

博士論文審査結果報告
Report on Ph.D. / Doctoral Dissertation Defense
National Graduate Institute for Policy Studies (GRIPS)
Professor (joint-appointment) Toshio KOIKE

審査委員会を代表し、以下のとおり審査結果を報告します。

On behalf of the Doctoral Thesis Review Committee, I would like to report the result of the Doctoral Dissertation Defense as follows.

学位申請者氏名 Ph.D. Candidate	Hemakanth Selvarajah		
学籍番号 ID Number	DOC18131		
プログラム名 Program	Disaster Management Program		
審査委員会 Doctoral Thesis Review Committee	主査 Main referee	小池 俊雄 KOIKE, Toshio	主指導教員 Main Advisor
	審査委員 Referee	Mohamed Rasmy	副指導教員 Sub Advisor
	審査委員 Referee	廣木 謙三 HIROKI, Kenzo	副指導教員 Sub Advisor
	審査委員 Referee	飯尾 潤 IIO, Jun	博士課程委員会委員長代理 Acting Chairperson of the Doctoral Programs Committee
	審査委員 Referee	鼎 信次郎 KANAE, Shinjiro (東京工業大学 教授 Professor, Tokyo Institute of Technology)	外部審査委員 External Referee
論文タイトル Dissertation Title (タイトル和訳)※ Title in Japanese	スリランカ国マハベリ川流域における社会的利益の最適化のための気候変動適応とレジリエンスに関する研究 A Study on Climate Change Adaptation and Resilience Strategies for Optimizing Benefits of the Mahaweli River Basin in Sri Lanka		
学位名 Degree Title	博士 (防災学) / Ph.D. in Disaster Management		
論文提出日 Submission Date of the Draft Dissertation	2021年5月12日	論文審査会開催日 Date of the Doctoral Thesis Review Committee	2021年6月9日
論文発表会開催日 Date of the Defense	2021年6月9日	論文最終版提出日 Submission Date of the Final Dissertation	2021年8月17日
審査結果 Result	合格 Pass		
	不合格 Failure		

※ タイトルが英文の場合、文部科学省に報告するため、和訳を付してください

Please add a Japanese title that will be reported to MEXT.

1. 論文要旨 **Thesis overview and summary of the presentation.**

This study focuses on providing comprehensive understanding of climate change impacts on water-related disaster risk and proposing adaptation strategies in terms of disaster risk reduction and effective water resources management by incorporate recent advancements in science and technology including data integration and analysis functions, advanced hydrometeorological modeling systems and an optimization scheme for dam operation optimization.

Six chapters constitute this Ph.D. dissertation.

Chapter 1 describes the background, placement, and location of this study through literature reviews with attention focused on the three key global agendas, i.e. the Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework) the Sustainable Development Goals (SDGs) and the Paris Agreement on Climate Change (Paris Agreement) and then identifies the following two objectives:

- Developing a methodology for understanding climate change impacts on water-related disaster risk.
- Developing an integrated approach for climate change adaptation and resilience strategies in optimizing benefits for river basins at the face of food-water-energy nexus.

Chapter 2 introduces the study area including the nation-wide topography, climate and hydrology, population, water resources, agriculture led economy, power and energy, and climate change and natural disasters in Sri Lanka, and the basin-wide climate and topography and water resources management system of the Mahaweli River Basin (MRB).

Chapter 3 presents an integrated approach for climate change impact assessment on hydro-meteorological characteristics of a river basin and its application to the MRB.

The assessment is accomplished by selecting reliable Global Climate Models (GCMs) based on their regional performance, identifying climate change signals, clarifying uncertainties from the selected GCMs, simulating the basin hydrological responses to floods and droughts seamlessly under climate change by using a sophisticated water-energy budget distributed hydrological model, Water and Energy Balance based Rainfall-Runoff-Inundation (WEB-RRI), and then facilitating decision-making procedures. The assessment identifies the following changes:

- The basin average annual temperature is very likely to increase in the future on average with a future temperature increase of 1.1 degree Celsius over the future 20 years.
- The future annual rainfall over the basin is very likely to increase, and the range will vary from 204 to 476 mm/year.
- Future heavy rainfall and meteorological droughts are likely to increase at the basin scale annually
- The hydrological floods are very likely to increase associated with the increase in inundated population, cropland, urban land area and economic flood damage.
- The trend of future hydrological droughts is uncertain.

Chapter 4 proposes climate change adaptation and resilience strategies in the Kotmale reservoir operation in the MRB with a focus on how to reduce the future flood risk and utilize the water resources to be increased in future. This study incorporates ensemble forecasting systems for the optimization of dam operations for reducing flood peaks and making the maximum use of water to support a decision support system for short-time dam operations during heavy rainfall and seasonal planning. The simulation results based on the two time scale approaches show possible improvements of the

reliability, sustainability, resilience and vulnerability of the reservoir operation as follows:

- Benefits of seasonal planning based on the integration of seasonal forecast information, a hydrological model, an optimization scheme with a defined reservoir operation rules.
- Benefits of the reservoir operation under flood emergency, when conducted by coupling short-term weather prediction, a hydrological model and an optimization scheme with reservoir operation strategies.

Chapter 5 provides policy recommendations to the stakeholders in the MRB based on the scientific evidences driven from this study.

Chapter 6 concludes and summarizes the finding of the study and the future research directions.

2. 審查報告 Notes from the Doctoral Thesis Review Committee (including changes required to the thesis by the referees)

The review committee members evaluated this study as follows:

- (1) This is an excellent research based on cutting-edge analysis tools, prediction models and an optimization tool for strengthening climate change adaptation and resilience and enabling sustainable development.
- (2) The dissertation is well organized by including the advanced and comprehensive research results, the expanded literature reviews, and the feasible policy proposals.

The dissertation was regarded as pass with minor revisions because the median score of individual evaluations of all the reviewers was 5. The review committee members asked the main adviser to check the revisions.

3. 最終提出論文確認結果 Confirmation by the Main Referee that changes have been done to the satisfaction of the referees

The main adviser found that the revised thesis addressed appropriately all the issues raised by the review committee members.

4. 最終審查結果 Final recommendation

The doctoral thesis review committee recommends that GRIPS award the degree of Ph.D. in Disaster Management to Mr. Hemakanth Selvarajah.