A Method for Creating Inland Flooding Hazard Map Based on Topographical and Geographical Characteristics

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In Tokyo Metropolis, especially in wards district, inland flooding has caused much damage. Recently, many local-scale floods have been induced repetitively by torrential downpours. Thus, we focused on topographical and geographical characteristics of the flooded areas. In this study, we analyzed topographical and geographical characteristics of flooded areas in Shinjuku, Toshima and Bunkyo wards and made a simple hazard map based on this analysis In these wards, inland flooding has occurred frequently and repeatedly in recent years.

According to the records of flooding that were compiled by Tokyo Metropolitan Government, there were 107 inundations between 1989 and 2009 in the study area. We classified these flooded areas into three groups: lowland type, upland type and valley on upland type, and extracted topographical and geographical parameters: depression depth, depression volume, catchment area, land coverage of catchment area, mean slope of catchment, mean slope from a flooded area to a discharge point of catchment, difference between these two slopes, length from upper most of catchment to a flooded area, length from a flooded area to a discharge point of catchment, difference between these two lengths, valley depth, valley width, of the flooded areas by using ArcGIS 10. These parameters were examined by principal component analysis (PCA) to evaluate topographical and geographical characteristics of the flooded areas.

The result of PCA gave two major components in lowland type, three major components in upland type and four major components in valley on upland type. We calculated these PCA scores in the whole study area. Then, we extracted the area that each PCA score was higher than the lowest score of the flooded areas and the total of all PCA scores was higher than the lowest ones of the flooded areas as the one that has risk of inside water inundation.

Risk map was made from this extracted area. We classified the area that has risk of inland flooding into two classes: very strong type and strong type. Very strong type is the area that at least one PCA score is ranked in the top 50%. Strong type is the area that all PCA scores are not ranked in the top 50%.

Keywords: inland flooding, urban area, topographical and geographical characteristics, principal component analysis, hazard map