Webinar Series on Global Sustainability: Interdisciplinary Discussions on the RISK Mitigation and Global Sustainability

Date: Thursday, 23 December 2021
Time: 16:00- 18:00 pm (UTC +8)

Agenda

Time	Activity
16:00- 16:05 pm	**Opening Remarks** - Professor Jian-Hong Wu Coordinator, Emergent Risks and Extreme Events Working Group, Future Earth, Taipei, Taiwan
16:05- 16:25 pm	**Key-note speech: Risk analysis on the impact area of a large landslide** - Professor Jian-Hong Wu Chairman, Department of Civil Engineering, National Cheng Kung University, Taiwan Coordinator, Emergent Risks and Extreme Events Working Group, Future Earth, Taipei Taiwan
16:25- 16:45 pm	**Key-note speech: Flood Inundation Simulation, Monitoring, and Mapping for Disaster Early Warning and Decision Support in Taiwan** - Dr. Jihn-Sung Lai Research Fellow, Hydrotech Research Institute, National Taiwan University
16:45- 17:05 pm	**Key-note speech: Agricultural Development and Water Supply-Demand Dilemma: Stakeholder-Supported Decision Making for Sustainable Groundwater Management** - Professor & Chairman Hwa-Lung Yu Department of Bioenvironmental Systems Engineering, National Taiwan University
17:05- 17:15 pm	**Coffee Break**
17:15- 17:35 pm	**Key-note speech: What islands can teach us about metabolic risks?** - Professor & Associate Dean Simron Singh, School of Environment, Enterprise and Development, University of Waterloo, Canada
17:35- 17:55 pm	**Q & A Session**
17:55- 18:00 pm	**Closing Remarks** - Professor Jian-Hong Wu Coordinator, Emergent Risks and Extreme Events Working Group, Future Earth, Taipei, Taiwan

Risk analysis on the impact area of a large landslide

Professor Jian-Hong Wu

Abstract

In Taiwan, the heavy rainfall of the Typhoon Morakot in 2009 warns the impact of climate change to change the mitigation policy of landslide disaster. The Hsien-du-shan landslide triggered by the heavy rainfall destroyed the Hsiaolin village near the toe of the slope and killed more than 400 local residents. It is impossible to use the conventional hard countermeasures, such as retaining walls, rock cables, and shotcrete etc., to stop the movement of a large landslide. Therefore, soft countermeasures, such as determine the impact area of a large landslide is considered as an alternative approach to mitigate the slope disasters. Dynamic behavior, contacts between many blocks, and expansive computation costs are major characteristics of a large landslide. Conventionally, the impact area of a large landslide is determined based on empirical approaches. However, local topography is a key factor to cause large variation in the empirical assessment of impact area. It is urgently required to develop a numerical approach to assess the risk of the impact area in a large landslide by explicitly considering the impact of local topography and geometry of joints in the analysis. In this study, we successfully demonstrate the numerical-based risk analysis on the impact area of a large landslide by integrating discrete element method and the point estimation method to assess the risk of the impact area of a large landslide by considering the joint spacing as a variable.

Flood Inundation Simulation, Monitoring, and Mapping for Disaster Early Warning and Decision Support in Taiwan

Dr. Jihn-Sung Lai

Abstract

Floods are the most hazardous natural disasters to cause considerable property damage and human injury. Flood risks increase continuously because of climate change, population growth, and economic wealth. With the demand for development, urban areas in lowlands and other flood-prone regions, along coasts, river floodplains, and inland depressions, are growing worldwide.

In Taiwan, research for the development of flood inundation models for flood risk assessment has been launched since 1984. The flood inundation model was developed to solve the two-dimensional shallow water wave equations, which could successfully deal with the irregular terrain and dry/wet moving boundaries. Many model applications have been implemented to simulate the interaction of storm sewer flow and overland flow during typhoons and storm events in Taiwan. Real-time water-level, velocity, and image monitoring play a key role in informing decision-makers of early warning. A practical flood warning system can be developed on the river basin or the urban drainage systems by integrating IOT technologies. Integrating sensors with a regional wireless sensing network can provide real-time data of water levels or discharges for model validation. Flood inundation map shows where flooding may occur over a range of water levels and flood extents. Coping with flood inundation simulation and monitoring technologies, the flood maps with various flood return-periods scenarios have been developed and applied to disaster preparedness and regional development.

In recent years, continuous researches for the improvement of model applicability with advanced numerical schemes. Moreover, many applications have been practiced to improve flood protection measures and damage assessment, including flood potential maps, risk assessment, vulnerability, and mapping for the operational flood warning systems.

Agricultural Development and Water Supply-Demand Dilemma: Stakeholder-Supported Decision Making for Sustainable Groundwater Management

Professor Hwa-Lung Yu

Abstract

Groundwater overexploitation has caused economic and ecological problems worldwide. Though many countries adopt the policy of restricting groundwater use to mitigate the problems, their implementation often remains problematic due to low compliance with set rules. Limited stakeholder involvement in regulating groundwater usage is considered a pivotal factor to low compliance. At the same time, many factors make stakeholder engagement in agricultural groundwater management difficult. Land subsidence potentially endangers the safety of the high-speed railway in the Choshui alluvial aquifer, which impacts both the local and national sustainable development. Agricultural groundwater withdrawal is commonly considered one of the significant factors for land subsidence. A better water resource or groundwater pumping management strategy is key to agriculture sustainability. However, the water resources are highly associated with the underlying social systems, including local economics, water rights, and farmers' habit of water usage. It is required to account for the relationship between the social systems and water resources utilization to develop the potential solution. In other words, we need to understand the underlying relationships among the major stakeholders and their associations with the water resources usages. The water allocation or delivery should consider the actual supply-demand and the underlying social system structure, regulations, socioeconomic conditions, water rights, and stakeholders' behavioral patterns. Developing a management strategy that fits the mechanisms of social systems will have a better chance to improve irrigation efficiency, reduce groundwater withdrawal, and improve the resilience of water resource systems to environmental disturbances, such as floodings or droughts that result from climate change.

What islands can teach us about metabolic risks?

Professor Simron Singh

Abstract

Small Island Developing States (SIDS) are at a tipping point from climate change impacts. The international community has frequently recognized the adverse effects of global warming on SIDS that significantly hinder their progress towards sustainable development. Many SIDS face additional sustainability challenges such as extensive reliance on imports to meet basic needs, tenuous resource availability, coastal squeeze, and reduced waste absorption capacity. As such, SIDS are consistently ranked high on various vulnerability indices. In this paper, we propose that framing SIDS' vulnerability from the perspective of "metabolic risk" can help identify effective leverage points and adaptation strategies. Metabolic risk is defined as systemic risks associated with the circulation, integrity, and availability of critical resources in a socio-ecological system. The breakdown of societies, such as from geopolitical and financial crises, warfare, ecological collapse by overexploitation of local resources, or climate events, strikes us as a disturbance to resource circulation within the socio-economic-technological complex. We argue that specific combinations and patterns of resource use on islands – qualitatively and quantitatively - and their resistance to change contribute to the system's proliferation of metabolic risk. Interventions will need to employ strategies to reconfigure resource-use patterns and associated services that not only alleviate such risk, but are also sustainable and socially equitable.