Optimal Design of evacuation route augmentation for flood hazard mitigation

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1. PURPOSE

A two-layered optimization scheme for the evacuation route augmentation design has been proposed by Fukunaga et.al.(2004), which can considerably reduce the computational load and enables us to search the optimal solution in reasonable computational time about this optimization scheme. I propose the way of improve this scheme, which can raises efficiency of searching the optimal solution.

2. OPTIMIZATION SCHEME OF ROUTE AUGMENTATION PROBLEM

The objective of the design is to find the augmentation pattern that maximizes the expected evacuation success rate under the condition that the construction cost does not exceed the given limit. Flood inundation process is simulated by two-dimensional shallow flow model with orthogonal grids arrangement ,the virtual road network which simplified the actual road network based on "the numerical map 2500" for the refuge simulation is set up, and I adopted genetic algorithm to find the optimal land augmentation pattern. The advantage of genetic algorithm is that it uses only the value of objective function: the evacuation success rate in this study.

The process of optimization dealt with in this study requires the largest computation load is the inundation simulation. If one can reduce its load without sacrificing the accuracy of solution search, the computational burden of total solution search process can be considerably reduced. From this viewpoint, we propose the two-layered solution search scheme. Two-layered solution search scheme is developed to obtain the optimal solution for the problem avoiding impractical computational burden. The method comprises of two levels of searching: one is approximate solution search process based on simple estimation of inundation levels, and the other is strict optimization stage based on the actual simulation of flood inundation.

3. APPLICATION AND DISCUSSON

In this chapter, two-layered optimization scheme is applied to the evacuation route augmentation design in the model floodplain and its performance will be checked. The results of optimizations are illustrated in Figure 1 for the cases where upper limits of augmentation volumes are set to 4.00 million cubic meters and evacuation starting times are set to 30, 15 minutes before dike break, the same time and 15 and 30 minutes after dike break. It can be observed that the optimization has been done with reasonable computational load.

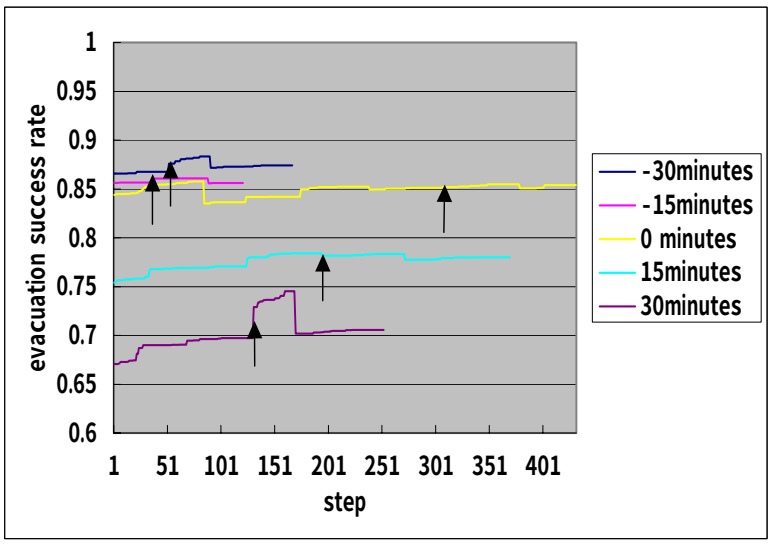

Figure1. total augmentation volume :4.00 million m^3