# NEW 3-D SOLAR RADIATION TOOLS FOR 3-D CITY MODELS

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**Abstract**

Solar radiation modeling is a complex problem that can be effectively solved in a GIS enviroment. However, most of the current solar radiation models implemented in GIS's can be adequately used only for 2-D surfaces (such as terrain and rooftops). More complex 3-D urban environments require 3-D data and GIS tools. In this paper, we describe new open-source 3-D solar radiation tools for GRASS GIS. We have developed the v.sun module based on the existing solar radiation methodology used in the topographic r.sun model with a new capability to process 3-D vector data frequently used in the 3-D city models representing complex urban environments. The calculation procedure is based on the effective volume tessallation using a voxel data structure. The shadowing algorithm uses a combined vector-voxel approach. The proposed model and algorithms have been applied to the sample area of Presov, Slovakia. The results showed strong spatial and temporal variations of solar radiation flows in the urban environment. The model can be used in various application areas including renewable energy or environmental applications.

**Keywords:** solar radiation model, geographic information system, 3-D city model, 3-D modeling

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