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The Importance of Interdisciplinary Research Connecting Historical, Anthropological, Information, and Engineering Science on the Case Study of ST-GIS Application: Experience from the East-Japan Earthquake and Tsunami and Duzce Earthquake

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We seldom encounter a huge natural disaster causing such extensive damage as the East-Japan Earthquake and Tsunami of March 11, 2011. Researchers, government officials, and related specialists have said this event was unexpected and unpredictable. Many lives and properties were lost. We were not prepared for this level of disaster because we did anticipate it but did not want to believe it by safety bias. People tend not to prepare for uncertain event which is not suitable for them.

Previous disasters have influenced people's lifestyles and cultures, and the precautions they took varied according to their various locations and different experiences. For individuals, a huge natural disaster is a rare event and fortunately most of us do not experience one. Therefore, other's records or reports of these experiences are valuable for improving our environment safe to live in.

In certain regions, however, natural events such as the Typhoons that often occur in southern regions but rarely occur in the north. As a result, southern people are better prepared for such events. Likewise, in northern regions few snowfall-related accidents occur because people are accustomed to snow. However, in southern areas a lot of such accidents happen when they experience a rare snowfall.

To prepare suitable countermeasures, collaborative research among different fields such as history, cultural, engineering and disaster prevention is important.

For our research on earthquakes, we will focus on sharing experiences based on the recent large quakes in Turkey in 1999(Duzce Earthquake) and Japan in 1995(Great Hanshin-Awaji Earthquake), 2007(Niigata-Chyuetsu Earthquake), and 2011(East-Japan Earthquake). We have found many differences in the procedures for countermeasures taken by the central and local governments, and the preparation to new quake resistant structures, the cost of recovery, the requirements from people, and so on also differed.

There is no doubt that a study of the related history of these events is important. We have started collaborative research among researchers of history, information science, planning, and social science to organize a platform to integrate all the information gathered from these different fields.

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For this purpose, a Spatial-Temporal Database management system is required because conventional GIS cannot accommodate historical data simultaneously. Moreover, a Relational Database system is not suitable for summarizing and analyzing differences in location. However, DiMSIS-EX, which has been developing to plot disasters by adapting to rapid changes in position, meets these requirements. For this purpose, historical data is recorded by location using coordinates.

We will focus on multidisciplinary research on disaster prevention in this presentation.

1. East-Japan Earthquake and Tsunami

Cities and towns in the coastal area were struck by a huge tsunami on March 11th, 2011.

Some people said that the height of Tsunami was unexpected. There was an indictor show us 3.1m Tsunami attacked in several 10 years which give us warning extremely high tsunami like 3.1 m may attack again. People did not expect higher Tsunami attack them from this indicator.

However, we have a record of a similar height of tsunami over 15m which struck 1000 years ago. Monuments and documents recording the event were made by people who survived it. Their messages are remaining which warning us about what they experienced to help us to avoid from a similar disaster.

A tsunami 3.1m in height has been recorded (within 50 years range. Not 1000 years or more)

2. Historical Object

Shrines were built to warn future generations that a Tsunami struck up to this point. People usually do not move shrines (house of god). This could be a good land mark to inform of potential danger.

We should be aware of these shrines and old tales and take precautions to reduce damage. People tend not to believe which is inconvenient to them.

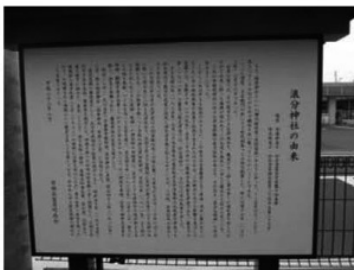


Photo: Y Kajitani

Tsunami attacked several Km from a sea coast where people did not think Tsunami come.
This shrine was built (rebuilt several times) pointing the boundary of Tsunami and tell not build houses on sea side from this point.

3. Old Poems and Literature

Some old poems (WAKA) used these rare phenomena even to express romantic feelings. If we had been attentive enough to catch these messages , we might have taken some precautions.

「契りきな。かたみに袖をしほりつつ、末の松山波越さじとは」
詠み人（清原元輔 ～ 950 ～）

Japanese Poem (WAKA) is express mind to think his lover.
My mind is always same as Tsunami did not overcome this point.

These information is important for city planning.

4. Collaboration and Platform

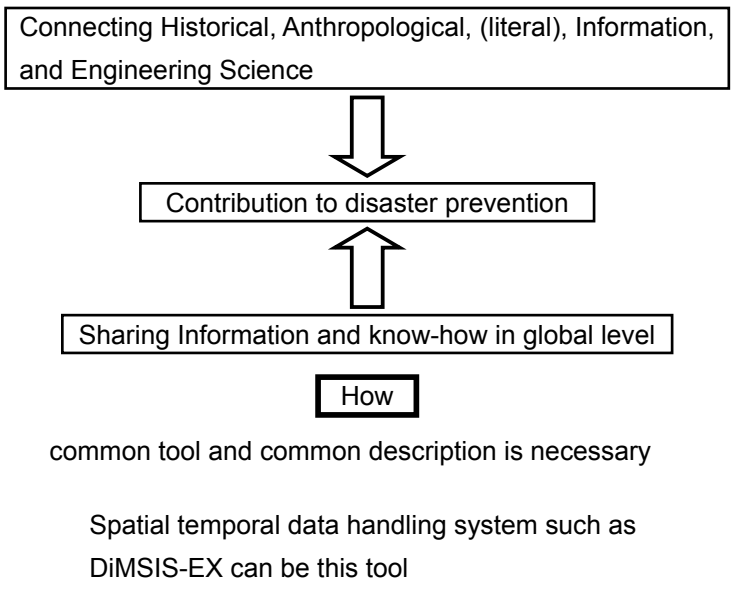
Integration of the historical data of different regions is important, especially for disaster prevention.

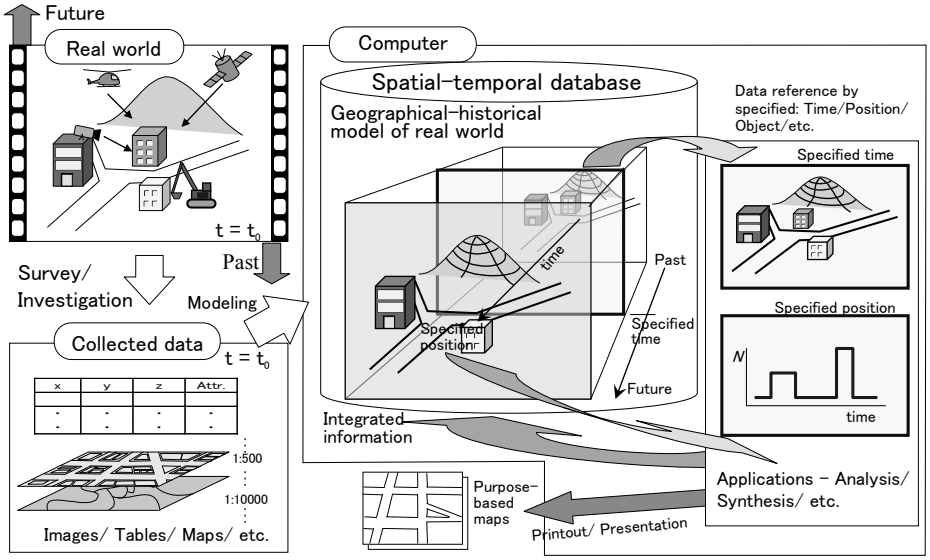
Disaster prevention is a requirement for peoples' security. Multi-disciplinary and multi-cultural data on experiences which reflect different lifestyles and cultures can provide much needed solutions. We have a possibility learn each other from experiences of disaster which is not experience often. Countermeasure of each region is different, because each region has different background.

All historical events and objects can be connected to a spatial-temporal position. Even if database management of local governments are different for different country or region, spatial-temporal position is same for every where. Spatial-temporal database management method which connects all data to position and period or time is universal for describing these data components. DiMSIS-Ex has been developing to meet this requirement. Concept of this system is organize spatial temporal database as a common platform which makes possible to describe historical data as geographical data.

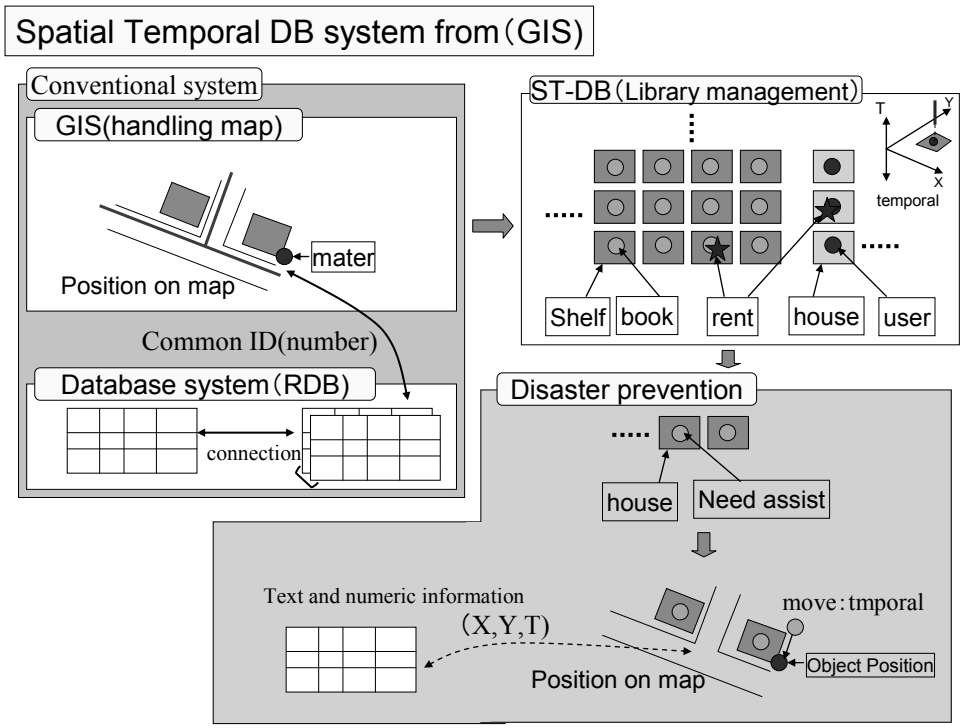
Turkish information can be managed same way to Japanese data in DiMSIS-Ex and apply to local use of different country because it has interface of multi-language adapt.

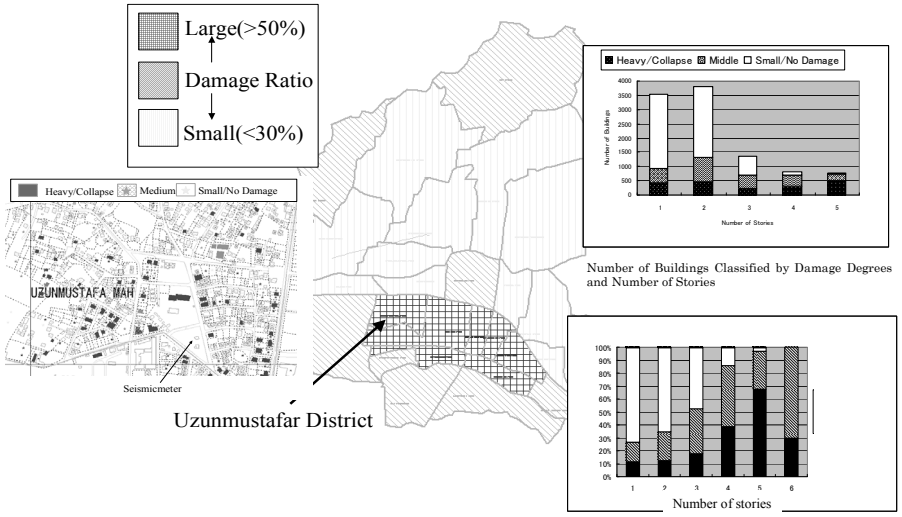
Data base is organized by connecting all information to certain spatial temporal position as unique key. This position can be virtual position but this position can also be real position. Virtual position is used for such as book management at library. Map database can be use to represent real position which make all database can be unified into one without additional efforts to combine database.





Overall concept of spatial-temporal GIS named DiMSIS-EX





Turkish case study in Duzce