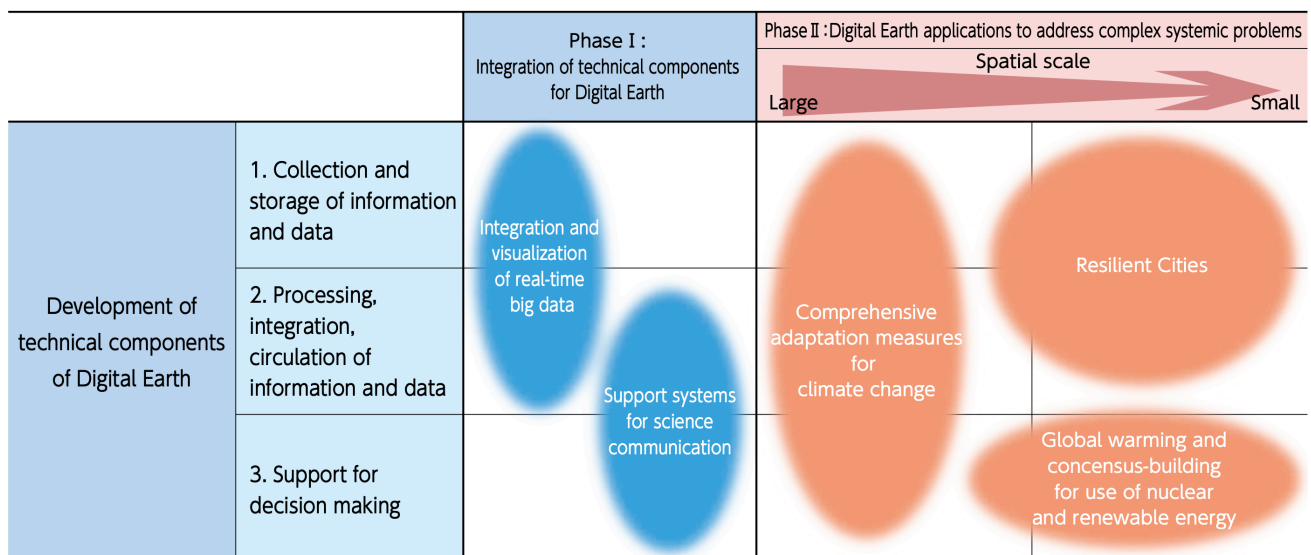


FY2025 Joint Usage and Joint Research Application Guide  
International Digital Earth Applied Science Research Center (IDEAS)  
Joint Usage/Research Center for Digital Earth to Address Emerging Complex Systemic Problems  
Chubu Institute for Advanced Studies, Chubu University

April 7, 2025

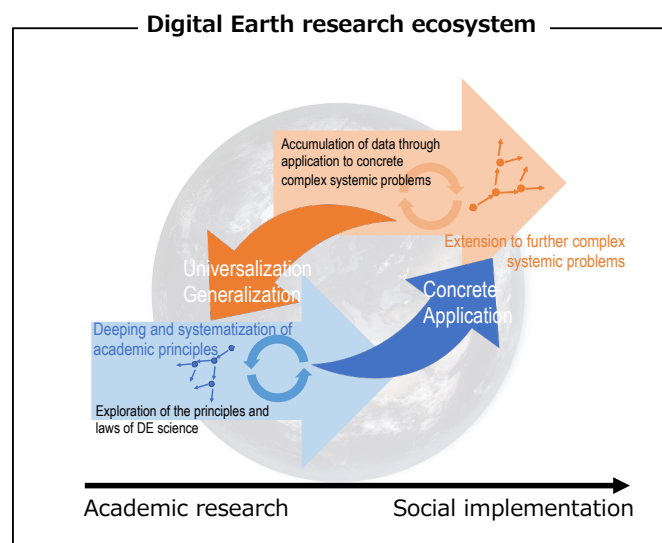
The International Digital Earth Applied Science Research Center (IDEAS) promotes research and development using Digital Earth (a multi-dimensional, multi-resolution model of the Earth created in cyberspace) through joint usage and joint research performed by researchers in the information sciences, remote sensing, GIS, social engineering, and other fields. Through joint usage/research by making Digital Earth available to researchers working on complex systemic problems such as environmental issues and disasters, IDEAS helps to identify so-called “wicked problems” as they relate to the creation of a sustainable society, and contributes to consensus building and the development of the related scientific fields. The accreditation of IDEAS as a Center of Excellence under the Ministry of Education, Culture, Sports, Science and Technology has been renewed, and it is now in its twelfth year. The specific research components and integrated research topics are envisioned as shown in the following figure.



Digital Earth research is enhanced through feedback and optimization between two research categories, Category 1 being integration of technical components for Digital Earth, and Category 2 being Digital Earth applications to address complex systemic problems. Specifically, IDEAS aims to promote the discovery of new problems and problem-solving approaches by sharing technologies and data obtained

through joint research, and based on the outcomes, to perform the cycle of further data creation and visualization technology improvements within the “Digital Earth ecosystem,” to promote Digital Earth-related research across multiple academic fields, and to create new fields through their integration.

This is an open call for applications for joint research on the theme of utilizing “Digital Earth to address emerging complex systemic problems” in order to continue advancing these activities this fiscal year.



## 1. Invited research

In fiscal 2014, IDEAS was accredited by the Minister of Education, Culture, Sports, Science and Technology as a joint usage/research center for Digital Earth to address emerging complex systemic problems, and its accreditation was renewed in fiscal 2020 for another six years. IDEAS views joint research as an important component of its activities, and expects it to be performed in close collaboration with the Center. This call for applications covers three types of opportunities: (1) specific project research, (2) general research, (3) research meetings, and (4) student research.

### 1. Specific project research

“Specific project research” is where participation is sought to address predetermined topics in collaborative research performed with IDEAS researchers. For this fiscal 2025 call for applications, besides the eight topics in two categories have been established from fiscal 2024. Additionally, we have established “Exploring the Sustainability of Socio–Ecological Systems” as a special category based on the future development direction of the center, from the fiscal year 2023. Research proposals are invited for participation involving the following joint usage/research topics. For more

details on each theme, please refer to the Attachment at the end of this Guide.

○Special Category: Exploring the sustainability of “Socio–Ecological systems”

○Category 1: Integration of technical components for Digital Earth

1-1: Development of high-performance API platform and apps for sensing data utilization

1-2: Construction and analysis of basic data and visualization of uncertainty

(3D data, chronological data)

1-3: Development of science communication systems

1-4: Application of Big Data Analysis to Digital Earth

○Category 2: Digital Earth applications to address complex systemic problems

2-1: Digital Earth applications for disaster prevention and reduction

2-2: Digital Earth applications for environmental and energy-related issues

2-3: Digital Earth applications for Sustainable Development Goals (SDGs) indicators

2-4: Digital Earth applications for One Health issues

## 2. General research

“General research” is defined as research performed collaboratively with IDEAS researchers on a topic that can be determined by the applicant but is related to IDEAS’ areas of research. This is an open call for applications for research topics related to Digital Earth. The use of research funds is limited to travel expenses and consumable items. The amount of funding provided is less than for specific project research.

## 3. Research meetings

A “research meeting” is defined as a meeting held collaboratively with IDEAS researchers on a topic that can be determined by the applicant but is related to IDEAS’ areas of research. This is an open call for applications for research meetings related to Digital Earth. The use of research funds is limited to travel expenses to participate in research meetings and invitation fee of special speaker, support is limited to a specified maximum amount. Also, in principle, support for holding meetings is for one meeting per fiscal year, and the facilities for a research meeting must be associated with Chubu University.

## 4. Student research

“Student Research” refers to collaborative research performed with doctoral students in a research field related to Digital Earth. With the approval and guidance of their supervisors, the student researchers propose a research topic related to Digital Earth and serve as the principal investigator.

The proposed topic should align with the research areas of IDEAS. Students of any nationality, are eligible to apply for the program. The research funds provided are limited to travel expenses and consumable items\*. Less funding is allocated for specific and general project research. Students participating in the selected research projects will receive training on Digital Earth-related technologies as necessary to complete their research projects.

\* Consumable items: In accordance with Chubu University regulations, the price of one item or one set of items is less than 50,000 yen including tax, excluding PCs, tablet devices (devices on which software can be installed), and Unmanned Aerial Vehicles. Software and licenses are also not considered consumables.

## 2. Research facilities for joint usage/research

The following joint usage equipment and facilities can be made available for use by applicants to contribute to the promotion of research topics listed as planned research at IDEAS. For other matters, please communicate with the Lead Contact on a case-by-case basis regarding other IDEAS facilities and the use of past joint research outcomes, etc.

- Digital Earth Room\*<sup>1</sup>
- Crisis management information collection vehicle\*<sup>2</sup>
- Fixed-wing autonomous UAV (Unmanned Aerial Vehicle) (SenseFly eBee international model, visible and near-infrared camera)
- Fixed-wing manual or autonomous UAV (Parrot Disco, Disco Pro AG)
- Multicopter manual or autonomous UAV (DJI Phantom, Mavic etc.)
- InGaAs camera for UAVs  
(In principle, a Lead Contact from IDEAS must be present during the use of the Digital Earth Room, crisis management information collection vehicle, and UAVs listed above.)\*<sup>3</sup>
- Digital Earth Server\*<sup>4</sup>
- Spatial data on the historical environment of Aichi Prefecture
- ArcGIS Pro, ArcGIS for Desktop Advanced and extension products
- Terra Scan (Aerial Laser Data Processing Software)
- Chubu University databases
  - ArcGIS data collection 2014
    - Wide area map (basic map information from Geospatial Information Authority of Japan)
    - Public maps (numerical information on national land, from Ministry of Land, Infrastructure, Transport and Tourism)
    - Block-level addresses
    - Basic statistics
      - \* 2010 National census Aggregation by town, character, etc. Aggregation of basic occupation, etc. (main index), Aggregation of population, industry, etc., by place of employment / school attendance (main index)

- \* 2010 Census mesh, statistics
- \* 2009 Economic Census, basic survey, mesh statistics
- \* 2011 Area use data
- \* 2011 Passenger boarding/unboarding statistics, by train station
- \* 2009 Land use subdivision mesh data, urban land use subdivision mesh data
- \* 2013 Prefectural land price survey, 2012/2013 official land price data
- \* 2000 and 2010 Keihanshin metropolitan area traffic flow data
- ArcGIS data collection, detailed map, Chubu region
- ArcGIS data collection, road network, 2015 Chubu and Hokuriku region
- JPS 2010 National Census 100 m mesh estimate data, all indicators, national edition
- Zenrin Building statistical data corresponding to administrative division maps, Aichi Prefecture
- Zenrin administrative division map data, Aichi Prefecture
- Terrain data (SRTM, 5 m mesh, 10 m mesh)
- Kasugai City GeoEye-1 image (taken in 2012)
- Kasugai City aerial photographs (1962, 68, 74, 76, 82, 1985)
- Japan Meteorological Business Support Center, meteorological Information (October 13, 2015 to the present)<sup>\*5</sup>
  - Local Numerical Weather Prediction Model GPV (LFM)
  - Marine current forecasting matrix documentation for seas around Japan
  - High resolution precipitation nowcast
  - Sediment disaster (landslide) warning mesh information
  - Soil rainfall index
  - Watershed rainfall index
- ULF / ELF band electromagnetic wave observation data observed by Chubu University seismic electromagnetic wave observation network<sup>\*6</sup>
- Environmental assessment and environmental science materials from the Yasuo Shimazu collection<sup>\*7</sup>
- In addition, data and systems, etc., from joint research performed to date.

**\*1 Digital Earth Room**

The evidence-based deliberation room is equipped with 15 55-inch full high-definition LCD screens arranged in a 3x5 configuration, with 8 digital and 16 analog inputs that can be freely arranged on the screens. The room also features an electronic blackboard, an electronic table with an embedded multi-touch display, a large-format plotter, a large 3D printer, and an in-house power generation equipment. The floor is equipped with HDMI and VGA ports for multiscreen display, allowing up to four groups to present and discuss their information while simultaneously displaying it on the multiscreen.

Personnel support is also provided for setting up the geospatial data needed for discussions, operating the multi-display and other presentation equipment during discussions, and recording video of discussions, etc.

**\*2 Crisis management information collection vehicle**

A four-wheel drive vehicle equipped with TOPCON 360-degree camera IP-S2 Lite, satellite Internet link, satellite mobile phone, A1-size large format plotter, power generator, etc.

**\*3 UAVs (Unmanned Aerial Vehicles)**

When operating UAVs, Flight Rules for Unmanned Aerial Vehicles (Drones, Radio Controlled Aircraft, etc.) by the Ministry of

Land, Infrastructure, Transport and Tourism must be strictly observed ([http://www.mlit.go.jp/koku/koku\\_tk10\\_000003.html](http://www.mlit.go.jp/koku/koku_tk10_000003.html)).

**\*4 Digital Earth Server**

CPU Xeon E5 (12 logic cores x 2), 64 GB RAM, 10TB HDD (RAID 5 configuration) with 4 nodes, CPU Xeon E5 (12 logic cores), 96 GB RAM, 24 TB HDD (RAID 5 configuration) with 1 node. Separate virtual partitions are provided as needed.

**\*5 Japan Meteorological Business Support Center, meteorological information**

For details, please refer to the web page (<http://www.jmbc.or.jp/hp/online/f-online0.html>).

**\*6 Seismo-electromagnetic observation network (Chubu University), observational facilities, observational data**

The university is developing a ULF and ELF seismic electromagnetic wave observation network, mainly in the Tokai region of Japan, and conducting environmental ULF and ELF electromagnetic observations. See the following paper for location of observation sites and the details on the data. Researchers wishing to make new observations at any sites are asked to consult with the Lead Contact in advance. (Reference: IZUTSU Jun, Observations and Analysis of Electromagnetic Phenomena Possibly Associated with Crustal Dynamics Conducted in Earth Watch Safety Net Research Center, Chubu University, Engineering Department Bulletin 46, 0-18, 2011 (in Japanese) (<https://elib.bliss.chubu.ac.jp/webopac/XC13000011>)).

**\*7 Environmental assessment and environmental science materials from the Yasuo Shimazu collection**

Download materials list here (in Japanese): <http://gis.chubu.ac.jp/zip/shimazu.zip>

### 3. Applicant eligibility

Persons who may apply shall be researchers from Japanese and non-Japanese universities and public research institutions, personnel from central or local governments, private-sector technology developers related to Digital Earth, researchers from NGOs and NPOs, Doctoral students enrolled in domestic or foreign graduate schools, or similar persons who are deemed to be appropriate by the Director of IDEAS. However, the Principal Investigator for Specific Project Research, General Research, and Research Meetings must be researcher affiliated with universities or public research institutions. The Principal Investigator for Student Research must be graduate student enrolled in doctoral courses at universities in Japan or abroad.

### 4. How to apply

The Principal Investigator (in consultation with the Lead Contact in the case of designated research, and in consultation with a researcher at IDEAS in the case of general research, research meetings and student research) must e-mail the prescribed “Joint Usage and Joint Research Application ” and “Joint Research and Joint Research Consent Form (Principal Investigator)” to [chubu-de\\_collabo@fsc.chubu.ac.jp](mailto:chubu-de_collabo@fsc.chubu.ac.jp) by Wednesday May 7, 2025, and also to send the originals to the address indicated in Section 14 of this Application Guide.

### 5. Lead Contacts

For joint research, researchers are requested to adequately consult with the Lead Contact and perform the work in ways that are appropriate for joint research with IDEAS. Please consult with the Lead Contact and the IDEAS Secretariat regarding announcements of the results of joint

research, the operation of research facilities for joint usage/research, the implementation of the budget, or other aspects of joint research.

A primary and secondary contact person can be named as the Lead Contact. For specific project research, please name the primary contact for each theme, as indicated in the Attachment at the end of this form. As the secondary contact, any willing faculty member at IDEAS can be requested and appointed, depending on the needs of the applicant. For general research, research meetings and student research the applicant is requested to ask any IDEAS faculty member to be the primary contact. As for the secondary contact, any faculty member at IDEAS can be requested and appointed, depending on the needs of the applicant.

6. Period for joint research

The period for research is from the date of selection until Tuesday, March 31, 2026.

7. Research to be continued from the previous year

The research period is basically single year, but based on the development of the research, applications with research content that continues from the previous year are also accepted (application and acceptance/rejection decisions are made each fiscal year, and budgets are allocated each fiscal year). However, even in the case of a continuing application, the content should not be identical from the previous year but should clearly state the progress made up to the previous year as well as the new research to be undertaken. Especially for continuing proposals, please make sure that the research content is well discussed with the Lead Contact and that the application budget is limited to necessary items based on the execution up to the previous year.

8. Selection decisions

In the selection process from among applications for joint research, the applications will be reviewed by the IDEAS Joint Usage/Research Committee, the final decision made by the Director of IDEAS, a project number assigned, and a notification of the results sent promptly to the Principal Investigator.

9. Selection criteria

To ensure the transparency of the selection process for joint research, the selection criteria are as presented below:

- Is the proposal appropriate as research regarding complex systemic problems to be advanced by the International Digital Earth Applied Science Research Center (IDEAS)? For specific

project research, do the research objectives match the details indicated at the end of this form? (See Attachment)

- Has the specific methodology of the research been adequately considered, and is the research plan feasible?
- Have the uses of the research funding been adequately considered, and are they appropriate for the performance of the research?
- Are the members of the research team suitable for the work being proposed?

#### 10. Number of projects to be selected

In fiscal 2024, 26 specific project research projects were selected, 8 general researchs project and 2 student research projects. Approximately the same numbers are expected in fiscal 2024.

#### 11. Research funds

The maximum amount of expenses covered for joint research is limited to 1,000,000 yen per case for the “Exploring the Sustainability of Socio–Ecological Systems” category, 500,000 yen per case for other specific project research categories, 200,000 yen per case for general research, 300,000 yen per case for research meetings and 100,000 yen per case for student research. Any decisions on funding shall be reviewed by the IDEAS Joint Usage/Research Committee prior to the final decision being made by the Director of IDEAS. Joint research expenses are paid from the budget of Chubu University, so the university will process the payment of expenses required in the performance of research through the Lead Contact or the IDEAS Secretariat. The price of one item or one set of items is more than 50,000 yen including tax, and any computer, tablet device, software, license regardless of price, are treated as property of Chubu University, so please return them to the university after research completion. However, they do not have to be returned if the research project continues the subsequent fiscal year.

#### 12. Reporting the results of joint research

The Principal Investigator, after consultation with the Lead Contact, is requested to submit a “Report of Joint Usage and Joint Research” and a “List of Achievements” (which serves as the basis for a report on implementation status to be submitted to the Ministry of Education, Culture, Sports, Science and Technology) by e-mail to the IDEAS Secretariat ([chubu-de\\_collabo@fsc.chubu.ac.jp](mailto:chubu-de_collabo@fsc.chubu.ac.jp)) by the specified date. Joint researchers are also requested to present their results at a Joint Usage and Joint Research meeting to be held at the end of fiscal 2025. The format and other details of the Joint Usage and Joint Research meeting will be determined in consideration of the factors, including the number of presentations anticipated. Principal



investigators are expected to prepare adequately in advance of the Joint Usage and Joint Research meeting.

In the event that the results of joint research are to be published in some form (academic paper, publication, report, etc.), please be sure to clearly state the project number and the fact that it was an IDEAS joint research project.

Recommended text: This work is supported by the Collaboration Research Program of IDEAS, Chubu University IDEAS2025○○○.

13. Deadline for submission of Joint Usage and Joint Research Application, and Joint Usage and Joint Research Consent Form

The deadline is Wednesday, May 7, 2025. If unavoidable circumstances such as personnel transfers make it difficult to submit before the deadline, please discuss the matter with the Lead Contact.

14. Contact information for application forms and inquiries

1200 Matsumoto-cho, Kasugai, Aichi 487-8501, JAPAN

Chubu Institute for Advanced Studies, Chubu University

International Digital Earth Applied Science Research Center (IDEAS)

FUJITANI Yumi

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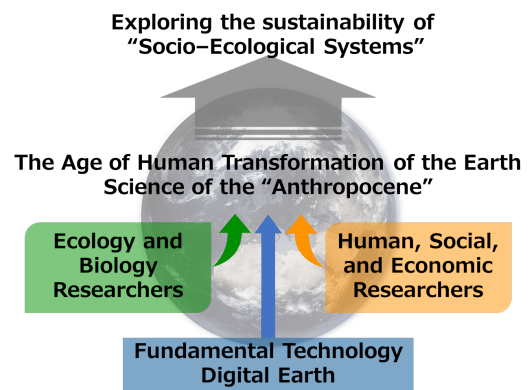
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## Special Category: Exploring the sustainability of “Socio–Ecological systems”

Lead Contact: FUKUI Hiromichi (fukui@fsc.chubu.ac.jp)

The “socio-ecological systems” sustainability study aims to develop a comprehensive understanding of the interplay between humans and nature and enhance socio-economic resilience. Specifically, we seek to quantify the relationship between ecosystem services and human social activities from the past to the present and visualize the interdependent and competing relationships, with a focus on geographical connectivity and material cycles. We invite research proposals to explore the optimal balance and design strategies for the future, using spatiotemporal analysis, spatial correlation mapping, telecoupling analysis, and other relevant methods



The Center has continuously promoted joint research on ecology and ecosystem services, primarily through “Category 2: Specific Case Studies of Problem Complexes.” This category is recognized as an essential element for constructing a sustainable Earth and human society. By accumulating research in this field, we aim to deepen and accelerate the quest for the sustainability of “socio-ecological systems” through the interdisciplinary fusion of research in humanities and social sciences concerning human society and ecology and biology. The “Digital Earth,” which has the ability to visualize and analyze information on ecosystems obtained from advanced earth observation and social big data in an integrated manner, will play a fundamental role.

For instance, the global carbon dioxide emissions from human activities, the carbon dioxide absorption by terrestrial vegetation and coastal seaweed beds, and biodiversity indices are mapped and the changes that would occur if human lifestyles and economic systems were to be altered are comprehensively examined to determine a sustainable global land use plan known as GeoDsign.

To promote joint research with the researchers at the Center in charge of Digital Earth, at least one researcher specializing in humanities and social sciences field and at least one researcher specializing in ecology- or biology-related field must participate in the joint research organization for this project.

Category 1: Integration of technical components for Digital Earth

1-1: Development of high-performance API platform and apps for sensing data utilization

Lead Contact: HONDA Kiyoshi (E-mail: [hondak@fsc.chubu.ac.jp](mailto:hondak@fsc.chubu.ac.jp))

Under this topic, research and development is conducted to utilize remote sensing data from satellites, aircraft, and UAVs, as well as from field sensors (land, sea, air), and to integrate it all in the form of web services using standard data models and APIs (WCS under OGC, WMS, SOS, etc.). Data sources include the latest large-scale satellite data platforms such as Tellus, Copernicus, and GEE. It is anticipated that research projects will develop portability-oriented apps utilizing data APIs and high-performance analytical APIs mainly for agricultural, environmental, and disaster information services. It is expected that researchers will consider how to ensure interoperability through standard models. Encouraged research projects include applications to make effective use of OGC data, API services, data standard models and services, or high-performance APIs, or to integrate one or more of them.

1-2: Construction and analysis of basic data and visualization of uncertainty (3D data, chronological data)

Lead Contact: WATANABE Nobuya (nov@fsc.chubu.ac.jp)

The handling of uncertainty was one of the core issues in communication challenges between science and the public as revealed by the earthquake- and tsunami-related disasters that occurred in March 2011. Uncertainty is a broad and deep issue that manifests itself not only in measurements and analytical results, but also in all kinds of ways in terms of spatial boundaries, temporal boundaries, and in the classification of events, etc. Digital Earth has a particular emphasis on urban areas with high population densities, but it is important to ask, how should we perceive and communicate about human activities, which are inherently so dynamic and characterized by uncertainty. Two research topics have been established, as follows:

Research topic 1: Research to construct and analyze basic information on urban areas

Research that focuses on the uncertainty inherent in fundamental data that are essential in urban areas (e.g., demographics), and is conduct on methods of construction and analysis of this fundamental data, as well as accuracy and error, issues with statistical aggregation, and methods of representation.

Research topic 2: Research on methods to visualize and represent uncertainty

Research that examines methodologies to visualize the degree of uncertainty in spatio-temporal data in easy-to-understand ways, and geobrowser-based methodologies to achieve concrete representation of uncertainty in 3D and time series data.

### 1-3: Development of science communication systems

Lead Contact: FUKUI Hiromichi (fukui@fsc.chubu.ac.jp)

In matters that involve more than one conflicting perspective, it is hoped that by helping the proponents of each perspective to reach a deeper level of evidence-based dialogue using the Digital Earth Room at IDEAS, they can determine whether the conflicting perspectives can move closer together or will remain apart. The issues will be discussed while a variety of evidential information is displayed, so that expertise may be applied in “methods for open communication through deliberate and evidence-based discussion,” and optimal approaches may be applied for the provision of information.

In effect, it is hoped that where the subject matter relates to phenomena ranging from the local to the global level, the ability to visualize matters at multiple levels of resolution using Digital Earth will help to clarify the overall nature of the issues and more precisely define areas of concern, thereby fostering more objective thought.

As for specific issues to be handled, a priority will be given to dealing with responses to disasters, global warming and climate change, but other important topics that reflect the current state of society may also be considered. However, it is hoped that geospatial information will be emphasized as the information being used as evidence.

## 1-4: Application of Big Data Analysis to Digital Earth

Lead Contact: SUGITA Satoru (satoru.sugita@fsc.chubu.ac.jp)

With improved performance of information and communications technologies and various types of sensors, the spread of cloud computing, and rapid progress being made in high speed networks, a vast amount of data is being instantaneously collected and accumulated for many different purposes, and through the utilization of such big data in recent years, we can expect to see the emergence of new academic fields and innovations. In particular, significant progress has been made in artificial intelligence and machine learning in recent years using big data as the knowledge base. In consideration of that, research proposal will be invited conducted on the following two topics.

### Research topic 1: Research on methods for analysis of big data

We are calling for research on statistical methods to extract rules from 3D time series big data by observation, measurement and computer simulation, where inherent rules or principles may seem complex at first and not easily understood. For data analysis, an emphasis is placed on dynamic (Lagrangian) rather than static (Eulerian) analysis in order to understand non-linear phenomena. In recent years, there has been some discussion about the limitations of local models, but emphasis with the research topic will be placed on model development methodologies that connect both the local and the global.

Technically, the project will cover big data analysis methods that utilize artificial intelligence with a focus on machine learning, data collection and analysis methods that utilize Open-source Intelligence: OSINT.

In the area of big data addressed in this research topic, any area of data can be considered if it will contribute knowledge from the research findings to Digital Earth, such as climate change, population location information, economic indicators, and epidemiology, etc.

### Research topic 2: Research on handling of big data and contributing to solutions to specific complex systemic problems

There are various risks today from the local to the global level, such as environmental problems, complex wide-area disasters, global warming, and the spread of infectious diseases. Risks are interrelated and when combined create complex, systemic, cross-disciplinary problems. This call for applications is for research to handle big data related to these complex systemic problems and obtain concrete results that contribute to solutions.

## Category 2: Digital Earth applications to address complex systemic problems

### 2-1: Digital Earth applications for disaster prevention and reduction

Lead Contact: IZUTSU Jun (izutsu@fsc.chubu.ac.jp)

Japan and Asia are in a region of the world where wide-area and complex natural disasters occur on a scale often unmatched elsewhere, such as earthquakes (main shocks and aftershocks) and subsequent tsunamis, as well as floods and landslides caused by typhoons and torrential rains. These wide-area complex natural disasters can be characterized as complex systemic problems that involve a mix of scientific and societal aspects, and it is anticipated that through specific case studies researchers will utilize and apply Digital Earth to examine responses and countermeasures to these kinds of disasters, including disaster prevention and mitigation.

Accordingly, it is anticipated that research and development will be conducted to create useful frameworks for disaster prevention and mitigation, through the use of Digital Earth to integrate a variety of disaster-related information. As a specific example, this could be data-driven research on what kind of disaster prevention and mitigation information can be provided in the form of services that represent a variety of geophysical observation data (e.g., meteorological, seismic data, and crustal movement data from the Japan Meteorological Agency and the Geospatial Information Authority of Japan) and how the results of analysis using that data can be represented via Digital Earth (e.g., disaster prediction and damage prediction based on past cases). Conversely, this could be service-driven research to examine what kinds of data and what kinds of analyses and systems are needed to provide certain types of information services for disaster prevention and mitigation (e.g., what kinds of services would be effective for determining the area of wind and flood damage in a disaster, and what kind of data and systems would be needed to provide those services).



## 2-2: Digital Earth applications for environmental and energy-related issues

Lead Contact: TAKEJIMA Kiyoshi (takejima@fsc.chubu.ac.jp)

This research is to propose and create prototypes of services that can be realized by creating new information related to the environment and energy, and applying it to Digital Earth. Examples include the following:

- 1) Research on the development of an environmental information platform and usage services covering the environment, energy, disasters, etc.
- 2) Research on self-sufficient and decentralized procurement of essential energy and food needed by humanity and society, and consensus-building initiatives using Digital Earth to realize self-sufficient and decentralized communities.
- 3) Initiatives to design and implement online “citizen science” projects that recruit volunteers (mainly with no scientific training) to collect local environmental data, collect data using participatory GIS, and activate environmental communications regarding topics such as watershed-based environmental management and regional energy supply/demand issues, while providing easy-to-comprehend overviews of the results.
- 4) Initiatives aimed at maintaining fundamental content related to the environment, energy, disasters, and other relevant topics and the construction of a clearinghouse that provides easy access to these contents using AI and helps in data collection and maintenance.

Priority will be given to research that will lead to specific services that utilize Digital Earth for climate change responses, the realization of a decarbonized society, and more.

## 2-3: Digital Earth applications for Sustainable Development Goals (SDGs) indicators

Lead Contact: FUKUI Hiromichi (fukui@fsc.chubu.ac.jp)

In September 2015, the UN Summit on Sustainable Development was held at the United Nations Headquarters in New York, where 193 member states adopted the declaration “Transforming our World: the 2030 Agenda for Sustainable Development.”

The Agenda sets out a declaration and targets as an action plan for people, planet and prosperity, and its Sustainable Development Goals (SDGs) consist of 17 goals and 169 targets. In March 2017, the 48th session of the UN Statistical Commission agreed on 232 global indicators to measure progress on the SDGs. It is believed that the SDGs and global indicators can be used to guide the activities of all stakeholders involved in sustainable development, including Japanese government agencies, the private sector, and NPOs, etc.

However, the concepts of the global indicators are not necessarily based on definitions and awareness held in common across the world. Thus, they have been classified into the following three tiers. (Reference, UN Statistical Commission: <https://bit.ly/2x36kzP>)

- Tier 1: Indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced...
- Tier 2: Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced...
- Tier 3: No standards are yet available for the indicator...

Meanwhile, discussions are underway under the Global Earth Observation System of Systems (GEOSS) regarding nine Societal Benefit Areas (SBAs, namely, disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity), and each SBA also has Essential Variables that are closely linked to the achievement of the SDGs.

Thus, research and development is encouraged relating to the development of frameworks to visualize and assess the level of achievement of the SDGs by integrating a variety of information into Digital Earth relating to the global indicators and Essential Variables.

Below are specific examples:

- 1) Collection of data and visualization on maps of data relating to the SDGs goals, targets, and global

indicators (especially those in Tier 3). Efforts to assess the achievement level of activities of each stakeholder, and to develop frameworks to provide feedback to the activities of each stakeholder.

2) Development of processes to encourage consensus-building relating to future activities of stakeholders, based on the visualized achievement levels and assessments.

3) Consideration of essential data and services that could be offered by Digital Earth so that Digital Earth can contribute to the SDGs, plus the development of prototypes. This could include specific data inventories, catalogs and collection methods, etc.

## 2-4: Digital Earth applications for One Health issues

Lead Contact: YASUMOTO Shinya (yasumoto\_s@fsc.chubu.ac.jp)

The concept of One Health emphasizes the need to comprehensively understand not only humans but also other animals, plants, climate change, disaster risk, and various other phenomena to preserve human health amidst rapid globalization. Spatial information technology is expected to play an important role in research focused on One Health.

The COVID-19 pandemic that started in early 2020 is an example that shows the importance of spatial information technology in One Health. In Japan, GIS was used to visualize the progression of infection cases on a map, showing the number of cases in each prefecture, municipality, or facility within a more detailed geographic area; furthermore, it was utilized for smooth information sharing and communication.

During the state of emergency, restrictions were imposed on people's movement. However, data on the number of people that went out were collected using the GPS built into smartphones and other devices. Spatial information technology has also been utilized to construct forecasting models for infectious disease outbreaks and to analyze the environmental and social impacts of voluntary restraint during a declared state of emergency.

This theme involves research and development aimed at developing comprehensive measures to preserve human health by integrating information related to One Health into the Digital Earth. Some examples of issues include the following.

Below are some examples of possible research topics.

- Research to clarify trends in infectious disease outbreaks and enable predictive simulations of epidemics
- Research that contributes to risk management such as the prevention of health risks and establishment of measures, by identifying populations vulnerable to infectious diseases, the distribution of medical resources, and places where outbreaks are likely to occur, etc.
- Research to provide materials that can be useful for measures and to develop effective communication tools, by collecting and visualizing information on health risks.
- Other