

Solar Resource Parameters from the GSIP database

GSIP (GOES Surface and Insolation Product) Version 1 (V1) database provides insolation parameters on an equal angle grid (with step 0.5 deg) covering CONUS with full-year data from 1999 to 2009 (with partial-year data before and after). The database is fully-validated against the ground truth of SURFRAD network.

GSIP V1 database provides us with one-hour temporal resolution data. We use this data to construct a set of the standard solar energy parameters (see <http://eosweb.larc.nasa.gov/sse/text/definitions.html> for definitions) with the same one-hour temporal resolution on an equal-angle grid with 0.5 degree step covering CONUS. The grid has 121 nodes in longitude, from -126 to -66 degree, and 61 nodes in latitude, from 24 to 54 degree North¹. Hourly data are provided in local time. Then we proceed to daily and monthly averages (some solar energy parameters have starting time scales at days or months, so not every parameter is represented at hourly time scale). And finally, we produce multiyear averages (1999 – 2009) for every month (1 – 12). We call the new database Solar Resource Data Base (SRDB) and present its version 1.0.

The processing of SRDB data proceeds as follows:

1. We apply filters to original data. These filters test fluxes for high- and low-value outliers, cloud information for being consistent. We also test GSIP images for other known deficiencies. Deficiencies are replaced with missing values.
2. Filtered GSIP data undergo time- and space-domain interpolation with the goal to fill in the missing values. Interpolation goes in the loop within every day of observation. Loop-breaking condition is end of interpolation within the maximal allowed number of loops (less than 5 loops usually).
3. Prepared in the first two steps GSIP data is used to produce SRDB parameters. For this goal, we use the following GSIP parameters:
 - 41 – Short wavelength surface downwelling total flux;
 - 46 – Short wavelength surface downwelling diffuse flux;
 - 39 – Short wavelength top-of-atmosphere downwelling flux;
 - 20 – Number of clear pixels in the cell;
 - 21 – Number of cloudy pixels in the cell;
 - 24 – Solar zenith angle.
4. To produce reliable SRDB, we impose several restrictions on the used GSIP data in order to increase the reliability of results:
 - minimal number of good CONUS images per day before interpolation – 3,
 - maximal solar zenith angle of a cell - 78 degrees,
 - minimal number of hourly data for calculation of daily averages - 3,
 - minimal number of daily data for calculation of monthly averages - 3,
 - minimal number of yearly data for calculation of multiyear averages - 3,
 - minimal number of sunlit cells in GSIP image - 10,
 - minimal percentage of good data in the image - 20%.

These restrictions may produce some artifact structures on SRDB CONUS images, especially in the areas and periods of scarce data.

5. We produce, where applicable, hourly, daily, and monthly averages. We also produce multiyear averages of monthly data over all 11 years of the covered time period (1999 to 2009). Every file in the SRDB database contains all SRDB parameters for the month and year specified in the HDF file name (month only for the multiyear averages). SRDB parameters are given on the GSIP V1 grid, so these are rank 2 arrays for the monthly and multiyear data, rank 3 arrays for daily data, and rank 4 arrays for hourly data. Data is unscaled in these HDF files, the files are gzipped.

Processing took place in Linux computing environment of NOAA/NESDIS/STAR.

¹ From 1999-01-01 to 2001-03-31 the grid size was 111x51 with bounds -124 to -71 in longitude and 25 to 50 North in latitude.