Analysis of solar potential in an urban area using LiDAR data: A case study of Belgium

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SUMMARY

Nowadays, there has been an increasing demand for solar energy as a type of renewable energy because of the advantages such as providing heating and electricity, avoiding environmental pollutions, and utilizing the sustainable approach for the development of natural resources. Depending on the different positions of the sun at various times, different terrain topographies, and man-made objects, the amount of received solar energy will vary in different times and places. The goal of this study is to select the best roof surfaces regarding their suitability for photovoltaic systems' installations taking into account shadowing effects, size, aspect, and slope of the roof surfaces. The first step in the proposed method is to detect buildings by segmentation of a Digital Surface Model (DSM) derived from LiDAR (light detection and ranging) data and classification of the segments as roof surfaces. The height information, slope, and aspect of the segments are utilized in the segmentation procedure. A shadow detection algorithm is developed to calculate the shadow coefficients for different roofs. Next, direct and diffuse solar radiations are obtained for each point on the selected roof, and values of shadow are considered for them. A high-resolution LiDAR and optical data set from Belgium are considered to execute the proposed methodology. The results show the efficiency of the proposed method for solar potential determination of surfaces in preferable locations.