

報告番号	※ 甲 第 11057 号
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主 論 文 の 要 旨

論文題目 Adaptation to flood risk and evacuation procedure changes in the Shonai river basin, comparison of the Tokai flood (2000) and the 2011 flood (庄内川流域における洪水リスクの適応と避難方法の変化-2000年の東海豪雨と2011年洪水の比較)

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論 文 内 容 の 要 旨

The purpose of a comparison of the 2000 and 2011 floods in the Shonai River Basin was to be able to apply occidental concepts like vulnerability, resilience and adaptation to the field of the Shonai River Basin in Japan. It was also to have a clear view of the changes and evolution in the flood risk management, from public actors to individuals.

First this study is focusing on the origins and evolutions of the concepts in occidental countries and their utilization in Japan. This theoretical study focuses on the differences between “risk” and “disaster” concepts in a first time. The purpose was to assess the origins (1755 Lisbon earthquake) and evolutions of the “risk” (in Europe) and the “disaster” (in the United States) concepts, leading to a cost-benefit analysis of the risk and the disaster, and what was called a “hazard” paradigm, primarily based on the implementation of structural measures to reduce the exposition of buildings and then people, the risk and disaster management was therefore primarily done by applied sciences, especially engineering sciences. In the 1990’s an assessment worldwide coming from social sciences like geography and sociology stating that the disasters and the risk were not disappearing, therefore a reduction of the exposure only and structural measures imputed were not a solution that could make the risk disappear and complementary studies should be done to assess risk and disaster. It can be linked to the Chernobyl accident, and the general assessment in sociology that disasters are less and less accepted as part of life by the human societies, and finally to the uncertainty underlying progress and unpredictable counterparts to supposed assets (like the nuclear energy in case of the Chernobyl accident). This general assessment lead to the rise in risk and disaster studies of the vulnerability concept, at first, during the 1990’s. The vulnerability concept’s history can be linked to the disaster management evolution, and therefore is very applicable to risk and disaster studies. It is used to study the “human” part of the risk, therefore at first the population at risk. Heavily developed

between the late 1980 ' s and 2000 ' s in studies located in developing countries, the vulnerability concept has been used to define the " root causes " of the disaster. Therefore the hazard considered at the origin of the disaster in the hazard paradigm was considered in these vulnerability-oriented studies as the indicator of vulnerabilities rooted in the society. These studies have been criticized for their focus on poverty, and politics.

The resilience concept is used in disaster management almost since its (supposed) creation in 1973, and has become very fashionable since the early 2000 ' s, due to its use in the disaster assessment in USA for the terrorist attacks on the Two Towers (2001) and for the Katrina Hurricane flood disaster (2005). Its origins are difficult to establish but its evolution in Climate Change studies and the popularity the resilience concept gained can be explained by two facts. The first one is whereas vulnerability focuses on " bad " aspects of the risk to improve, the resilience concept focuses on " good " aspects of the risk allowing societies to cope and recover after a disaster. The second is that when vulnerability focuses especially in poverty reduction, bad policy management and population exposed victimization, the resilience concept is often used to put into light the individual responsibility for coping and recovering from a disaster and is less politically interested.

In Japan, the vulnerability concept is used since the beginning of the 2000 ' s in official documents, and used to assess society ' s capacity to be harmed, however taking into account that structural measures are part of " society " contrary to the occidental hazard paradigm. The resilience concept appears in 2005 and its use was not very numerous until 2014. It is to be expected that the resilience concept should be more and more used in the future in Japan.

The adaptation concept has been chosen in order to escape the underlying meanings or focuses of vulnerability and resilience. It is also considered in Japanese studies done by European as a concept fitting the Japanese concepts of " coexistence ". Finally the adaptation concept helps to focus not on the disaster but on the changes between disasters and the evolution of the flood risk management. The adaptation model has been built to study the factors for changes, improving resilience and the factors causing remaining vulnerabilities for structural and nonstructural measures, for the different times of the disaster (mitigation = structural measures setup, preparedness as nonstructural measures setup, crisis time, recovery time). Because this model was focusing on the evacuation process, the mitigation, preparedness and crisis time were focused on. The study of changes in risk management should lead to a more integrated risk management through better risk governance, and a more efficient way of dealing with flood risk.

The chosen field of study was the Shonai river basin, because of the occurrence of two flood events of similar nature (hazard) in 2000 and 2011, one leading to the Tokai flood and the other leading to a minor flood event. The methodology applied was a study of the structural measures changes between 2000 and 2011, and interviews to disaster managers and population to setup factors for resilience and vulnerability for evacuation. A GIS model was

created to assess the needed evacuation in case of a disaster and compared to the actual evacuation process during the two flood events.

From structural measures enhancements, the assessment made in this study is the high effectiveness of the structural exposure reduction between 2000 and 2011 leading to a diminution of the flood risk in the lower reach of Shonai river basin. The structural improvements in the middle reach are still ongoing and therefore their impact might not be assessed before the end of the public works in 2035. There is however an improvement in the river basin integrated logic, as the works after the 2000 Tokai flood tend to try to protect in a more integrated way the Shonai river and its tributaries.

These structural measures improvements have been coupled with nonstructural measures improvements in order to launch evacuation at the right time during a disaster. A communication enhancement has been assessed for the national to local communication (River bureau to Mayor Office) and an integration of new actors for the flood risk management like the media companies. The new actors integration however might take more time to be efficient as there are remaining communication problems between risk specialists and the information they want to send, and the reception of this information by media companies and the actual information send (like it was during the 2011 flood when 1 million people were asked to evacuate).

For nonstructural measures enhancements, however, a problem is remaining, as the population have problems assessing the flood risk before they are actually flooded, and the threshold reach leading to evacuation was in 2000 a levee breach for the population interviewed living in Kiyosu area. The individual housing enhancements seem to lead to the same conclusion, as there are protection measures against minor flood risk but not against major flood risk. Coupled with a low willingness to evacuate, this may be a problem if a major disaster should happen in the area. The resilience to flood risk is high, but not due to nonstructural improvements, as the information received and their uses and analysis by the population is very low. The hazard maps are almost not used, because the information contained do not fit the information need of the population, and the population has a hard time to conceive the probability of a disaster therefore has difficulties to willingly get informed about disasters. There is a risk acceptance nowadays lower than it was one century ago, therefore the efforts put into place to fight flood risk are lower too. However, for population members having experienced the Tokai flood, a general resilience improvement has been assessed for all types of risks, not only floods but also earthquake. The experience of the Tokai flood has therefore had a positive impact on part of the population, and their willingness to be better protected and evacuating sooner in the future.