Impact of Urban Functional Area Subdivision on Simulation of Flash Flood in Hydrological Model

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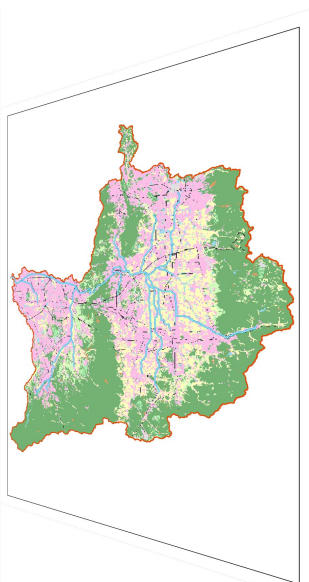
Flash flood is one of the most common natural disasters, floods and other water-related disasters account for 70 per cent of all deaths related to natural disasters. Due to the short time of flash flooding, higher time accuracy is required for simulation. Soil and Water Assessment Tools (SWAT) is very widely used in watershed research. Boithias et al. simulated flash floods at SWAT model hourly time-step in Mediterranean river coastal basin and proved that the SWAT model appears to be a reliable modelling tool to predict discharge over long periods of time in large flash-flood-prone basins.

For flood simulation and prediction, it is important to know the flood risk area, especially in densely populated urban areas. But sometimes it was limited by land use and land cover information. Traditional land use classify method could not reflect detail hydrologic property discrepancy clearly. For example, commercial blocks with high building density and impervious percentages and university campuses with high greenery are both classified as "urban" in the land use classification system. But in fact, there are large differences in its hydrological process.
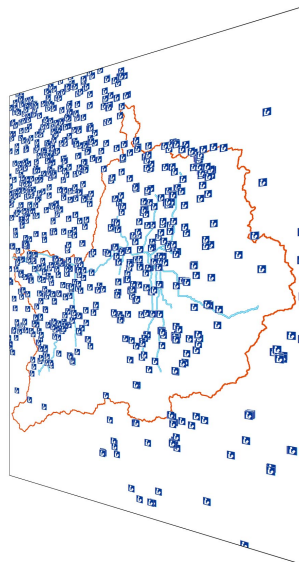
POI means "Point of information", a kind of big data. Urban POI can effectively describe the division of functional areas within a city. Use POI to refine land classification and give POI hydrological attributes. So as to improve the accuracy of land use information. Yamato River Basin has experienced 13 flash floods in the last 20 years, especially in recent years, almost each year one-time flash flood. The flood caused the streamflow in the river channel to be too large, the water level was too high, and there was a risk of flooding the surrounding area. The SWAT model is a commonly used watershed hydrological model. SWAT can simulate runoff in hours, which is very important for simulating the corresponding flood.

This study extracts 15 types of POI including parks, schools, medical facilities, post offices, city streets, cultural facilities, passenger facilities, and industrial land, etc., use remote sensing methods to statistically calculate their surface characteristics. Selected SWAT model to compare the difference between the daily simulation and the hourly simulation under the traditional land use map and the POI-enhanced land use map, search the weak areas in urban area. In the results of the SWAT model, the POI enhanced map can display richer urban hydrological process information, and the simulation of river runoff has higher accuracy.
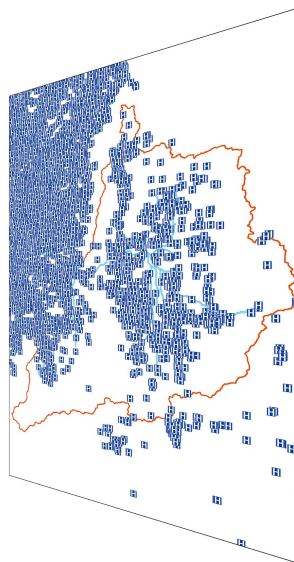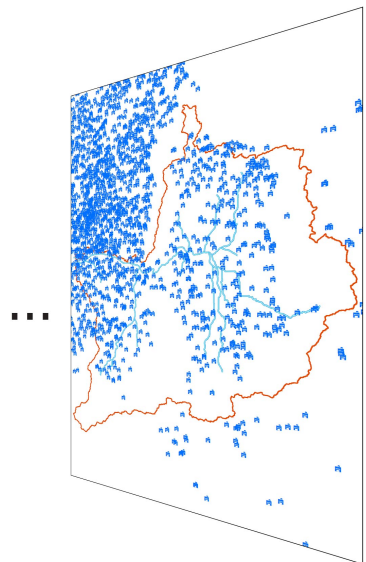
Keywords: POI, big data, SWAT, hourly simulation, urban flooding

Land use map

Library POI

Hospital POI

School and University POI