

method. Furthermore, as shown in the previous section, buildings height distribution tends to show power-law distribution. This characteristic has to be considered in the calculation of sky view factors for non-uniform urban areas using a power-law probability distribution function. Representation of the non-uniformity of urban morphology in the calculation of sky view factors remains a pressing issue.

Table 1 Average Sky View Factors Calculated by the Simplified Method and GIS Analysis.

| Location | Marunouchi | Nishi-Shinjuku | Kokura |
|--|------------|----------------|--------|
| Average Building Height [m] | 18.826 | 15.979 | 6.140 |
| Average Building Width [m] | 20.484 | 17.172 | 9.644 |
| Average Canyon Width [m] | 11.693 | 9.644 | 4.407 |
| Simplified Method | | | |
| Average Sky View Factor by Simplified Method | 0.370 | 0.465 | 0.394 |
| GIS Analysis | | | |
| Number of Samples | 1,000 | 10,000 | 1,000 |
| Average Sky View Factor by GIS Analysis | 0.403 | 0.410 | 0.615 |
| Medium | 0.419 | 0.427 | 0.617 |
| Standard Deviation | 0.158 | 0.154 | 0.182 |
| Minimum | 0.025 | 0.010 | 0.114 |
| Maximum | 0.727 | 0.730 | 0.930 |

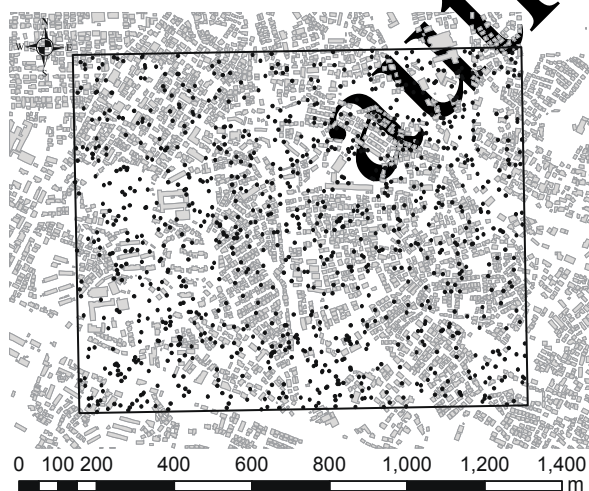


Fig.8 Map of the Kokura area. Grey polygons are buildings and black points are sampling points set in ArcGIS to calculate sky view factors.

5. Summary

In this study, urban morphology in Japanese cities was analyzed to create an input data set for the urban canopy model and to investigate the non-uniformity of urban canopies by means of GIS. The results show that the building height distribution in entire Japan follows a power-law distribution. At a local scale with a resolution of about 1 km², building height distribution also showed a power-law distribution. Furthermore, sky view factors calculated by GIS analysis and the simplified method for real urban areas were compared. The results of the simplified method displayed non-negligible errors because of the lack of consideration for contrasts in building density within meshes. These analytical results will be used to update the non-uniform urban canopy model in future work.

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