

GENERATION OF SOLAR RADIATION DATASET OVER MOUNTAINOUS TERRAIN USING AMEDAS AND DIGITAL ELEVATION MODEL

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Abstract: Solar radiation is one of the important elements that influence the growth of vegetation, and it is the essential input data of environmental modeling such as forest production and local meteorology. Solar radiation has been observed by over 1300 meteorological stations in Japan. However, it is not possible to apply for mountainous region because the data are not take the slope and shading by terrains into account. The objective of this study is to generate the dataset of solar radiation which make consideration of these terrain-oriented factors, using meteorological data acquired by Automated Meteorological Data Acquisition System (AMeDAS) and the Digital Elevation Model (DEM). Time series of AMeDAS from 1979 to 2009 were interpolated into approximately 1km grid by means of existing tool. Fifty meters resolution DEM was utilized in order to calculate slope of land surface and shading by surrounding mountainous terrains. Solar radiation was separated into direct and diffuse components by statistical relations derived from multiple regressions of historical data. Direct component was, subsequently, decreased by the fraction of the duration of shading by surrounding terrains at local site. Diffuse component of radiation was also changed in proportion to open sky. These modified components were integrated again in order to compute the global solar radiation under the mountainous condition. The dataset covers the whole Shikoku area in Japan, and temporal coverage is from 1979 to 2009 in monthly bases. Our dataset shows remarkably larger differences of global solar radiation, compared with original data, especially due to the complex geographical aspects of terrains. This dataset can be used as input data of environmental models for the estimations of forest growth and agricultural products in Shikoku area.