TU-TUAT WISE Joint Workshop

Natural Disasters and Their Countermeasures from the Perspective of the Interrelationship Between Human and Nature

Friday, December 18, 2020
@ Fuchu, Tokyo and
Sendai, Miyagi

TU-TUAT WISE
Joint Workshop
2020

ご挨拶

はじめまして、本ワークショップ運営代表の東京農工大学卓越大学院プログラムの荒田洋平と申します。

私は、2020 年 3 月に修士課程を東京農工大学国際環境農学専攻で修了し、同年 4 月から、同大学の連合農学研究科環境資源共生科学専攻の博士課程の学生として卓越大学院プログラムに参加しています。私は流域水文生態系管理学研究室（研究室長：五味高志教授）に所属し、地震後の山地上流域内の水文・地形プロセスの解明から、その後の豪雨に伴う土砂災害に向けた対策強化を目指しています。

一方で、災害リスク軽減では、自然プロセスの場に基づくハザード評価のみならず、暮らしの場における地域脆弱性や曝露状態の評価も重要であり、これらの両方面に着目した検討をしていく必要があります。そこで、文理融合型教育基盤とする多様な学生が参加し、自然プロセスの場や暮らしの場に関する災害対策研究・活動が精力的に実施されている東北大学卓越大学院プログラムと協働でワークショップを開催することで、災害リスク軽減に向けた各「場」における課題やその解決策について検討する機会が創出されると考えました。

さらには、学生を中心としたワークショップとすることで、世界的に国際防災戦略の節目である 2030 年や、気候変動に関する環境問題や自然災害などで注目される 2050 年に向け、その時に主役となる私たち若手研究者のネットワークを活性化することも視野に入れています。今回は、東北大学と東京農工大学による比較的、規模の小さなワークショップになりますが、様々な専門分野の学生が参加しますので、これを契機に様々な共同研究や起業案の創出など、皆様の将来の可能性を広げる一助となればと思っております。

最後になりますが、今回のワークショップ開催にあたり、運営者として最初に声を挙げていただいた東北大学卓越大学院プログラム生の迫中あやめさんと Jiang Mingjin さん、さらには農工大生からは佐藤龍さんと宇川千夏さん、Liu Zitong さんには、右も左も分からない私のサポートをしていただきました。ありがとうございます！

荒田 洋平

Greeting

Hello! My name is Yohei Arata, I am a Ph.D student from the TUAT WISE program and the leader of the TU-TUAT Joint Workshop.

I have completed the Master's degree in Agriculture in March 2020 at the department of International Environmental Agricultural Science, Tokyo University of Agriculture and Technology. From April 2020, I am a first-year doctoral course student at the department of Symbiotic Science of Environment and Natural Resources, United Graduate School of Agricultural Science, and join the TUAT WISE program. I am currently conducting a research project with Dr. Takashi Gomi in Watershed Hydrology and Ecosystem Management Laboratory. My research topic is to evaluate both hydrological and geomorphological processes in headwater catchments affected by earthquakes, which can contribute to the development of disaster countermeasures associated with subsequent extreme rainfall.

In Disaster Risk Reduction (DRR), however, it is important to evaluate not only hazard assessments based on natural processes, but also the vulnerability and exposure based on social conditions, and we need to consider both of these aspects at the same time. To realize it, I have decided to hold the workshop by collaborations with students from the WISE program of Tohoku University, which focuses on the interdisciplinary approach based on the integrations of literature and science and their contributions to disaster countermeasures. Organizing the workshop with them can create an opportunity to discuss the challenges and solutions for DRR in both “Natural process” and “Society condition”.

Furthermore, through holding the student-centered workshop, I hope to revitalize the network of young scientists who will play a leading role in 2030, a turning point in the global strategy for disaster reduction, and in 2050, a time when environmental issues and natural disasters related to climate change. Although this workshop is a relatively small-scale collaboration between Tohoku University and Tokyo University of Agriculture and Technology, as students from various fields will join, I hope it will be a good opportunity for you to start various joint research projects and start-ups in the future.

Finally, I would like to express my gratitude to Ayame Sakonaka and Mingjin Jiang, students from the WISE program of Tohoku University, who were the first to speak up as organizers of this workshop, as well as Sato Ryu, Ukawa Chinatsu, and Zitong Liu from the TUAT WISE program. They have been fully supporting me. Thank you very much!

Yohei Arata

謝辞

本ワークショップの開催にあたり、東京農工大学卓越大学院プログラム（「超スマート社会」を新産業創出とダイバーシティにより牽引する卓越リーダーの養成）と、東北大学卓越大学院プログラム（変動地球共生学卓越大学院プログラム）、および関連機関の先生方には大変お世話になりました。特に、東京農工大学卓越大学院機構長の五味高志教授には、東北大学へのファーストコンタクトから運営方針まで、ご丁寧にご指導いただきました。東北大学卓越大学院プログラム長の中村美千彦教授には、企画提案にご快諾いただき、多くのご支援を賜りました。東北大学の新谷直己助教には、運営方針や会場セッティング、企画の周知まで、多大なるお力添えをいただきました。東京農工大学卓越リーダー養成機構の一條洋子特任准教授には、会場セッティングに関する多くのアドバイスをいただきました。東京農工大学卓越リーダー養成機構の金子聖子特任助教は、農工大卓越大学院全体へのご連絡を快く引き受けていただきました。東京農工大学卓越リーダー養成機構の柴田玲奈様には、開催周知に関するリーフレットへの作成や、それらの大学内への掲示にご協力していただきました。東北大学卓越大学院プログラム支援事務の山岸幸子様には、ワークショップ企画の円滑な推進や、東北大学卓越大学院全体への開催周知にご尽力いただきました。国立研究開発法人土木研究所の小柳賢太氏と KPMG ジャパンコンサルティングの塩野拓氏は、ご多忙の中、基調講演をご快諾いただきました。東北大学と東京農工大学からの発表者の皆様は、ワークショップの趣旨にご賛同いただき、発表依頼をお引き受けいただきました。最後になりますが、本企画の実現のために、多くのご支援とご協力を頂きました皆さまに対しまして、心より感謝申し上げます。

本ワークショップは、令和 2 年度東京農工大学卓越大学院プログラムのプロポーザル型プロジェクト経費により遂行されたものです。この場を借りて御礼申し上げます。

ワークショップ運営者一同

Acknowledgment

For holding this workshop, we would like to thank the faculty members of WISE Programs of Tokyo University of Agriculture and Technology (TUAT) (Excellent Leader Development for Super Smart Society by New Industry Creation and Diversity) and Tohoku University (WISE Program for Sustainability in the Dynamic Earth), as well as associated institutions, for their great supports. We are deeply grateful to Dr. Takashi Gomi, Director of WISE Program of TUAT. In particular, he gave us careful guidance, such as the first contact with Tohoku University and the management policy. Dr. Michihiko Nakamura, Director of WISE Program of Tohoku University, kindly agreed to our proposal and provided us with a lot of supports. Dr. Naomi Araya of Tohoku University gave us insightful comments and suggestions in terms of management policy, venue setting, and dissemination of the plan. Dr. Yoko Ichijo of TUAT gave us a lot of advice on venue set-up and warm encouragement. Dr. Seiko Kaneko of TUAT graciously agreed to contact the entire TUAT Outstanding Graduate School. Ms. Reina Shibata of TUAT kindly supported us to publicize to the entire TUAT in terms of making a leaflet and displaying it in TUAT. Ms. Sachiko Yamagishi of Tohoku University promoted the workshop plan smoothly and publicized it to the entire WISE Program of Tohoku. Mr. Kenta Koyanagi of the Public Works Research Institute and Mr. Taku Shiono of KPMG Japan Consulting kindly agreed to give the keynote lecture despite their busy schedules. We are grateful to the presenters from Tohoku University and TUAT for agreeing with the purpose of the workshop and accepting our request to present. Lastly, we would like to express the deepest appreciation to all those who have helped to realize this project.
This workshop was funded by the Proposal-based Project of WISE Program of TUAT.

All coordinators of the workshop

趣旨と目的

「自然プロセスの場」と「暮らしの場」における課題を、学際アプローチから特定し、
その課題解決に向けた最新技術を紹介する

災害リスク軽減は、持続可能な資源の利活用や安心・安全な社会の実現において必要不可欠である。この災害リスク軽減の検討では、自然プロセス・現象由来のハザードと社会システム由来の脆弱性や曝露の 3 要素が重要である。特に、近年の災害事例では、「自然プロセスの場」における気候変動に伴う集中豪雨や大型台風、および大規模地震の頻発化などの想定外のハザードに相まって、「暮らしの場」における防災文化や土地利用、農業、インフラなどの社会システム上の脆弱性や曝露により被害が拡大していることが予想される。このような複雑な災害に対して、私たちが備えていくために、本ワークショップでは、社会と自然の「場」に関わる若手研究者を集め、学際的なアプローチから各「場」における災害リスクを理解し、その軽減に向けた課題の抽出や最新技術の紹介をすることに焦点を当てた。

ゴール

災害リスク軽減に向けた、"研究や防災計画の方向性提示"や
"次世代を担う若手研究者のネットワーク醸成"から、2030 年の仙台目標に貢献する

私たちの暮らしを劇的に変化させる自然災害に対するリスク軽減は、人口増加やそれに関連する食糧危機などの問題と相まって、近年ではさらにその重要性が高まってきている。これまでの世界の災害リスク軽減への取り組みとして、1990 年代では、国連総会が「国際防災の 10 年」を提唱し、2000 年代では、国連防災世界会議で 2005 年に"兵庫行動枠組 2005-2015"、および 2015 年に"仙台防災枠組 2015-2030"を採択してきた。特に、仙台枠組では、気候変動などに伴う災害の多発を受け、2030 年までに大幅に災害リスクを軽減することを目標としている。これらの枠組みを推進していくために、日本の内閣府では、2020 年に「防災×テクノロジー」タスクフォースを設置し、ICT や新たな技術を活用した防災強化を検討している。特に、この中では、発災時対応やその後の復旧・復興の迅速化や効率化、省力化に焦点を当てている。これに対して、より被害を軽減していくためには、発災前における地域の災害リスクを理解し、それに備えることが重要であり、科学的なアプローチが欠かせない。本ワークショップは、ここに焦点を当て、分野横断による検討から、リスク軽減における課題を抽出し、今後の研究や防災計画の方向性を提示することを目標としている。さらには、本ワークショップで、これからの世代を担っていく様々な分野の若手研究者を収集することで、ネットワークの醸成を促し、仙台枠組における 2030 年目標への到達に貢献する。

Purpose and Objective

Identification of the issues in nature and society for DRR and introduction to advanced technique to solve them

Disaster Risk Reduction (DRR) is one of the most important issues for the utilization of sustainable resources and the realization of safety and secure society. DRR consists of 3 factors: hazards based on natural process and phenomena, and vulnerability and exposure based on social systems. Particularly, in recent disaster cases, unexpected hazards associated with climate change and frequent earthquakes coupled with vulnerability and exposure associated with social conditions, such as culture, land-use, agriculture, and infrastructure might have increased damages on society. To prepare for such complexed disasters, this workshop has gathered young scientists working in fields of society and nature to understand and find disaster risks in each field by the interdisciplinary approach. Then, we discuss the issues and advanced techniques for DRR.

Goal

"Providing directions for research and disaster mitigation planning" and "Developing a network of young scientists for the next generation" for DRR to contribute to the Sendai goal of 2030

DRR has become even more important in recent years, coupled with population growth and associated food crises. Previous global efforts to reduce disaster risk include the United Nations General Assembly's "International Decade for Disaster Reduction" in the 1990s, the United Nations World Conference on Disaster Reduction's "Hyogo Framework for Action 2005-2015" in 2005, and the "Sendai Framework for Disaster Risk Reduction 2015-2030" has been adopted. In particular, the Sendai Framework aims to significantly reduce disaster risk by 2030, in response to the high incidence of disasters caused by climate change and other factors. In order to promote these frameworks, the Japanese Cabinet Office has established a task force on "Disaster Prevention x Technology" in 2020 to study the use of ICT and new technologies to enhance disaster prevention. In particular, the task force focuses on speeding up, streamlining, and labor-saving in disaster response and subsequent recovery and reconstruction. On the other hand, to mitigate the damage, it is also important to understand and prepare for local disaster risks before an event occurs, and a scientific approach is essential. Hence, the goal of this workshop is to identify issues in DRR from a cross-disciplinary perspective, and to suggest directions for future research and disaster prevention planning. Furthermore, the workshop has gathered young researchers with various backgrounds, who will be responsible for the next generations to develop a network and contribute to reaching the 2030 goals of the Sendai Framework.

Workshop Logo

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地球を連想させる球を、自然プロセスの場を象徴した緑色と、暮らしの場を象徴した青色が絡み合う図形によって描き、各「場」が融合して生じる災害を表現しています。

地球から空に向かって飛び立つ様な緑色と青色の 2 つの軌道は、国と研究領域の壁を超えて研究者同士が連携し、自然現象・防災研究の更なる発展や、学問的なブレークスルーを創出するという、本ワークショップに込めた願いを表現しています。

マークの全体を囲む力強い赤色の軌道は、これからの自然現象・防災研究を支える若手研究者の姿を表現し、自然と人間とが共生しながら、より安全で豊かな未来を築いていきたいという、私たちの強い思いを託しました。

The sphere, which is reminiscent of the earth, is depicted with intertwined shapes of green impressing the “Natural process fields” and blue impressing the “Society condition fields”, to visually represent the disasters that occurred due to the interaction of each "Fields".

The two green and blue orbits soaring from the earth to the sky represent this workshop’s goals, which is to trigger academic breakthroughs and further advances in the Geoscience and Disaster Science via international and interdisciplinary collaboration of researchers.

The red orbit surrounding the entire symbol represents a young researcher who is responsible for the future. The symbols having the rich meanings that come together to shape the logo, and our strong will that we will continue striving to realize the enriched and safety society in harmony with the nature.

ワークショップにおける新型コロナウイルス感染症対策

東北大学-東京農工大学協働ワークショップ 2020

1. ワークショップ開催の遵守事項

① 都道府県知事からの施設の使用の制限・休止の要請があった際は，適切に対処する．講演会場 (東北大学 青葉山キャンパス・東京農工大学 府中キャンパス) または会場の所在地域の学校が臨時休校を行った場合，ワークショップの休止を検討する

② 新規感染者数が増加・感染がまん延している場合は，ワークショップをオンライン主体とする．オンラインのみでの開催が難しい場合は，現地参加人数を削減して，現地開催とオンライン開催を併用するなど感染拡大防止対策に努めた上で実施する

③ 緊急対応のできる連絡網等を整備する

④ 参加者の体調管理には十分に留意してもらうようお願いし，体調不良の場合は参加を控えてもらう

2. ワークショップ当日の対策

① 参加者にマスク着用をお願いする．忘れた方に対してはスタッフより配付する

② 受け付けは設置せず，注意事項は会場のスライドに映写する

③ ワークショップ当日に検温を行い，下記に該当する場合は来場を控えてもらう

- 37.5 度以上の発熱があった場合 (本人の平熱より 1 ℃以上高い場合)
- 風邪症状のある場合
- 味覚・嗅覚障害，息苦しさ (呼吸困難)，強いだるさ，咳，咽頭痛等の体調不良がある場合
- 新型コロナウイルス感染症の陽性者と濃厚接触がある場合
- 海外から入国し 14 日を経過していない場合
- 海外から入国し 14 日を経過していない者と濃厚接触がある場合

④ アルコール消毒液を出入口及び会場内に設置し，出入りの際などに手指消毒を徹底する

⑤ 配布資料は，あらかじめ座席に置いておく．また，PDF 版のみの配布に限定する

⑥ 他人と共用する物品や手が頻回に触れる箇所を最低限にする．接触が多い部分 (講演用 PC，マイクなど) は，使用者が変わるごとに消毒液 (消毒用エタノールや次亜塩素酸ナトリウム等) で清拭する

⑦ 会場における参加者座席の間隔を 1~2 m 確保する. 座席は, 隣との間隔を空けて使用し，講演者との距離が近い席などは使用しない

⑧ 使用できない席には，張り紙を張る

⑨ 講演者の移動経路を指定し，講演者同士の不用意な接触が起こらないようにする

⑩ 身体的距離の確保として，人と人との間隔は最低 1 m 開ける．対面で会話する機会はなるべく減らし，やむを得ない場合は真正面の位置を避けて必要最小限の会話のみ行う

⑪ 風通しの悪い空間を作らないようにするために定期的に換気を行う．また，感染拡大予防の観点から室内のドアを開放する場合があるため，各自で防寒用具の準備をする

⑫ トイレは，感染リスクが比較的高いと考えられるため，使用時は感染対策を徹底するよ

う留意する．トイレの蓋を閉めて汚物を流すよう徹底し，使用後は手洗い及び手指の消毒を行う

⑬ ゴミの廃棄について，鼻水，唾液などが付いたごみは，ビニール袋に入れて密閉して縛り，個人で持ち帰る

⑭ 準備・片付けにおいては決まった人が行い，主催者管理のもと消毒作業を徹底する

⑮ 会場内においては密を防ぐため，会場正定員の半数以内でワークショップを実行する

⑯ 場内では，マスクを着用する．マスクの着用ができない場合は，必要最小限の会話とし，対面での会話は禁止とする

⑰ 大声での会話は禁止とする

⑱ エレベーターの使用は原則禁止とする

⑲ ワークショップ終了後はスタッフが室内の消毒を徹底する．消毒薬はアルコール 70%以上の薬液か次亜塩素酸ナトリウム 0.05%溶液（保健所推奨濃度）を使用する

3. 終了後

① 帰宅後も，体調管理に留意してもらう

② 終了後に，感染が疑われる者が発生した場合は，保健所等の指示に従い，必要な情報収集・情報提供を行う

参考 URL:

「催事等開催時の新型コロナウイルス感染症予防ガイドライン」

令和 2 年 6 月 16 日東北大学新型コロナウイルス感染症対策本部

https://www.bureau.tohoku.ac.jp/covid19BCP/pdf/staff/event_guidelines_ja.pdf

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Guide to Prevent the Spread of COVID-19 Infection in the Workshop

TU-TUAT WISE Joint Workshop 2020

1. Compliance Rules of the Workshop

i. When there is a request from the prefectural governor to restrict or suspend the use of facilities, we will take appropriate measures. If the lecture hall (Tohoku University Aobayama Campus, Tokyo University of Agriculture and Technology Fuchu Campus) or the school in the area where the venue is located temporarily closes, consider suspending the workshop.
ii. If the number of newly infected people is increasing or the infection is widespread, the workshop will be mainly online. If it is difficult to hold the event only online, reduce the number of local participants and take measures to prevent the spread of infection, such as using both the local event and the online event.
iii. Prepare a contact network that can provide emergency response.
iv. Participants are requested to take care of their health and refrain from participation if they are not feeling well.

2. Measures during the Workshop

i. Participants are requested to wear the masks. For those who have forgotten, staff will provide.
ii. No reception desk, cautions are projected on the slides in the venue.
iii. The temperature measurement of all participants will be conducted on the day of the workshop. Refrain from participating in the following cases,
iv. The temperature is more than 37.5 °C (or 1 ° C higher than your normal temperature) or if you have a cold symptom.
v. Illnesses such as taste or smell disturbance, breathlessness (dyspnea), severe lethargy, cough, or sore throat
vi. Close contact with a COVID-19 infected person
vii. Travelled to countries/regions where the government has announced that entry restrictions, or observation periods after entry are required or have close contact with the person concerned within the past 14 days
viii. Set hand sanitizer in the entrance and inside the facility, To prevent infection, disinfect your hands when entering the venue.
ix. Put the handouts on your seat in advance. It is also limited to distribution of the PDF version only.
x. Minimize the items shared with others and the places where your hands frequently touch. Regularly clean the parts that come into contact with each other (lecture PC, microphone, table, chair back, door, electric switch, faucet, etc.) with a disinfectant solution (rubbing ethanol, sodium hypochlorite, etc.) each time the speaker changes
xi. Keep a distance of 1~2 m from each seats and sit at least one seat away from anyone else. Avoid using seats that are too close to the speaker.
xii. Put up signs on unavailable seats.

xiii. Designate the speaker's moving route to prevent inadvertent contact between speakers.

xiv. Keep a distance of at least 1 m from each other. Avoid face-to-face opportunities as much as possible. If unavoidable, avoid a face-to-face position and have only minimal talking.

xv. Try to ventilate diligently so as not to create a poorly ventilated space. Since the door inside the room may be opened from the viewpoint of preventing the spread of infection, please prepare warm clothing.

xvi. Toilets are considered to have a relatively high risk of infection, so thorough infection control measures should be taken when using them. Close the lid of the toilet and make sure that the filth is flushed.

xvii. Regarding the disposal of garbage, put the garbage with runny nose, saliva, etc. in a plastic bag, seal it tightly, and take it home personally.

xviii. The preparation and tidying up should be performed by the decided person, and the disinfection work should be thoroughly carried out under the control of the organizer.

xix. In order to prevent crowding in the venue, the workshop will be held within half of the capacity of the venue.

xx. Wear a mask in the hall. For people who did not wear a mask, the minimum required conversation is allowed but face-to-face conversation is prohibited.

xxi. Avoid loud conversations

xxii. Using the elevator generally prohibitedAfter the workshop, the staff will thoroughly disinfect the room. Use a chemical solution of more than 70% alcohol or a 0.05% sodium hypochlorite solution (concentration recommended by the public health center) as the disinfectant.

3. After the Workshop

i. Take care of yourself after you return home

ii. If participants is suspected of being infected after termination, follow the instructions of the health center and provide the necessary information.

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Time schedule

Session 1: Opening remarks and Invitation (9:45 - 10:55), Chair person: Ayame SAKONAKA (TU WISE)				
9:45 - 9:55	**Opening remarks**	Yohei ARATA (TUAT WISE)	Purpose, objective, goal of the workshop	
9:55 - 10:25	**Keynote**	Kenta KOYANAGI (PWRI)	How to connect oru findings to disaster risk reduction (DRR)	P.16
10:25 - 10:55	**Keynote**	Taku SHIONO (KPMG)	BCP (Business Continuity Plannning) and utilization of digital technology: Advance measurements for "natural disasters x business" by Japanese companies	P.17
10:55 - 11:05 Coffee break				
Session 2: Natural process causing disasters (11:05 - 12:05), Chair person: Ryu SATO (TUAT WISE)				
11:05 - 11:20	**General**	Rasis Putra RITONGA (TUAT WISE)	Examining the Influence of Two Different Vegetation Covers on Landslides Triggered by the 2018 Mw6.7 Eastern Iburi Earthquake Hokkaido	P.18
11:20 - 11:35	**General**	Rozaqqa NOVIANDI (TUAT WISE)	Evaluating the mobility of landslides with volcanic deposits: A case study of the 2018 Eastern Iburi earthquake, Hokkaido	P.19
11:35 - 11:50	**General**	Masanari ARAO (TU WISE)	Volcano - benefit and damage -	P.20
11:50 - 12:05	**General**	Shaoyuan PAN (TU WISE)	MPM-FEM hybrid analysis for coupling between submarine landslide and tsunami	P.21
12:05 - 13:00 Lunch time				
Session 3: Social conditions and disasters (13:00 - 14:00), Chair person: Chinatsu UKAWA (TUAT WISE)				
13:00 - 13:15	**General**	Gina Ko (TU WISE)	Long-term impact of temparature rise on rice yield in Japan	P.22
13:15 - 13:30	**General**	Anna SHINKA (TU WISE)	The Analysis of the Tsunami Evacuation Behavior Combining Transition of Thinking with Movement Path: The Case of Hashikami Area, Kesennuma City	P.23
13:30 - 13:45	**General**	Tomohiro NOMURA (TUAT WISE)	A strategy for the development of surper typhoon-resistant rice varieties with strong culms	P.24
13:45 - 14:00	**General**	Shodai INOKOSHI (TUAT WISE)	How can we secure watersources during a disaster?	P.25
14:00 - 14:10 Coffee break				
Session 4: Introductions to advanced disaster countermeasures (14:10 - 15:10), Chair person: JIANG Mingjin				
14:10 - 14:25	**General**	Ryu SATO (TUAT WISE)	Design a process on precursor of levulinic acid production from waste biomass under recyclable catalysis for natural disaster prevention and instead fossil foil dependence	P.26
14:25 - 14:40	**General**	Keisuke MATSUMURA (TUAT WISE)	Energy harvesting powered IoT sensor devices	P.27
14:40 - 14:55	**General**	Mboup AISSATOU (TUAT WISE)	Seismic retrofitting of vulerable RC building by inserting cross-laminated timber panels inside the RC frame	P.28
14:55 - 15:10	**General**	ALJUHMANI Ahmad Ghazi (TU WISE)	Solar energy devices as a countermeasure to disasters	P.29
Session 5: Closing remarks (15:25 - 15:50), Chair person: LIU Zitong (TUAT WISE)				
15:25 - 15:50	**Closing remarks**	Yohei ARATA (TUAT WISE)	Discussion, conclusion and summary	

Keynote Speakers

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Volcano and Debris flow Research Team, Sediment Control Research Group, Tsukuba Central Research Institute, Public Works Research Institute

He is the current enrollment of Public Works Research Institute (PWRI) after MSc in Forest Science, University of Freiburg (Aug. 2019), MSc in Agriculture and Forestry, University of Eastern Finland (Dec. 2019), and Research fellow in Watershed Hydrology and Ecosystem Management Laboratory in TUAT (Mar. 2020). His research interest is sustainable resource management, particularly ecohydrology, geomorphology, natural disaster and remote sensing. Currently, he is focusing on sediment runoff phenomena and countermeasures for large-scale sediment disasters as Joint projects with the government and prefectures in PWRI.

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He is currently in the Director in KPMG’s Japan Consulting Company after completing his Bachelor in Bio Science, Tokyo Institute of Technology. He focuses mainly on Manufacturing/Distributor/IT/Telecommunication industry, Application/Infrastructure integration, Change management, DX (Digital Transformation) strategy planning support, Providing business planning, BPR, RPA/AI/CRM/ERP solutions. He also lectures at seminars and writes technical books.

How to connect our findings to disaster risk reduction (DRR)

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The importance of disaster risk reduction (DRR) has been recognized for decades both domestically and internationally. In Japan, catastrophic typhoons and earthquakes shortly following WWII led to the establishment of a legal framework for DRR. Internationally, Yokohama Strategy and Plan of Action for a Safer World (1994), Hyogo Framework for Action (2005-2015), Sendai Framework for Disaster Risk Reduction (2015-2030) have continuously provided the pathways to build a more resistant and resilient society. Scientific advances have also greatly contributed to DRR by offering novel and better countermeasures. In spite of these enormous efforts, however, our society is still facing greater disaster risks owing to changing society and climate combined with tectonic activities. Therefore, in this workshop, I would like to discuss how we, postgraduate students and early career researchers, can become part of the driving force for DRR based on our own findings.

My presentation provides a case of sediment disaster (土砂災害) in Japan. Beginning with the brief introduction to Public Works Research Institute, PWRI (土木研究所), it focuses on our role, research objectives, and research activities for developing effective DRR. Next, processes and human activities governing sediment disasters are addressed, followed by the frequency and magnitude of sediment disasters in Japan during recent decades. In addition, scientific advances and emerging issues which have shaped current structural/non-structural measures against sediment disasters are overviewed. Then, the relationship between our research activities and DRR are discussed, highlighting a gap between our research and policy which implements countermeasures. Three steps that might help us with bridging the gap are finally outlined mainly based on my own experience.

BCP (Business Continuity Planning) and utilization of digital technology: Advance measurements for "natural disasters x business" by Japanese companies

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Nowadays, with the increase in diverse global risks such as terrorism, natural disasters, and internal scandals, Japanese companies are facing a situation where they never know when a crisis will occur. Once a crisis occurs, it can not only have a direct impact, but can also lead to secondary disasters or damage to the company's reputation, depending on how it is handled.

The World Economic Forum in Davos in 2013 led to the use of the keyword "Resilience" in a variety of fields. In Japan, the introduction of the resilience certification system for companies working on national resilience in 2016. Moreover, the BCP (Business Continuity Plan) for the heavy rains in western Japan and Hokkaido Eastern Iburi Earthquake in 2018 have served as opportunities to reaffirm the need for business continuity plans.

In this lecture, I will discuss the concept of "Resilience" and how companies should build the BCP in the event of the various disasters from the perspective of maintaining supply chains, and how Japanese companies should face the crisis of the disasters under the theme of "Natural Disasters x Business".

Additionally, I focus on the strategy of applying the rapidly evolving digital technology to the natural disasters and business, and introduce examples of solutions that Japanese companies are using to tackle the Digital Transformation (DX) challenge.

Examining the Influence of Two Different Vegetation Covers on Landslides Triggered by the 2018 M_w6.7 Eastern Iburi Earthquake Hokkaido

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A huge amount of sediments originated from thousands of landslides induced by the 2018 M_w6.7 Eastern Iburi Earthquake Hokkaido were transported downstream on hilly topography area (<500 m). The landslides occurred mainly within two different vegetation types which are forested areas (FA) and logged areas (LA). The landslides frequency, size, and mobility within these different vegetation types were examined based on GIS analysis and field survey. A total of 1440 landslide scars were identified in an area of 18.9 km^2 (87% FA and 13% LA). Landslide number density in LA was higher (79 landslides/km^2) compared in FA (76 landslides/km^2). The mean landslide area in LA (mean: 2306 m^2) tended to be larger than that in FA (mean: 1762 m^2). Based on the field investigation, the mean depth of landslides in FA (1.5 m) and LA (1.4 m) were similar, while the mean estimated landslides volumes in FA and LA were 3610 m^3 and 6359 m^3. The mean runout distance of landslides in LA was longer (231 m) than that in FA (146 m). The greater landslides size in LA was possibly associated with the less availability of lateral root networks to provide more cohesive lateral hillslope reinforcement. These differences in landslide size and runout distance in different vegetation types are important for zoning high landslides risk zones in forest management activities.

Evaluating the mobility of landslides with volcanic deposits: A case study of the 2018 Eastern Iburi earthquake, Hokkaido

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Earthquake-induced landslides (EIL) can lead to tremendous destruction of infrastructures and natural resources. Its impacts depend strongly on landslide mobility. Numerous studies showed that landslide mobility is significantly controlled by soil characteristics and water content.

The mobility of landslides with volcanic deposits differs from that with non-volcanic materials. Previous studies showed that landslides with volcanic deposits have higher mobility than those from other sub-aerial settings. However, factors that control such processes are unclear.

More than 6,000 landslides occurred by the Eastern Iburi earthquake, Hokkaido, in September 2018. These landslides transported 30 billion m^3 of volcanic deposits which mainly consist of pumice and andosol. Laboratory tests indicated numerous inner-particle voids on pumice and high organic content on andosol. These features enable pumice and andosol to hold a substantial amount of water.

We used a small flume apparatus to evaluate the mobility of landslides by the Eastern Iburi earthquake (**Fig. 1**). We applied various degrees of saturation on pumice and andosol from dry to saturated (S=0-1). Our experiment showed that landslide travel distance became two times higher when the water-holding capacity of soils is exceeded (**Fig. 2**).

Our findings imply that such high mobility of landslide with volcanic deposits might be associated with high water-holding capacity in soil layers. The variability of mobility might be associated with the variability of water content in soil layers, which is related to the variability of water accumulation by topography and different transpiration rate of vegetation. Findings of this study can be useful for developing zonation for sediment hazard mitigation.

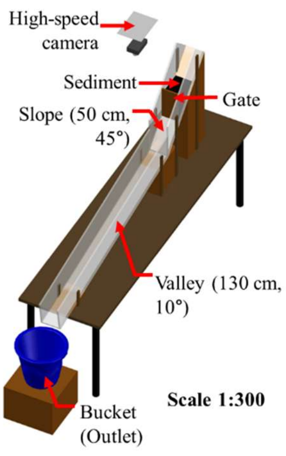

Fig. 1 Flume apparatus

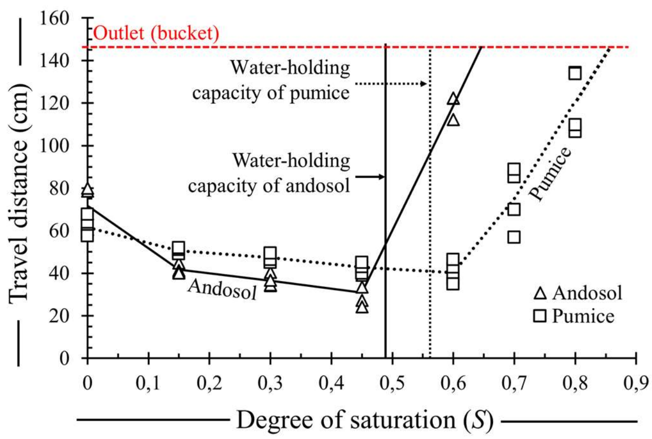

Fig. 2 Travel distance of sediment for various S

Volcano - benefit and damage -

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There are 111 active volcanoes in Japan and about 1,500 in the world. The definition of active volcano is “a volcano that erupted in approximately the last 10,000 years” and/or “a volcano with vigorous fumarolic activity at present.”.

Volcanoes have a deep connection with our daily lives. For examples, volcanic activities provide us resources (e.g, minerals and thermal energy), landscape around volcano is emotional and important tourism attractions. On the other hand, volcanoes have a potential to cause large-scale disasters. Volcanic eruptions cause disaster in various ways: eruptive product (lava flows, volcanic gas, large projectiles, and pyroclastic flows), phenomena following eruptions (volcanic mudflow, snowmelt lahars, large-scale mountain collapse, and tsunami), volcanic earthquakes, and crustal deformation. Especially, large projectiles, pyroclastic flows, and snowmelt lahars offer little lead time for evacuation after the onset of an eruption and thus are positioned as highly hazardous volcanic phenomena in disaster prevention measures.

Volcanic eruptions which cause severe disasters occur with long intervals. Therefore, structural measures (e.g., shelter) and volcanic sediment and erosion control projects are not sufficient to prevent and mitigate volcanic disaster. Rather, it is important to take non-structural measures to improve awareness of local people living around volcanoes for volcanic disasters through disaster prevention education and drills. A well-balanced combination of structural and non-structural measures will lead to disaster prevention and mitigation measures for volcanic disasters.

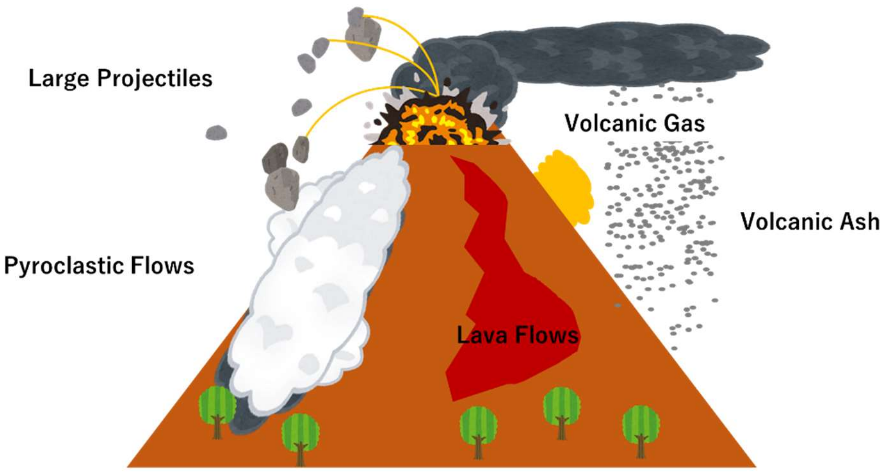

Fig. 1. “Volcanic eruption”

MPM-FEM hybrid analysis for coupling between submarine landslide and tsunami

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Submarine landslide is a natural phenomenon in which sediment on the submarine slope slides down due to external forces, resulting in a series of disasters such as the cutting of submarine cables and submarine pipelines, occurrence of obstacles in resource development facilities, and the occurrence of large-scale tsunami. The occurrence of tsunami caused by submarine landslides has been regarded as a global problem, and there are various research results all over the world. However, the process of submarine landslide has not yet been well understood, due to its complex interactions between seabed and seawater. Recently, some particle methods, such as Smoothed Particle Hydrodynamics (SPH) and Material Point Method (MPM), are proposed to analyze the complex interactions between solid particles and the fluid and to capture the behavior of seawater flow due to collapse of ground. However, there are some difficulties for the representation of tsunami from the viewpoint of calculation cost and accuracy. Based on previous studies, Eulerian methods have been confirmed to be advantageous for the tsunami simulation in comparison with Lagrangian particle methods. Therefore, in this study, we propose a multi-physics hybrid modeling for simulation of tsunami induced by submarine landslide. The MPM is applied to the governing equation of the soil phase and the FEM is applied to the governing equation of the water phase in reference to a previous study using MPM. Several numerical examples, which include the reproduction of a model experiment of impulsive caused by underwater landslide, are presented to demonstrate the applicability of the proposed method to deal with the wide range of behavior of multistage and multi-physics problems.

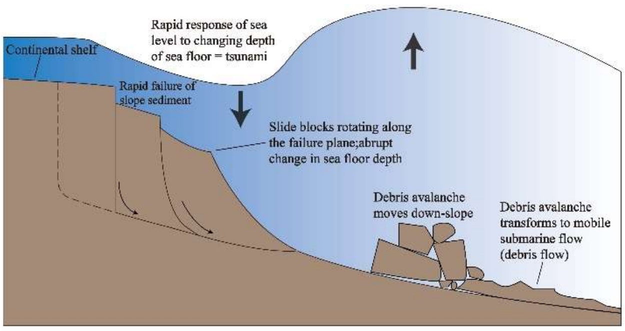

Fig. 1. Tsunami induced by submarine landslide

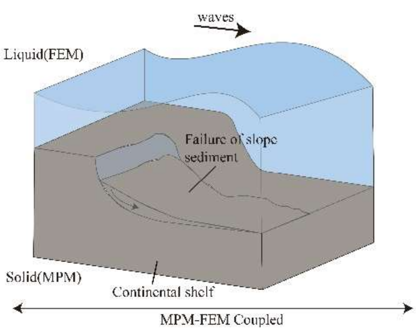

Fig. 2. MPM-FEM hybrid model

Long-term impact of temperature rise on rice yield in Japan

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Global warming is serious future risk to our society and is likely to decrease the productivity of some crops in higher temperature area. Rice is the main crop in Japan, which will be affected by temperature rise. Hence, understanding the temperature impact on rice productivity in Japan is essential. Following Burke and Emerick (2016), we explore the long-term relationship between temperature and rice yield in Japan. In this study we estimate the rice yield model using the city level panel data of northern region (Tohoku area, i.e. a lower temperature region), and southern region (Kyushu area, i.e. a higher temperature region). We consider the threshold temperature in formulating the model. This is because we generally observe that when the temperature exceeds some threshold, higher temperature affects the crop yield negatively, while under the threshold, higher temperature is likely to result in higher crop yield. In this analysis, we searched the threshold in estimation. The main findings are as follow:

(1) The threshold temperature is found to be 24 Celsius.

(2) Higher temperature beyond the threshold leads to significant negative impact on rice yield, while temperature below the threshold leads to significant positive impact on it.

(3) We found weak evidence that rice yield has an inverse U-shaped relationship with precipitation.

(4) Using estimation result, we created a simulation of the impact of future temperature rise by 2 degree Celsius and found reduction by 8.2% in Kyushu area and promotion by 5% in Tohoku area.

The Analysis of the Tsunami Evacuation Behavior Combining Transition of Thinking with Movement Path: The Case of Hashikami Area, Kesennuma City

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This research aims to reveal factors assist or interfere evacuation behavior by developing a method to clarify both the change of thinking and movement path. In this study, we conducted an interview survey to analyze the changes of evacuees' thinking from conversation during the interview. In order to clarify the change of thinking, we coded sentences from conversation using "strongest motive". In addition, the movement path was also analyzed from the map of the evacuation route obtained from interview. The time when evacuees arrived at and leaved each point were estimated by time stamp from conversation, objective information and so on. Then, the latitude and longitude were calculated every second by linear interpolation for movements between points that were difficult to estimate from interview.

The right figure is the one of the results of this research. The top graph is the analysis result of movement path. The movement in the longitude direction can be classified into three clusters as a result of hierarchical cluster analysis and the average movement tendency of each cluster is shown. The middle graph shows the movement tendency of the three clusters in the height direction. The below bar graph shows the time change of strongest motive. From these figures, we can clarify the movement tendency of each cluster and find the reason why the tendency occurred. For example, in cluster B, the movement to the seaside was seen right after the earthquake, and the movement to the inland and the upland started at the time when the tsunami attack might occur, from the analysis of the movement path. From the analysis of the strongest motives and the character of the cluster, many people in this group moved to evacuate their family at seaside right after the earthquake, and many people started to evacuate the tsunami from the time when the tsunami attack might occur.

We would like to make definitive coding rule and create survey/analyzing manual to conduct study in other area as a future study because results are strongly based on the case.

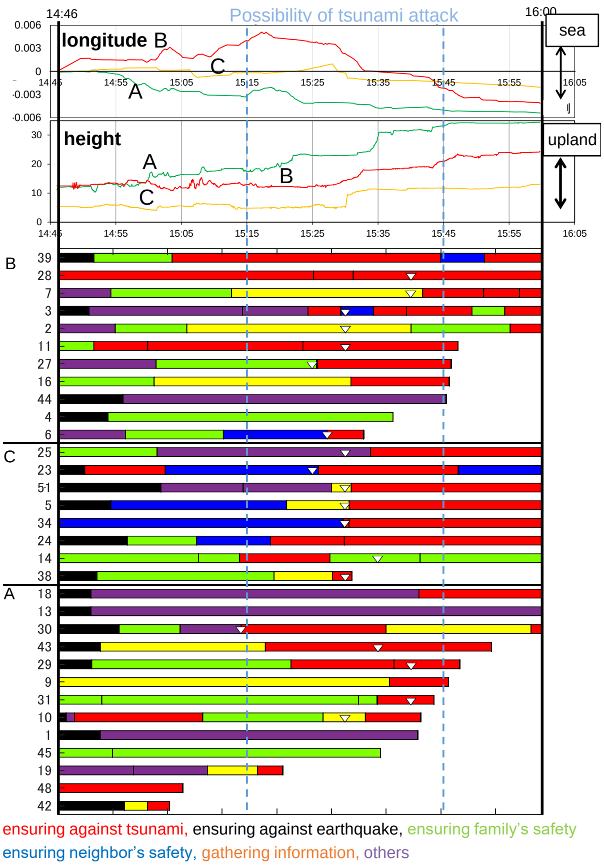

Fig. 1. tendency of the change of moving path and strongest motive

A strategy for the development of super typhoon-resistant rice varieties with strong culms

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Since the "Green Revolution", rice breeding for lodging resistance has been carried out by introducing *semi-dwarf1* (*sd1*) gene (Sasaki et al., 2002). Semi-dwarf varieties relatively resist lodging even under high nitrogen fertilization conditions due to the advantage of short culms. In East and Southeast Asia, however, rising sea surface temperatures due to greenhouse gas emissions may reduce the number of tropical cyclones but increase the size and intensity of each one in the future (Mei & Xie, 2016; Murakami et al., 2020). Recently, the occurrence of lodging has become a problem even in semi-dwarf varieties due to super typhoons such as the Super Typhoon Goni that hit the Philippines (Fig. 1). Therefore, a major shift in strategy will be needed in the future, such as improving lodging resistance by strengthening culms instead of relying on culm dwarfism.

To achieve this strategy, an extremely thick-culm and high-yielding variety, Monster Rice 1, was developed by cross-breeding and selection using the strong-culm and high-biomass variety Leaf Star, the strong-culm and high-yielding variety Takanari, and the high-yielding variety Akenohoshi as parents (Nomura et al., 2019; Fig. 2). In this study, it was shown that, compared with Takanari, Monster Rice 1 had thicker and stronger culms. In addition, quantitative trait locus (QTL) analysis identified QTLs from Monster Rice 1 that were associated with superior strong culm. In the future, it is important to develop varieties that can resist super typhoons by pyramiding strong culm-associated genes, such as *APO1* and *FC1*, which have been identified so far (Ookawa et al., 2010; Yano et al., 2015).

Fig. 1. A semi-dwarf rice variety that was lodged by a typhoon in Philippines.

Fig. 2. Left and right canopies are Monster Rice 1 and Fukuhibiki (a semi-dwarf variety) in Japan, respectively.

How can we secure water sources during a disaster?

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When disaster occur, many houses fall in water outage due to water supply facility destroyed. For example, by 2011 Tohoku earthquake, up to 2 million homes were water outage and water outage could be continued for nearly one month in some cases. In addition, the heavy rain in the July of this year caused water outage more than 30000 houses widespread in Japan. [Fig.1]. That is to say, water security is one of the most important issue during a disaster.

When it comes to securing water in a disaster, it is important to consider the water requirement (amount of water, water quality and location). Our water use can be divided two types, drinking water and domestic water (water for washing and toilet etc.). During the emergency situation, drinking water with 3 litter per days and domestic water (water for washing and toilet etc.) with 20 litter per day per person is required. Drinking water can be supplied by emergency water transport and stored by local and household water stocks. On the other hand, domestic water is typically shorted because it is required more water than drinking water although not as high quality as drinking water is required. Also, because the water is heavy, the place where the water can be secured must be in close. Therefore, it is necessary to consider the close sources of domestic water that can ensure us sufficient water and be available during disaster.

One of the possible candidates for such a water source is water runoff from mountain. I am learning about forest hydrology, which deals with the water cycle in mountainous area. The purpose of this presentation is to give an overview of water use under previous water outage during disaster, and to propose mountainous groundwater as a source of domestic water in emergency from knowledge of forest hydrology.

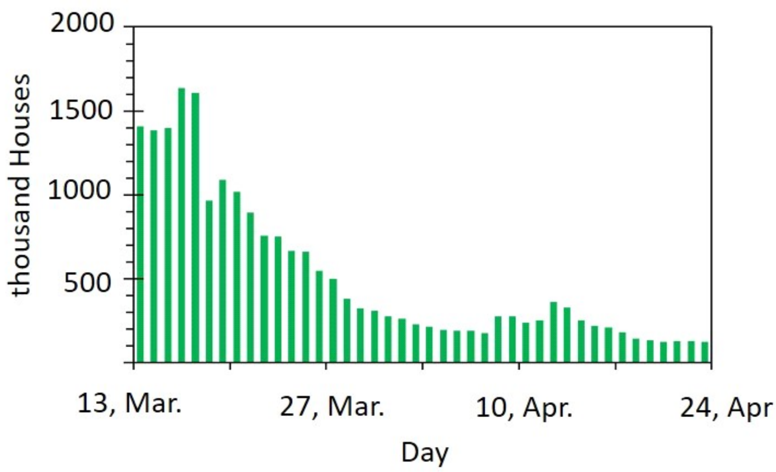

Fig.1. Number of houses of water outages after Tohoku earthquake Tohoku occurred March 11, 2011

Design a process on precursor of levulinic acid production from waste biomass under recyclable catalysts for natural disaster prevention and instead fossil foil dependence

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Renewable energy and chemical production technologies have been extensively developed to reduce CO_2 emission and mitigate the depletion of fossil fuel resources. Biomass, which can be used for not only fuel resources but also chemical resources, has a potential to replace petroleum. Levulinic acid (LA), which was selected as one of the top 12 valuable chemicals by the National Renewable Energy Laboratory (NREL) (Werpy et al., 2004), is a promising platform organic acid in sugar-based biorefinery because LA can be produced relatively easily from cellulose. It can be also converted to fertilizers, pharmaceuticals for cancer treatment, solvents, polymers, and biofuels that do not need engine modifications (Alonso et al., 2013; Christensen et al., 2011; Kasar et al., 2018; Cherubini, 2010; Wettstein et al., 1995; Inoue, 2017; Mukherjee et al., 2015; Heda et al., 2019; Song et al., 2019; Song et al., 2018). Therefore, biomass to LA conversion technologies has attracted great attention. Recently, mineral acid and metal chloride is studied actively for producing LA from biomass. A process of LA precursor production is attracting attention in same time. However, to prevent natural disaster has becoming more important due to the climate changing. Here, the precursor of LA such as aminolevulinic acid (ALA) and diphenolic acid (DPA) have a potential to contribute the disaster countermeasures via renewable resources. In this workshop, presenter is introducing for the how LA precursor can prevent natural disaster and the future prospective of zero–waste process on LA precursor production process to reduce the fossil resources dependence.

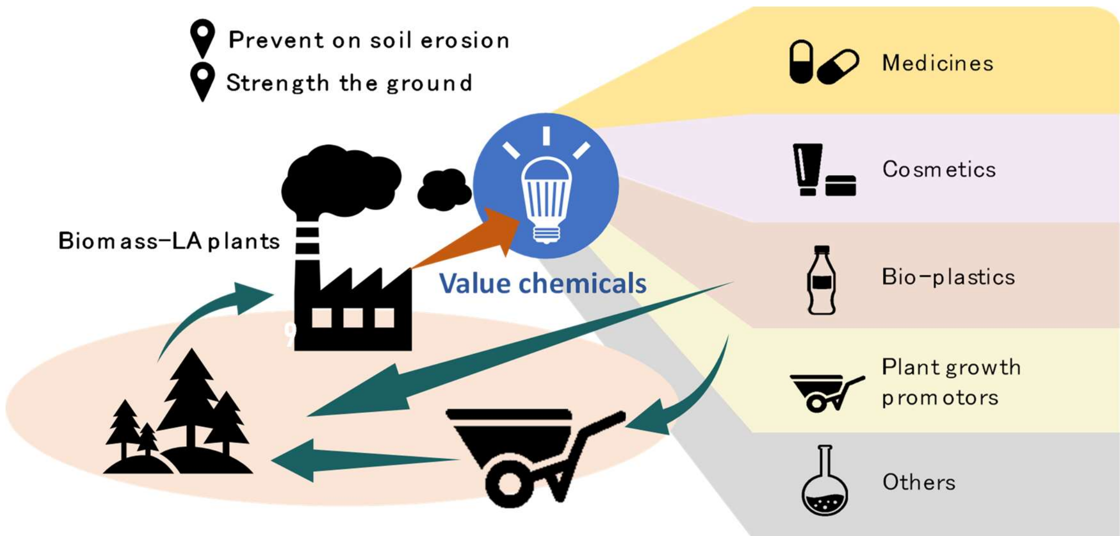

Fig. 1. The contribution of LA precursor production process to disaster countermeasures

Energy harvesting powered IoT sensor devices

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Continuous observation of the natural environment plays an essential role in predicting the occurrence of natural disasters. Installing many sensors, such as those upstream of a river, and continuously collecting local data will enable highly accurate hazard prediction. Such devices, such as sensors connected to the Internet, are called the Internet of Things (IoT) devices, which, in combination with data science technologies, are expected to be an effective way to utilize the information that has not been converted to data. Nowadays, development tools are easy for beginners to use, and it is relatively easy to create an IoT device and a system to collect and analyze data. However, a little knowledge about electronic devices, cloud services, and programming is required for their development. In this presentation, we will introduce a method of building a system for sensing. Specifically, we will describe a design using an AWS cloud server and a wireless communication module called ESP32. Besides, this presentation will introduce energy harvesting as a method of power supply in the natural environment. How to obtain continuous power in the open air is a significant challenge. A system that combines BLE and intermittent operation can dramatically reduce the power consumption of devices and enable them to operate with low power from ambient power.

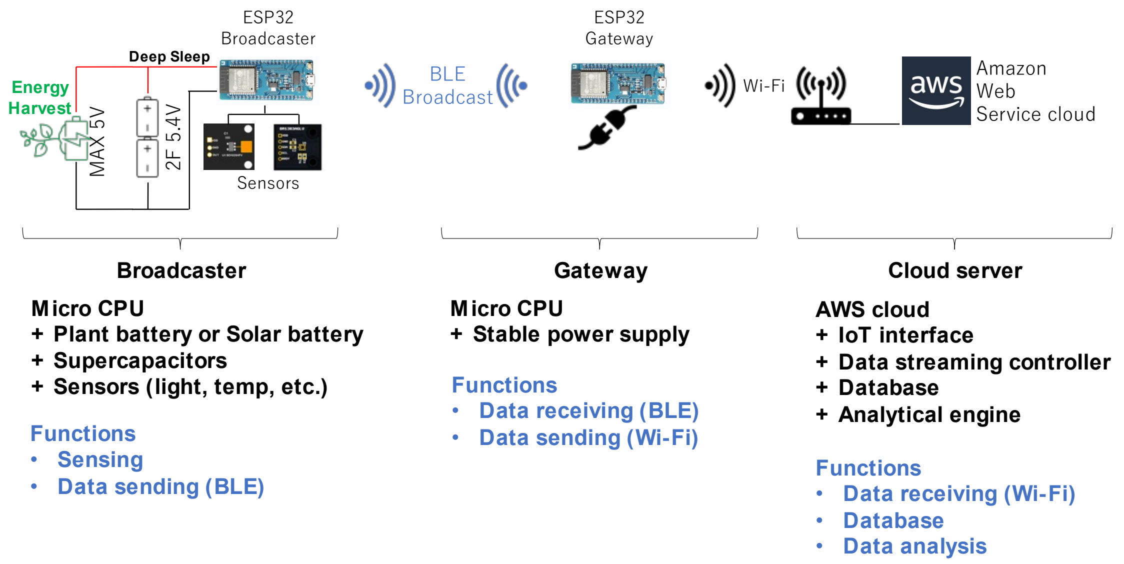

Fig. 1. The architect of the IoT system on AWS

Solar energy devices as a countermeasure to disasters

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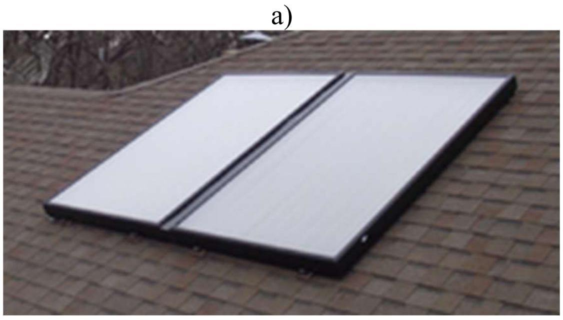
Disasters are now part of our everyday life in Japan and around the world. And we are never prepared enough for them. It also seems that only when disaster strikes, we realize the extent to which we rely on electrical power and heat. Cooking, refrigeration, furnace operation, pumping of gasoline, and even recharging of laptop computers and cellular phones, all require electricity or heat. What we can do is prevention that means thinking in advance about what may happen, plan and design to lessen the damages.

The advantage of solar energy is that it’s available everywhere for free, it is clean and can be transformed in electricity or heat. In this session, we will talk about the topic of solar energy devices. What is solar energy? What kind of solar devices exist? What are their possible applications? How can we use them as a countermeasure to disasters? Taking as an example what happen in Chiba in October 2019, after the typhoon, some people had to wait for weeks before getting back to normal life after power and water outages due to the fallen big trees and so on. Now, imagine having a solar device or multiple solar devices that can be used either individually or in communities to fix these problems or to give an alternative while people are waiting. That is very possible, and some solar devices are already being used in disaster-hit regions and shelters as shown in Fig.1. Feel free to join us to find out more!

a)



b)

Fig. 1.a) Solar panels for Off-Grid and Disaster-Hit Regions. b) Solar collectors installed on a roof

Seismic retrofitting of vulnerable RC building by inserting cross-laminated timber panels inside the RC frame

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Existing reinforced concrete (RC) buildings built before 1981 in Japan have suffered severe damage repeatedly in recent earthquakes such as the 2011 Great East Japan Earthquake and 2016 Kumamoto Earthquake as seen in Fig.1. This problem of existing RC buildings is also a problem worldwide such as the 2009 L'Aquila Earthquake in Italy and the 2015 Nepal Earthquake as seen in Fig.2. In addition to the seismic vulnerability problem, global warming and environmental issues also urge sustainable and eco-friendly materials for improving the seismic capacity of RC buildings to avoid severe earthquake damage. This research aims to reduce earthquake disaster risk by improving the seismic capacity of vulnerable RC buildings by strengthening with Cross-laminated timber (CLT) panels which are a practical eco-friendly retrofitting scheme. Specifically speaking, this research develops retrofitting techniques using the CLT infill panel method.

The existing methods of retrofitting RC buildings are expensive, take time, and are not eco-friendly materials that emit a lot of heat and carbon dioxide and worsen global warming. Therefore, the main goal of this study is to strengthen the seismic capacity of RC frames, either bare frame or by replacing the URM (unreinforced masonry infill) using a practical, eco-friendly, and economical method. This research proposes a retrofit scheme of RC building by installing cross-laminated timber (CLT) panels as shown in Fig. 3 inside the RC frames which will increase both strength and ductility. A schematic diagram of the overall test loading frame is shown in Fig.3. The retrofitted RC frame with CLT panels will be tested under cyclic loadings.

Fig. 1. Damaged RC building in Kumamoto EQ.

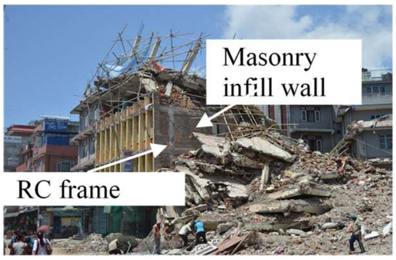

Fig. 2. Damaged RC building in Nepal EQ.

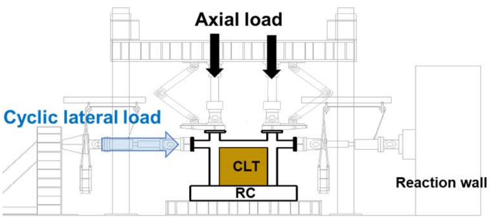

Fig. 3. Schematic diagram of loading setup.

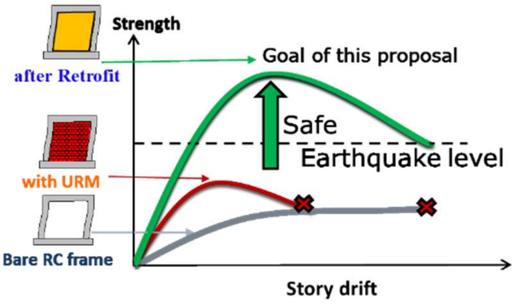

Fig. 4. Expected performance of retrofitted RC frame.

「超スマート社会」を新産業創出とダイバーシティにより牽引する卓越リーダーの養成

東京農工大学卓越大学院プログラム（プログラム名：「超スマート社会」を新産業創出とダイバーシティにより牽引する卓越リーダーの養成）では“新産業創出”と“ダイバーシティ”を特色とし、農学と工学が協創し、民間企業や海外研究教育機関等と協力して、“先端工学技術によって実現する農業流通革命に資する新産業創出”を一つの課題テーマ例とし、様々な研究分野における研究テーマを自由度高く設定して高度博士人材の養成に取り組みます。

新産業創出

成長産業としての農業、エネルギー、AI・IoTをはじめ、多様な分野で連携企業等との“新産業創出コンソーシアム”を組織し、卓越したイノベーションリーダーを養成します。

ダイバーシティ

多様性（性別・国籍・言語・社会経験など）を重視した大学院教育に取り組み、男女共に、国内外の多様な場で活躍する卓越した博士人材を育てます。

農工協創

農

土地利用
感染症
育種・品種
野生動物
大気汚染
植物工場
機密農業
食品機能
森林科学
土壌・水資源

協創

工

センシング
自然エネルギー制御
ロボット
イオン液体
AI
IoT
キャパシタ
イメ-ジング技術
ビッグデータ
バイオ素材

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学務課教育支援室
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WISE-TUAT
東京農工大学
卓越大学院プログラム

Excellent Leader Development for *Super Smart Society* by New Industry Creation and Diversity

The Tokyo University of Agriculture and Technology (TUAT) WISE Program (Program name: Excellent Leader Development for *Super Smart Society* by New Industry Creation and Diversity) The characteristic of the WISE Program is that it features the creation of new industries and diversity. One of the Program's themes is the creation of new industries that revolutionize agriculture and distribution through the application of high engineering technology. This is achieved through agri-engineer collaboration, and cooperation with private companies and overseas research / educational institutions. The Program seeks to nurture advanced PhDs, with scholars having great freedom in setting their research theme from various research areas.

Creation of New Industries

The Consortium for the Creation of New Industries is established with cooperation companies, etc., from a wide range of fields, including growth industries such as agriculture, energy, AI and IOT, to nurture brilliant innovation leaders.

Diversity

The WISE Program engages in graduate education that emphasizes diversity (gender, nationality, language, social experience, etc.). It nurtures brilliant male and female PhDs who will be active in various arenas both in Japan and abroad.

Collaboration of Agriculture and Engineering

Agriculture

Soil Management
Infection
Wild Animal
Nutrition
Plant factory
Smart Agriculture
Soil and Water
Functional Food
Forest Technology
Breeding

COLLABORATION

Engineering

Capacitor
Sensing
Robot
Ionic Liquid
Imaging Technology
AI
IoT
Big Data
Bio Materials
Energy Control

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Tokyo University of Agriculture and Technology
東京農工大学

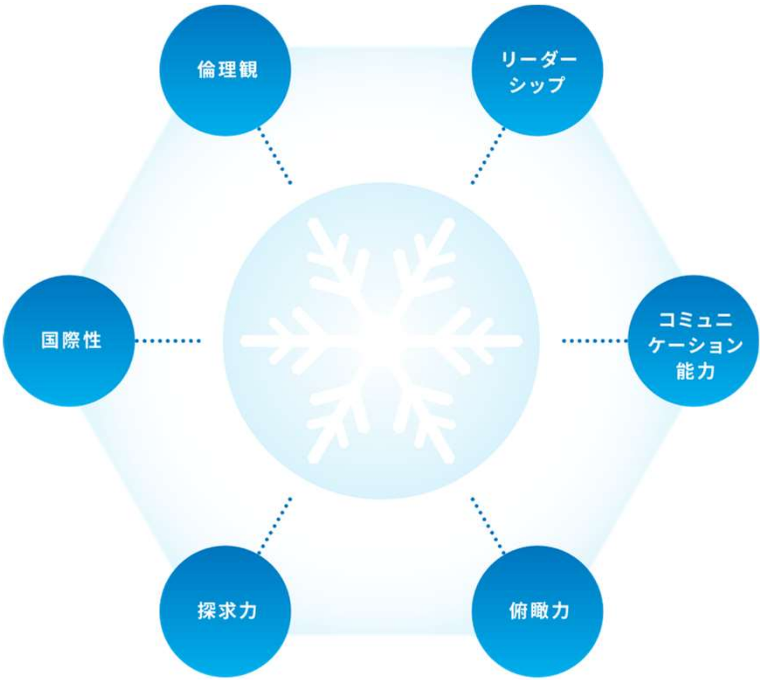
SyDE
WISE Program for Sustainability in the Dynamic Earth

地球を学び、未来を見つめる。
仲間に学び、現場で鍛えられ、
世界で磨かれる。

背景

災害の多くは、環境要因と社会的な要因が複合して発生します。とりわけ近年では、災害が社会条件により、様々な様相を呈する傾向にあります。一方で、多様なリスクを低減し、安全で安心できる持続可能な社会を構築し、変動地球と共生していくためには、自然災害、資源、環境、エネルギーなどといった課題に取り組む必要があります。複雑化し、多岐にわたるリスクと向き合う高度専門人材、実践力を基軸に多角的能力を発揮する個性が待望されています。

人材像



スノークリスタル型人材

プログラムの特徴

３つの教育方針：仲間から学ぶ、現場から学ぶ、世界から学ぶ

実践型文理融合教育、民間企業・団体との協育、国際教育を通じて、スノークリスタル型人材を育成し、社会の期待と産官学の要請に応じえていきます。

世界的防災・減災戦略との連携

震災の経験を知見に編み、優れた人材の供給を通じて、「仙台防災枠組」の実現に貢献していきます。

多様なキャリアパス

大学・研究機関、グローバル企業、官公庁、国際機関など、多様なセクターで活躍します。

東北大学
変動地球共生学卓越大学院プログラム

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SyDE Website https://www.syde.tohoku.ac.jp/

東北大学

SyDE

WISE Program for Sustainability in the Dynamic Earth

Learn the Earth, Find the future.
Study in diversity, on the job,
from the world.

Background

Many disasters are caused by a combination of environmental and social factors. Particularly in recent years, the social factors have led disasters to assume various forms. In order to reduce apparent and hidden risks in the human society, build a safe and secure sustainable society and live on the dynamic Earth, issues such as natural disasters, resource deficit, environment protection, and energy generation need to be tackled. Advanced experts who face complex and diverse risks and employ their multifaceted skills practically are desired.

The ideal candidate

Snow Crystal -like map of human traits

Characteristics of the Program

Three educational policies: learn from peers, train on site, and become refined in the world

Through practical education combining the humanities and sciences, cooperative education with private business and groups and international education, the snow Crystal -like map of human traits are fostered. Thus, the expectations of the society and needs of the industry, government, and academia can be met.

Collaboration for global disaster prevention and reduction strategies

In the future, through our resources and expertise, we will contribute to help achieve the targets of the Sendai Disaster Prevention Framework.

Diverse career paths

Play an active role in various sectors, such as universities and research institutions, global companies, government offices, international organizations.

Tohoku University
WISE Program for sustainability in the Dynamic Earth

Support Office of the WISE Program for Sustainability in the Dynamic Earth E-mail syde-office@grp.tohoku.ac.jp
SyDE Website https://www.syde.tohoku.ac.jp/

TOHOKU UNIVERSITY