

Development of real-time forecasting technologies for coastal disaster analysis

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Abstract— In recent years, climate changes and natural disasters including tsunami, typhoon, and flood are on the rise all over the world and cause huge losses of both life and property. Accordingly, when a natural disaster occurs, it is very important to promptly issue a disaster warning, collect information from damaged region, and have a lifesaving system. The purpose of this research is to establish a strategy of real-time disaster management based on each type of maritime disasters and develop a demonstration model of coastal SBB (Safe Coast Big Board) applied by visible technology development for the result of disaster prediction. This demonstration model is intended to develop technology for forecast and warning of disaster risk for real-time management and decision making of disaster situation and the contents of that model are as follow : 1) Establishment of a strategy of real-time disaster management for each type of disasters 2) Technical development for visualization of forecast result of disasters 3) Demonstration model development of coastal SBB(SafeCoast Big Board)

Keywords— disaster management; forecasting

I. INTRODUCTION

In recent years, climate changes and natural disasters including earthquake, tsunami, typhoon, flood and forest fire are on the rise all over the world and cause huge losses of both life and property. Accordingly, when a natural disaster occurs, it is very important to promptly issue a disaster warning, collect information from damaged region, and have a lifesaving system.

Climate change may occur as natural phenomena with no human activity and an abnormal climate phenomena may be caused when climate change is added by human activities. Natural disaster and accident or mishap due to climate change are vulnerable to abnormal climate changes and a local community may be led to a disaster when it is exposed to climate changes and the stakes of natural disaster and accident become high. Thus, natural disasters caused by climate changes have continued and the strength of disasters and scale

of damages become complicated and extensive, which makes it hard to forecast and take countermeasures against them

The purpose of this research is to establish a strategy of real-time disaster management based on each type of maritime disasters and develop a demonstration model of coastal SBB (Safe Coast Big Board) applied by visible technology development for the result of disaster prediction. This demonstration model is intended to develop technology for forecast and warning of disaster risk for real-time management and decision making of disaster situation and the contents of that model are as follow :

- 1) Establishment of a strategy of real-time disaster management for each type of disasters
- 2) Technical development for visualization of forecast result of disasters
- 3) Demonstration model development of coastal SBB(SafeCoast Big Board)

II. METHOD AND PROCEDURE OF RESEARCH

The purpose of this research is to develop a test system for establishing smart-type maritime disaster management system for: presenting real-time observation data and analysis data for each domestic institutions necessary for disaster situation management based on the type of disasters such as typhoon, storm surge, tsunami, waves, wind and tidal water; establishing automatized and visualized system for the result of forecast of storm surge and tsunami; and presenting even the standards of disaster risk judgment.

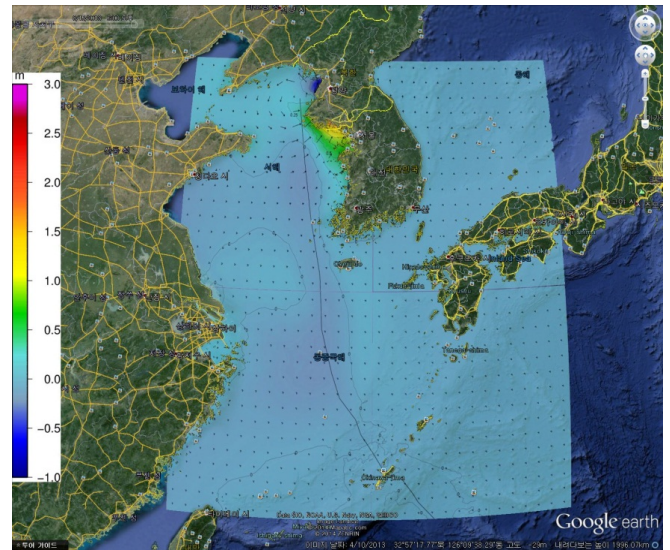
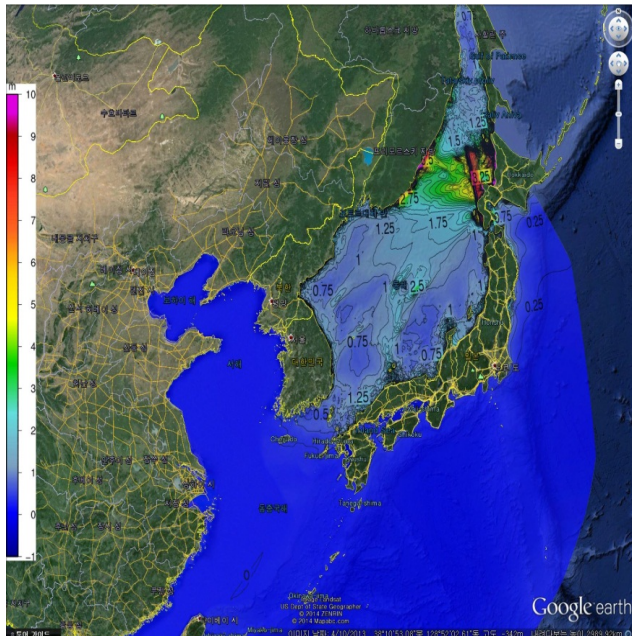
For these, as a development of technology for forecasting maritime disasters, a system for turning into scientific disaster situation management through real-time monitoring of disaster sites and interpretation of customized model for each type of disasters by utilizing advanced information such as Human

Sensor (SNS), radar and satellite is developed and a smart management system for disaster situations is established for developing contents for expanding smart big board and analyzing maritime risk situations focusing on sites in case of disasters and safety accidents. In addition, through development of technology for support for decision making in real-time disaster situation, a demonstration model of system for supporting for forecasting and warning services for disaster occurrence is developed.

A. Summary of display technology of earthquake and storm surge

- Results of forecast models for earthquake and storm surge are expressed in the lists of simple data in either binary or ASCII form. In this research, a system is established and it can more effectively express the result of forecast by transferring result data into raster image, vector image, Google earth data and GIS data so that time loss and inconvenience in data processing can be alleviated in the course of analysis of predictive value results of earthquake and storm surge by using visualization system for construction of integrated flood model of 'connection between ocean and river' (I) (2013).
- Cartography in the area of earth science was made by software based on a display method of forecast result for earthquake and storm surge by using the software of Generic Mapping Tools (GMT) manufactured by Wessel and Smith.

Fig. 1. Example of display method of KMZ file form for earthquake and storm-wave height



B. Visualization through connection with situation analysis simulation

- As a situation analysis simulation operated by NDSRI, there is the forecast simulation of storm-wave height and it is written by the entry data from the typhoon notice of NWS. The following screen is a simulation of wind/storm-wave height affected by Bolaven typhoon showing a formation of typhoon focusing on the location of typhoon at this point in time, scope and danger of its effect in the typhoon track.

Fig. 2. Simulation of wind Typhoon(A).

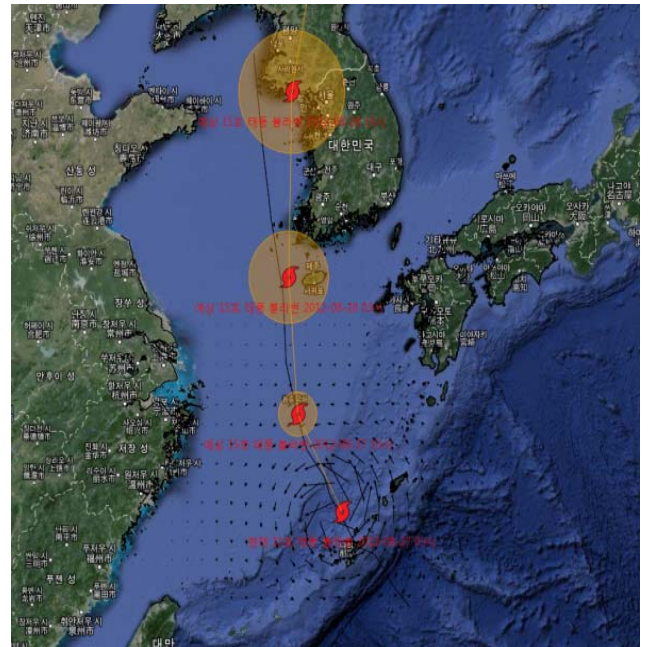
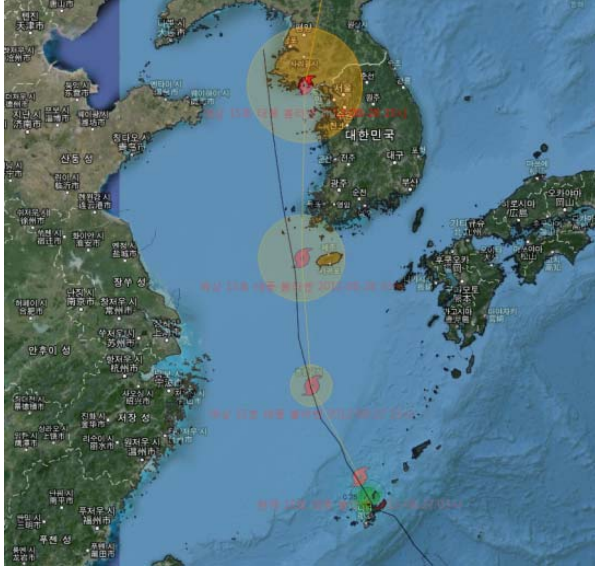


Fig. 3. Simulation of wind Typhoon(B).



C. Demonstration model of coastal SBB(SafeCoast Big Board)

- Screen composition of demonstration model of coastal SBB (SafeCoast Big Board) consists of areas of GIS function, function of 'see marine weather', see details menu zone, see examples, main screen, and screen additional information. With the function of monitoring, you can check present marine weather and the one in the past. For this function, you must select the date and time in the menu and select the items of weather to be exposed on the screen and you can check this in the main screen after then.

Fig. 4. Screen design of coastal SBB(A)

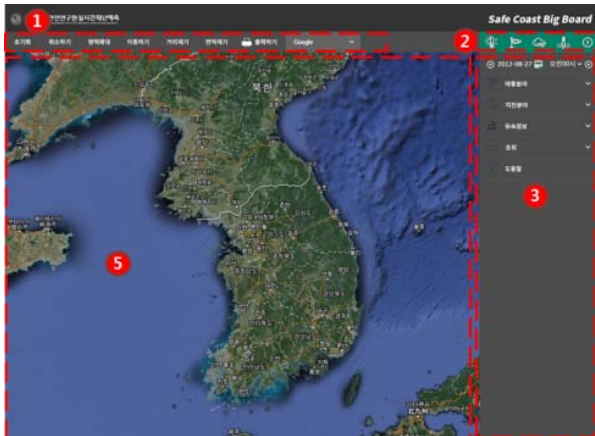
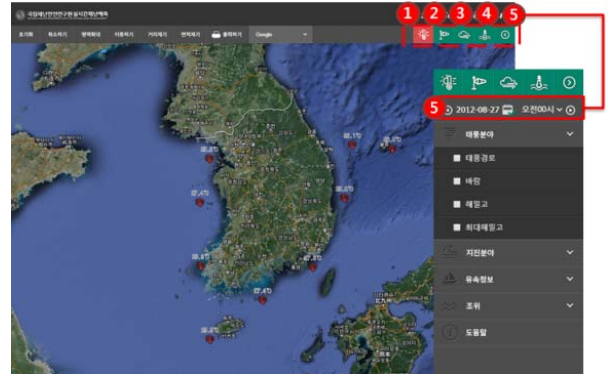


Fig. 5. Screen design of coastal SBB(B)



III. CONCLUSIONS

In order to develop the forecast and warning technologies for supporting for management of realtime disaster situation and decision making, I established a strategy for real-time disaster management for each type of marine disasters in this research. In addition, I also develop a demonstration model of coastal SBB (SafeCoast Big Board) applied by visualization technology for disaster forecast results and present real-time observation and analysis data based on domestic agencies necessary for disaster situation management for each type of disasters such as typhoon tsunami, earthquake tsunami, waves, wind, and tide level through this research results. I also construct an automatic visualization system showing forecast result of forecast system for storm tsunami and earthquake tsunami. Furthermore, I construct a demonstration model for development of forecast technologies for marine disaster situations which can suggest even the standard for disaster risk judgment

For these, I examine domestic and overseas disaster information and present status of forecast system operation, identify present status and trends of disaster situation management systems and examine connection composition of data for data processing based on disaster types and the composition of operating structure of data distribution system which can utilize such connection composition.

Also, I visualize the results of disaster forecast by developing the simulator function of disaster forecast and I expect that this will be helpful for disaster forecast manager and consumers to make prompt identification of disaster risks. In order to make a correct measurement and issue a forecast and warning, the followings must be conducted: disaster type-based observation; collection of analyzed information; prompt decision making on the standard of warning stages and warning stages; and spread of conditions to competent agencies responsible for handling disasters in every region.

The technology development for these forecast and warning of disaster risks forms a part of establishment of smart-type disaster management system and will be helpful for constructing a system for immediate response to disaster situations today when more people are becoming aware of disaster safety management system due to continuous catastrophes and increasing coastal disasters.

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