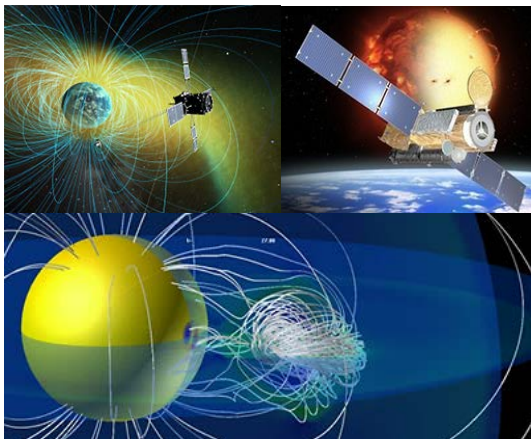# 9-2. Research Centers
Center for Integrated Data Science (CIDAS)

Research topics and keywords

- Hinode Science Center
- ERG Science Center
- Research and development of advanced simulations (SUSANOO, CReSS, Monte Carlo simulations for high-precision age calculations, etc.)
- Construction of various databases (IUGONET, WDS-CR, etc.)
- Operation of CIDAS supercomputer system
- Membership activity of HPCI consortium

Introduction to CIDAS

The aim of the Center for Integrated Data Science (CIDAS) was to construct infrastructure and conduct research and development to realize cutting-edge scientific study of the space–Earth environmental system through integrated analyses using various kinds of observational data and advanced computer simulations. CIDAS operates many projects in cooperation with the research divisions and the centers of the ISEE, as well as other universities and institutes.

Science centers for space missions: Hinode and ERG

The Hinode Science Center is operated as a joint project with the NAOJ and developed the database and analytical environment for the data provided by the Japanese solar observation satellite Hinode. In addition, ERG Science Center operates as a joint research center in cooperation with ISAS/JAXA, which releases the data from ERG and develops the data analysis software.

Cooperative research program for database construction and supercomputing

CIDAS produces various databases for space–Earth environmental research and provides supercomputing facilities in collaboration with the Information Technology Center (ITC) of Nagoya University and other universities and institutes. CIDAS has also joined the inter-university network project (Inter-university Upper atmosphere Global Observation NETwork: IUGONET) with Tohoku University, the NIPR, Kyoto University, Kyushu University, and Nagoya University to develop a metadata server and data analysis software. CIDAS is in charge of activities in the ISEE as a member of the High-Performance Computing Infrastructure Consortium (HPCI) in Japan.

Research and development of advanced simulations

CIDAS plays a leading role in research and development in the following advanced computer simulation models: Space Weather Forecast Usable System Anchored by Numerical Operations and Observations (SUSANOO), the Cloud Resolving Storm Simulator (CReSS), and Monte Carlo simulations for accurate Th-U-Pb dating. The CReSS model is designed for any type of parallel computer to simulate detailed structure of clouds and storm structures, and is free to use for the scientific community. It has been used for meteorological studies and real time weather forecast experiments, simulation experiments of tropical cyclones, heavy rainfall events, snow clouds, tornadoes and downscaling experiments of future tropical cyclones, among other applications.

Main Achievements in FY2017

1. Development of data analysis system for the ERG project

The scientific data from the ERG satellite, ground-network observations and modeling/simulation are archived at the ERG Science Center operated by ISAS/JAXA and ISEE/Nagoya University. These data files are in the CDF file format that includes metadata for each file, which is a de facto standard format for the solar-terrestrial physics community. The Space Physics Environment Data Analysis System (SPEDAS), widely-used software in the solar-terrestrial physics community, can easily read and manipulate CDF files. The ERG Science Center has developed and generated CDF files and SPEDAS plug-in software for the ERG project, and organized SPEDAS training sessions in Japan and Taiwan, which have provided important opportunities to learn SPEDAS and ERG data. The ERG Science Center has also developed a data analysis environment in the CIDAS system, and users can access the CIDAS system via the internet and analyze ERG project data using SPEDAS.

2. Development of nonlinear force-free field database of solar active regions

Solar flares are disruptive events in which the energy stored in the solar coronal magnetic field is explosively liberated. To measure the stored energy in the solar corona, reconstruction of the coronal magnetic field using photospheric magnetic field data is required, because direct measurement of the coronal field is not yet feasible. CIDAS has developed a tool that is utilized to semi-automatically calculate the nonlinear force-free field of the solar active region using Solar Software (SSW) and Interactive Data Language (IDL) in the CIDAS supercomputer system. Using this tool, we are constructing a database of the nonlinear force-free field for about 300 relatively large active regions observed by the Solar Dynamics Observatory (SDO) satellite since 2010.

3. Activity of Inter-university Global Upper atmosphere Observation NETwork (IUGONET)

We have promoted the use and application of upper atmospheric observation data through a database and analysis software in collaboration with other institutions (for example, the Research Organization of Information and Systems (ROIS)), and developed a foundation for a universal infrastructure for disclosing and citing data rapidly. We also abstracted a database design, a website, an analysis routine, and hardware construction equipped so that anyone can install these procedures easily and quickly, and now provide these developments to each institute and committee to promote data activity. We have held several international data analysis workshops in developing countries such as Nigeria and Indonesia in collaboration with a number of international programs: Variability of the Sun and Its Terrestrial Impact (VarSITI) and World Data System (WDS) affiliated with the International Council for Science (ICSU), and we have also started to support the construction of infrastructure for disclosing data and data integrity.

4. Operation of the CIDAS supercomputer system

The CIDAS supercomputer system for integrated data analysis has been under operation since FY 2016. The system consists of 20 compute nodes, and each compute node has two Intel Xeon E5-2660 v3 CPUs and 256 GB memory. In FY 2017, a total of 100 researchers/students were registered as users of the CIDAS supercomputer system, and data analyses related to the Hinode Science Center and the ERG/Arase Science Center were conducted.

5. Development of CReSS model

The CReSS model has been developed and improved for physical processes. It is available for scientific studies from CIDAS. It is planned that simulation output data from the CReSS model will be provided openly by CIDAS.