



The National Solar Radiation Database (NSRDB) and its use in Solar Applications

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The National Solar Radiation database (NSRDB) is a widely used public database (<https://nsrdb.nrel.gov>) containing high-resolution satellite-based solar radiation data used in solar energy modeling and grid integration. This dataset covers the Americas (from Canada to Brazil) and enables various PV and CSP projects, production cost and capacity expansion modeling, resource planning, and national and regional integration and deployment. Historically satellite-based solar radiation models have used an empirical approach relating satellite radiance directly to surface radiation but the NSRDB uses a physics-based approach. Developed by NREL, the NSRDB uses the Physical Solar Model (PSM) framework to produce gridded solar irradiance including global horizontal irradiance (GHI), direct normal irradiance (DNI), and diffuse horizontal irradiance at a 4-km by 4-km spatial and half-hourly temporal resolution. The dataset covers a 19-year period from 1998–2016. The PSM uses a two-stage scheme that first retrieves cloud properties using a modified AVHRR Pathfinder Atmospheres-Extended (PATMOS-x) scheme and uses those properties in the Fast All-Sky Radiation Model for Solar Applications (FARMS) to calculate surface radiation. Aerosol and water vapor for clear sky calculations are derived from Modern-Era Retrospective Analysis for Research and Applications, v2 (MERRA2).

This presentation will include a summary of the development of the NSRDB and the underlying PSM modeling framework. A comprehensive validation of the NSRDB using high-quality ground measurements will be presented. In addition we will present a spatial and temporal analysis of the data. This analysis will include a study of the inter-annual and seasonal variability and provide an insight into the strengths and weaknesses of using Typical Meteorological Year (TMY) data for solar energy analysis.