Global Surface Solar Energy Anomalies Including El Nino and La Nina Years

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Abstract:

This paper synthesizes past events in an attempt to define the general magnitude, duration, and location of large surface solar anomalies over the globe. Surface solar energy values are mostly a function of solar zenith angle, cloud conditions, column atmospheric water vapor, aerosols, and surface albedo. For this study, solar and meteorological parameters for the 10-yr period July 1983 through June 1993 are used. These data were generated as part of the Release 3 Surface meteorology and Solar Energy (SSE) activity under the NASA Earth Science Enterprise (ESE) effort. Release 3 SSE uses upgraded input data and methods relative to previous releases. Cloud conditions are based on recent NASA Version-D International Satellite Cloud Climatology Project (ISCCP) global satellite radiation and cloud data. Meteorological inputs are from Version-I Goddard Earth Observing System (GEOS) reanalysis data that uses both weather station and satellite information. Aerosol transmission for different regions and seasons are for an 'average' year based on historic solar energy data from over 1000 ground sites courtesy of Natural Resources Canada (NRCan). These data are input to a new Langley Parameterized Shortwave Algorithm (LPSA) that calculates surface albedo and surface solar energy. That algorithm is an upgraded version of the 'Staylor' algorithm. Calculations are performed for a 280X280 km equal-area grid system over the globe based on 3-hourly input data. A bi-linear interpolation process is used to estimate data output values on a 1 X 1 degree grid system over the globe. Maximum anomalies are examined relative to El Nino and La Nina events in the tropical Pacific Ocean. Maximum year-to-year anomalies over the globe are provided for a 10-year period. The data may assist in the design of systems with increased reliability. It may also allow for better planning for emergency assistance during some atypical events.

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