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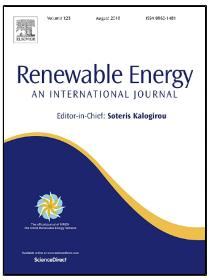

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A New Algorithm Using a Pyramid Dataset for Calculating Shadowing in Solar Potential Mapping

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Abstract

The efficiency of solar potential mapping is becoming increasingly important as solar energy technologies further develop. As digital surface models (DSMs) with improved spatial resolution become more available, the efficiency and accuracy of calculating solar potential need to be better improved. This study analyzes the algorithms available for calculating shadowing and proposes a new algorithm using a pyramid dataset. The available algorithms can be categorized as either shadow-based calculation algorithm (SBC) or Viewmap-based calculation algorithm (VBC). Relatively, SBC can generate simple results rapidly while VBC can generate detailed results slowly. VBC comprises three algorithm types: line scanning, all-data scanning, and the proposed pyramid dataset algorithms. The calculation time and accuracy of these algorithms were analyzed with respect to the spatial resolution of the DSMs and sky division resolution. The results show that the calculation time for each algorithm increases significantly as the resolution of the DSM increases. The proposed pyramid dataset algorithm showed high calculation speed and time complexity compared to previous VBCs. It is also able to generate a more detailed map than the SBC. The proposed algorithm showed high potential for further study as it can generate a detailed map of high resolution DSM rapidly.

Keywords: Solar potential, GIS, Solar mapping, Shadow calculations, Calculation time, Photovoltaic

1. Introduction

Solar projects often need to consider spatial distribution as well as irradiance. As solar energy supply increases, solar potential mapping becomes increasingly important. These maps are essential for estimating solar energy capacity from global irradiance to city energy output scale. These maps are used to select sites for power plants and estimate total energy potential, among other purposes.

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