Urban Energy Demand Modelling: Spatial Analysis Approach

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Abstract : Energy consumption in the urban environment has attracted numerous researches in recent decades. However, it is comparatively rare to find literary works which investigated 3D spatial analysis of urban energy demand modelling. In order to analyze the spatial correlation between urban morphology and energy demand comprehensively, this paper investigates their relation by using the spatial regression tool. In addition, the spatial regression tool which is applied in this paper is ordinary least squares regression (OLS) and geographically weighted regression (GWR) model. Normalized Difference Built-up Index (NDBI), Normalized Difference Vegetation Index (NDVI), and building volume are explainers of urban morphology, which act as independent variables of Energy-land use (E-L) model. NDBI and NDVI are used as the index to describe five types of land use: urban area (U), open space (O), artificial green area (G), natural green area (V), and water body (W). Accordingly, annual electricity, gas demand and energy demand are dependent variables of the E-L model. Based on the analytical result of E-L model relation, it revealed that energy demand and urban morphology are closely connected and the possible causes and practical use are discussed. Besides, the spatial analysis methods of OLS and GWR are compared.

Keywords : energy demand model, geographically weighted regression, normalized difference built-up index, normalized difference vegetation index, spatial statistics

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