

1. Introduction of the laboratory

Transmit a common understanding that transcends language through satellite images.

Geomatics Engineering Laboratory

Professor Yuji KUWAHARA

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Introduction

Geomatics Engineering Laboratory is a laboratory for studying 1) geospatial information related technologies (4S: RS, GIS, GPS, Sensor) & AI in construction-related fields, 2) environmental measurement technologies, 3) new technologies for telemetry (mainly from the air: processing and analysis of UAV images), 4) ground experiments to confirm sensor performance, and 5) geographic information generation and processing systems for environmental and disaster prevention. This laboratory mainly studies aerospace surveying of national land space, which covers information generation and design of processing systems. If described in the existing field of civil engineering, it is a laboratory that specializes in "surveying," "spatial information engineering," and "urban spatial analysis." One of the features of the career paths of students in this laboratory is that almost all of them have entered the master's course. In this laboratory, we hope that you will go on to the master's course. After that, the students in this laboratory mainly find jobs in aerial surveying companies, construction consulting firms, geographic information vendors, and big manufacturing companies. We believe that a good job for you is aligned with your self-realization as an engineer or researcher, so please feel free to write your resume or entry sheet, etc., and bring it with you. We will write down some harsh comments to help you get through the selection process, so please refer to them.

There are three main activities in the laboratory: seminars, conference activities, and writing theses. The following is an explanation of each of these activities. We are looking forward to welcoming you to our laboratory.

Research Environment

When you enter Geomatics Engineering Laboratory, you will probably be told to "clean up" and "keep things tidy". The purpose of this is not just to keep the room clean and tidy. I encourage you to keep your room tidy, clean your room, and come to school at a certain time in the morning (9:30 in the lab) because it will help you develop a rhythm in your life. I am certain that a professional interviewer can immediately know if a person is following a systematic rhythm and is enthusiastic about their studies and research. You can't do this with a sense of urgency!

Seminar

In our laboratory, we form groups according to the research theme fields shown in Figure-1, and create an environment where we can brush up our research content and support each other, always with the connection of "M2-M1-B4". The seminar will be held once a week, and students will report on what they have done that week using ppt. Graduate students will ask questions according to your ppt. Professor will ask only the core questions, so please feel free to defense. Taking research notes is necessary for every seminar. Please make your weekly milestones clear in the seminar.

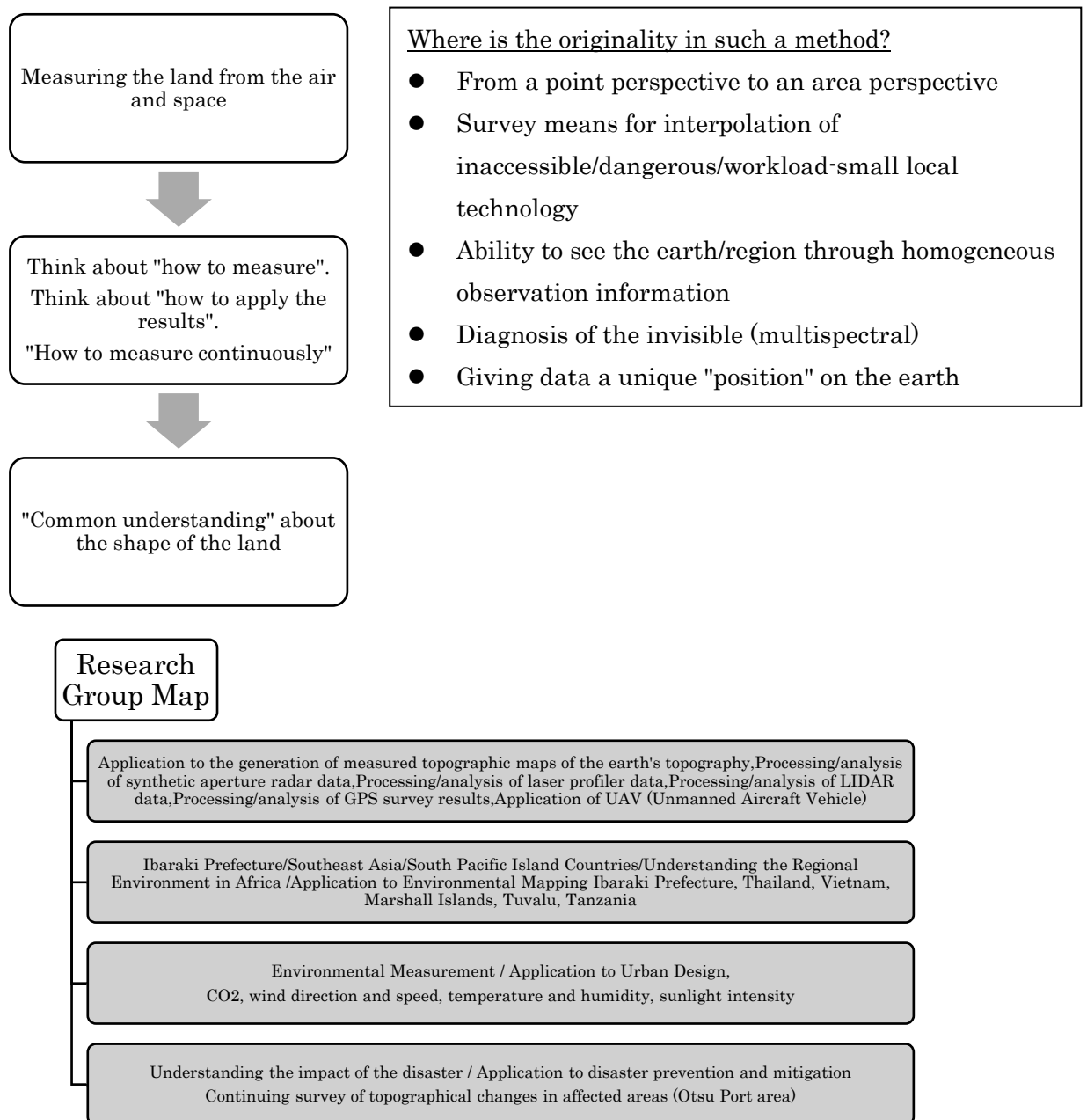


Figure-1

Academic Conference Activities

In our laboratory, we are actively involved in both "participation" and "planning and management" of lectures, symposia, and workshops organized mainly by " The Japan Society of Civil Engineers (JSCE), The Remote Sensing Society of Japan (RSSJ), and Japan Geoscience Union (JpGU)". This is a unique opportunity to get the latest information from people outside the university, so be sure to participate actively.

Writing a thesis

Theses can be divided into two types: "dissertations" such as graduation theses and master's theses, and "academic research papers" such as journal articles. Dissertations are compulsory written by all students. In addition to that, students are required to write an "academic research paper" in this laboratory. It may be a little bit difficult to write it during the master's course, but when you thoughtfully write a thesis, you can learn a lot of common sense in academia, such as "logical structure, what is an easy-to-understand text, and the importance of credits such as reference citations". For this reason, we have made it compulsory for all master's students to write one paper, regardless of the outcome. Why don't you take up the challenge? What you get out of it is different for each person, but I am sure that you will gain valuable experience.

Other Features

As a characteristic of our research field, we actively propose and participate in fusion research projects with other fields (cross-departmental/faculty, cross-industry/government/academia, international collaborative research, etc.) We aim to grow as one of the laboratories responsible for this type of research (research form). We are looking forward to working with all of you freshmen, so please consider joining us. (by Yuji KUWAHARA)

Geomatics Engineering Laboratory

Yuji KUWAHARA

Born on May 1, 1968

Born in Hadano, Kanagawa Prefecture, raised in Oyama, Tochigi Prefecture, engaged in research on satellite remote sensing and geographic information analysis since 1994. I have no likes or dislikes. I drink and eat anything. When I get tired, I tend to get a sore throat and have no voice.

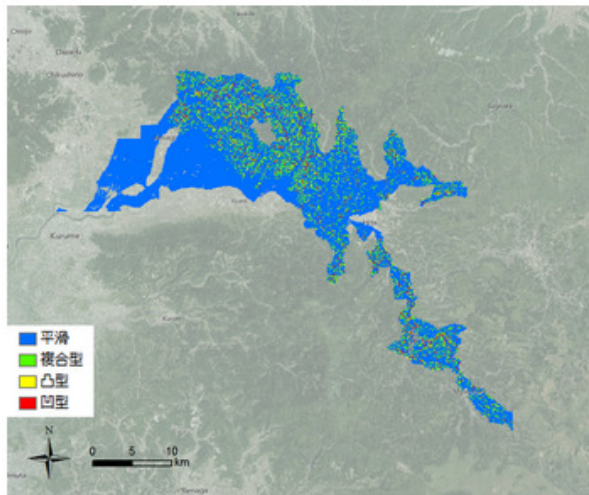
<p>For provisionally assigned students: If you have already been assigned, I will hold a welcoming seminar on Friday, October 22, 2021 (just a tentative schedule). Please be sure to make time for it.</p>

2. Outline of Research Projects

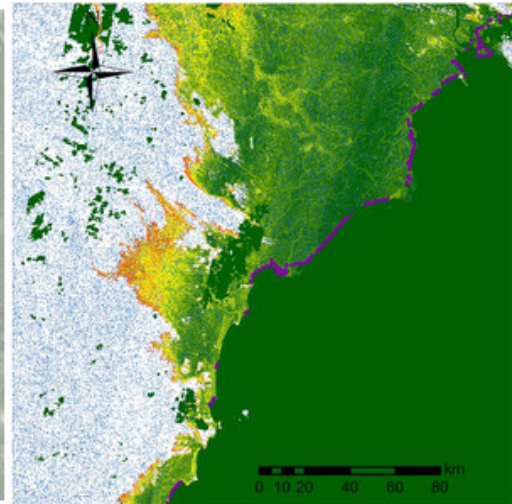
In the Geomatics Engineering Laboratory, we focus on the development of basic technologies and analytical applications so that society can realize the application of spatial information-related technologies in the conservation of the natural environment and land management. As many of our predecessors have pointed out, there are many limitations and problems with conventional systems and technologies to counter the future decline in the number of workers in construction-related industries and to improve international competitiveness. In the Geomatics Engineering Laboratory, we respect various research fields and aim to propose new spatial information-related technologies for "conservation of the natural environment and national land management". We are working on applied research topics that organically combine multi-scale earth observation data (ground, air, space) and spatial information using the time axis.

Application of satellite remote sensing technology for the conservation of the natural environment and land management

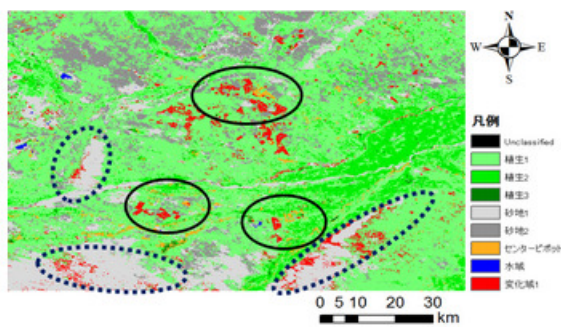
- ◇ Research on the effective estimation method of driftwood disaster risk areas
- ◇ Time series analysis of long-term land cover change and its direction in semi-arid land
- ◇ Time-series analysis of long-term land cover change and its direction in semi-arid land (targeting the Ar Horqin Banner in Inner Mongolia)
- ◇ A study on the method of generating global levee data
- ◇ Proposal of a new green area evaluation index focusing on the variation of CO₂ concentration
- ◇ Research on liquefaction damage using synthetic aperture radar (for Hinode area, Itako city)
- ◇ Study on time-series biomass data for all of Japan
- ◇ Research on the evaluation of beach management projects in South Pacific island countries



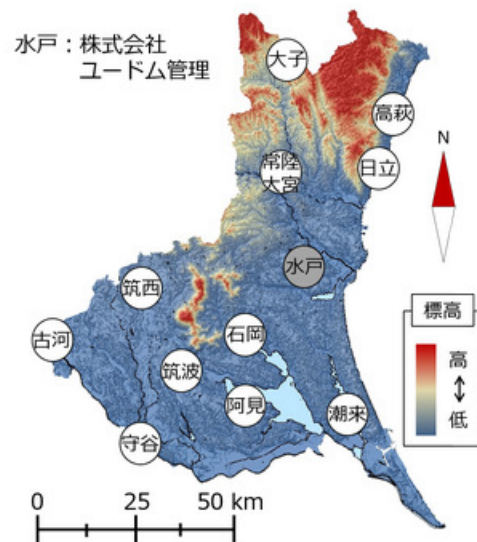
Topographic analysis for identifying driftwood damage locations



Dike extraction in Vietnam



Land cover change in Inner Mongolia using satellite images



CO2 observation points in Ibaraki prefecture

Development of innovative technologies through technological integration of ICT and multiple fields

- ◇ Study of flood prevention using AI technology
- ◇ Extraction of slope disaster areas in steep mountainous terrain by using super-resolution technology
- ◇ Verification of the resolution characteristics of UAV-mounted cameras and investigation of the island environment



Flood countermeasures in Sawatari River



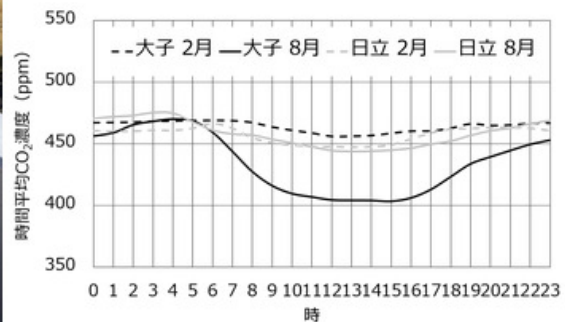
Extraction of slope disaster areas in Nepal

Development of environmental measurement technology by using multi-scale big data

- ◇ Experimental study for estimating the effective range of observation of fixed-point observation data (for CO₂ concentration measurement)
- ◇ Analysis of the trend of long-term CO₂ concentration data variation in the living environment (in Ibaraki Prefecture)



Stevenson screen for observing CO₂ concentration



Change in CO₂ concentration per hour

The challenge to new technology

- ◇ Generation of information on marker points using a laser scanner
- ◇ 2-way CO₂ sensor
- ◇ Atmospheric CO₂ observation using the DOAS method (Differential Optical Absorption Spectroscopy)
- ◇ Generation of evacuation support information MAP
- ◇ Creating SafetyMAP and future simulation
- ◇ Development of duck damage prevention system in lotus field using infrared camera and drone

3. Laboratory Members (FY2021)

Faculty

Yuji KUWAHARA

Dr. Eng., Professor

Faculty Member, Global and Local Environmental Co-creation Organization (GLEC),
Ibaraki University

Faculty members who graduated from our lab (working on the same project)

Teppeï ISHIUCHI

Dr. Eng., Assistant Professor, School of Business and Regional Development, Miyagi
University

Researchers working together on research projects

Osamu SAITO

Dr. Eng.

Part-time Lecturer, Department of Information Engineering, Ibaraki University /

Part-time Lecturer, Faculty of Informatics, University of Tsukuba

Fukuyama Consultant / Udom Co.

These are the researchers who collaborate with us on each project or theme. They are
not exclusive to the Research Group.

Overseas Researcher, Ibaraki University

Wudabalaqiqige

Researcher, Ph.D

The Graduate School of Science and Engineering, Doctor's Program

Social Infrastructure System Science

D4]

Takahiro KIKUCHI

D3]

Koji SHIMAZAKI

The Graduate School of Science and Engineering, Master's Program

Major in Urban and Civil Engineering

M2]

Takashi KIGURE

XU Yuyang

Takumi SHINBO
Shingo TOYODA
Hikaru YOSHIDA
LI Han

M1]

Masato OGASAWARA
Yuko SATO
TAN Yan Ling
GONG Nan

Postgraduate, the College of Engineering

-

**Department of Urban and Civil Engineering, the College of Engineering
Undergraduate**

B4]

Yuki NAKAI
Yoshihiko MURANAGA
Yoshiyuki MORISHITA
Karen WATANABE

Students in the lab

We all get along very well in our lab, from seniors to juniors!

When we get tired from our research works, we chat with each other at the big desk in the student room. When we have free time, we go to the nearby convenience store together. We also like to gather in izakaya to have a drink. (We are currently refraining from doing so because of the Covid-19.) When we do research, we do research seriously, and when we play, we play with all our might.

4. Introduction to our research environment

Based on the recognition that the maintenance of the physical and human environment is the first step in safety management, we have taken the following measures through discussions between faculty and students. Necessary equipment is being purchased regularly, and it will be fully used once installed. Although not all of the equipment is the latest model, it is maintained with an emphasis on function.

For physical safety

Eliminate taco-style wiring using OA strips, protection against lightning currents entering through LAN cables, protection of data servers using UPS, full installation of LCD monitors, fixing of furniture to walls (earthquake countermeasures), permanent installation of gargle corners and sterilizing alcohol corners, and installation of CO2 concentration measuring devices (improvement of indoor air quality).

Protection of information

Thorough user management of servers, regular backup of server data, resident virus software designated by the IT department, room access control (using student ID cards), CD/DVD protection by installing lockable storage devices, management of equipment and supplies lists using the intranet

To ensure the health and physical condition of users

Take a walk or stare into the distance after working for an hour straight, ventilate the room frequently, throw away garbage regularly, keep the room tidy.

Student Room

This is the student room, where all students from 4th year to Dr. share the large desk. We believe that the most effective use of a fixed space is to ensure that students have the appropriate space for their needs. The desks are also equipped with four LAN cables and a PC for common use. However, it is important to handle personal valuables, so each student has one locker space with a lock. There are many bookshelves on the north wall, and each student is assigned a space (roughly two levels) to put their books and other materials. This room is managed by M1, who is in charge of garbage management, arranging necessary equipment, and others.



Surveying Machine Space

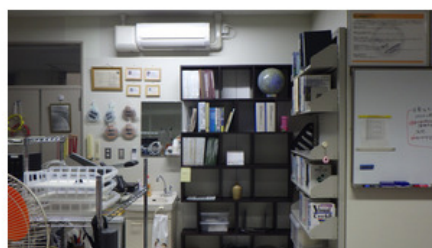
In our laboratory, we have our GPS equipment, total stations, and auto-levels for surveying. In 2010, we introduced a new total station for student training. To utilize these items for a long time, we have set up this space to place them. The total station is placed on a steel frame to prevent injury from the tripod, and the battery charger is placed via an OA tap to prevent fire from occurring during charging.



Analysis Room

This room is set up for the analysis of satellite data and geographic information. A PC and related devices are placed in front of the entrance, and a record is taken automatically with a faculty/student ID card when entering and leaving the room. So, students in the research group always carry their faculty/staff/student ID cards in their name folders as name tags. We also post announcements to warn students about using the PC for more than one hour continuously. We have also installed a CO2 concentration measuring device to monitor the air quality in the rooms (especially to prevent influenza in winter). The faculty and staff conduct a simple operation check almost once a week to ensure that the PC is always working properly.

The number of PCs is 11 (one of them is a server) based on the number of assigned students. All PCs are installed with software for writing texts, tables, presentations, editors, a C language compiler, image analysis software, GIS engine, and dedicated software for satellite data analysis. In addition, 3D computer graphics software and dedicated software for aerial photogrammetry have been installed so that many spatial information analyses can be performed in this analysis room. A huge amount of files are generated, but in this regard, we have set up one (Tera) server for each of the following two perspectives: 1) storage of work-in-progress files, and 2) storage and retrieval of original and completed data and papers from all PCs.



Kim Jinyoung Clock

This is a clock donated by Dr. Kim Jinyoung of the University of Tokyo, who was involved in the research activities of our research group until 2009. We will do our best to make a research discovery and achieve a result corresponding to the amount of time engraved on it.



Preparation Room

This room is located in the N3 building, which is different from the student rooms and the analysis room that are located in the S2 building. The preparation room is equipped with the necessary workbenches, tools, and equipment for environmental observations and experiments. In addition, two new advanced PCs have been installed, which are used for processing high-resolution images taken by UAVs and performing heavy analyses such as inundation simulations. In addition, meeting space has been installed and used for research meetings and presentation practice. In all of these rooms, it is essential to keep them tidy to ensure "safety first" and "to be able to find what you need when you need it."



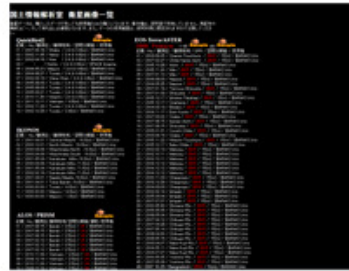
Intranet

There is an enormous amount of equipment used in research, such as satellite data, geographic information, paper maps, surveying equipment, and surveying instruments. These devices must be "working properly" and "ready for use" when needed. For this reason, we have established an intranet to allow users to search for

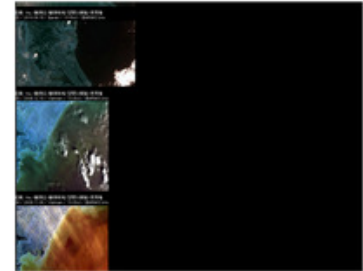
information on where and what information is available. These operations, information construction, and organization are the result of the efforts of faculty, staff, and students working together.



IntraPages Home Page



IntraPages Satellite Image List



Intra Page Sample

Images

Scanner

The long-awaited color image scanner for A0 size has been installed. There are many documents such as maps and drawings that exist only in paper form. This scanner is being used to transfer these materials to the PC. We hope to use it with utmost care.

Printer

We have a color laser multifunction printer, an A1 inkjet printer, and a duplex inkjet printer (A3 printer). We usually use the inkjet printer with recycled paper. The color laser and A1 printer are used mainly for publishing documents.

File Server

This is a device for storing important data. It is equipped with an uninterruptible power supply so that it can cope with unexpected power failure. The user management and file management of this device are updated and changed regularly.



Air conditioning equipment

Air purifiers and humidifiers are installed in the student rooms and analysis rooms to prevent allergies and dryness.



Measures against COVID-19

As measures against COVID-19, we have newly installed transparent boards, plastic partitions, and alcohol for hand disinfection. In addition, we try to ventilate the room frequently. Moreover, all PCs have been equipped with webcams and headsets for remote conferencing.