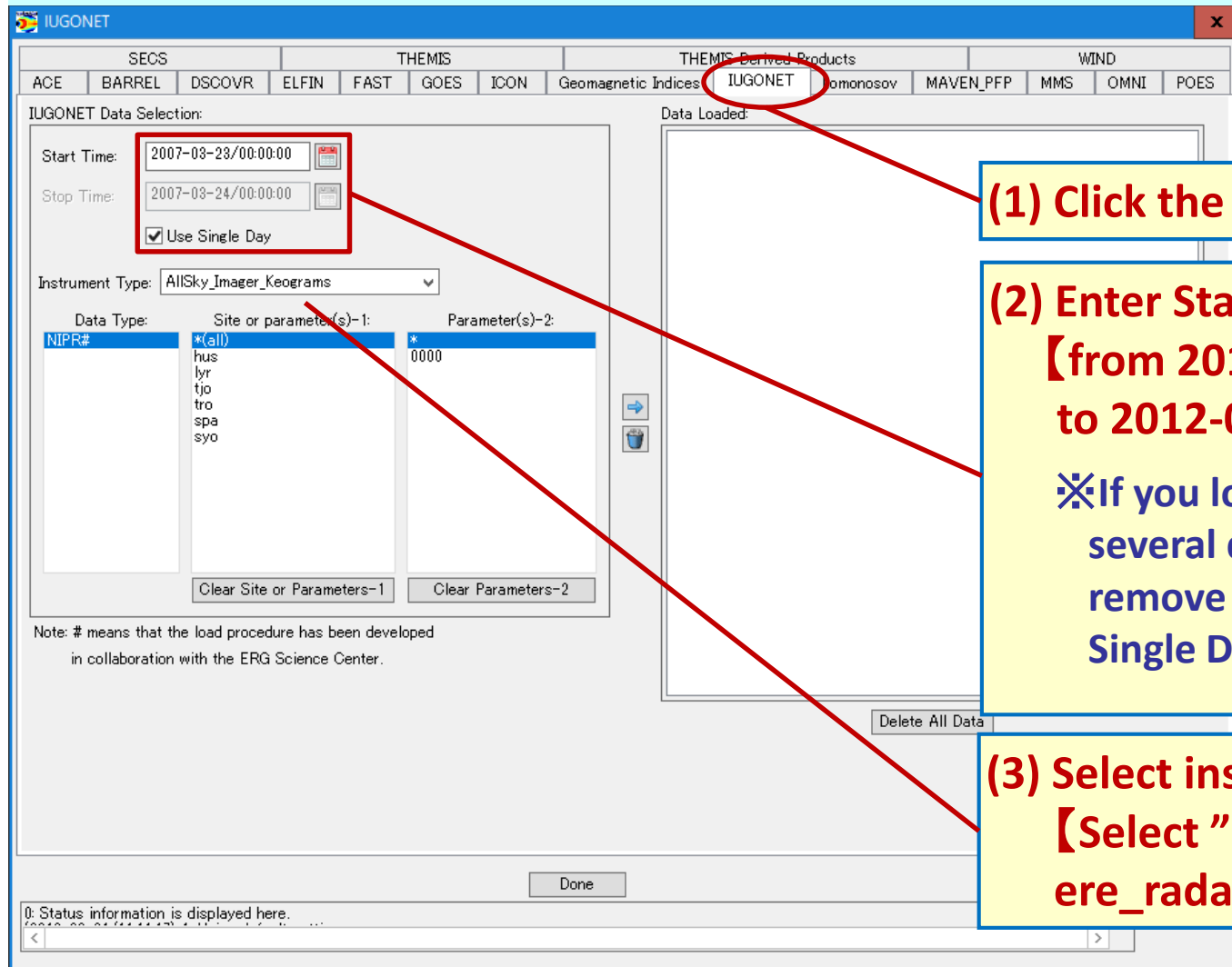
or

**(2) Select "Data" → "Load Data from Plug-in"**



## 3.4 Load and plot the EAR data

**[5] To select the data name you want to load on the Load Data Window**



The screenshot shows the IUGONET Load Data Window. The 'IUGONET' tab is selected in the top menu. The 'Start Time' and 'Stop Time' fields are set to 2007-03-23/00:00:00 and 2007-03-24/00:00:00 respectively, with the 'Use Single Day' checkbox checked. The 'Instrument Type' is set to 'AllSky\_Imager\_Keograms'. The 'Data Type' is 'NIPR#' and the 'Site or parameter(s)-1' is '\*(all)'. The 'Parameter(s)-2' is '0000'. The 'Data Loaded' area is empty. A red box highlights the 'IUGONET' tab, the 'Start Time' and 'Stop Time' fields, and the 'Use Single Day' checkbox. A red line points from the 'IUGONET' tab to the first instruction box. Another red line points from the 'Data Type' and 'Site or parameter(s)-1' fields to the third instruction box.

**(1) Click the tab "IUGONET"**

**(2) Enter Start/Stop Time**  
**【from 2012-03-04/00:00:00 to 2012-03-11/00:00:00】**

✂If you load the data during several days, you have to remove the check "Use Single Day".

**(3) Select instrument.**  
**【Select "Equatorial\_Atmosphere\_radar"】**

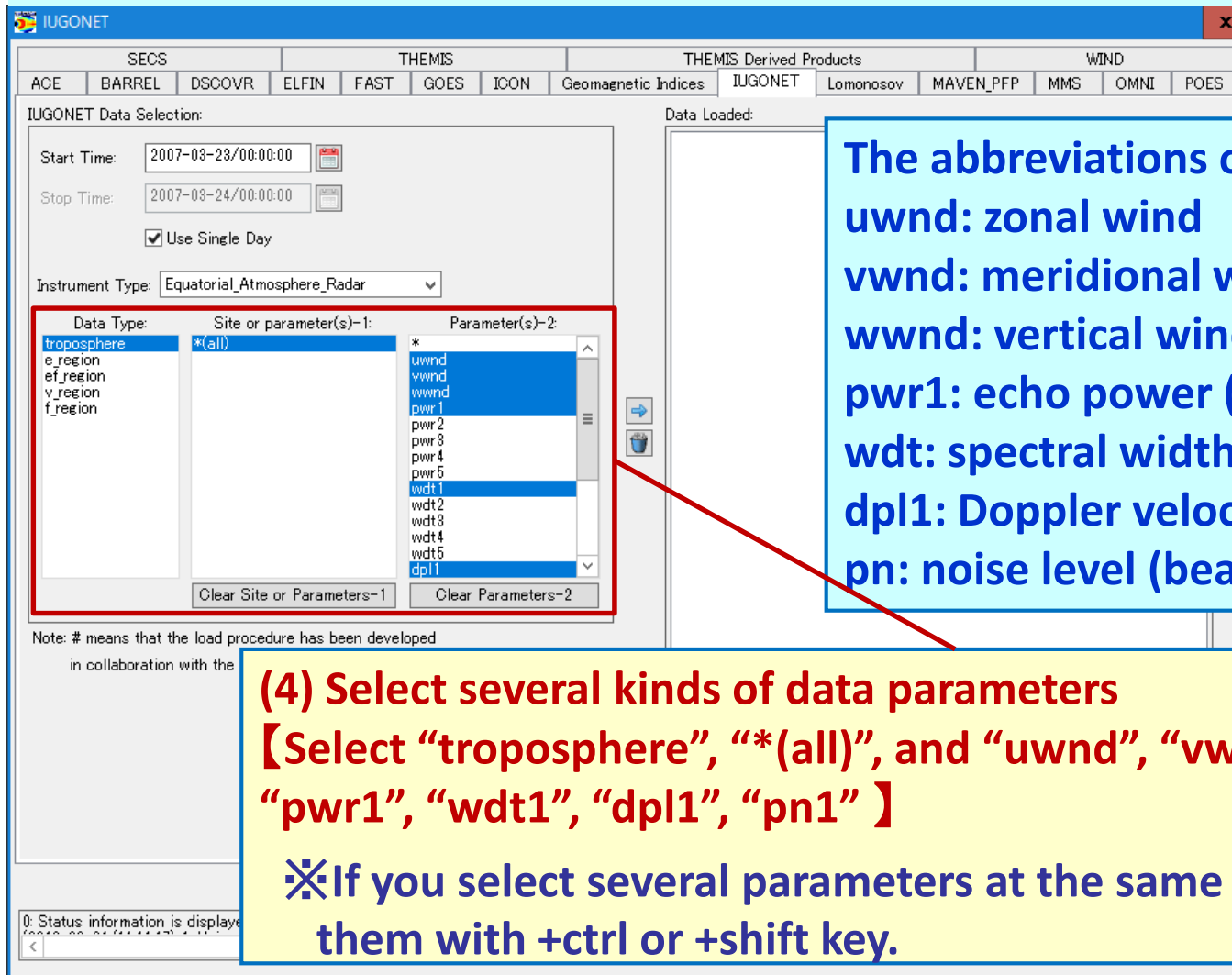
Note: # means that the load procedure has been developed in collaboration with the ERG Science Center.

Done

0: Status information is displayed here.

## 3.4 Load and plot the EAR data

**[5] To select the data name you want to load on the Load Data Window**



The abbreviations of parameter mean

- uwnd: zonal wind
- vwnd: meridional wind
- wwnd: vertical wind
- pwr1: echo power (beam-1)
- wdt: spectral width (beam-1)
- dpl1: Doppler velocity (beam-1)
- pn: noise level (beam-1)

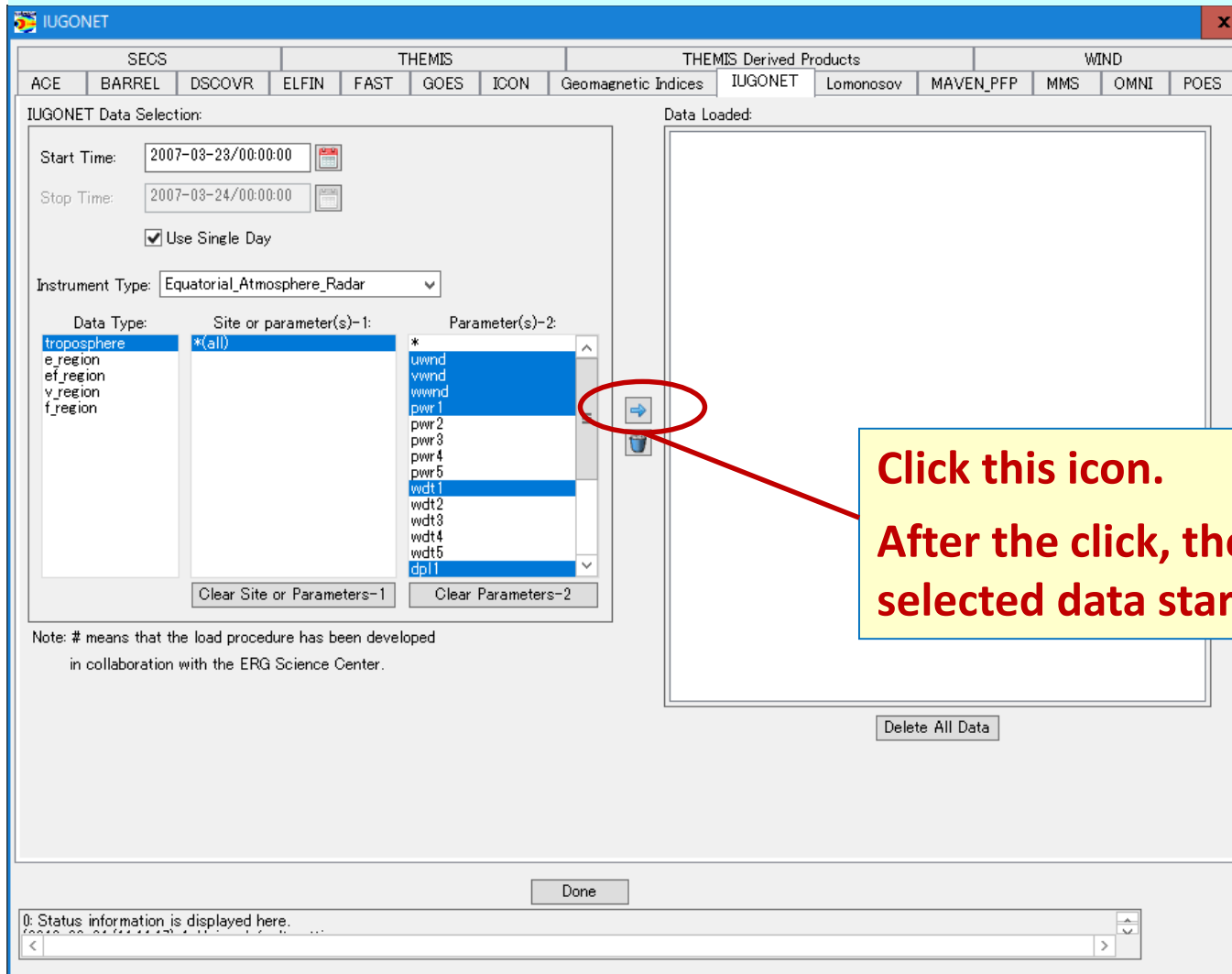
**(4) Select several kinds of data parameters**

**【Select “troposphere”, “\* (all)”, and “uwnd”, “vwnd”, “wwnd”, “pwr1”, “wdt1”, “dpl1”, “pn1”】**

**✖If you select several parameters at the same time, you select them with +ctrl or +shift key.**

## 3.4 Load and plot the EAR data

**[5] To select the data name you want to load on the Load Data Window**

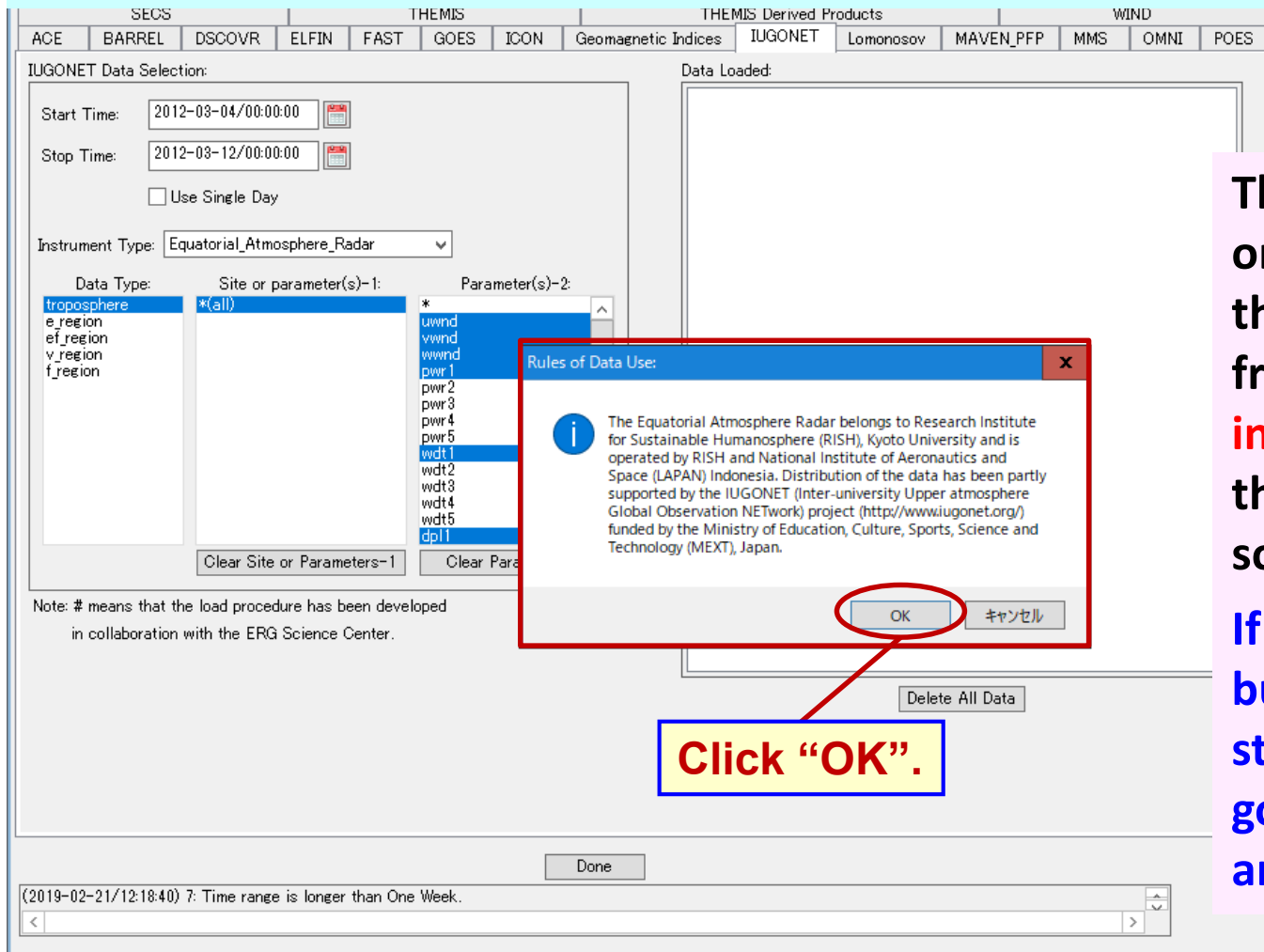


**Click this icon.**

**After the click, the load of selected data starts.**

## 3.4 Load and plot the EAR data

**[6] After you carefully read “Rules of Data Use” described on a new window, please click the button “OK”.**



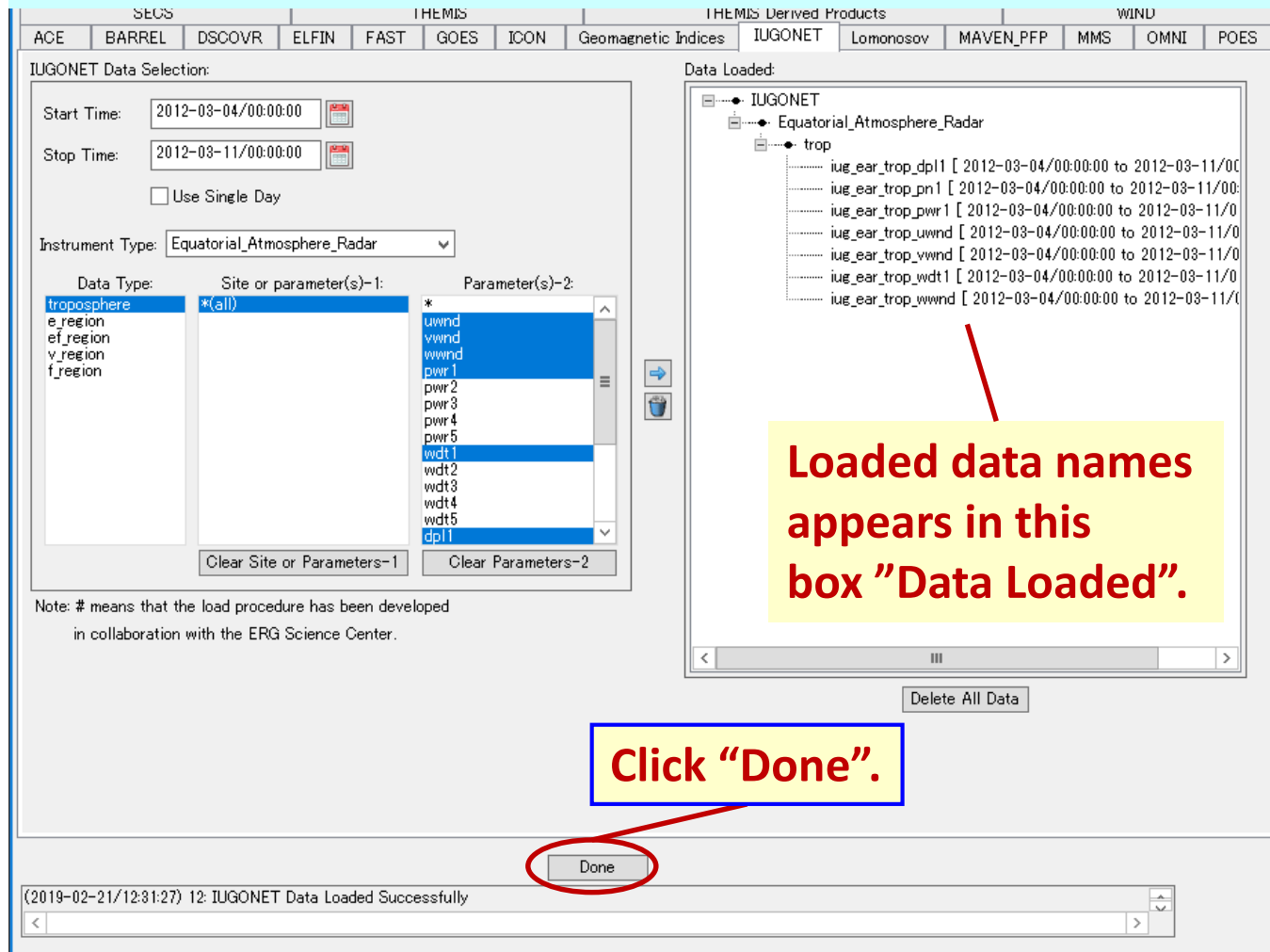
This window appears only when you loaded the data obtained from each instrument **in the first time** after the start of this software.

If you push the cancel button, the data load stops and you cannot go ahead of data analysis.



## 3.4 Load and plot the EAR data

**[7] Please confirm whether the loaded data appear in the right box “Data Loaded” or not.**



**IUGONET Data Selection:**

Start Time: 2012-03-04/00:00:00  
 Stop Time: 2012-03-11/00:00:00  
☐ Use Single Day  
 Instrument Type: Equatorial\_Atmosphere\_Radar

Data Type: troposphere  
 Site or parameter(s)-1: \*(all)  
 Parameter(s)-2: \*  
 uwnd  
 vwnd  
 wwnd  
 pwr 1  
 pwr 2  
 pwr 3  
 pwr 4  
 pwr 5  
 wdt 1  
 wdt 2  
 wdt 3  
 wdt 4  
 wdt 5  
 dpl 1

**Data Loaded:**

- IUGONET
  - Equatorial\_Atmosphere\_Radar
    - trop
      - iug\_ear\_trop\_dpl1 [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_pn1 [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_pwr1 [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_uwnd [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_vwnd [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_wdt1 [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]
      - iug\_ear\_trop\_wwnd [ 2012-03-04/00:00:00 to 2012-03-11/00:00:00]

**Loaded data names appears in this box "Data Loaded".**

**Click "Done".**

Done

(2019-02-21/12:31:27) 12: IUGONET Data Loaded Successfully

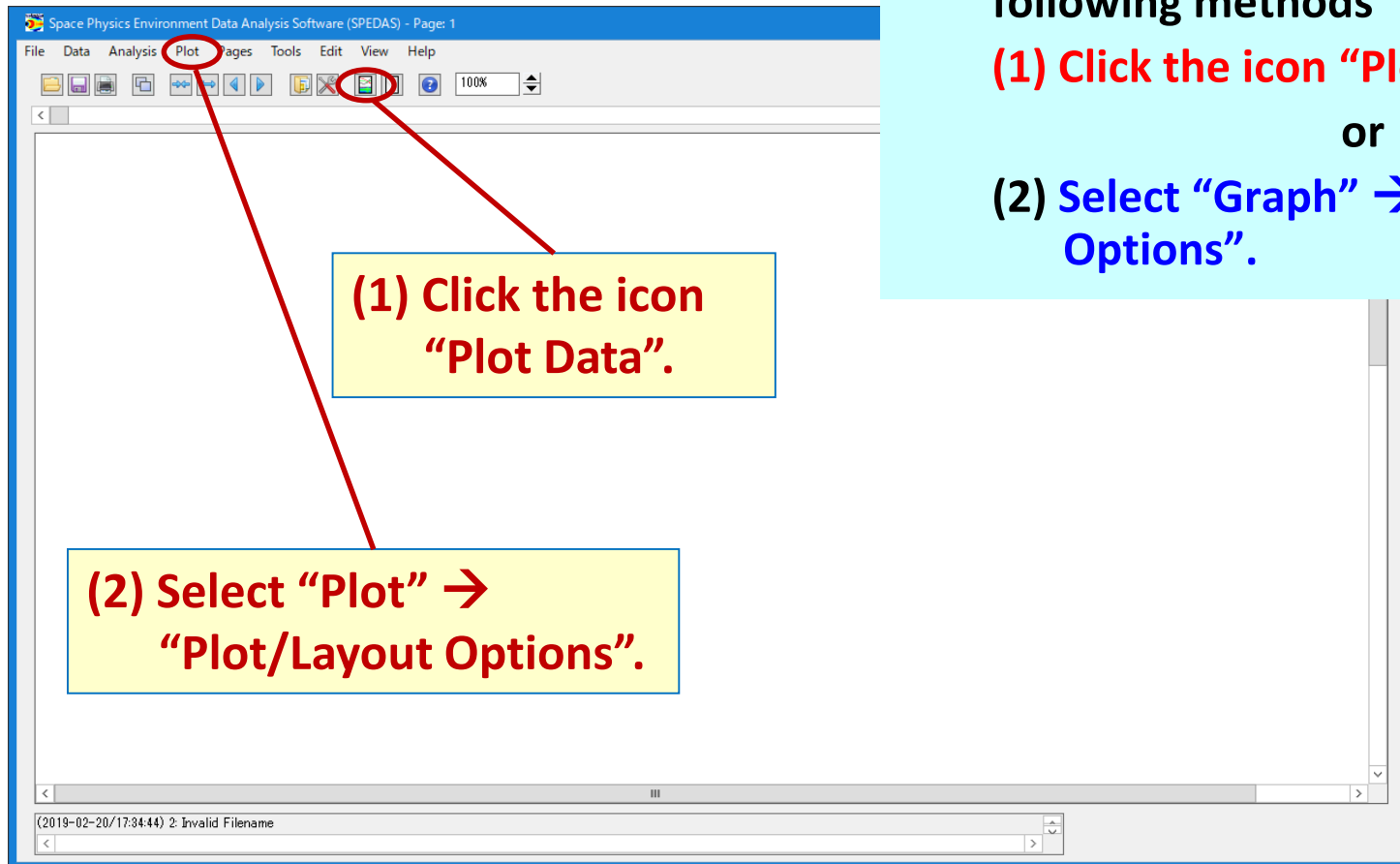
## 3.4 Load and plot the EAR data

[8] You open the “Plot/Layout Options Window” with one of the two following methods

**(1) Click the icon “Plot Data”.**

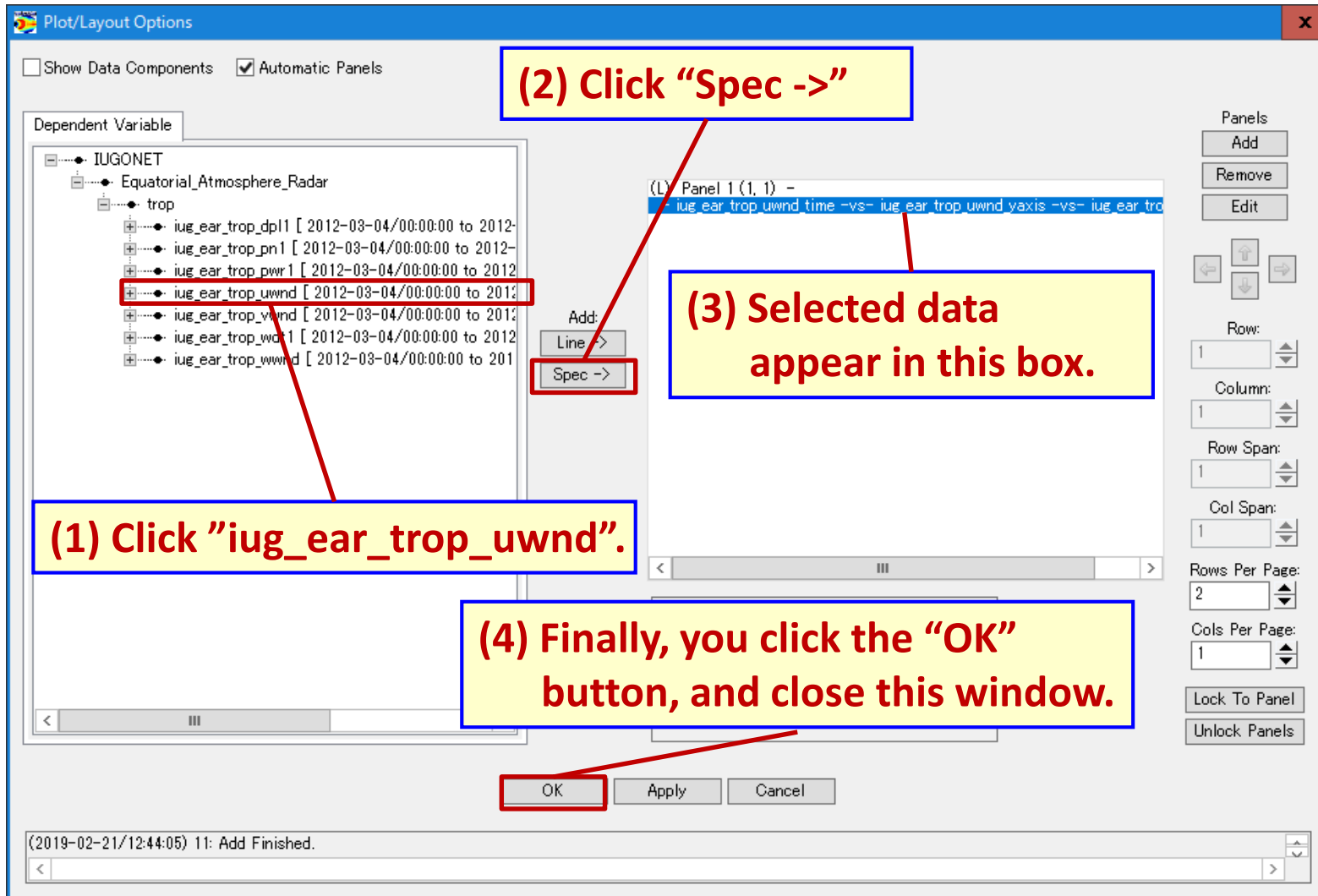
or

**(2) Select “Graph” → “Plot/Layout Options”.**



## 3.4 Load and plot the EAR data

[9] To set up the layout of plot on the window “Plot/Layout Options”.



The screenshot shows the 'Plot/Layout Options' window. On the left, under 'Dependent Variable', a tree structure shows 'IUGONET' expanded to 'Equatorial\_Atmosphere\_Radar' and then 'trop'. The variable 'iug\_ear\_trop\_uwnd' is selected and highlighted with a red box. A red arrow points from this box to a yellow callout box labeled '(1) Click "iug\_ear\_trop\_uwnd"'. In the center, there are 'Add', 'Line ->', and 'Spec ->' buttons. The 'Spec ->' button is highlighted with a red box, and a red arrow points from it to a yellow callout box labeled '(2) Click "Spec ->"'. To the right of the buttons, a text box shows the command: '(L) Panel 1 (1, 1) - iug\_ear\_trop\_uwnd time -vs- iug\_ear\_trop\_uwnd yaxis -vs- iug\_ear\_trop\_uwnd'. A red arrow points from this text box to a yellow callout box labeled '(3) Selected data appear in this box.'. At the bottom, the 'OK', 'Apply', and 'Cancel' buttons are visible. A red arrow points from the 'OK' button to a yellow callout box labeled '(4) Finally, you click the "OK" button, and close this window.'. On the right side of the window, there are controls for 'Panels' (Add, Remove, Edit), 'Row', 'Column', 'Row Span', 'Col Span', 'Rows Per Page', and 'Cols Per Page'.

**(1) Click "iug\_ear\_trop\_uwnd".**

**(2) Click "Spec ->"**

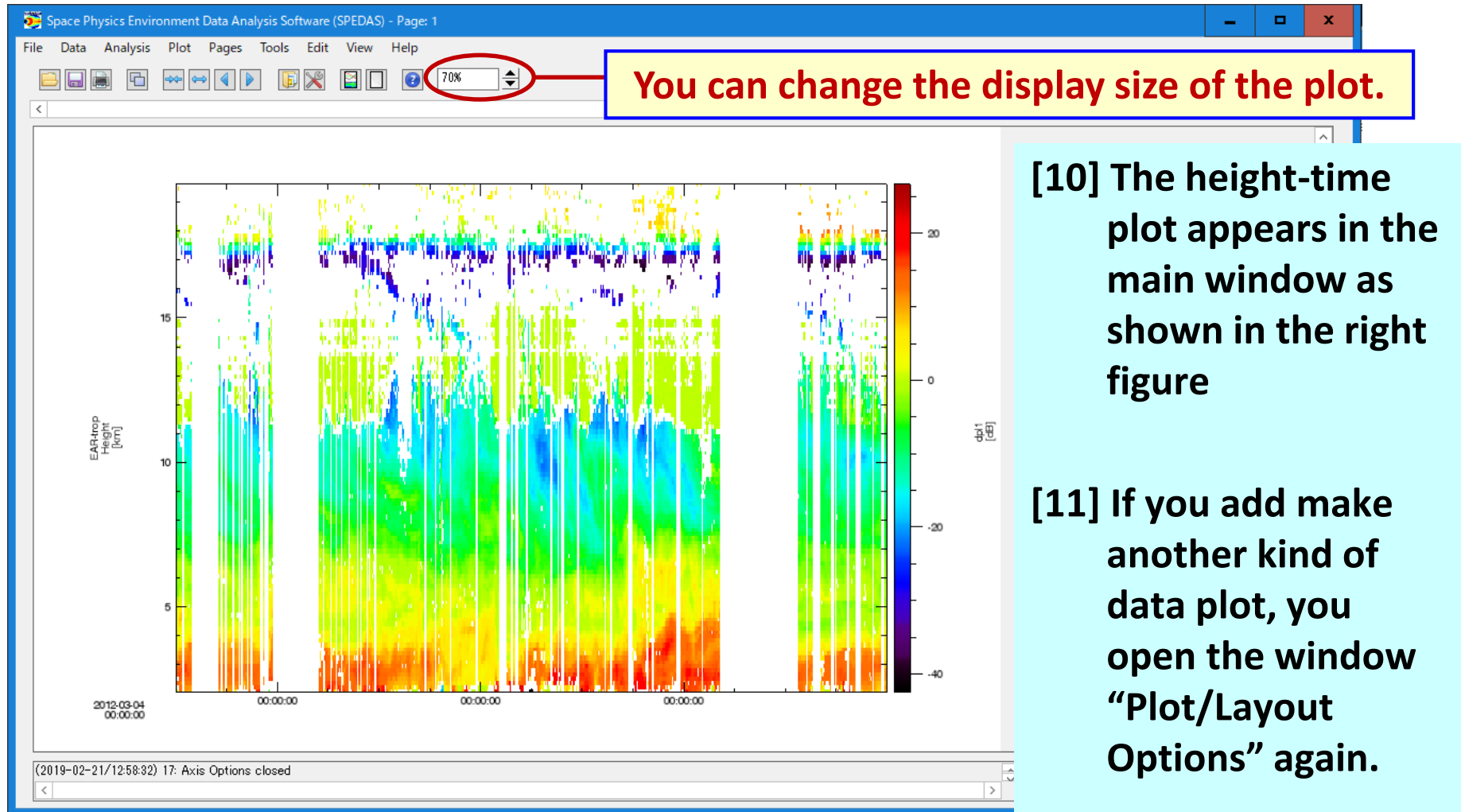
**(3) Selected data appear in this box.**

**(4) Finally, you click the "OK" button, and close this window.**

OK Apply Cancel

(2019-02-21/12:44:05) 11: Add Finished.

## 3.4 Load and plot the EAR data

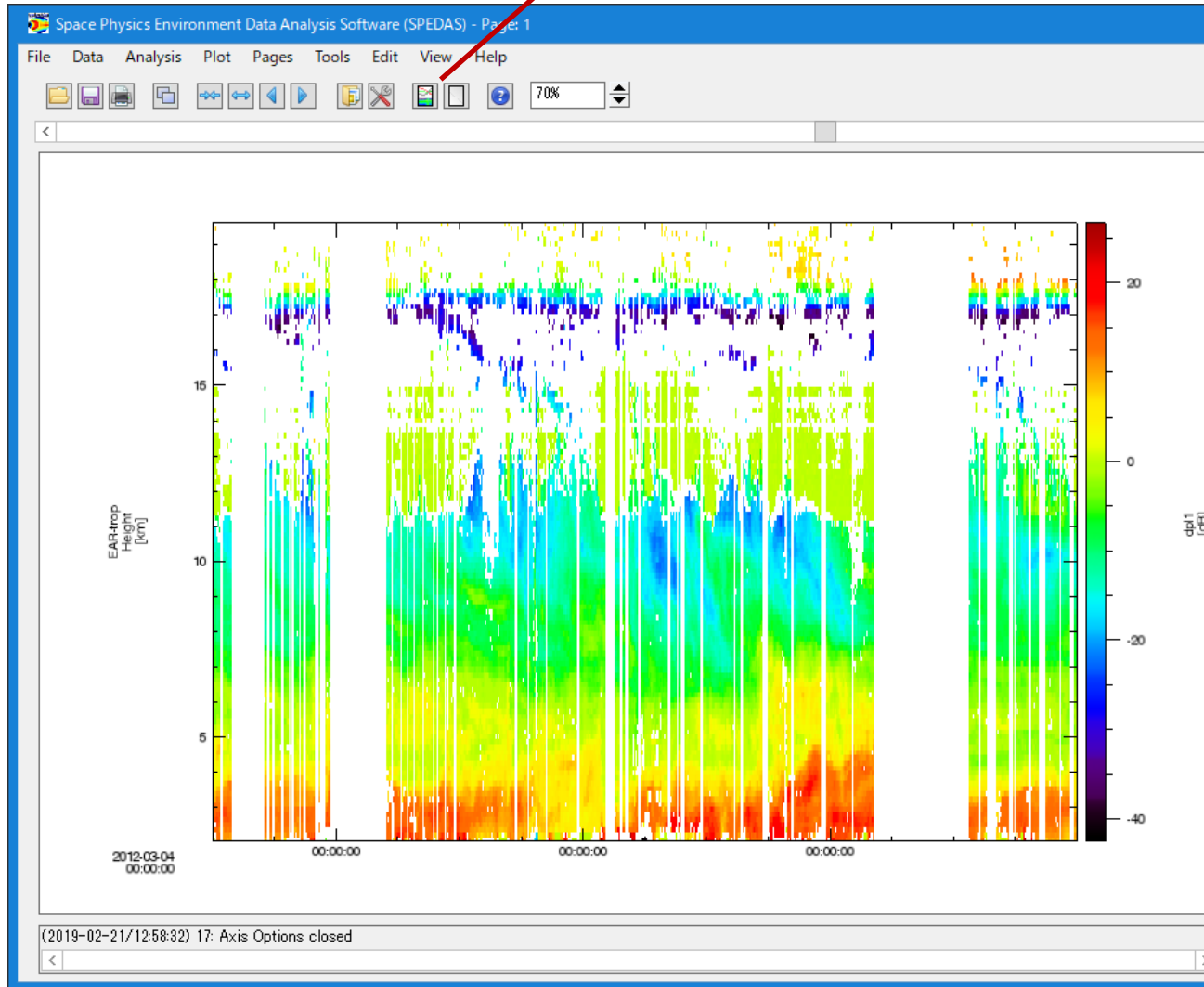




# 3. How to use SPEDAS

## 3.4 Load and plot the EAR data

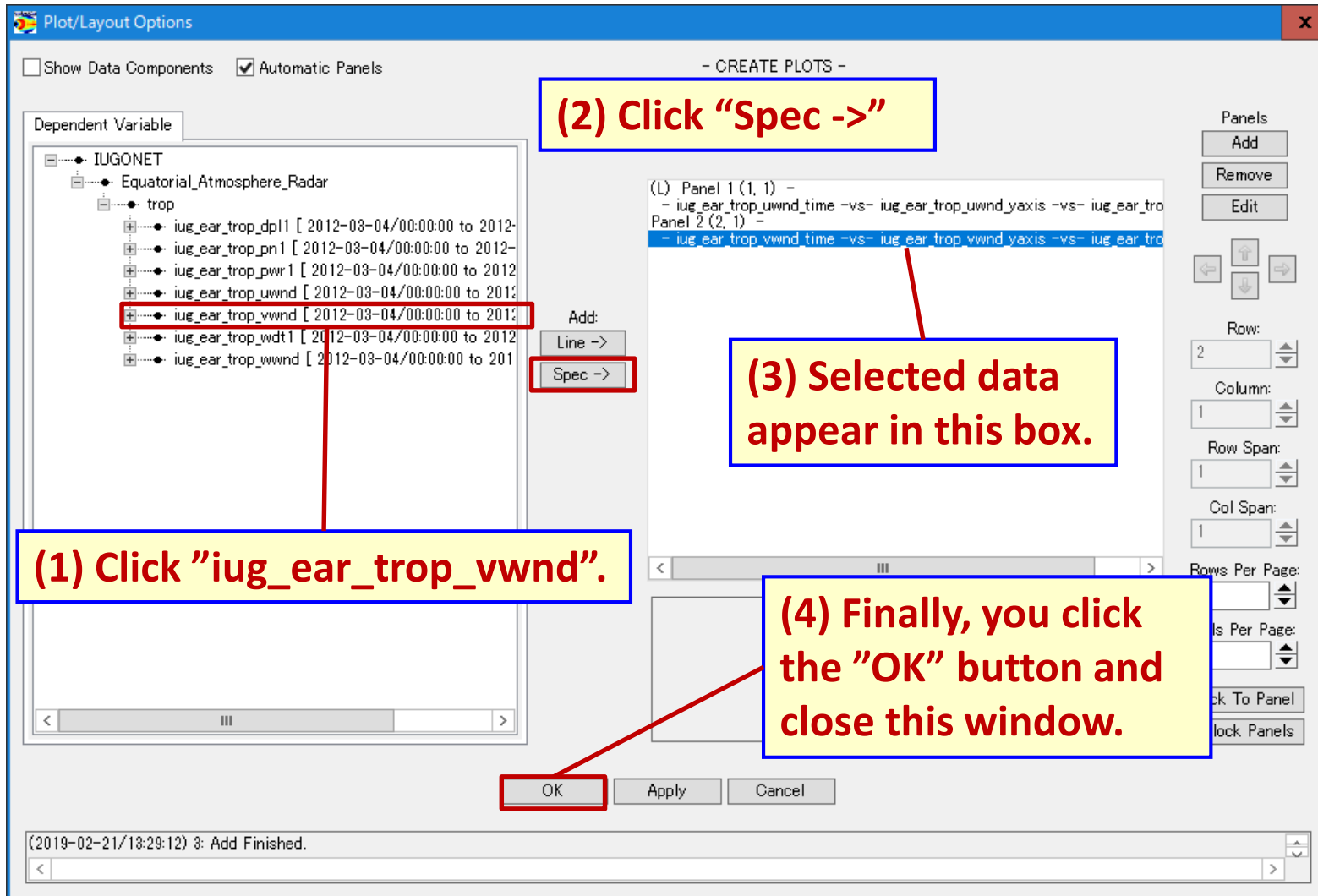
**Click here.**



**[11] If you add make another kind of data plot, you open the window “Plot/Layout Options” again.**

## 3.4 Load and plot the EAR data

[12] To add the new plot data with the following procedure

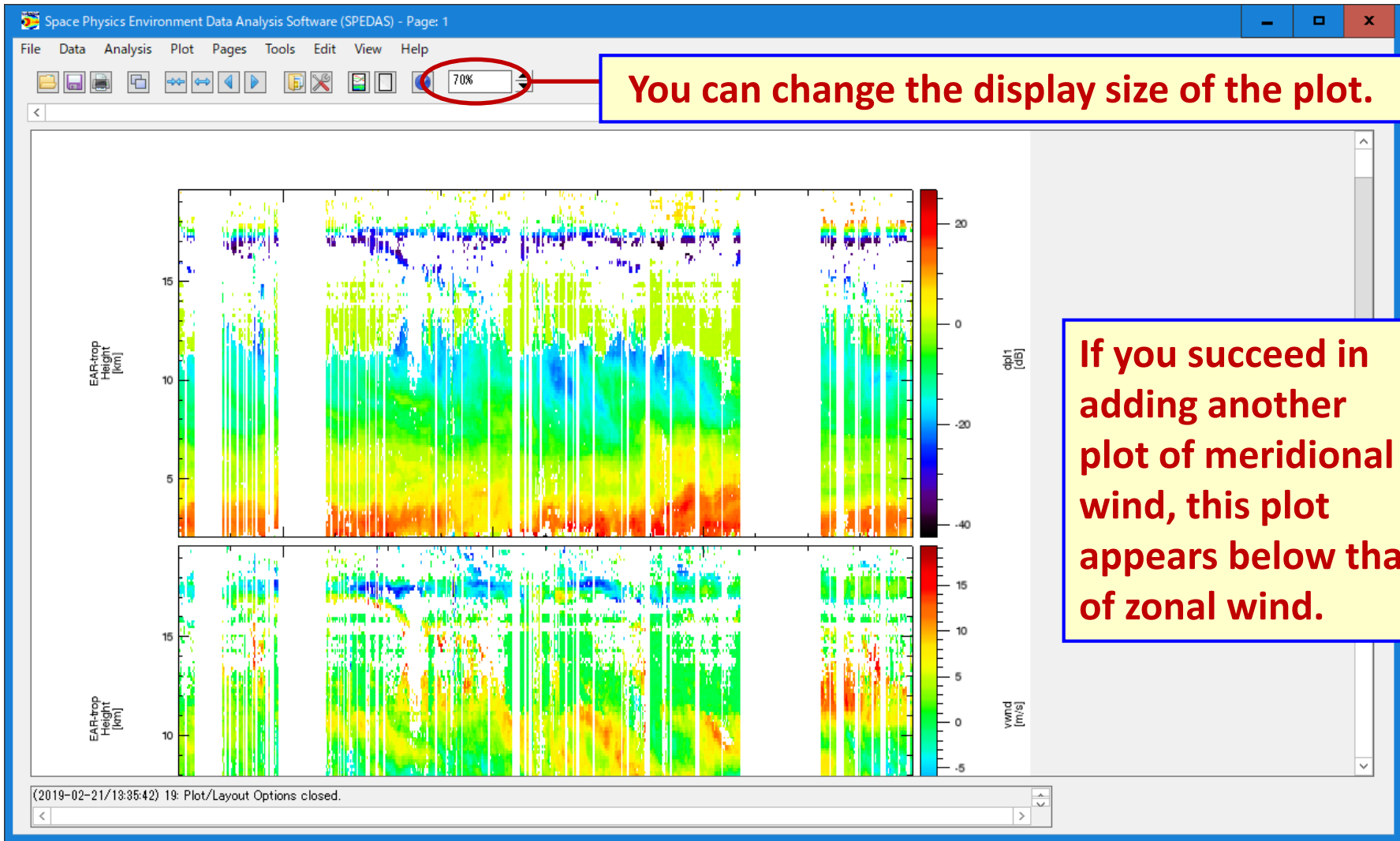


The screenshot shows the 'Plot/Layout Options' window in SPEDAS. The 'Dependent Variable' tree on the left lists various data components under 'IUGONET' and 'Equatorial Atmosphere Radar'. The 'iug\_ear\_trop\_vwnd' variable is highlighted with a red box. A red line points from this box to a yellow instruction box labeled '(1) Click "iug\_ear\_trop\_vwnd"'. Below the tree, the 'Add:' section has 'Line ->' and 'Spec ->' buttons. The 'Spec ->' button is highlighted with a red box, with a red line pointing to a yellow instruction box labeled '(2) Click "Spec ->"'. The 'Spec ->' button points to a text area showing plot panel definitions. The text area contains:
 

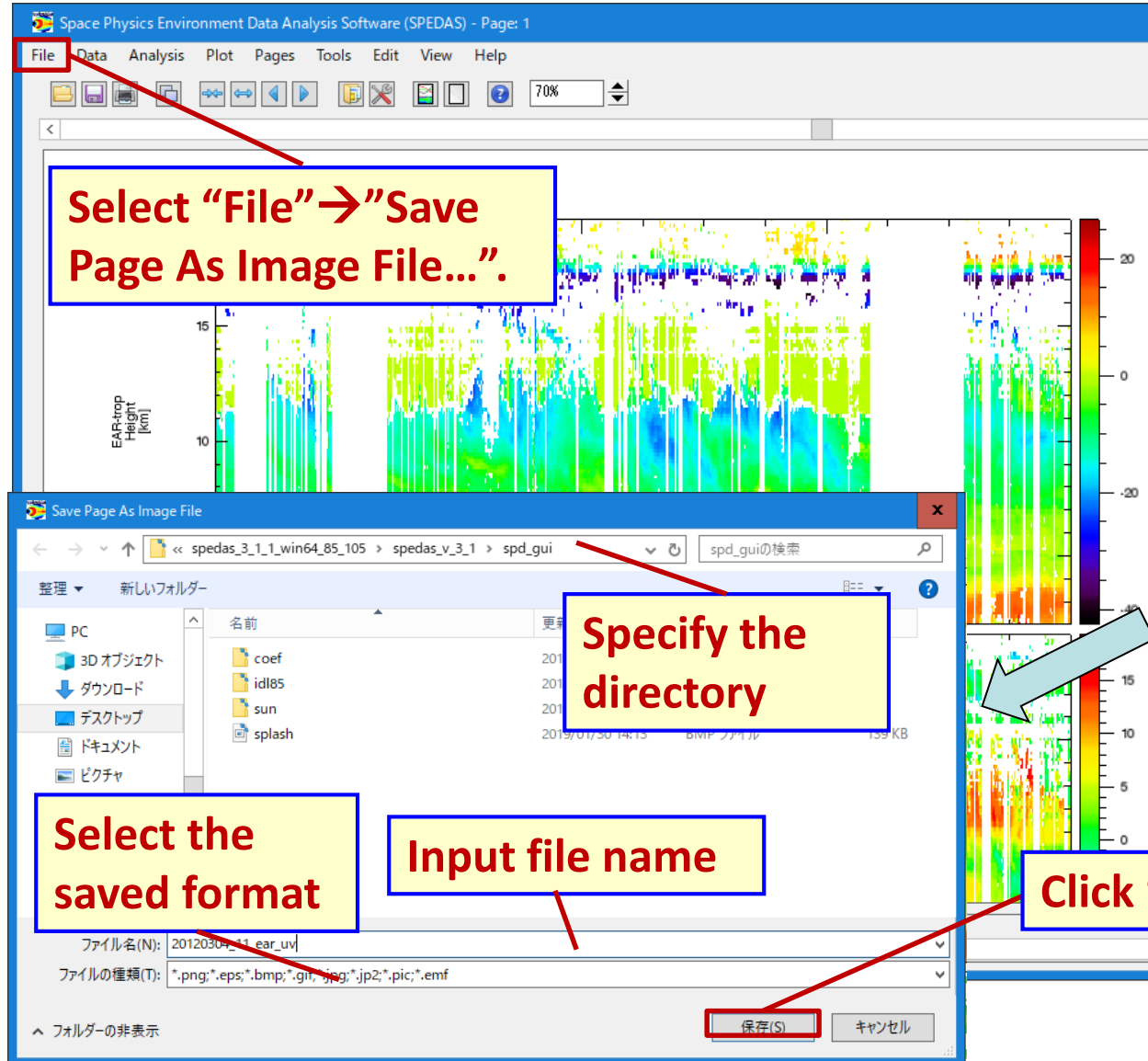
```
(L) Panel 1 (1, 1) -
  - iug_ear_trop_uwnd_time -vs- iug_ear_trop_uwnd_yaxis -vs- iug_ear_tro
Panel 2 (2, 1) -
  - iug_ear_trop_vwnd_time -vs- iug_ear_trop_vwnd_yaxis -vs- iug_ear tro
```

 The text 'iug\_ear\_trop\_vwnd\_time -vs- iug\_ear\_trop\_vwnd\_yaxis -vs- iug\_ear tro' is highlighted in blue. A red line points from this box to a yellow instruction box labeled '(3) Selected data appear in this box.'. At the bottom of the window, the 'OK' button is highlighted with a red box, with a red line pointing to a yellow instruction box labeled '(4) Finally, you click the "OK" button and close this window.'. The status bar at the bottom left shows '(2019-02-21/13:29:12) 3: Add Finished.'

## 3.4 Load and plot the EAR data



## 3.5 Output of plot image file



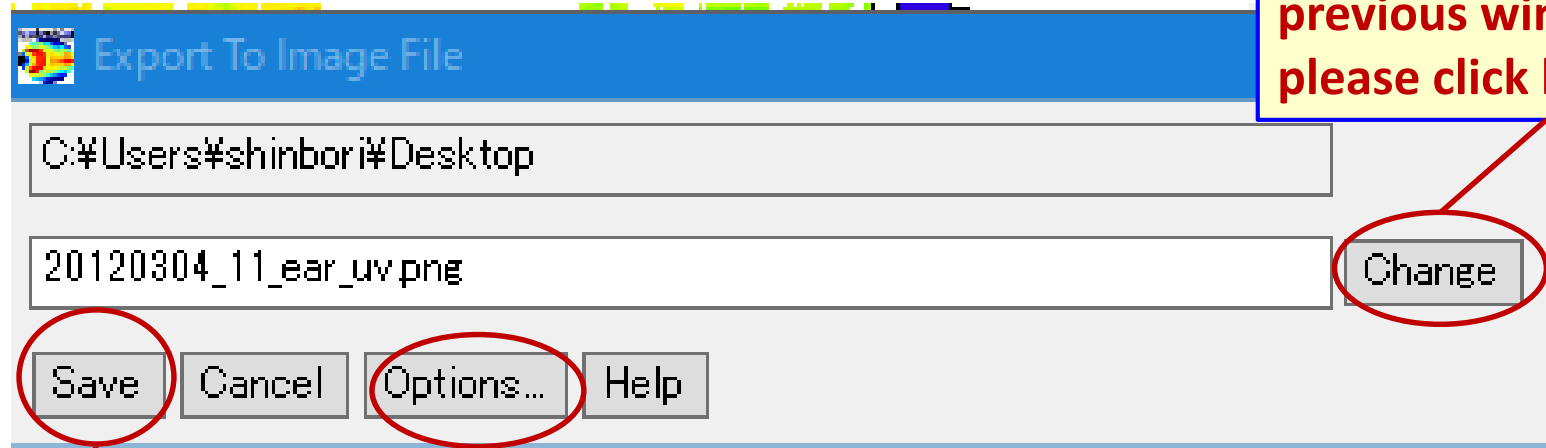
[13] In order to output the plot image file, you select "File" → "Save Page As Image File ..." on the main window.

[14] Specify the file format, name and save location and click the "SAVE" button on the Save Image window.

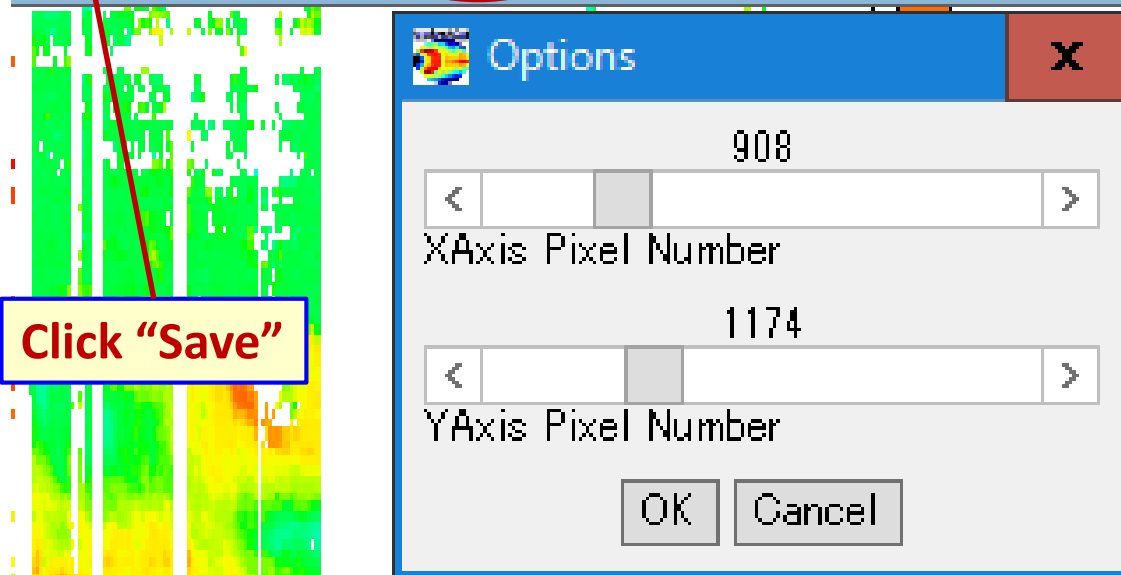


## 3.5 Output of plot image file

### Conformation window



If you go back to the previous window, please click here.



Click "Save"

vwind  
[m/s]

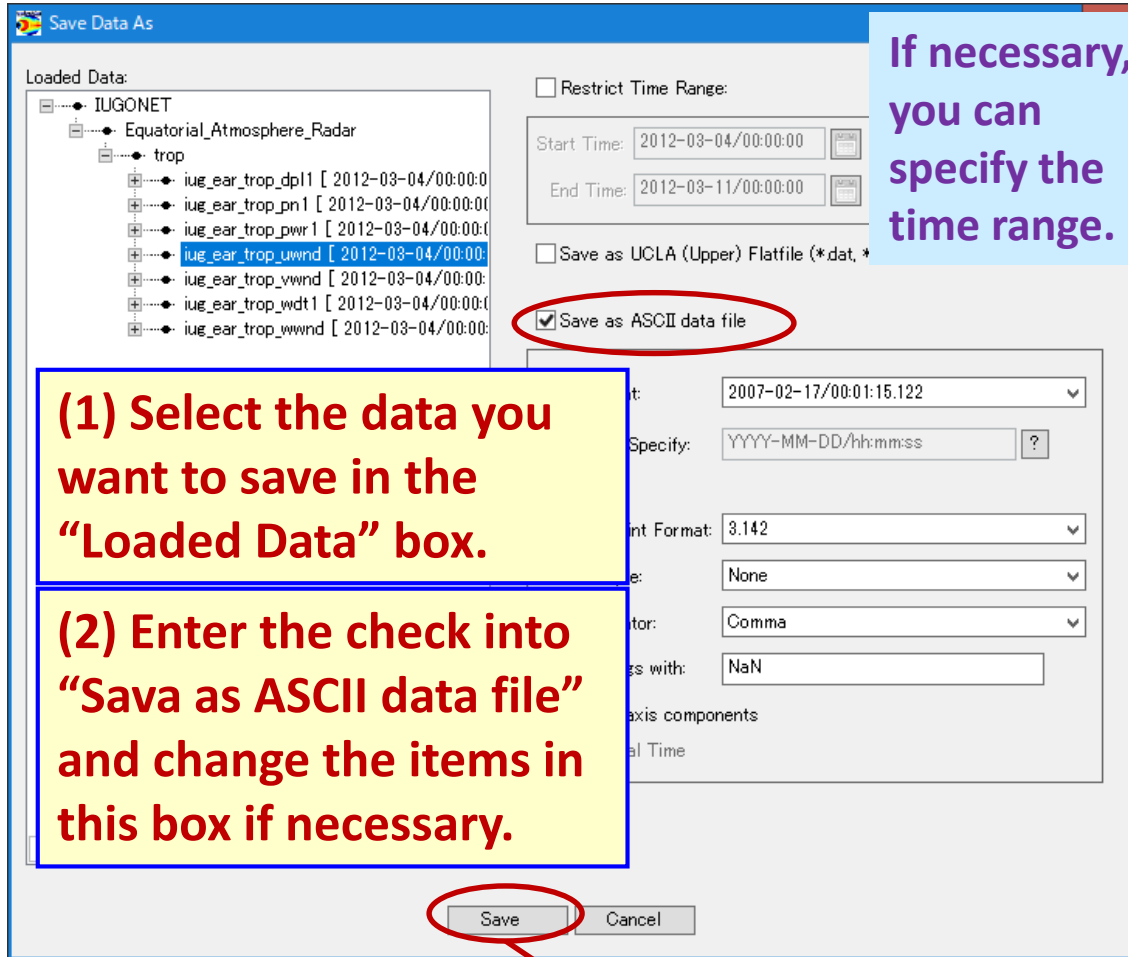
If you click "Options...", another window appears like this. In this window, you can change the resolution of the image data.

## 3.6 Save the EAR data in ascii (text) format

[15] If you save the loaded data in ascii format, you first select “Data” → “Save Data As...” on the main window.

[16] You specify several items on the “Save Data As” window as shown in the right figure, and click the “Save” button after you check “Save as ASCII data file”.

[17] You click the “OK” button in this window.



**Save Data As**

Loaded Data:

- IUGONET
  - Equatorial\_Atmosphere\_Radar
    - trop
      - iug\_ear\_trop\_dpl1 [ 2012-03-04/00:00:00
      - iug\_ear\_trop\_pn1 [ 2012-03-04/00:00:00
      - iug\_ear\_trop\_pwr1 [ 2012-03-04/00:00:00
      - iug\_ear\_trop\_uwnd [ 2012-03-04/00:00:00**
      - iug\_ear\_trop\_vwnd [ 2012-03-04/00:00:00
      - iug\_ear\_trop\_wdt1 [ 2012-03-04/00:00:00
      - iug\_ear\_trop\_vwnd [ 2012-03-04/00:00:00

☐ Restrict Time Range:

Start Time: 2012-03-04/00:00:00

End Time: 2012-03-11/00:00:00

☐ Save as UCLA (Upper) Flatfile (\*.dat, \*

☒ Save as ASCII data file

Specify: YYYY-MM-DD/hh:mm:ss

Unit Format: 3.142

Separator: None

Fill with: NaN

axis components

al Time

Save Cancel

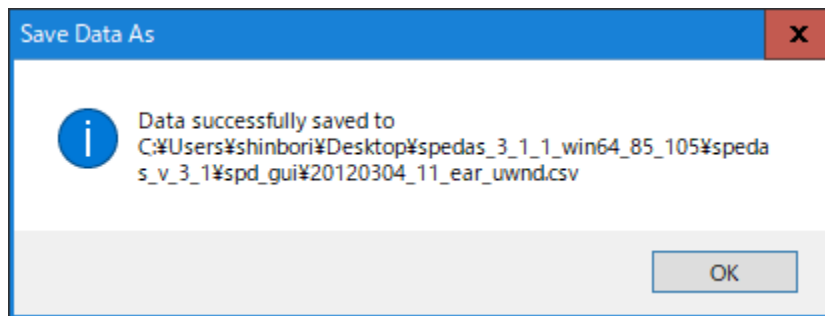
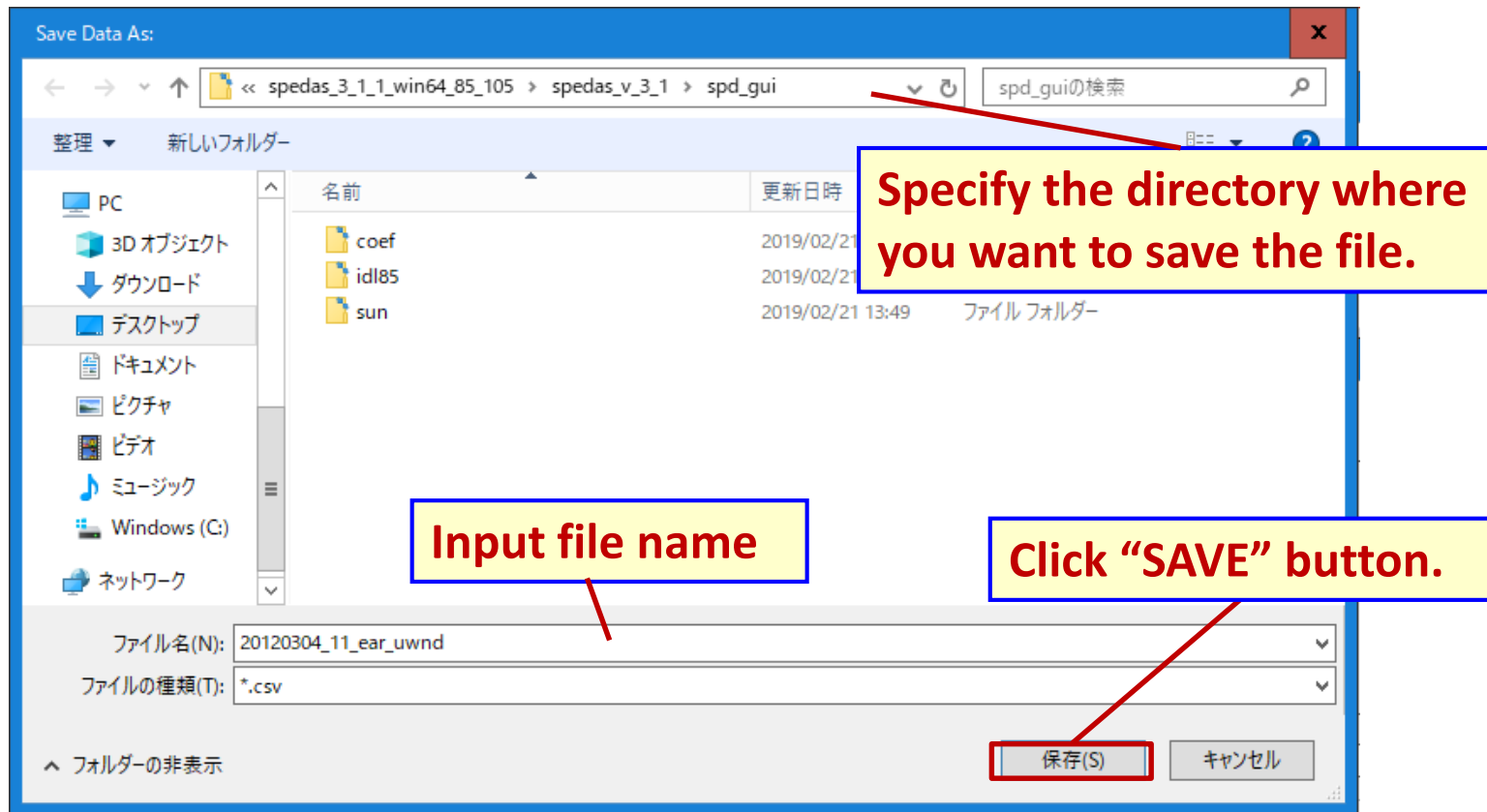
If necessary, you can specify the time range.

(1) Select the data you want to save in the “Loaded Data” box.

(2) Enter the check into “Sava as ASCII data file” and change the items in this box if necessary.

(3) You click “Save” button.

## 3.6 Save the EAR data in ascii (text) format



When you successfully save the data in ASCII format, this another window appears.  
→Click "OK" button.

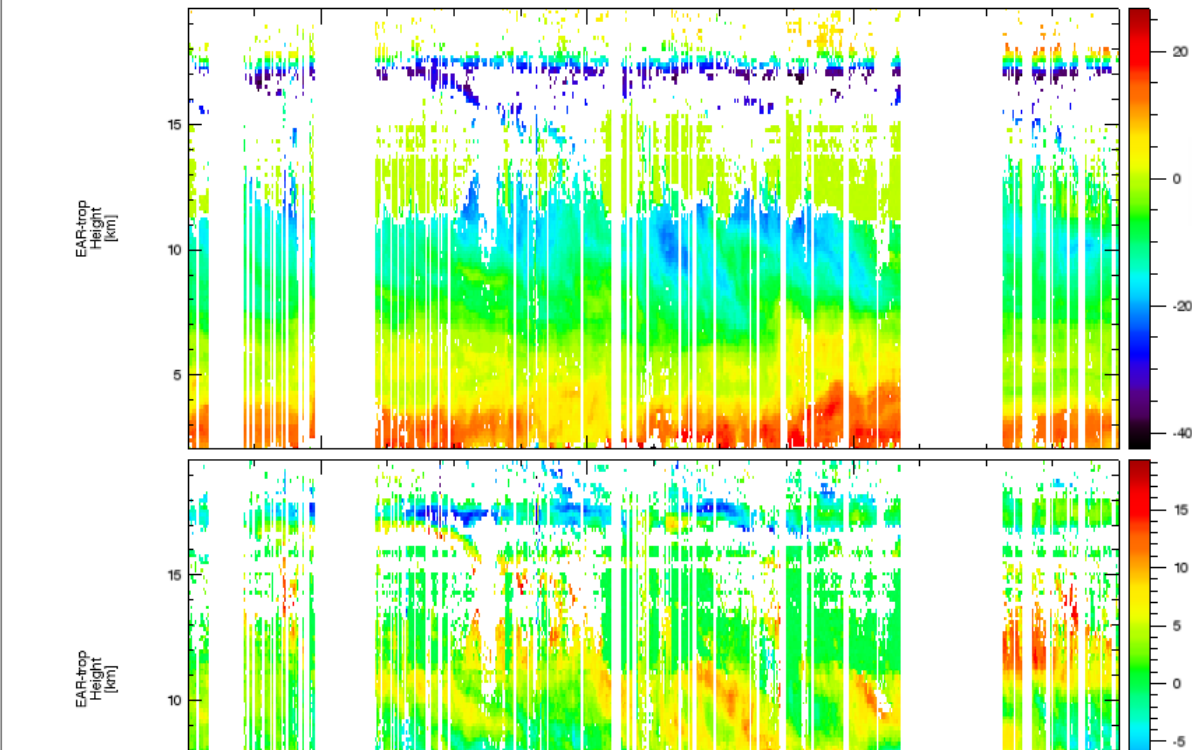
# 3. How to use SPEDAS

## 3.7 Customize the data plot (change the plot time range)

Space Physics Environment Data Analysis Software (SPEDAS) - Page: 1

File Data Analysis Plot Pages Tools Edit View Help

If you click this icon, you can change the plot time range.



EAR-trop Height [km]

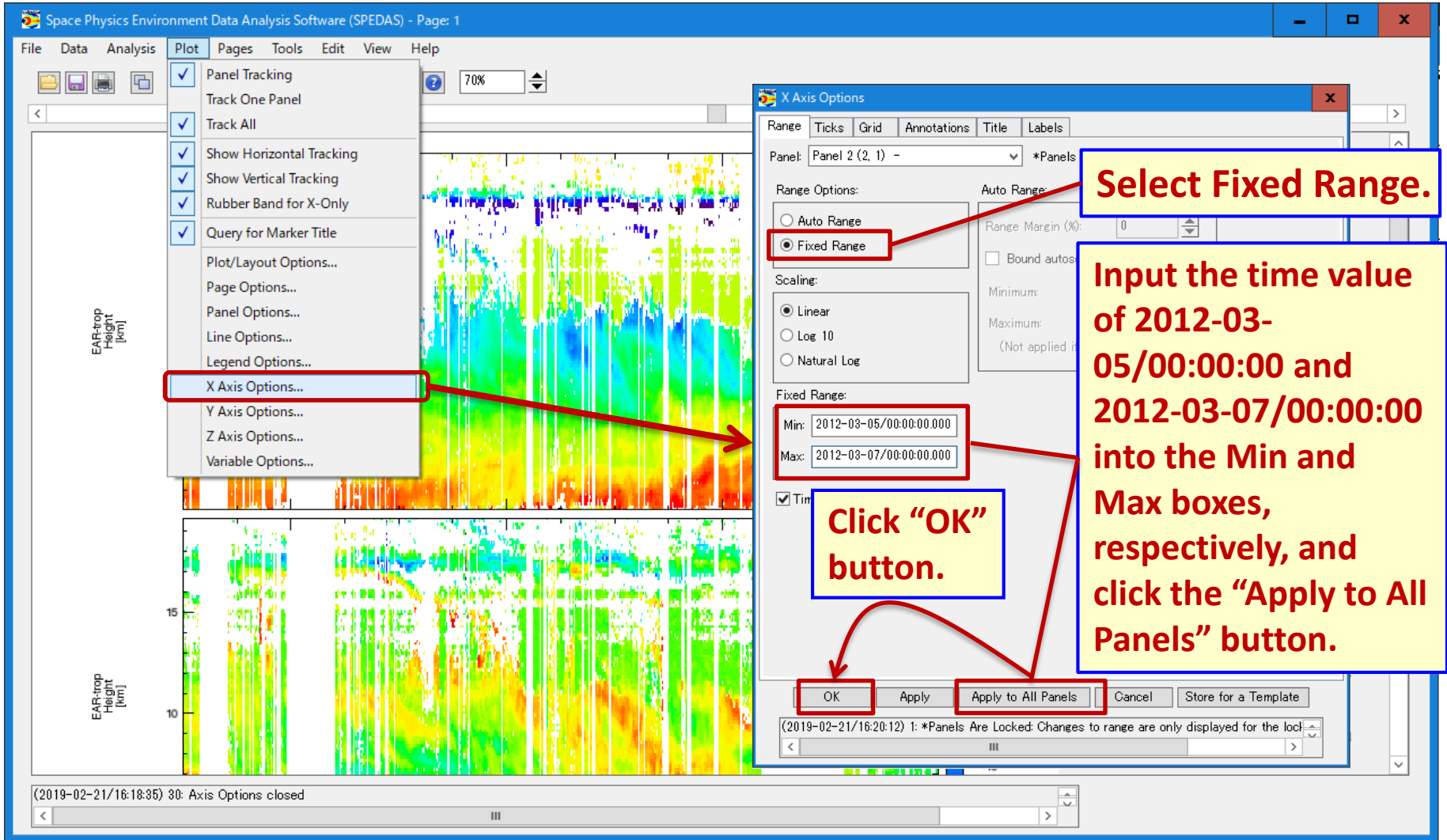
EAR-trop Height [km]

(2019-02-21/13:35:42) 19: Plot/Layout Options closed.

- To shorten the time range.
- To extend the time range.
- To shift the plot time range behind.
- To shift the plot time range forward.



## 3.7 Customize the data plot (change the plot time range)



The screenshot shows the SPEDAS software interface with the 'X Axis Options' dialog box open. The dialog box has tabs for Range, Ticks, Grid, Annotations, Title, and Labels. The 'Range' tab is selected, showing 'Range Options' with 'Fixed Range' selected. The 'Fixed Range' section has 'Min' set to '2012-03-05/00:00:00.000' and 'Max' set to '2012-03-07/00:00:00.000'. The 'Scaling' section has 'Linear' selected. The 'Range Margin (%)' is set to 0. The 'OK' button is highlighted. A red arrow points from the 'X Axis Options...' menu item in the 'Plot' menu to the dialog box. Another red arrow points from the 'OK' button to a text box. A third red arrow points from the 'Apply to All Panels' button to a text box. The background shows a data plot with 'EAP-trop Height [km]' on the y-axis and a color-coded data distribution.

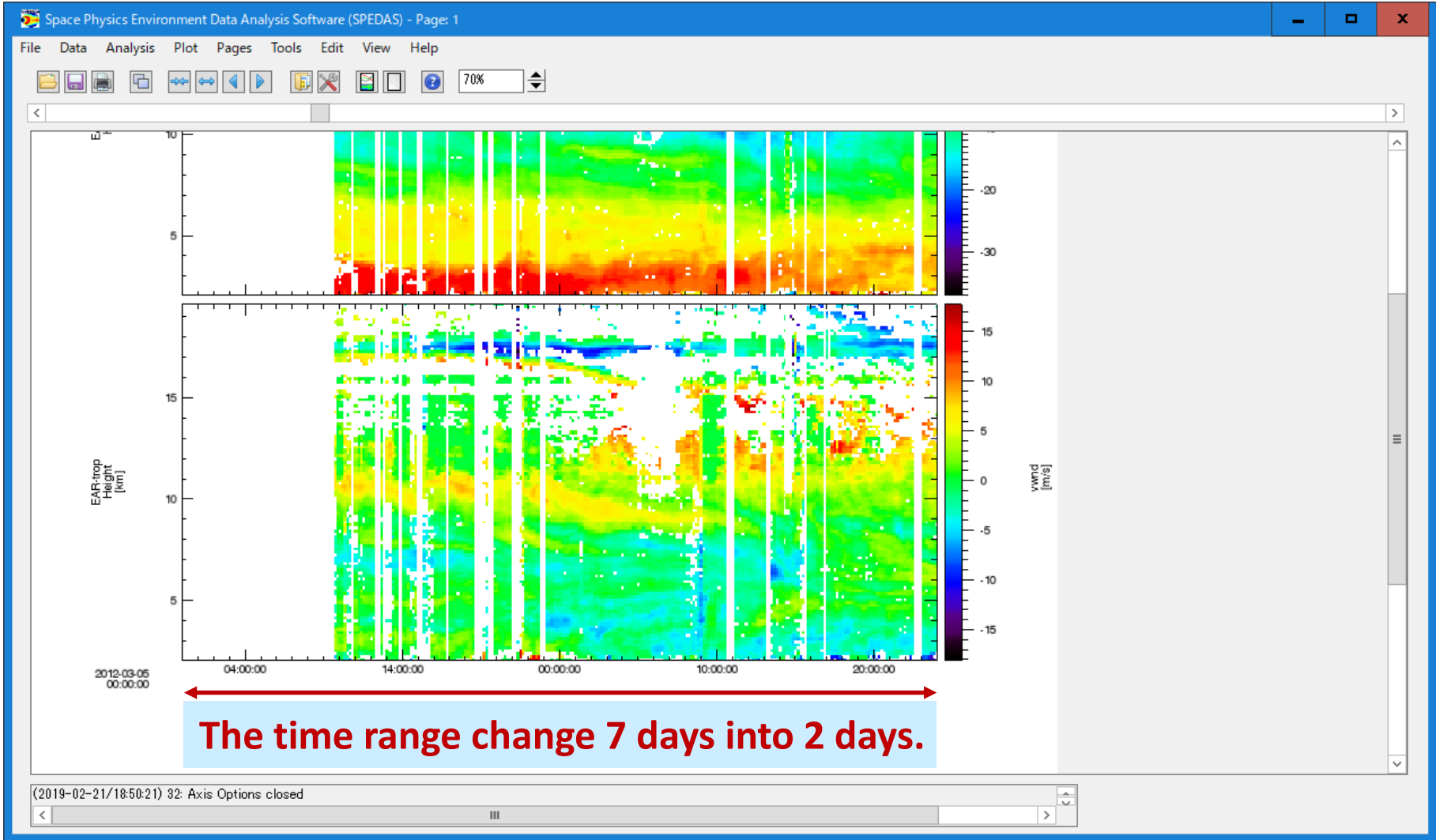
**Select Fixed Range.**

**Input the time value of 2012-03-05/00:00:00 and 2012-03-07/00:00:00 into the Min and Max boxes, respectively, and click the "Apply to All Panels" button.**

**Click "OK" button.**

(2019-02-21/16:18:35) 30: Axis Options closed

## 3.7 Customize the data plot (change the plot time range)



# 3. How to use SPEDAS

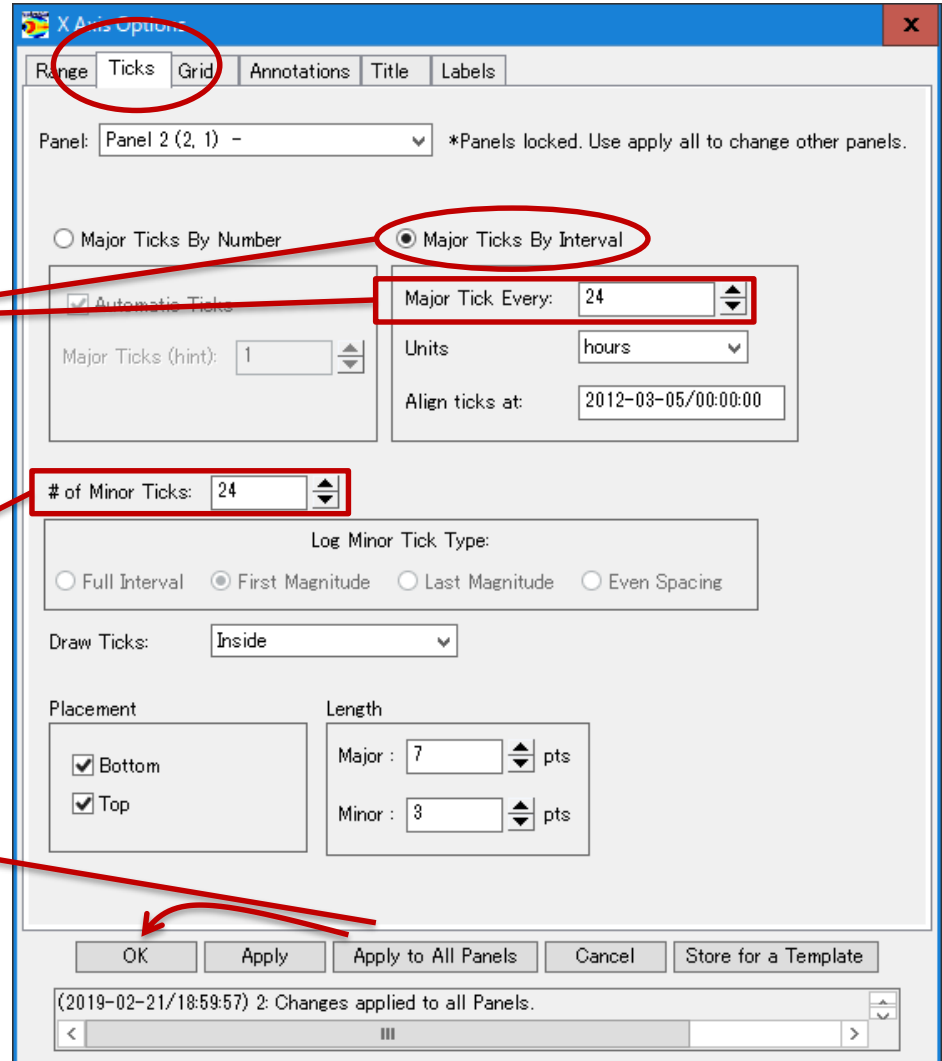
## 3.7 Customize the data plot (change the time ticks)

You can freely customize the plot Tick on the Ticks tab.

Select Major Tick By Interval and change the Major Tick Every into 24 hours.

You specify the # of Minor Ticks as 24. That is, 24 Minor Ticks are represented in 1 hour.

Finally, you click "Apply to All Panels" → "OK".



The screenshot shows the 'X Axis Options' dialog box with the 'Ticks' tab selected. The 'Panel' dropdown is set to 'Panel 2 (2, 1)'. The 'Major Ticks By Interval' radio button is selected. The 'Major Tick Every' field is set to 24, and the 'Units' dropdown is set to 'hours'. The '# of Minor Ticks' field is set to 24. The 'Log Minor Tick Type' section has 'First Magnitude' selected. The 'Draw Ticks' dropdown is set to 'Inside'. The 'Placement' section has 'Bottom' and 'Top' checked. The 'Length' section has 'Major' set to 7 and 'Minor' set to 3. The 'Apply to All Panels' button is highlighted with a red arrow.

# 3. How to use SPEDAS

## 3.7 Customize the data plot (change the time format)

You can change the time format on the Annotation tab.

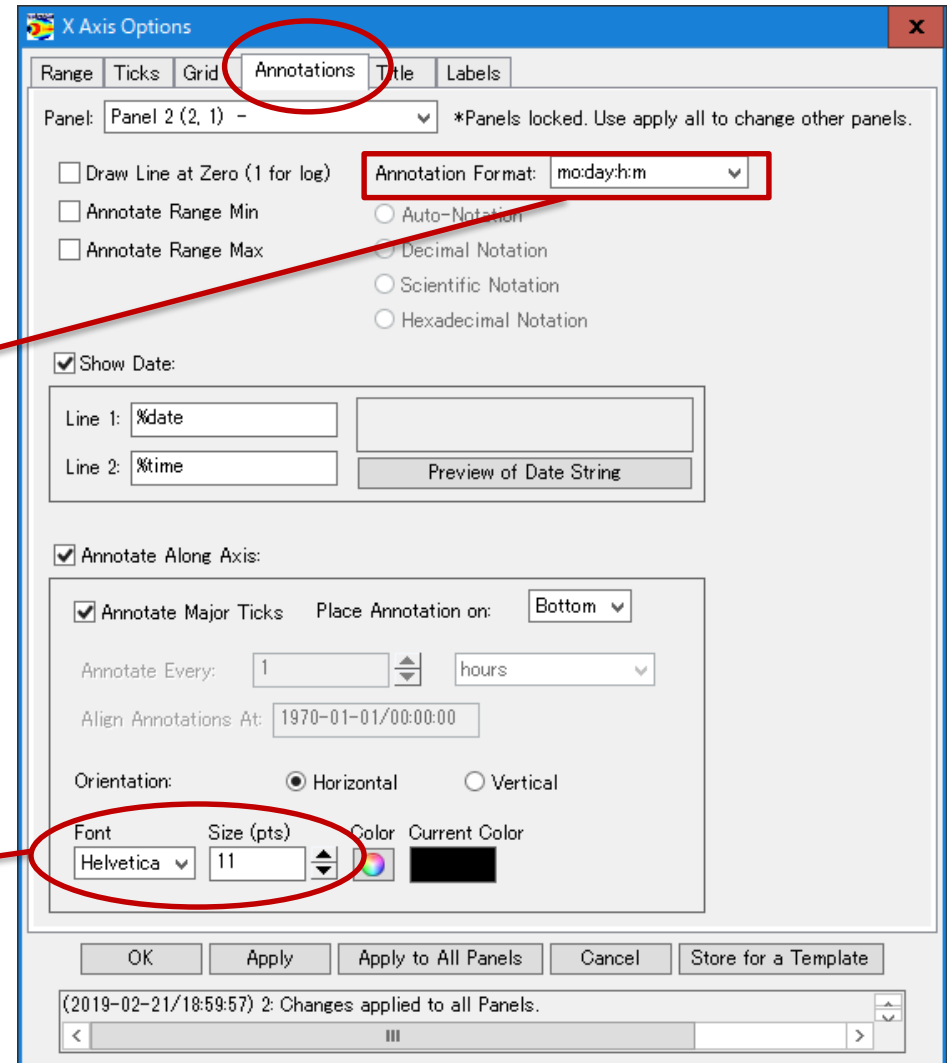
Select "mo:day:h:m" in the pull-down menu of the Annotation Format.

Click Apply to All Panels → OK

If you want to change the character font and size, you select your favored format in the pull-down menu of Font. Specify the character size from "Size".

Selectable format :

Courier, Helvetica, Times



# 3. How to use SPEDAS

## 3.7 Customize the data plot (change x-axis label)

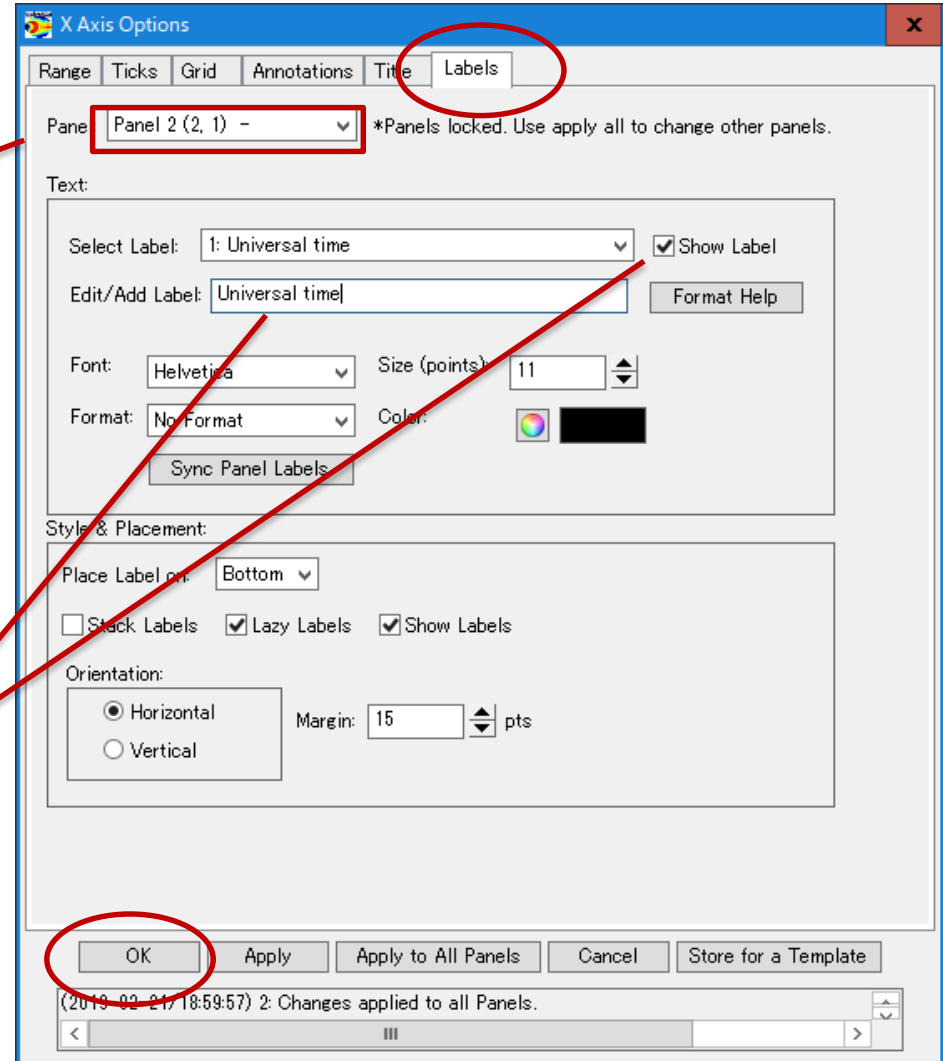
You can customize the time label (X axis) on the Labels tab.

Select "Panel 2" which is the bottom panel.

You enter the check into the "Show Label" box, and enter "Universal Time" on the Edit/Add Label: .

Click OK

(Note that you do not click Apply to All Panels)



**X Axis Options**

Range Ticks Grid Annotations Title **Labels**

Panel: **Panel 2 (2, 1)** \*Panels locked. Use apply all to change other panels.

Text:

Select Label: 1: Universal time ☒ Show Label

Edit/Add Label: Universal time

Font: Helvetica Size (points): 11

Format: No Format Color:

Style & Placement:

Place Label on: Bottom

☐ Stack Labels ☒ Lazy Labels ☒ Show Labels

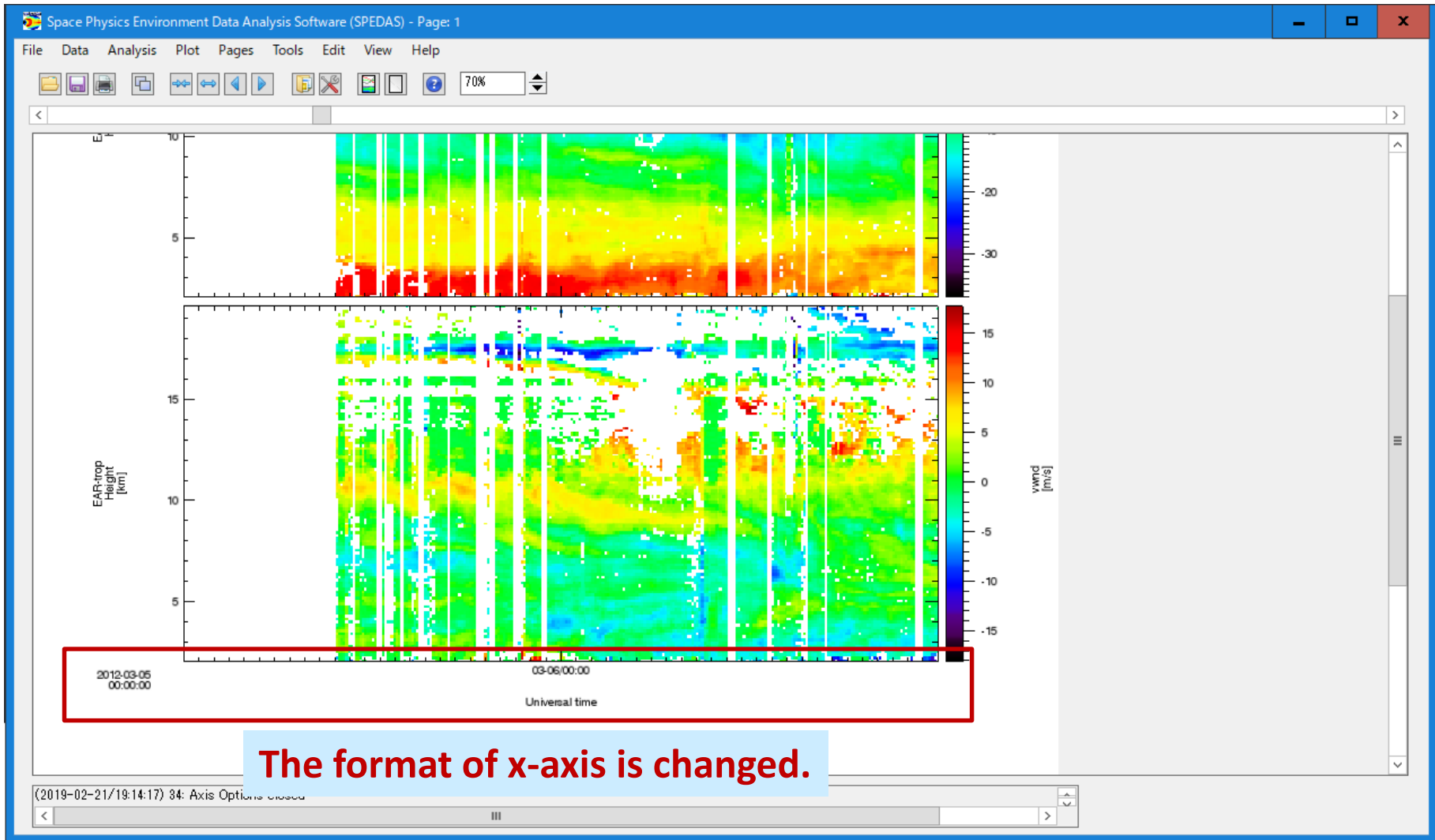
Orientation:

☒ Horizontal ☐ Vertical Margin: 15 pts

(2019-02-27 18:59:57) 2: Changes applied to all Panels.



## 3.7 Customize the data plot (results)



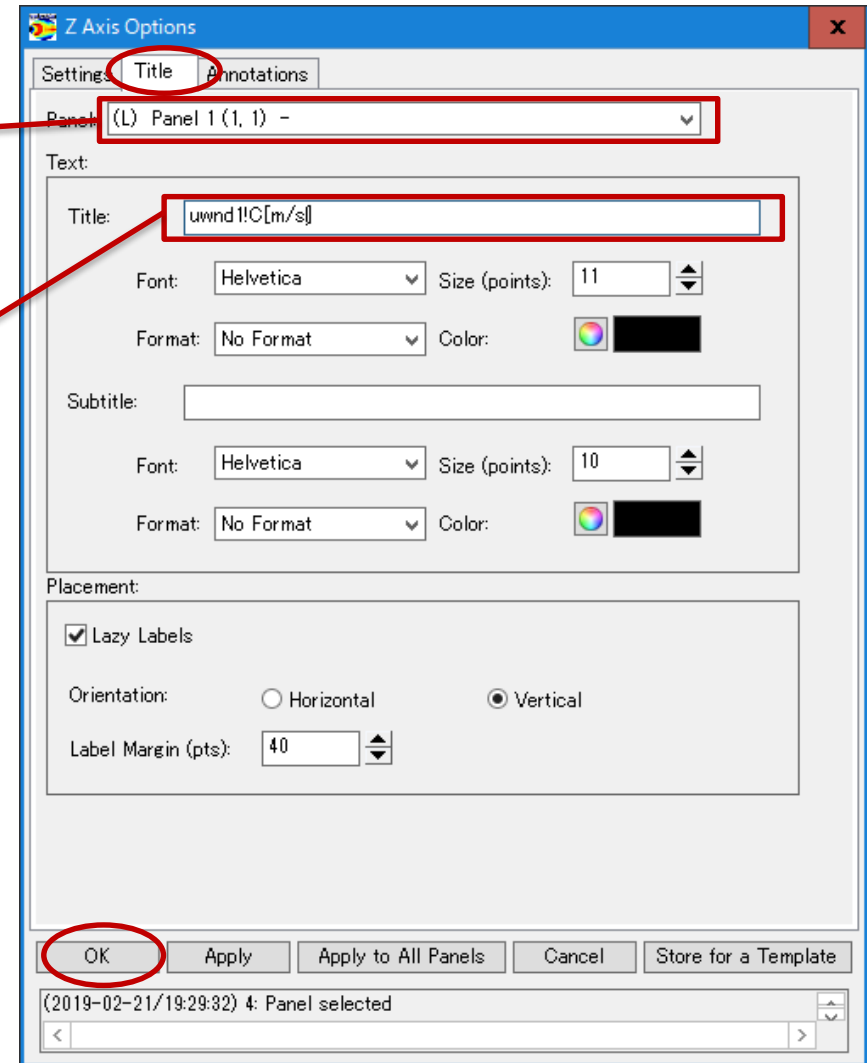


# 3. How to use SPEDAS

## 3.7 Customize the data plot (change the color bar format)

If you want to change Panel 1, you select Panel 1.

Change the title of z-axis “dpl1!C[dB]” into “uwnd!C[m/s]”, and click the “OK” button.



**Z Axis Options**

Settings **Title** Annotations

Panel: (L) Panel 1 (1, 1) -

Text:

Title: uwnd!C[m/s]

Font: Helvetica Size (points): 11

Format: No Format Color: [Color Picker]

Subtitle:

Font: Helvetica Size (points): 10

Format: No Format Color: [Color Picker]

Placement:

☒ Lazy Labels

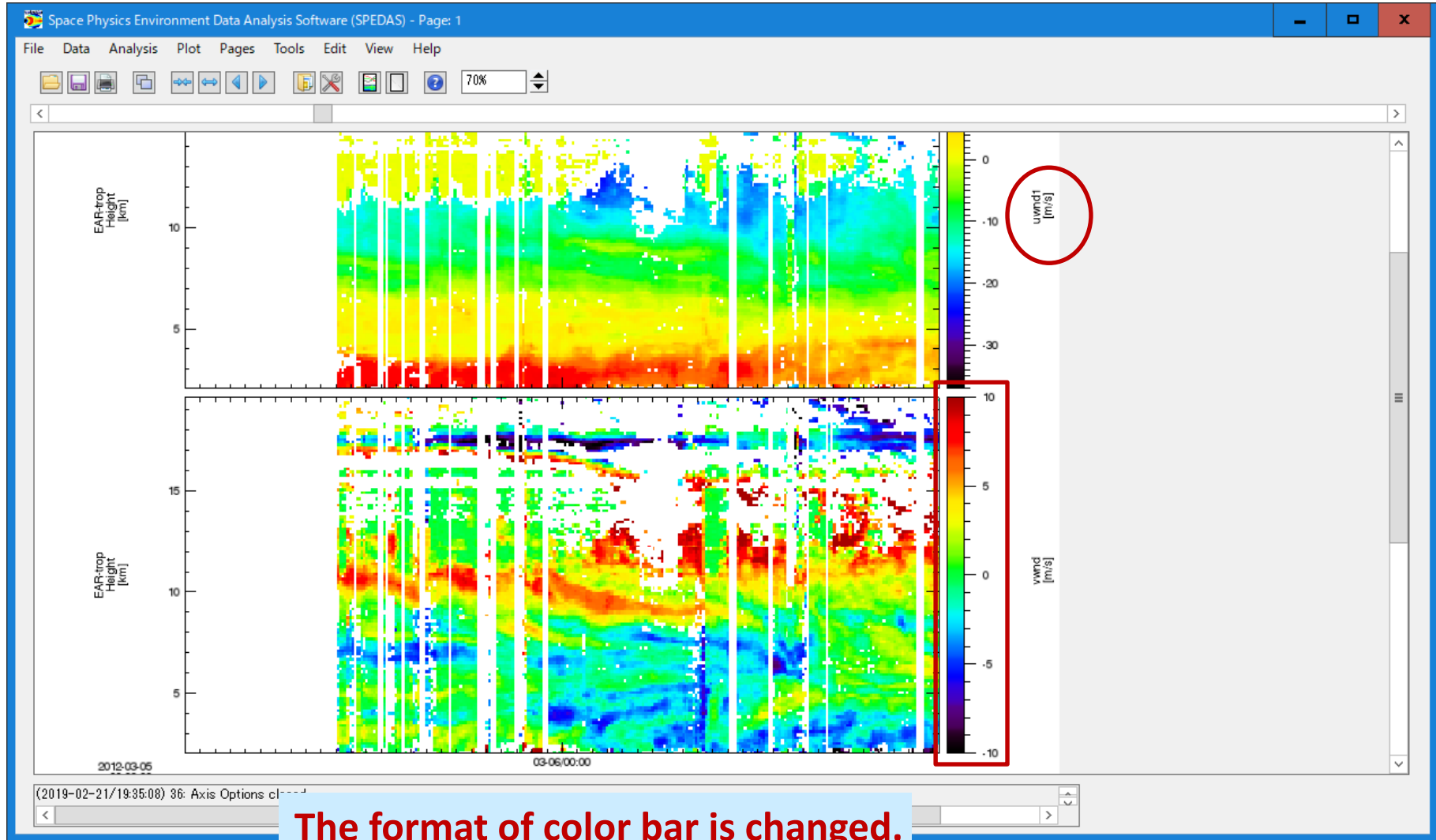
Orientation: ☐ Horizontal ☒ Vertical

Label Margin (pts): 40

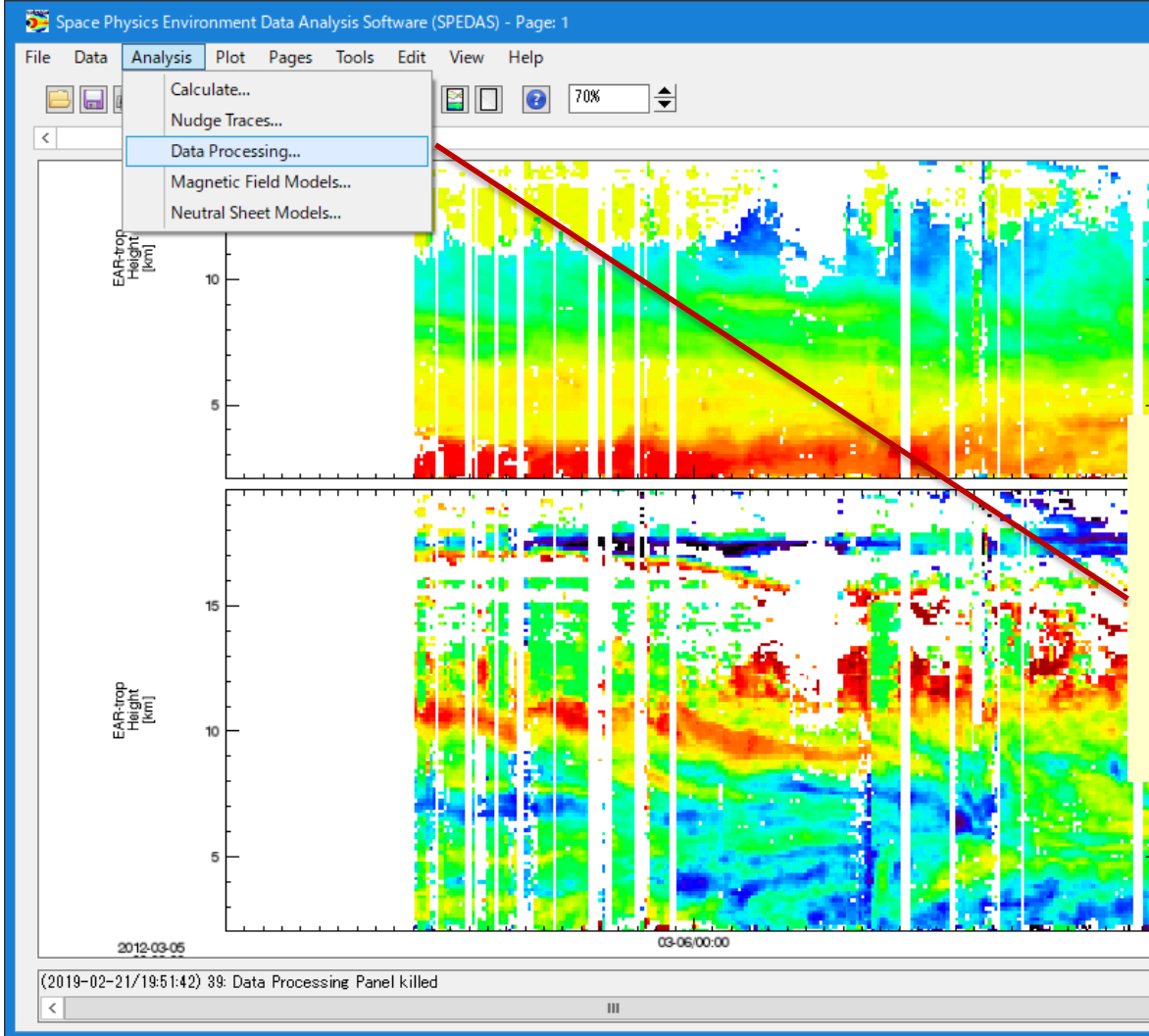
OK Apply Apply to All Panels Cancel Store for a Template

(2019-02-21/19:29:32) 4: Panel selected

## 3.7 Customize the data plot (change the color bar format)



## 3.8 Time-series analysis of the EAR data



**Excise 1**

**Running average of zonal wind in the MLT region**

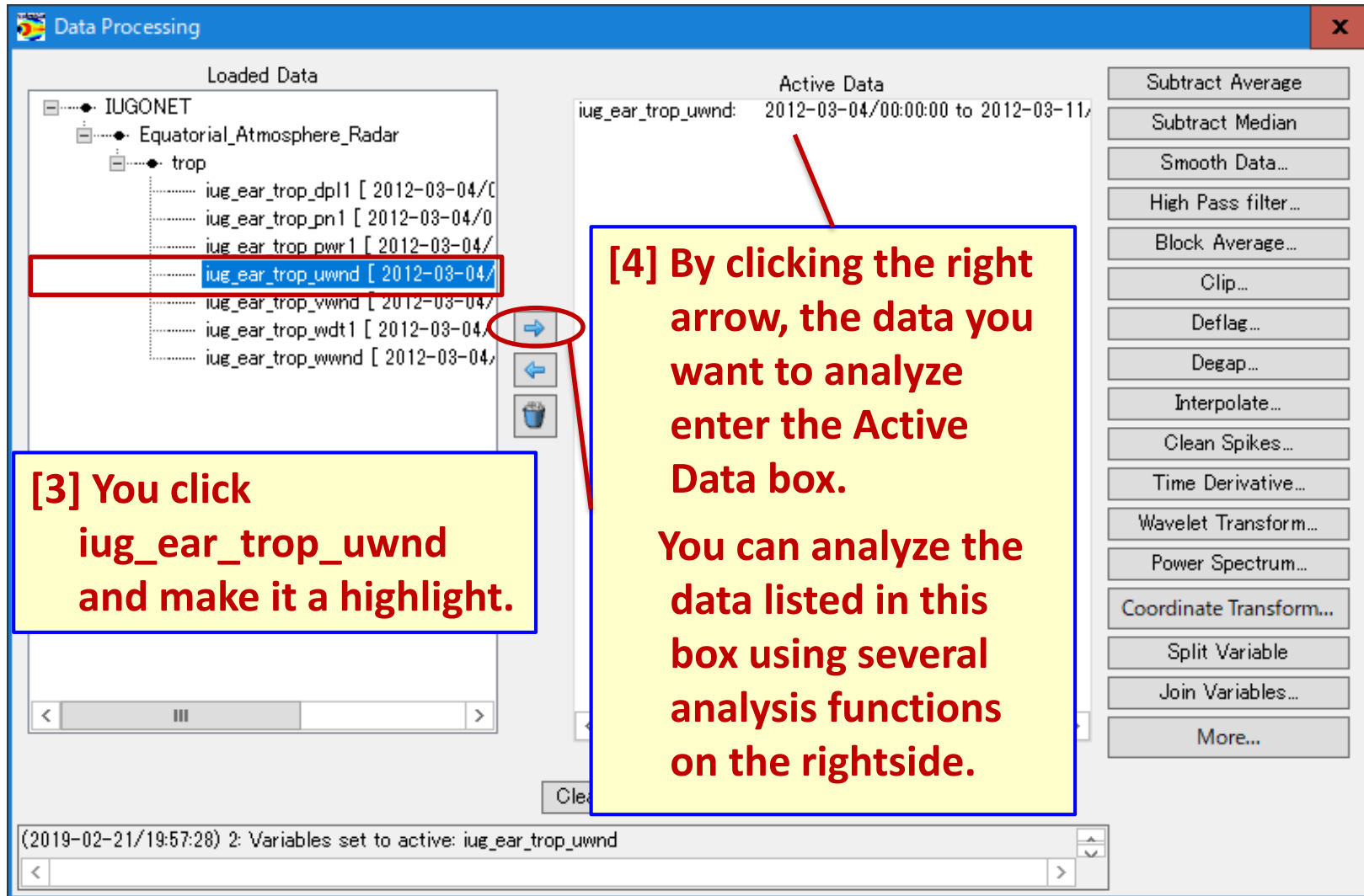
**[1] Click Analysis**

**[2] Click Data Processing**

**Then, the Data Processing window appears.**



## 3.8 Time-series analysis of the EAR data



The screenshot shows the SPEDAS Data Processing window. On the left, the 'Loaded Data' tree shows a hierarchy: IUGONET > Equatorial\_Atmosphere\_Radar > trop. The variable 'iug\_ear\_trop\_uwnd' is highlighted with a red box. A red arrow points from this box to a right-pointing arrow button. Another red arrow points from this button to the 'Active Data' box, which now contains 'iug\_ear\_trop\_uwnd: 2012-03-04/00:00:00 to 2012-03-11/...'. On the right, a list of analysis functions is available, including 'Subtract Average', 'Subtract Median', 'Smooth Data...', 'High Pass filter...', 'Block Average...', 'Clip...', 'Deflag...', 'Degap...', 'Interpolate...', 'Clean Spikes...', 'Time Derivative...', 'Wavelet Transform...', 'Power Spectrum...', 'Coordinate Transform...', 'Split Variable', 'Join Variables...', and 'More...'. A status bar at the bottom indicates '(2019-02-21/19:57:28) 2: Variables set to active: iug\_ear\_trop\_uwnd'.

**[3] You click `iug_ear_trop_uwnd` and make it a highlight.**

**[4] By clicking the right arrow, the data you want to analyze enter the Active Data box.**

You can analyze the data listed in this box using several analysis functions on the rightside.

## 3.8 Time-series analysis of the EAR data

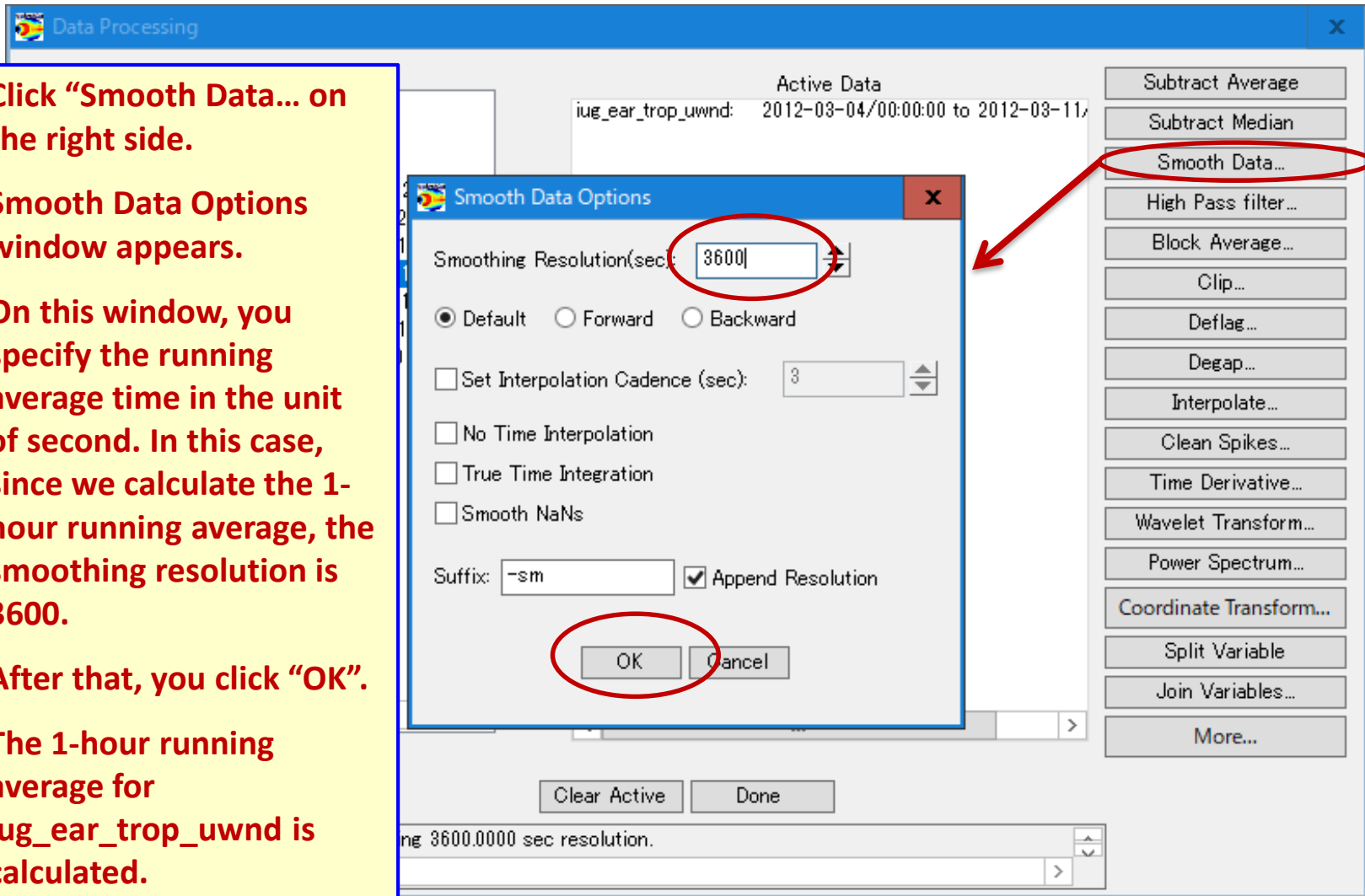
Click “Smooth Data...” on the right side.

Smooth Data Options window appears.

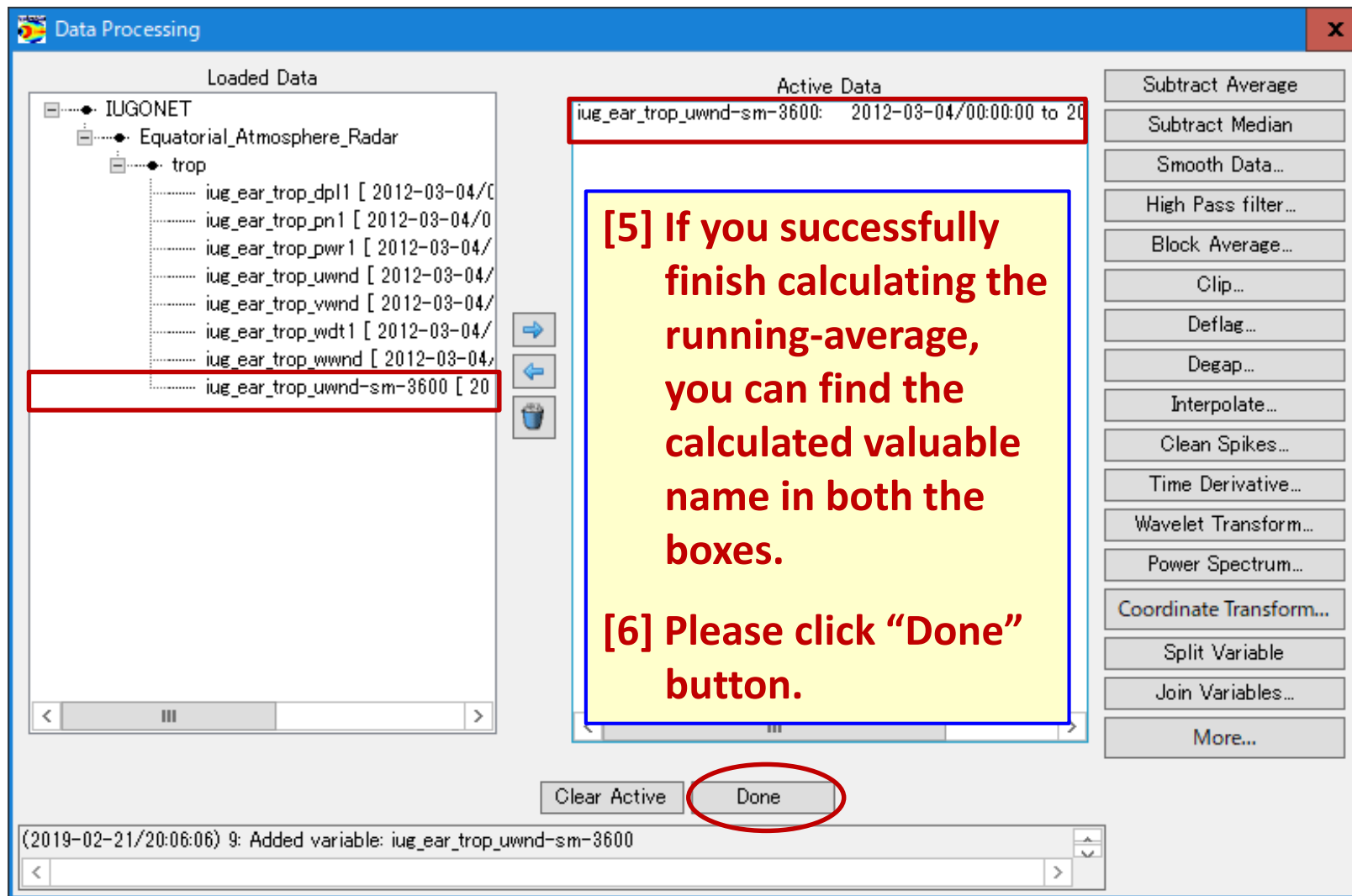
On this window, you specify the running average time in the unit of second. In this case, since we calculate the 1-hour running average, the smoothing resolution is 3600.

After that, you click “OK”.

The 1-hour running average for iug\_ear\_trop\_uwnd is calculated.



## 3.8 Time-series analysis of the EAR data



**Loaded Data**

- IUGONET
  - Equatorial\_Atmosphere\_Radar
    - trop
      - iug\_ear\_trop\_dpl1 [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_pn1 [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_pwr1 [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_uwnd [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_vwnd [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_wdt1 [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_wwnd [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]
      - iug\_ear\_trop\_uwnd-sm-3600 [ 2012-03-04/00:00:00 to 2012-03-04/00:00:00]**

**Active Data**

iug\_ear\_trop\_uwnd-sm-3600: 2012-03-04/00:00:00 to 2012-03-04/00:00:00

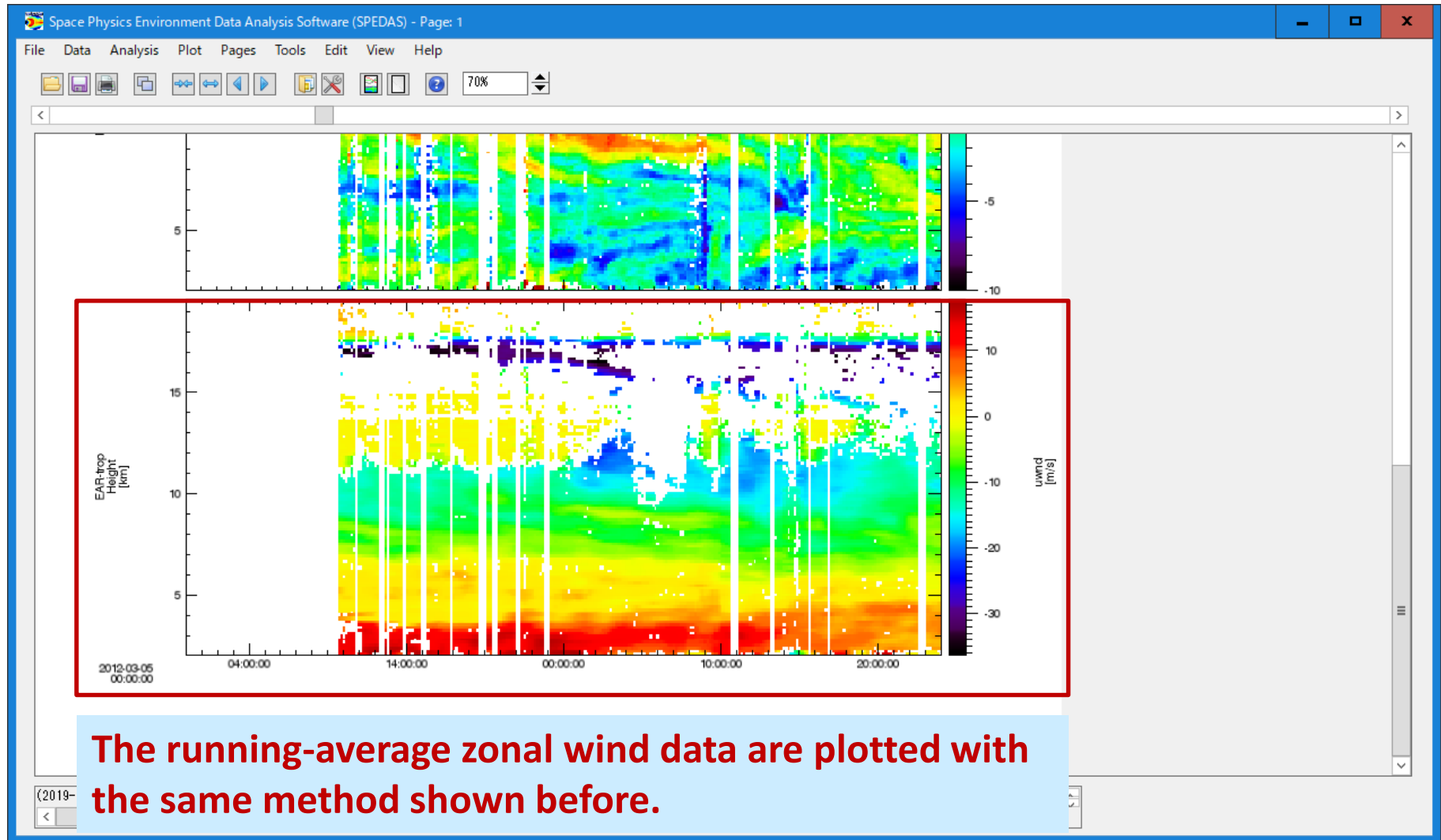
**[5] If you successfully finish calculating the running-average, you can find the calculated valuable name in both the boxes.**

**[6] Please click “Done” button.**

Clear Active Done

(2019-02-21/20:06:06) 9: Added variable: iug\_ear\_trop\_uwnd-sm-3600

## 3.8 Time-series analysis of the EAR data



### 3.9 Exercise (3.4~2.8 items)

**Let's try SPEDAS**

You try to analyze various kinds of ground-based and satellite observation data with SPEDAS.

For example, **automatic weather station (AWS), wind profiler radar, EAR, radiosonde** etc.

If you have some time, please try to search other datasets (solar, geomagnetic field, ionospheric plasma, air glow etc.)

Time limit: 15 – 20 minutes

If you have any questions and suggestions on this exercise and SPEDAS, please let me know them.



## 4. Summary and conclusions

- The IUGONET project (<http://www.iugonet.org>) has been **establishing a IUGONET web service (IUGONET Type-A)** which combines a database of data information (metadata) and data analysis software (SPEDAS).
- This IUGONET Type-A is useful **for researchers in efficiently finding and obtaining various kinds of observation data spread across the IUGONET institutes.**
- The IUGONET Type-A and integrated data analysis software (UDAS) will significantly facilitate the analyses of a variety of observation data, which **will lead to more comprehensive studies of coupling process in solar-terrestrial system (long-term variation in the Earth's atmospheric environment) and interdisciplinary studies using different kinds of data.**
- The IUGONET products have been released!

**IUGONET Type-A :**

<http://search.iugonet.org/>

**Analysis software :**

<http://www.iugonet.org/en/software.html>

## 4. Summary and conclusions

- In order to enhance an international use of the IUGONET products and data for non IDL users, **we have a plan to develop the data analysis software working on other platforms (for example, MATLAB,...).**
- In near future, we will add several kinds of geoscience data in the web service (IUGONET Type-A).  
Solar surface (Ca obs.) [NAOJ], GPS-TEC [Nagoya U/NICT]
- Recently, we developed a UDAS EGG (UDAS Easy Guide to Generate your load routines) to provide users with the templates for IDL procedures that can load their own data into SPEDAS/IDL.
- If you have any feedbacks, questions, requests on the IUGONET tool, please send email to the following:

**E-mail [iugonet-contact\(at\)iugonet.org](mailto:iugonet-contact(at)iugonet.org)**

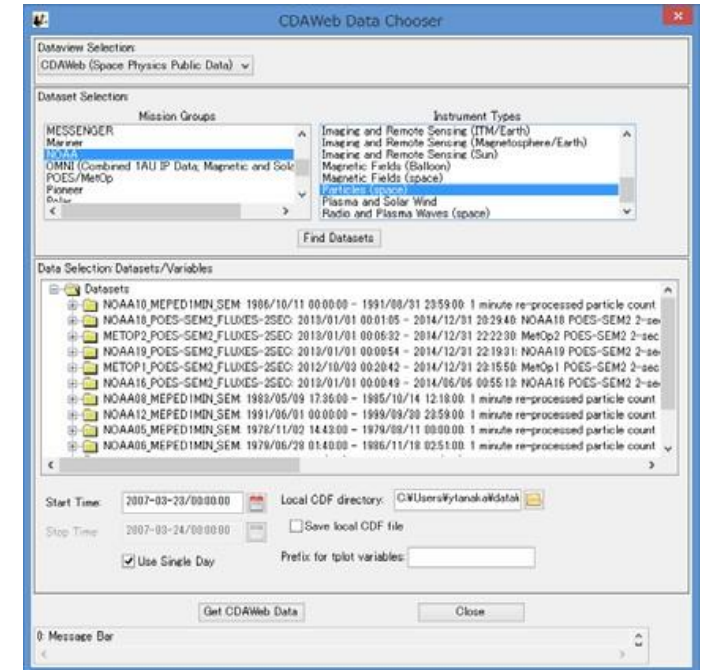
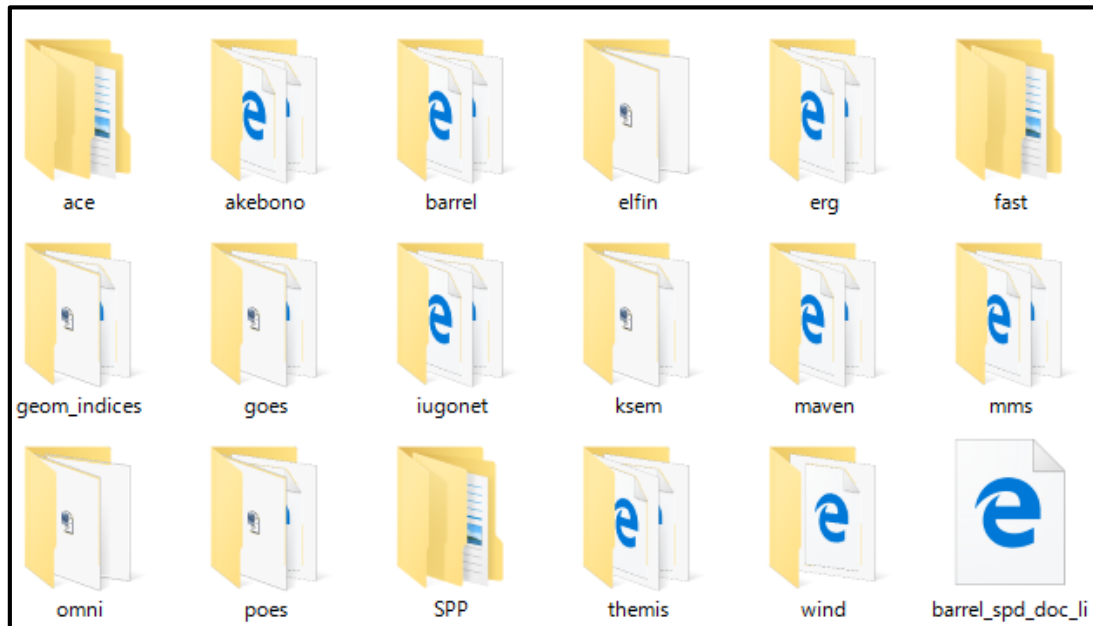
**You also check the IUGONET homepage (<http://www.iugonet.org>)**



## 2. IUGONET data analysis system

### 2.7 IUGONET data analysis software (UDAS)

< Latest plug-in tools included in SPEDAS >



Plug-in tools stored in a bleeding edge of SPEDAS (2016/10/20)

- ✓ SPEDAS contains various kinds of project plug-in tools ([iugonet](#), erg, ace, akebono, fast, wind etc.)
- ✗ rbsp and stereo are stored in another directory.
- ✓ We can load and plot various kinds of satellite data which are open in CDAWeb managed by NASA.

### 2.7 IUGONET data analysis software (UDAS)

#### < Load command of UDAS/SPEDAS >

UDAS s1.00.1 (for SPEDAS v1.00)

- ◆ **29 kinds of load commands** are available.
- ◆ This package includes the **statistical analysis** and **metadata cooperate tools**.
- ◆ We have a plan to add the load routines of all-sky imager, riometer, VLF, and GPS-RO data to UDAS.
- ◆ (\*) means alias of load command developed in ERG-SC.

No.	Instrument Type	Load routines
1	Solar images obtained by the SMART telescope	iug_load_smart
2	Solar VHF/UHF radio spectrum	iug_load_iprt
3	Jupiter's/Solar wide band spectral data in HF-band	iug_load_hf_tohokuu
4	Automatic weather station	iug_load_aws_rish
5	Boundary layer radar	iug_load_blr_rish
6	L-band lower troposphere radar	iug_load_ltr_rish
7	EAR (ST and FAI)	iug_load_ear
8	MU radar (MST, IS, Meter/RASS/FAI)	iug_load_mu
9	Meteor radar	iug_load_meteor_rish
10	MF radar	iug_load_mf_rish
11	Wind profiler radar	iug_load_wpr_rish
12	Ionosonde (Shigaraki)	iug_load_ionosonde_rish
13	Radiosonde	iug_load_radiosonde_rish



### 2.7 IUGONET data analysis software (UDAS)

No.	Instrument Type	Load routines
14	SuperDARN radar (*)	iug_load_sdfit (*)
15	EISCAT radar	iug_load_eiscat
16	EISCAT radar (ion velocity/electric field)	iug_load_eiscat_vief
17	Imaging riometer at Syowa	iug_load_irio_nipr
18	Low-frequency radio transmitter observation data	iug_load_lfrto
19	Asia VLF Observation Network (AVON/VLF-B)	iug_load_avon_vlfb
20	Optical Mesosphere Thermosphere Imagers (OMTI)	iug_load_camera_omti_asi (*)
21	All sky imager	iug_load_asi_nipr
22	All sky imager keogram	iug_load_ask_nipr
23	Geomagnetic index (AE, Dst, ASY/SYM) and WDC geomagnetic field data	iug_load_gmag_wdc
24	Magnetometer network data at Syowa, Ice land and Anterctica	iug_load_gmag_nipr
25	210 Magnetic Meridian magnetometer network data (*)	iug_load_gmag_mm210 (*)
26	MAGDAS geomagnetic field data	iug_load_gmag_magdas_1sec (*)
27	STEL induction magnetometer data (*)	iug_load_gmag_stel_induction (*)
28	Syowa and Ice land induction magnetometer	iug_load_gmag_nipr_induction
29	Kyushu GCM simulation data	iug_load_kyushugcm

### 2.8 Outreach activities of the IUGONET project

In order for many research communities to use the IUGONET data analysis service (IUGONET Type-A and UDAS) as an essential e-infrastructure to investigate long-term variation in the upper atmosphere, an outreach activity is very important.

#### ● Mini- training of how to use the IUGONET MDB system and data analysis software (UDAS)

- 2011/03/27-28 : NARL, India
- 2012/08/27-30 : LAPAN, Bandung, Indonesia
- 2013/01/12 : Online lecture (RISH-LAPAN)
- 2013/02/11 : Online lecture (RISH-LAPAN)
- 2014/11/13-15 : SPL/NARL, India
- 2015/10/21-22 : LAPAN, Bandung, Indonesia



Mini-training of the IUGONET data analysis at LAPAN on Oct. 21-22, 2015

### 2.8 Outreach activities of the IUGONET project

#### ● Online tutorial movies

Researchers can learn how to use IUGONET MDB and data analysis software anytime online at the IUGONET's YouTube site.

#### ● Updating Web page

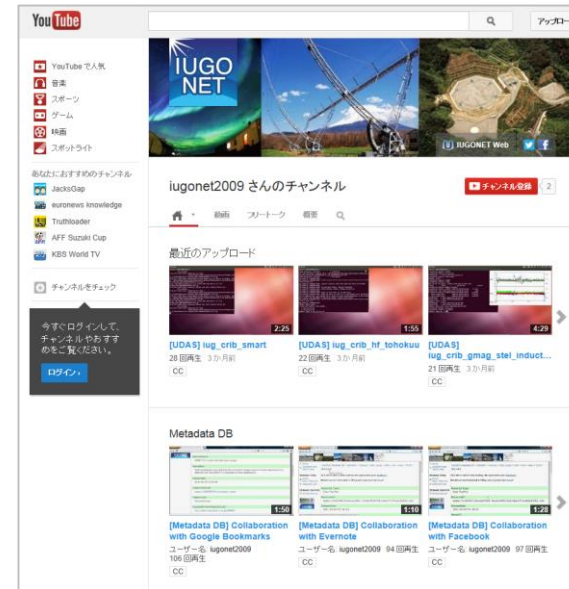
<http://www.iugonet.org/en/index.html>

#### ● IUGONET mailing list

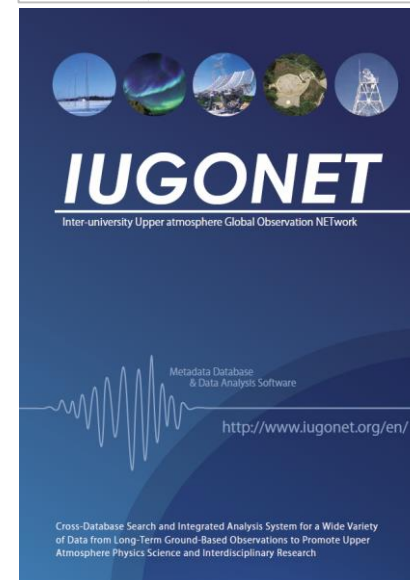
<http://www.iugonet.org/en/maillinglist.html>

Users registered to the IUGONET mailing list can get **all the latest IUGONET-related information** about new releases of UDAS and IUGONET data analysis service, workshops, and so on.

#### ● IUGONET pamphlet



<http://www.youtube.com/user/iugonet2009>



[http://www.iugonet.org/doc/iugonet2015e\\_A4.pdf](http://www.iugonet.org/doc/iugonet2015e_A4.pdf)

### 2.10 Example of upper atmospheric researches

We are promoting several scientific researches in order to evaluate the IUGONET products and to introduce a good example of application of solar-terrestrial physics researches.

- Evaluation of the IUGONET products

- To modify interface, and to add new functions to the IUGONET system.

- Examples of application of solar-terrestrial physics researches

- To acquire researchers to use the IUGONET data analysis system for long-term variation in solar-terrestrial physics.

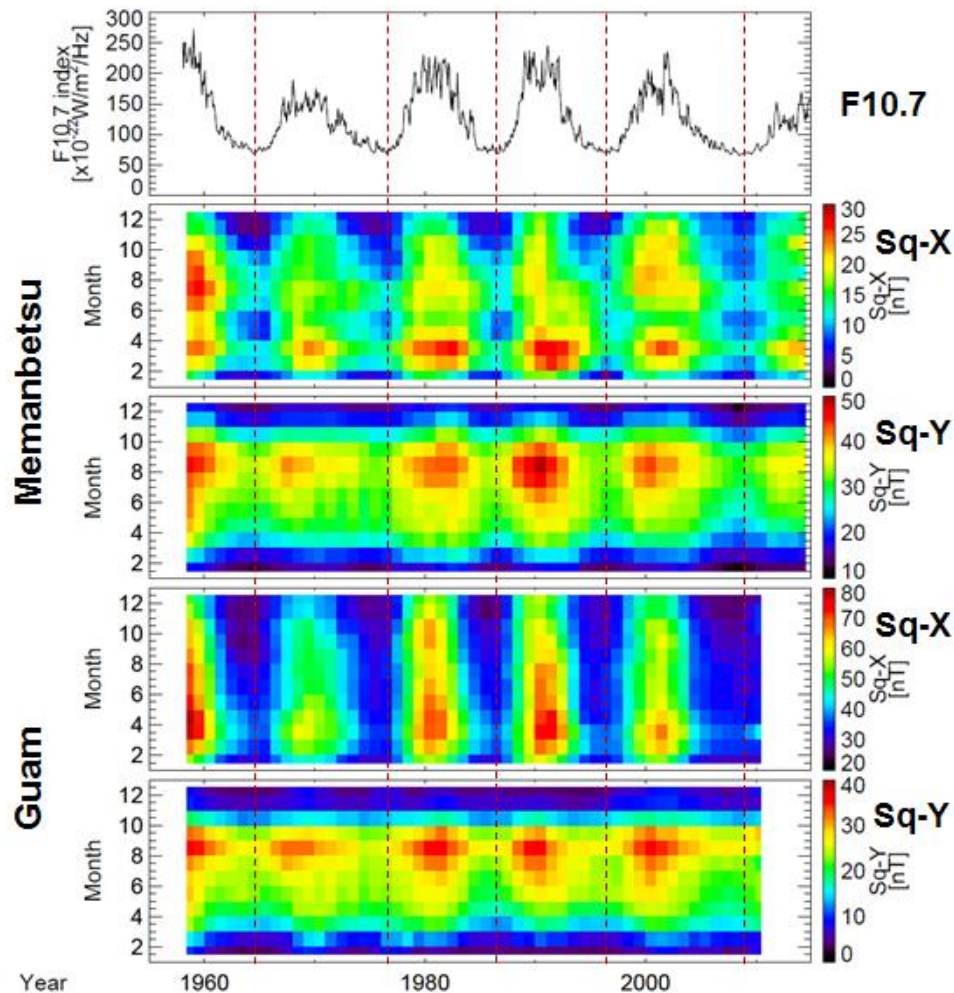
#### 【Examples of upper atmospheric researches using the IUGONET products】

- ❖ Influence of solar EUV radiation on upper atmosphere based on solar image data analysis [Kyoto and Nagoya Univ.]
- ❖ Long-term variation of upper atmosphere as seen in the geomagnetic solar quiet daily variation [Kyoto and Nagoya Univ.]
- ❖ Geomagnetic field variation and ionospheric disturbance dynamo during geomagnetic storms [Kyoto and Nagoya Univ., NIPR]
- ❖ Long-term variation in the MLT winds and wave activity [Student education, Kyoto Univ.]



### 2.10 Example of upper atmospheric researches

#### Long-term variation in the amplitude of geomagnetic field variation



- Using the IUGONET data analysis system, we can easily handle the long-term observation data.
- In this case, the size of geomagnetic field variation depends on solar activity.