IUGONET

Metadata DB for Upper Atmosphere

超高層大気長期変動の全球地上ネットワーク観測・研究

Inter-university Upper atmosphere Global Observation NETwork

JpGU Meeting 2012, Chiba (Japan), 23 May 2012

- *U-01* Toward a New Framework of Global Data Activity -

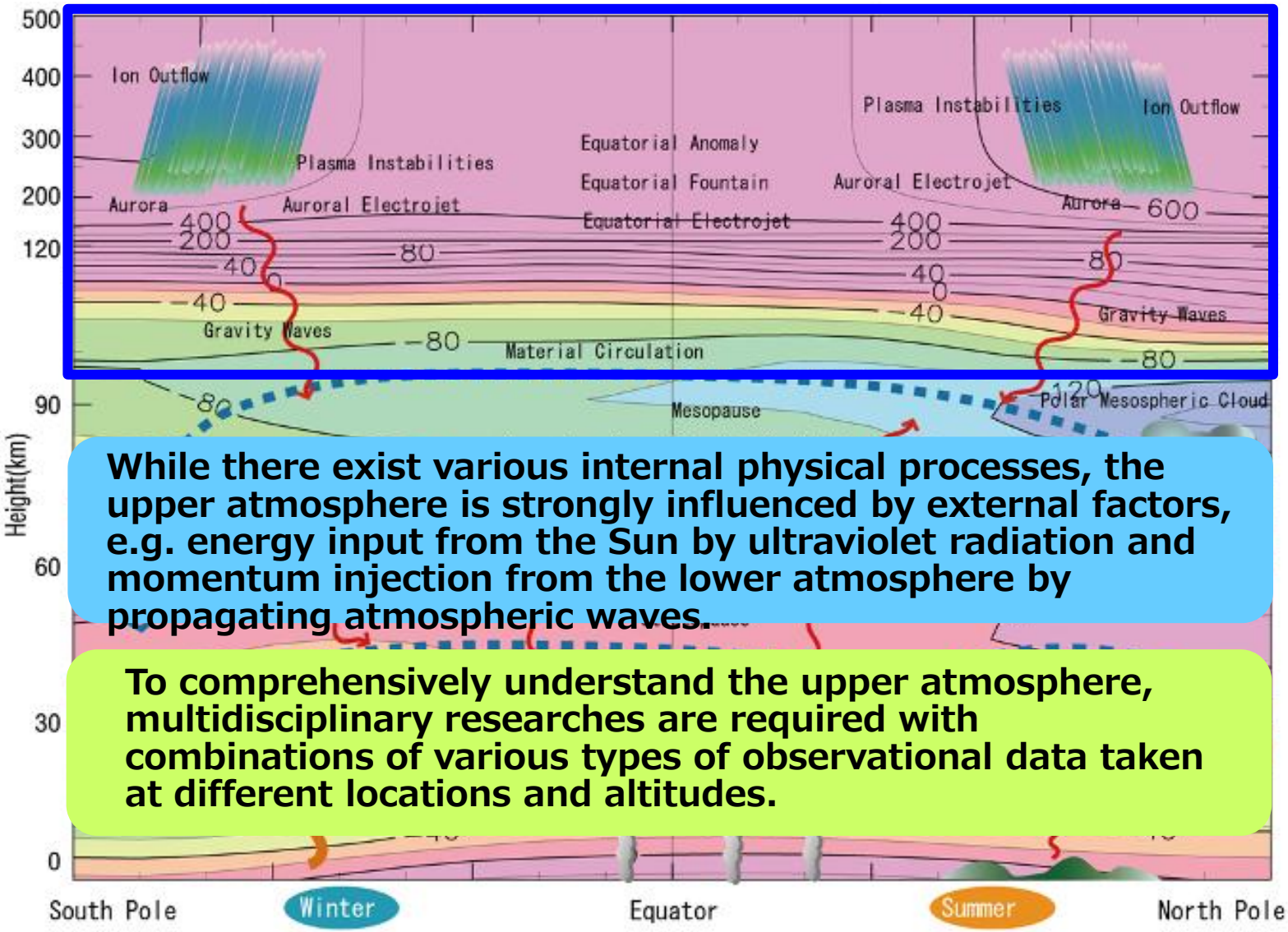
U01-06

Inter-University Upper Atmosphere Global Observation Network (IUGONET)

T. Tsuda, N. Sato, R. Fujii, T. Ono, K. Yumoto, T. Iyemori, T. Shibata, H. Hayashi, T. Hori, Y. Tanaka, Y. Koyama, S. Abe, A. Shinbori, N. Umemura, M. Yoneda, S. Ueno, N. Kaneda,

and IUGONET project team

Upper Atmosphere



While there exist various internal physical processes, the upper atmosphere is strongly influenced by external factors, e.g. energy input from the Sun by ultraviolet radiation and momentum injection from the lower atmosphere by propagating atmospheric waves.

To comprehensively understand the upper atmosphere, multidisciplinary researches are required with combinations of various types of observational data taken at different locations and altitudes.

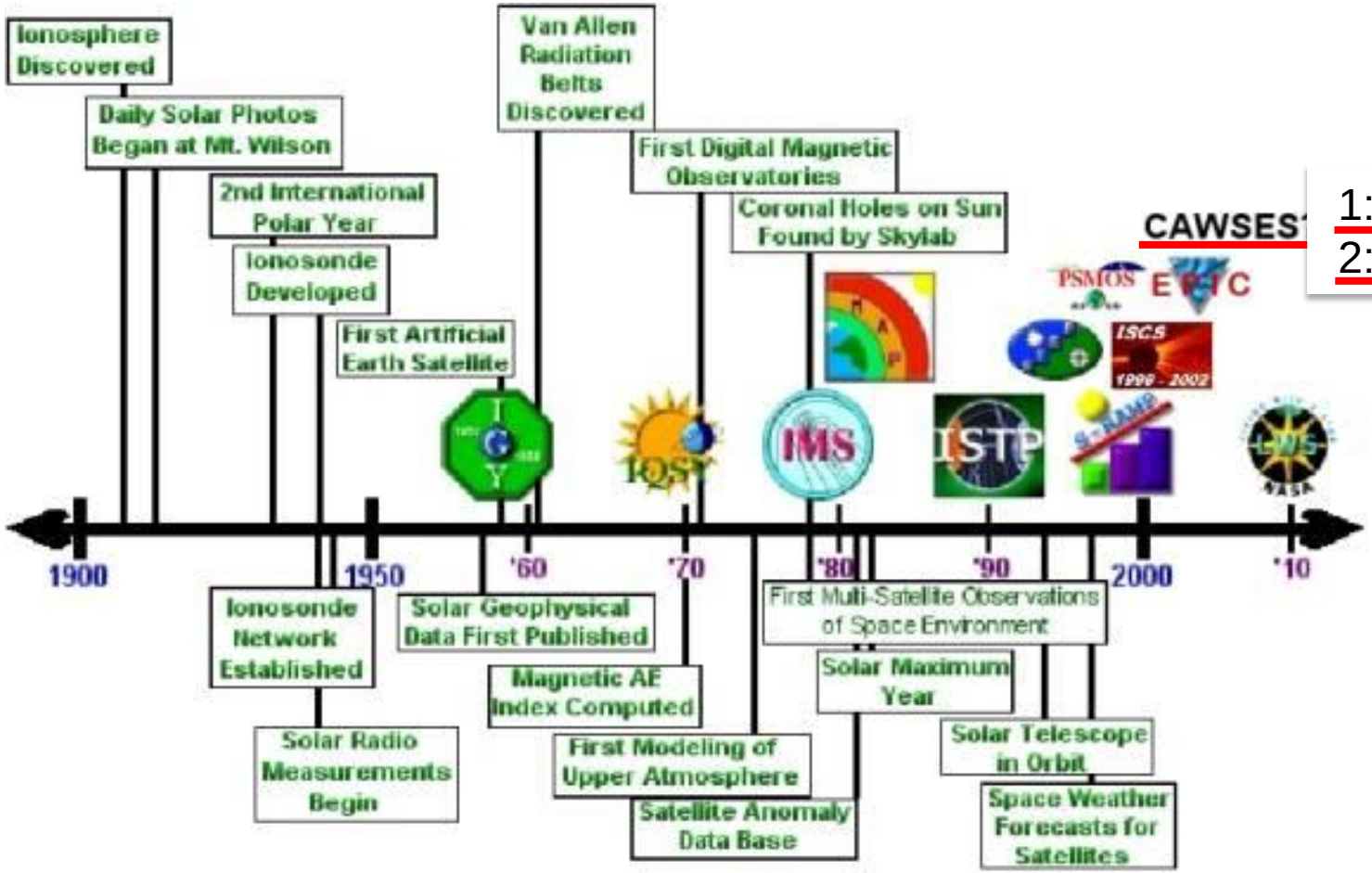
International Research Collaborations under ICSU

ICSU ------ Antarctic Research (SCAR)
|--- Biodiversity (DIVERSITAS)
|--- Climate Observation (GCOS)
|--- Climate Research (WCRP)
|--- Data for Science & Technology (CODATA)
|--- Disaster Risk (IRDR)
|--- Ecosystem Change & Society (PECS)
|--- Geosphere-Biosphere (IGBP)
|--- Human Dimensions of Global Environmental Change (IHDP)
|--- Ocean Observations (GOOS)
|--- Ocean Research (SCOR)
|--- Radio Astronomy & Space Science (IUCAF)
|--- Solar-Terrestrial Physics (SCOSTEP)

President; Nat Gopalswamy (NASA)
Vice President; F. J. Luebken, (IAP)
Bureau from URSI, IAMAS, IAGA, IUPAP, SCAR, COSPAR

|--- Space Research (COSPAR)
|--- Terrestrial Observations (GTOS)
|--- World Data System (WDS)

Historical Development of SCOSTEP Programs



1: 2004-2008
2: 2009-2013

IGY: International Geophysical Year (1957/58)
IQSY: International Quiet Sun Year (1964/65)
IMS: International Magnetospheric Study (1976-79)
MAP: Middle Atmosphere Program (1982-85)
STEP: Solar-Terrestrial Energy Program (1990-95)

Post-STEP sub programs (1998-2002)

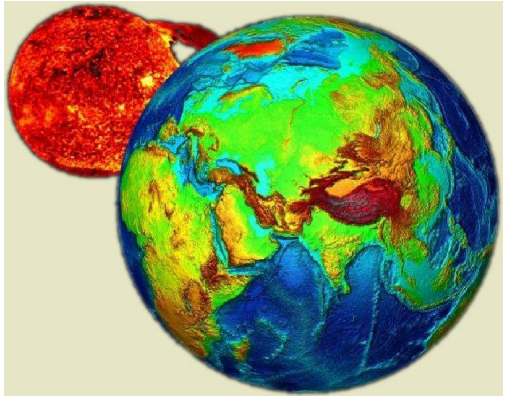
S-RAMP: STEP Results, Applications, and Modeling Phase
EPIC: Equatorial Processes Including Coupling
ISCS: International Solar Cycle Study
PSMOS: Planetary Scale Mesopause Observing System

CAWSES: Climate and Weather of the Sun-Earth System, 2004-2008

Climate
And
Weather of the
Sun-
Earth
System

SCOSTEP's international program in 2004-2008 to link the world's scientists in a cooperative effort to enhance our understanding of the Solar Terrestrial relations, which impacts on life and society. In particular, we put special emphasis on the short (weather) and long-term (climate) variability of the solar activities and their effects in geospace and Earth's environment.

- **space missions, ground-based observations, and theory, modeling, and data analysis**
- **space weather forecasting, design of space- and Earth-based technological systems, and understanding the role of solar-terrestrial influences on global change.**

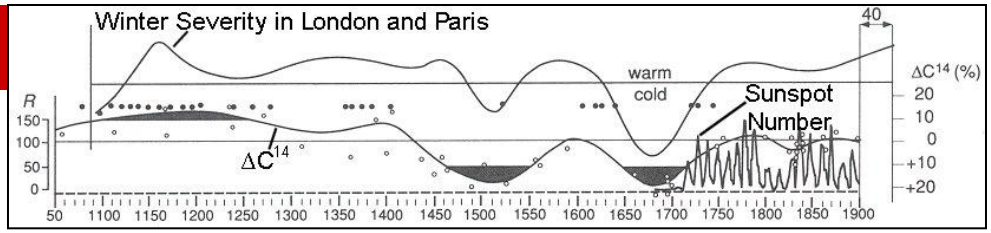


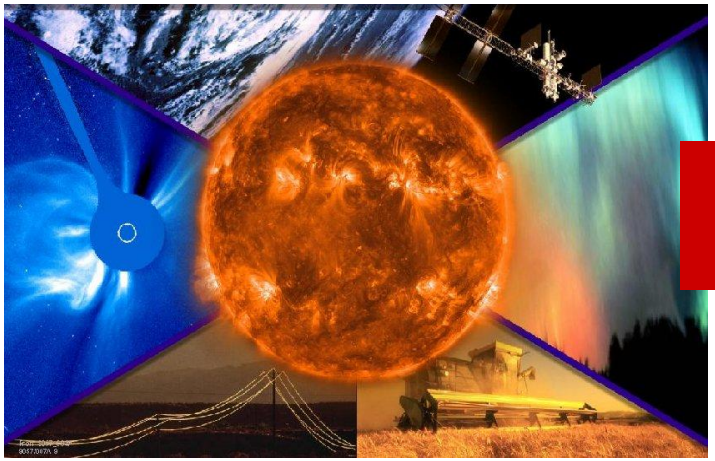
CAWSES Science Steering Group (SSG)

(1) Solar Influence on Climate
(2) Space Weather: Science and Applications
(3) Atmospheric Coupling Processes
(4) Space Climatology

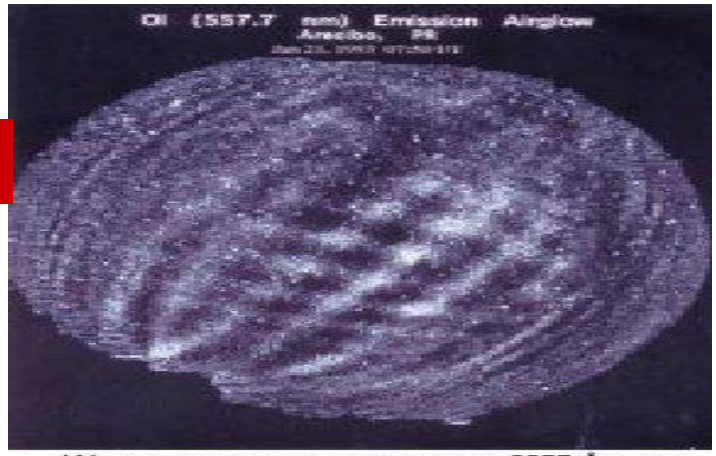
Four Themes under CAWSES

Solar Influence on Climate



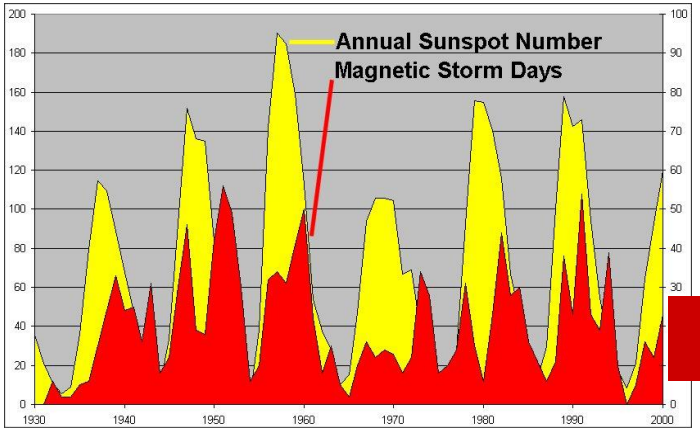


Space Weather: Science and Applications



Wave structures in atomic oxygen 5577 Å image.

Atmospheric Coupling Processes



Climatology of the Sun-Earth System

Ground-based observational data of upper atmosphere

For the ground-based observation of the upper atmosphere, huge, various kinds of observational data have been accumulated at universities and institutes since IGY in 1957-58.

These observational data have not been necessarily well used by various researchers.

↓

IUGONET started in FY 2009!

CAWSES II: Towards Solar Maximum, 2009-2013

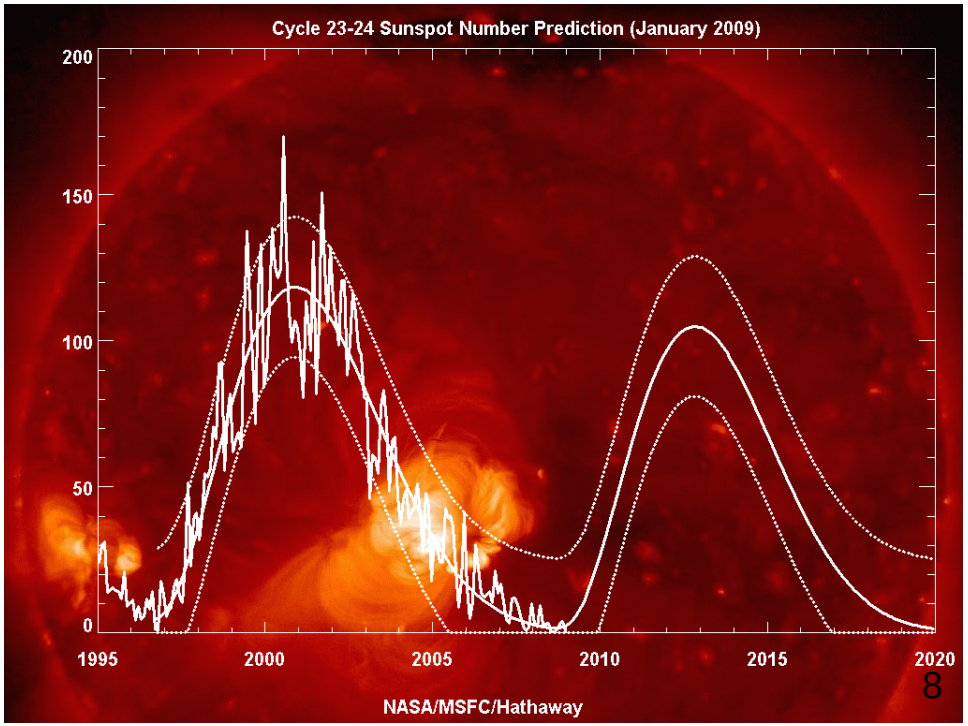
CAWSES II addresses:

- **Fundamental questions of how the coupled sun-earth system operates on timescales of minutes to millenia**
- **Questions that require coordinated inter-disciplinary international effort**

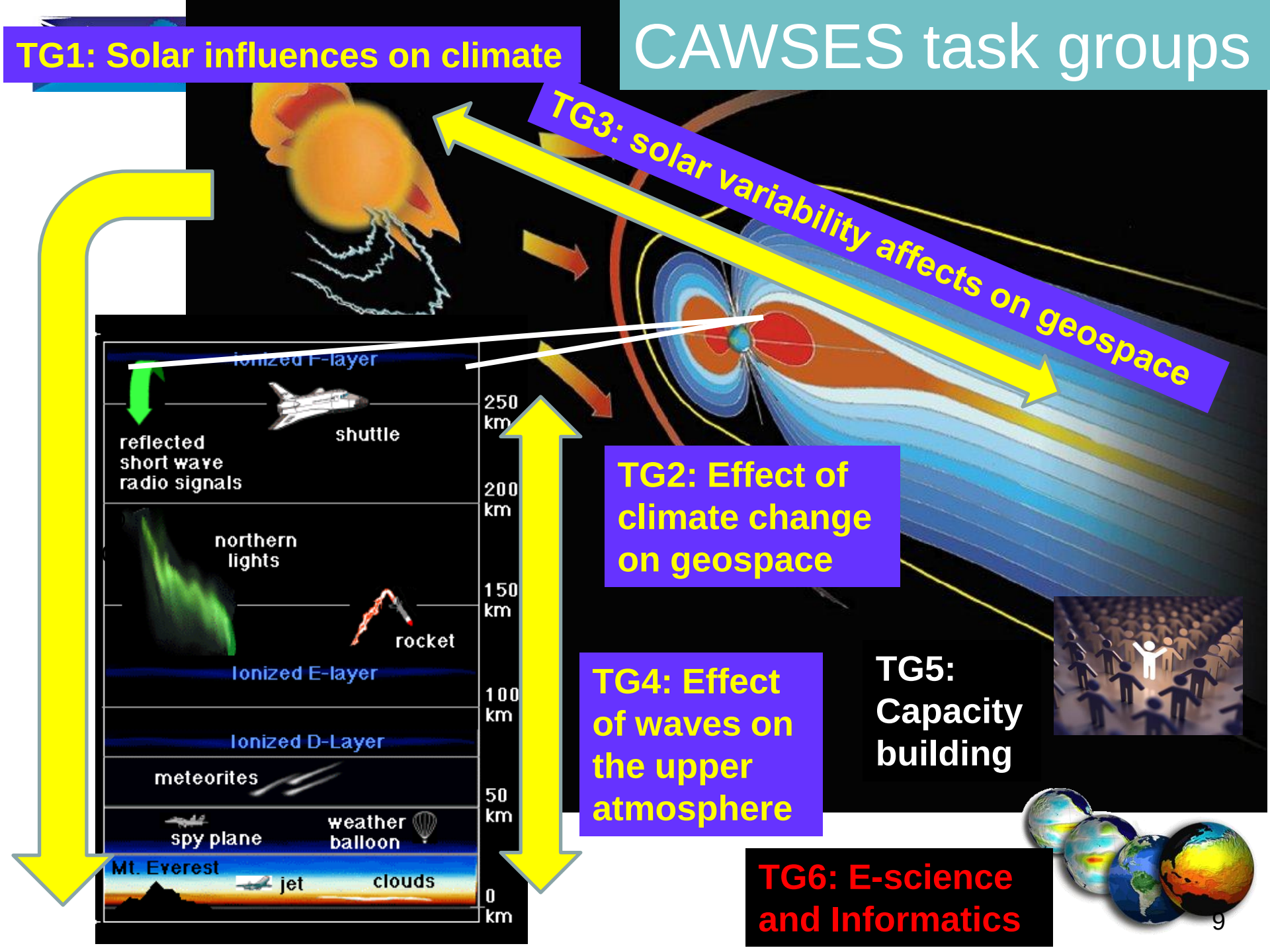
Co-Chair of CAWSES-II

2009-10: Susan Avery & Alan Rogers

2011-13: Joe Davila & Toshitaka Tsuda



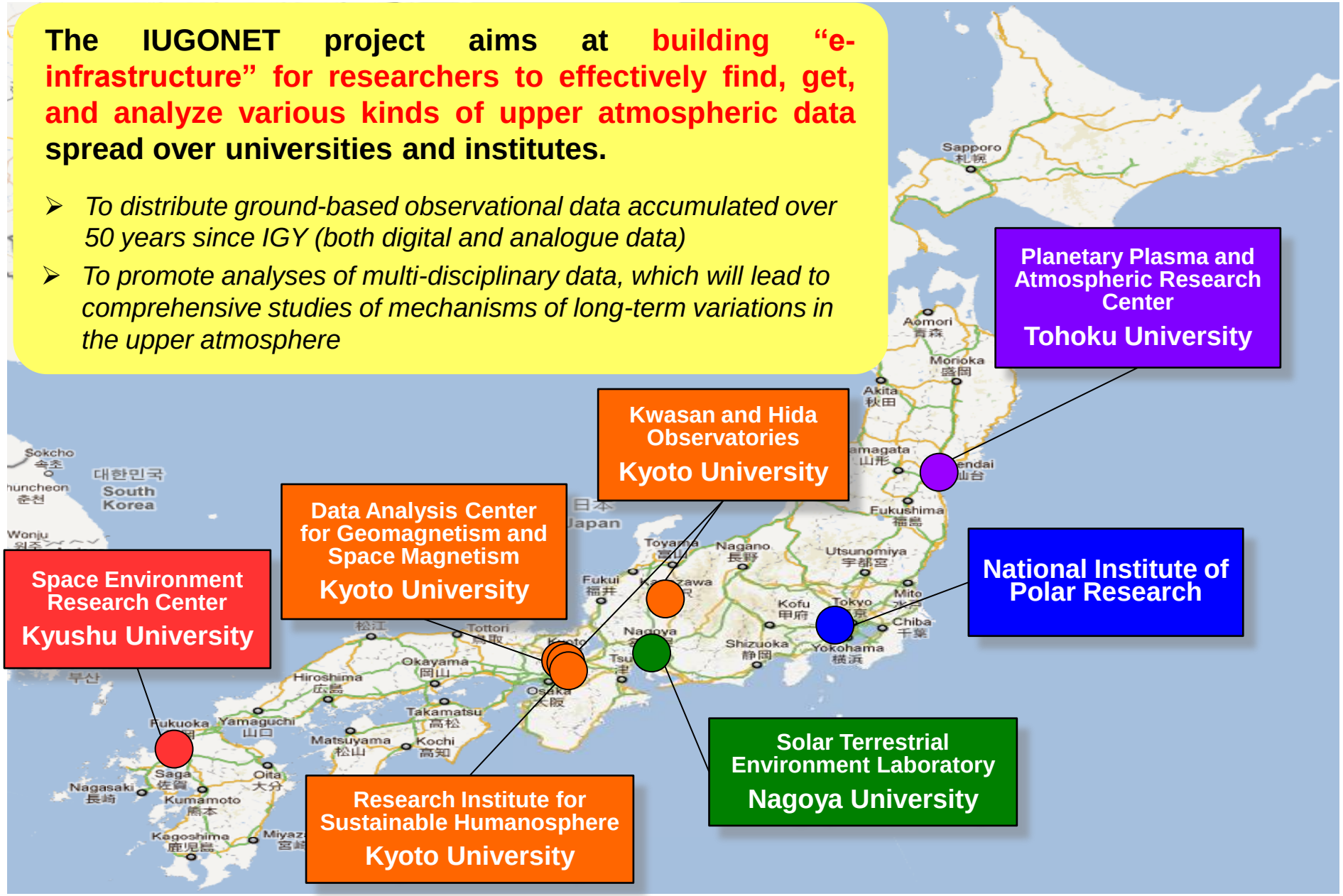
CAWSES task groups



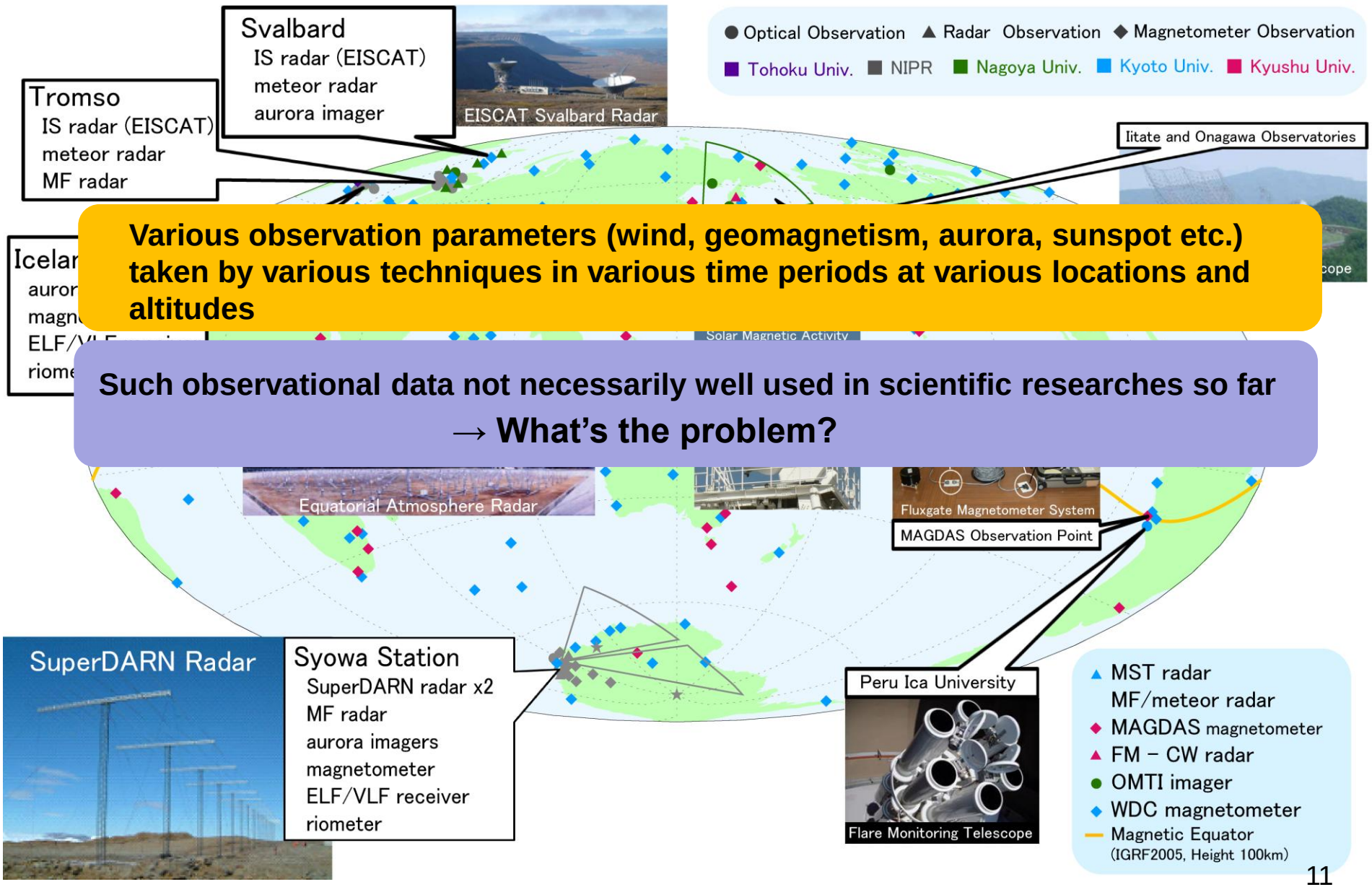
The IUGONET project - Objectives

The IUGONET project aims at building "e-infrastructure" for researchers to effectively find, get, and analyze various kinds of upper atmospheric data spread over universities and institutes.

- *To distribute ground-based observational 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*



Observational Data Collected by the IUGONET Institutes



Various observation parameters (wind, geomagnetism, aurora, sunspot etc.) taken by various techniques in various time periods at various locations and altitudes

Such observational data not necessarily well used in scientific researches so far

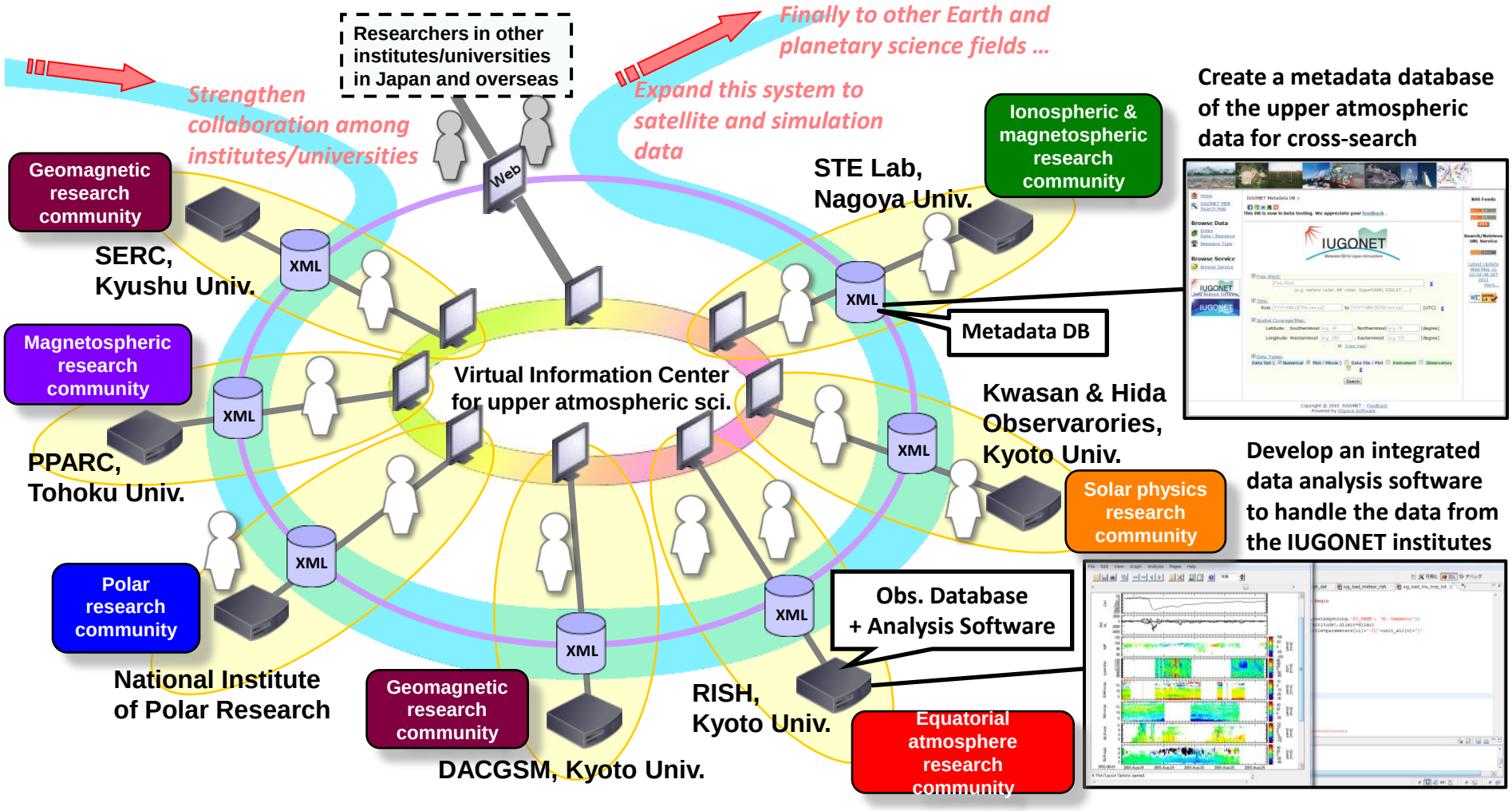
→ What's the problem?

Schematic View of IUGONET Project

PROBLEM: Various kind, huge amount of data spread over research institutes with little info.

SOLUTION: Create a <u>metadata database</u> for cross-search of these dispersed data

Promote new types of the upper atmospheric research by the analysis of multidisciplinary data



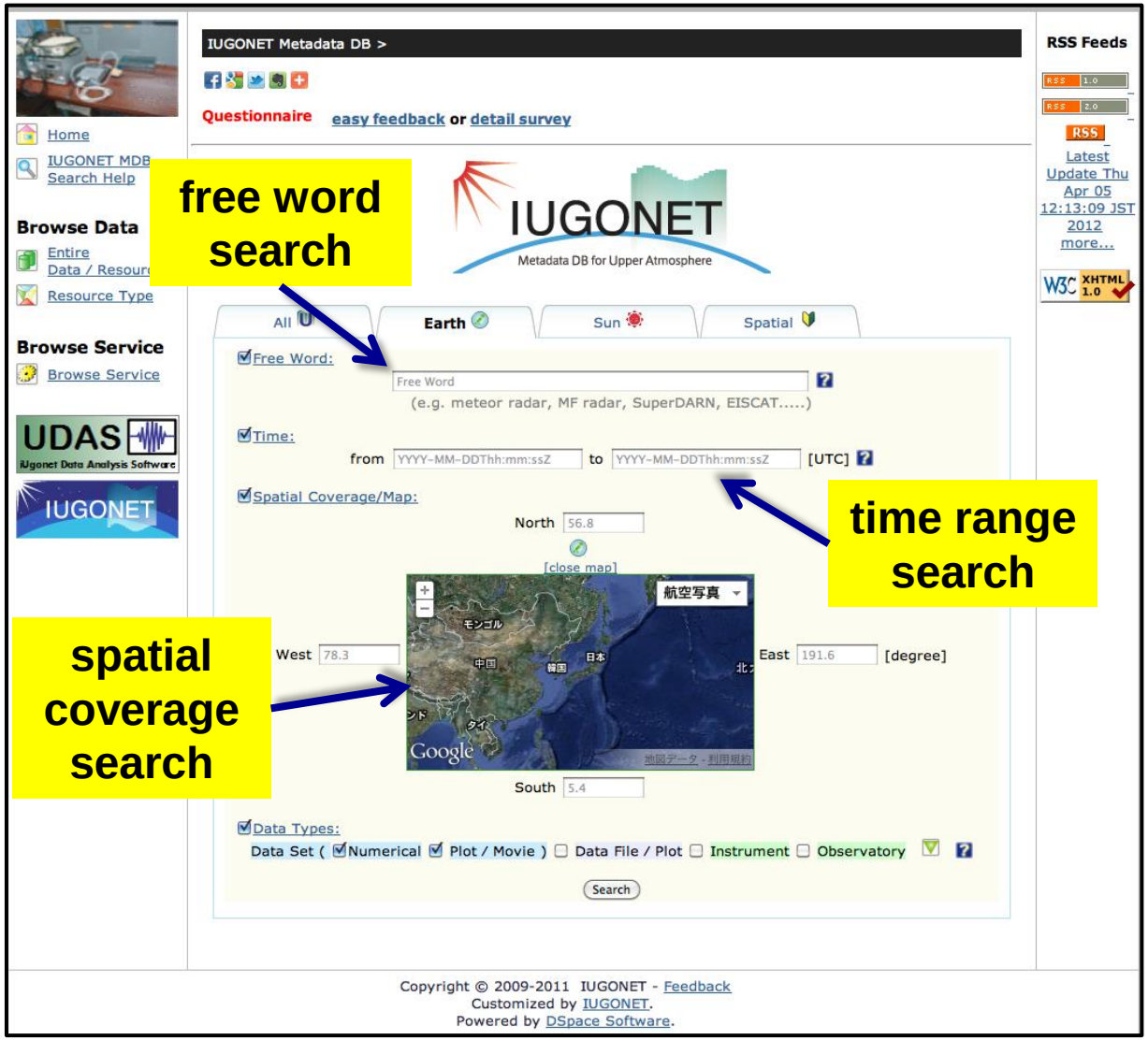
IUGONET Project Timeline

ITEMS		FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	REMARKS
Virtual Information Center	Installation & stable operation	Install system						Construct the integrated research environment (video and/or web conference system, etc.)
	Extension to other disciplines							Wrap up the project and discuss further extension of the system to other discipline
Metadata DB system	Development	Make prototype	Develop regular system	Release product to public				Design and build the IUGONET metadata DB system on the basis of DSpace
	Stable operation				Update computers			Conduct regular operation of the metadata DB and customize it as needed
Metadata	Design of metadata format	Release ver.1 format	Prepare documents	Update the format as needed				Formulate the IUGONET common metadata format and keep updating it if necessary
	Creation of metadata			Open metadata thru metadata DB	Target relatively old, undatabased items			Create metadata in the designated format and register them in the metadata DB system
Analysis Software	Survey & Specification of analysis software	Specification	Prepare documents					Design an integrated analysis software to download, visualize, and analyze data provided from the IUGONET institutions
	Programming			Release product to public	Target relatively old, undatabased items			Develop the IUGONET analysis software by using TDAS (a set of IDL subroutines)
Others	Rearrangement of observational DBs		Rearrange DBs corresponding to metadata & software development		Arrange relatively old, undatabased items and digitize analogue data			Rearrange existing observational DBs and newly set up DBs of undatabsed items
	Application to scientific researches				Conduct interdisciplinary researches by utilizing the IUGONET products			Make a self-assessment of the IUGONET products and introduce how to use them in researches
	Outreach activities	Build project homepage			Organize regular workshops and provide tutorial movies of the IUGONET products			Conduct promotion activities to settle the IUGONET products as an essential e-infrastructure

Today

Development of metadata DB

http://search.iugonet.org/iugonet



# of metadata registered
(as of April 2012)

1.68 million

(* including metadata of data files)

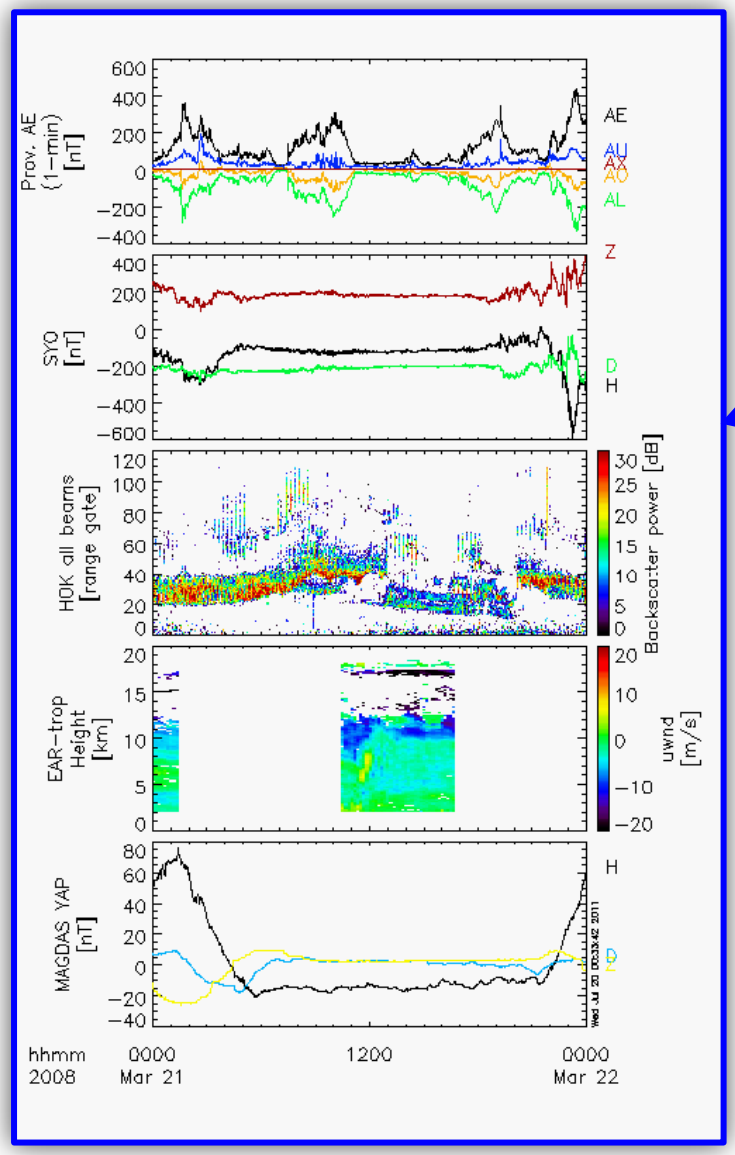
- **Metadata DB platform**

DSpace - an open source software to manage digital contents and their metadata - with customization depending on our metadata

- **Metadata format**

SPASE metadata model with some modifications according to characteristics of the ground-based observational data of the upper atmosphere

Development of Data Analysis Software

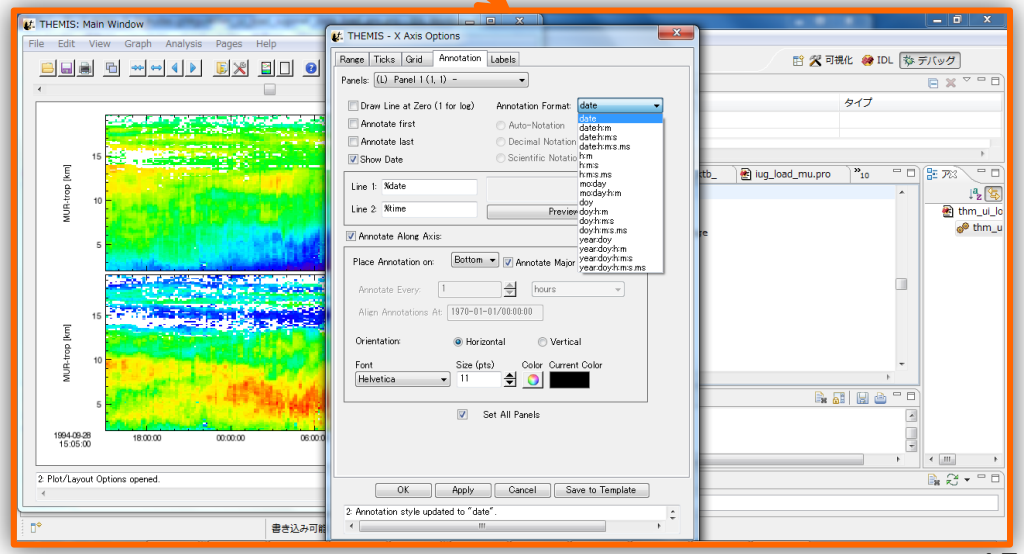


- ✓ **To help users easily download, visualize, and analyze various data provided from the IUGONET institutes**
- ✓ **With TDAS libraries in IDL**

THEMIS Data Analysis Software suite

Able to make stacked plots of time series to compare various kind of data

Easy to handle data by using GUI even for those who are not familiar with IDL



Outreach Activities

We are doing promotional activities to settle the IUGONET products as an essential e-infrastructure in the research communities.

● Data analysis workshop

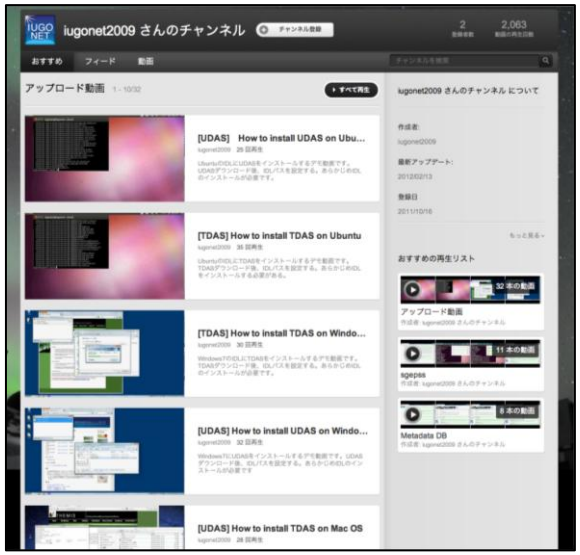
We provide intensive course to learn how to use the IUGONET metadata DB & data analysis software and to analyze observational data provided by the IUGONET institutes

Next workshops

- **July or August 2012 @ Tachikawa**
- **February or March 2013 @ Nagoya**

Data analysis workshop @ Tachikawa (Jul 2011)

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



● Online tutorial movies

Researchers can learn how to use IUGONET metadata DB & data analysis software anytime online at the IUGONET's YouTube site.

IUGONET Channel

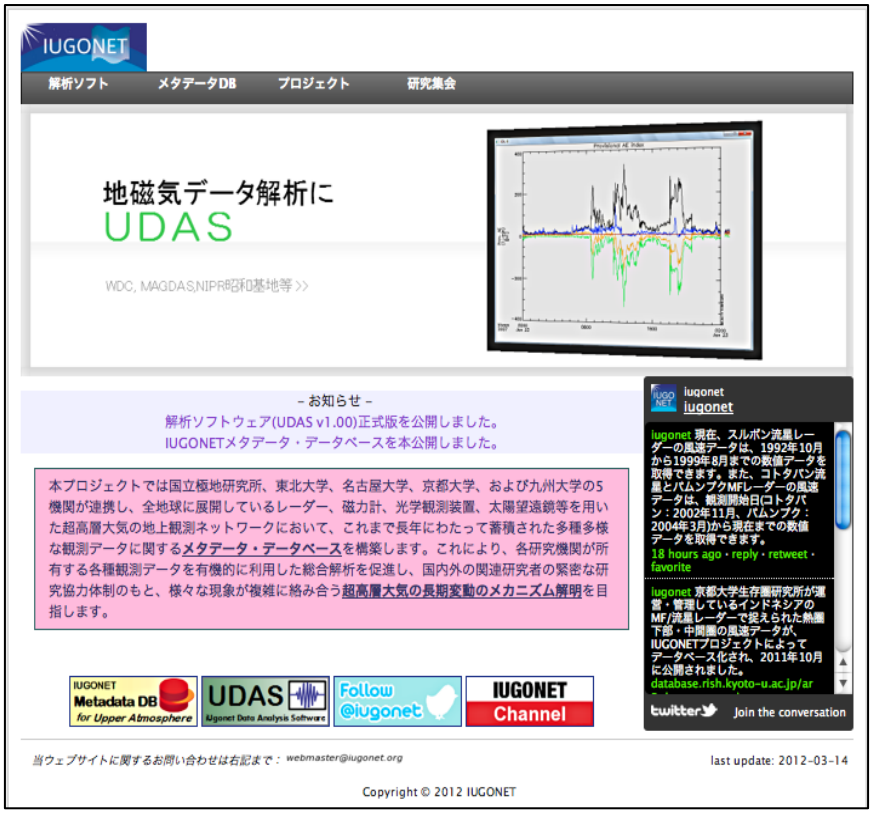
Outreach Activities

Follow @iugonet

http://twitter.com/#!/iugonet

Provide various information of metadata database, analysis software, data provided by each institute, meeting presentations, IUGONET workshop, etc.

http://www.iugonet.org/



Provide overview of the IUGONET project and its products

Summary

- **The IUGONET project (http://www.iugonet.org) builds metadata database and analysis software to promote effective distribution and use of upper atmospheric data taken by various ground-based observations.**

- **The IUGONET products have just been released!**

  Metadata database : **http://search.iugonet.org/iugonet/**

  Analysis software : **http://www.iugonet.org/en/software.html**

- **The IUGONET tries various promotional activities to settle the IUGONET products as an essential e-infrastructure in the research communities and plans to extend the products internationally and interdisciplinarily.**