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Thesis Title: Socio-Ecological Vulnerability and Risk Assessment of the Mekong Delta (メコンデルタにおける社会・生態学的脆弱性とリスク評価)

Summary

The Mekong Delta region has been recognized as the most productive agricultural land and an important economic zone of Vietnam. Unfortunately, with its very low-laying topography of about 0.3-0.7m above mean sea level, this delta region is very vulnerable to the impacts of global climate change, sea level rise and other coastal hazards. Currently, this delta region is remarkably affected by the seasonal flooding event, although seasonal flood is considered as both beneficial and destructive to the delta dweller. However, the characteristics and impacts of the said flooding occurrence are likely to change due to constant increase of anthropogenic pressures both from the upstream countries and within the delta itself. For instance, the remarkable land subsidence resulting from groundwater extraction inside the delta can potentially increase the magnitude and alter the pattern of flood impacts across the delta system. Considering the concurrence of this land subsidence, sea level rise and the alteration of Mekong River flow, the Mekong Delta region is very vulnerable to extreme flooding hazard. Understanding the characteristics and consequences of such an extreme event can assist the Mekong Delta dweller and policy maker in developing the disaster risk reduction mitigation, management as well as adaptation plan against future flood risks. Nevertheless, the knowledge of this extreme inundation phenomenon is remained limited until the present day.

In this study, the characteristics of various extreme flooding scenarios and the vulnerability of the Mekong Delta region to their impacts were explored. Furthermore, relevant issues, which are important for the development of future mitigation and management plan against future environmental risks, were also investigated. The major objectives of this thesis include (i) to understand the present socio-economic and environmental conditions of the Mekong Delta region, (ii) to investigate the variability of socio-economic, environmental threats, awareness, risk perception and the stewardship of delta local community, (iii) to clarify the characteristics of local sea level fluctuations along the delta coast and to assess their impacts on environmental dynamics in the delta coastal plain, and (iv) to evaluate the vulnerability and sensitivity of the Mekong Delta system to extreme inundation phenomena, which may occur as the results of anthropogenic pressures (i.e., land subsidence), variation of Mekong River flow, and the variation of sea level along the delta coast. The content of this thesis comprises 6 chapters. In the first chapter, a brief introduction about the Mekong Delta region and the motivations for this research are given. The second chapter provides knowledge about the

variation of socio-economic, environmental awareness, risk perception and stewardship across the entire Mekong Delta region based on the results of an in-person survey conducting with 1006 households throughout the delta region. The underlying relationship among the above-mentioned parameters was also revealed by applying a multiple correspondence analysis (MCA) on the results of the said survey. The third chapter clarifies the characteristics of sea level fluctuation around the Mekong Delta coast and the related risk of inundation and saline intrusion based on direct investigation and statistical analysis of the observed sea level and other relevant parameters. The findings of this chapter also reveal the possible impacts of sea level seasonality on increasing flood magnitude inside the delta region and stresses the importance of appropriate setting of sea level boundary when performing flood simulation for this delta system. Chapter 4 gives key information regarding the vulnerability of the delta system to risk of extreme inundation under various scenarios. The 2-dimensional hydrodynamics model of Delft3D flow package was used to regenerate inundation patterns of seasonal flood in year 2000. The model result was validated by comparing with the observed river discharges and water levels at several stations along the main rivers inside the delta. The vulnerability of the delta's socio-ecological system to the more severe inundation cases was examined by introducing land subsidence scenarios for year 2050, sea level rise of 35cm and 50cm, and 45 days delay in seasonal flooding event. The worst inundation case was also investigated by assuming the concurrence of the above phenomena. The fifth chapter is a supplement material of this thesis. It provides two case studies focusing on the applicability of remotely sensed data in studying coastal environment. Owing to the great advantage of remote sensing technology for data mining and the increase availability of free remotely sensed data, remote sensing application is a great adding tool for future research especially when time series of spatial data is required (e.g., assessment of coastal environment). For this reason, this chapter is included in the present study. Lastly, chapter 6 offers the summary of major research findings and important notices on future management and research directions for the Mekong Delta region.

The results of this study provide important knowledge to local people regarding the risk of severe flooding and relevant environmental issues, which are likely to occur in the Delta region in the near future and the variation in socio-economic, environmental awareness, risk perception and stewardship of the Mekong Delta residents. This knowledge may assist policy makers in developing a proper future management plan for the Delta region.

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Acknowledgement

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