Recent Improvements in the National Solar Radiation Database (NSRDB)

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Abstract

- The National Solar Radiation Database (NSRDB) has significantly evolved since the first release of the point source database in 1992.
- The NSRDB has been widely used by the solar energy industry to provide long-term time-series solar resource data for various project phases.
- The NSRDB represents the state of the art in the satellite-based estimation of solar resource information and uses a unique physics-based modeling approach that allows improvements in accuracy with the deployment of the next-generation geostationary satellites.
- The historical NSRDB data are available from 1998 to the present with a 1-year lag and are processed on a nominal 4x4-km grid spacing at a 30-min frequency. Beginning in 2018, the NSRDB has additional data sets available at a 2x2-km, 5-min resolution available for the continental United States, Hawaii, Mexico, and the Caribbean Islands and at a 2x2-km, 10-min resolution for North and South America from +60 to –60 degrees latitude.
- This poster demonstrates (1) the improved spatiotemporal resolution; (2) on-demand services and their applications; (3) future improvements, such as a new direct normal irradiance (DNI) model and new methods to gap-fill missing data using physics-guided machine learning; (4) data quality; and (5) data dissemination.

Physical Solar Model (PSM)

Data sources
- Satellite Data
- Final NSRDB

Model inputs
- Radiative transfer model
- Solar irradiance time-series variables

Spatiotemporal Coverage

Recent Additions

Updated products to contain 2022 data

New products released in 2021

Validation

Data Dissemination

The data sets can be accessed:
- By point location or small area downloaded through the NSRDB Data Viewer (https://maps.nrel.gov/nsrdb-viewer/)
- By application programming interface to access larger quantities of data through automated approaches (https://nsrdb.nrel.gov/data-sets/api-instructions.html)
- Through the Highly Scalable Data Service (HSDS) hosted on Amazon Web Services (https://github.com/NREL/hsds-examples/blob/master/notebooks/03_NSRDB_introduction.ipynb).

Updates in Fiscal Year (FY) 2022

Parallax-Correction, Shading, and Remapping

Albedo Adjustment

Previous surface albedo on March 1, 2020

Updated surface albedo on March 1, 2020

\[ \alpha = \begin{cases} 0.8, & \text{if } \frac{\text{WW}}{\text{T}} < 268 \text{K} \\ 0.65 + \frac{0.03(273 - \text{T})}{\frac{268}{\text{T}}} & \text{if } 268 \text{K} < \text{T} < 273 \text{K} \\ 0.65, & \text{if } \text{T} = 273 \text{K} \end{cases} \]

Ross and Walsh (1987) suggested a parameterization that decreases the albedo linearly with temperature when it approaches the freezing point. The snow/ice albedo is updated according to Ross and Walsh (1987).


Updates in FY 2023–FY 2024

- Implement machine learning/artificial intelligence-based derivation of cloud identification.
- Investigate the availability of aerosol data sets from GOES-16 and GOES-17 satellites.
- Custom typical meteorological year in the plane of array.
- High-resolution cloud properties (500 m) to get cloud fraction and improved cloud optical depth.
- A 50-year projected solar radiation data set going out to 2070 from regional climate models.

References