AUTOMATED GRID GENERATION FOR FLOOD PREDICTION USING LIDAR DATA

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Recently, airborne laser mapping system (LiDAR; Light Detection And Ranging), which can give very detailed topographical information, has become available. The objective of this study is to develop not only accurate but also automated and labor saving procedure for converting LiDAR data into information which is used for flood prediction.

The workflow of our method is described as follows,

i) Extract buildings from DSM(Digital surface model) and DTM(Digital terrain model), and make mask image.
ii) Extract outlines of each building.
iii) Outline grid is generated and inner area is filled up by using advancing front method.
iv) Elevation of each grid is configured by DTM information.

Fig.1 shows a city planning map of the test area, sized 200 m x 200 m. In this area, small residential houses, school buildings and commercial facilities are densely packed. Fig.2 shows extracted outline of the buildings overlaid on the map. The gray region indicates the road and bare-earth area where flow goes through. As it can be seen in the figure, the layout of each block and road connection is represented well. Fig.3 shows the outline on the aerial photograph. In the aerial photograph, the vegetation can be seen in the areas pointed by white arrows and that is also represented well on the outline information, which is difficult to recognize only by using the City planning map.

Eight calculating meshes with different grid spacing, from 5 m to 30 m, are generated. Fig. 4 shows 4 samples of generated grids. As it can be seen, coarser mesh (25m) cannot express detailed boundary shape and small houses are omitted in the grid. On the other hand, finer meshes (10 m and 5 m) represent an outline configuration well and 8 m mesh (figure not included) also shows similar result. Consequently, with respect to the clarity of the boundary shape, 10m or finer meshes express boundary shapes clearly. As depicted in Fig.5, generating time increases approximately linearly with the number of triangles.

Fig.6 shows the relationship between number of triangles and grid size. Evidently, a grid spacing smaller by half needs four times the number of total triangles, and it makes not only a slower grid generation process but also increases calculating time and memory size exponentially.

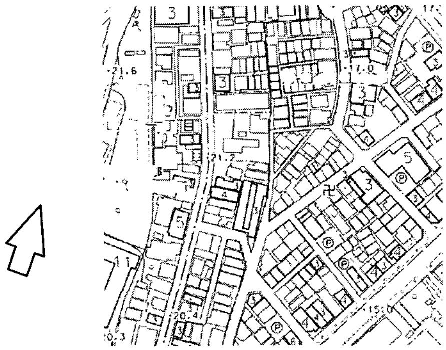

Fig. 1 City planning map.

Fig. 2 Extracted outline overlaid on city planning map

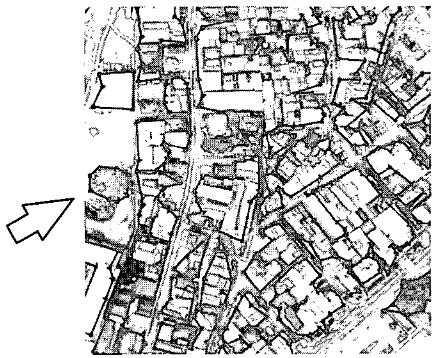

Fig. 3 Extracted outline overlaid on aerial photograph

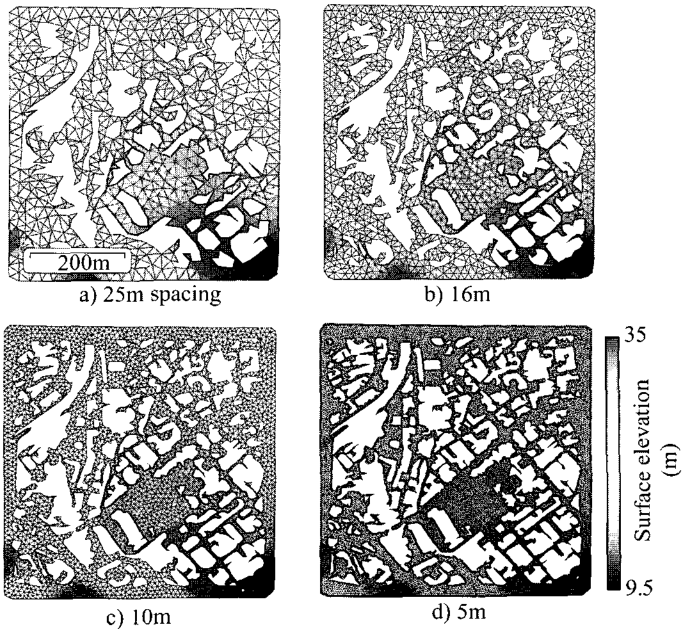

Fig. 4 Generated meshes with different grid spacing

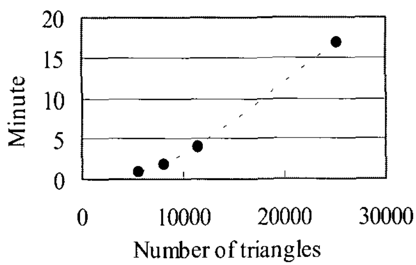

Fig.5 Processing time to generate grids

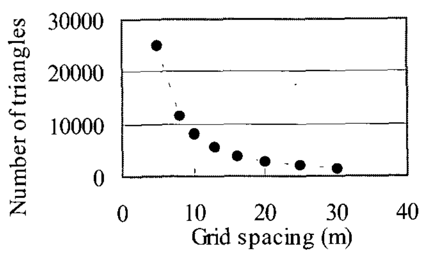

Fig.6 Total number of the triangles depends on grid spacing