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A Comprehensive Quality Assessment of the Bureau of Meteorology's Satellite Gridded Solar Data

Ian Grant

Bureau of Meteorology, GPO Box 1289, Melbourne VIC 3001, Australia
E-mail: ian.grant@bom.gov.au

The Australian Bureau of Meteorology (the Bureau) continues to distribute satellite-derived gridded solar radiation data covering Australia. Time series of daily global horizontal exposure and hourly global horizontal and direct normal irradiance, extending back to 1990, as well as monthly and annual climatological averages of hourly and daily values, are available from the Bureau free of charge or for the cost of distribution (http://www.bom.gov.au/climate/data-services/solar-information.shtml). Visualisations of grids and time series data at point locations are also available from the Australian Renewable Energy Mapping Infrastructure (AREMI, https://www.nationalmap.gov.au/renewables/).

Up until recently, the uncertainties of the Bureau's gridded solar data have only been broadly quantified by a small set of statistical metrics. Thorough and reliable characterisation of dataset uncertainties increases confidence in the data and optimises its use in several applications in the solar energy sector. This particularly applies, for example, in the assessment of the availability and variability of the solar resource at a potential site for utility-scale solar generation and the improvement in financing arrangements brought by reducing uncertainties in the solar resource estimate.

The Bureau has recently produced a comprehensive suite of metrics to quantify the uncertainty of its satellite-derived gridded solar data products. These are based on comparison of the satellite-derived data with observations from the Bureau's high-quality ground-based radiation network. The comparison metrics include basic statistical measures of bias and spread, and also higher order measures such differences between probability distribution functions that give a more complete picture over the full range of radiation levels. Metrics quantifying characteristics other than uncertainty, such as completeness, round out the suite of data quality measures.

Looking at dataset assessment more broadly, solar resource datasets are provided over Australia by other data producers such as NASA's POWER coarse resolution (50 km, 3 hours) datasets (https://power.larc.nasa.gov/) and various commercial providers. Ideally all such datasets would be benchmarked with a standard set of methods and metrics that allowed assessments to be intercomparable. To date there is no standardised method for accuracy assessment of satellite datasets (Sengupta et al., 2015). A set of good practices for the assessment of uncertainties of satellite-derived solar radiation data is under development with the intention they could be adopted as an international standard. Formally, a validation protocol document is being developed under the auspices of the Committee on Earth Observation Satellites (CEOS, http://ceos.org/), an international organisation that coordinates the operation and utilization of non-meteorological applications of civilian Earth observing satellites. The protocol development is in the work plan of the Land Product Validation (LPV, https://lpvs.gsfc.nasa.gov/) Subgroup of CEOS's Working Group on Calibration and Validation (WGCV). The validation protocol will aim to recommend "good" practices rather than necessarily "best" practices, since a WGCV priority is to encourage consistency in validation practices across the community of data producers and users. The protocol will be available for adoption by data producers, be they CEOS agencies or others, or anyone else who validates satellite data products. The solar radiation protocol will draw on recently published LPV validation protocols such as the one for land surface albedo (Wang et al., 2018) as guidance for its structure, and build on previous work on solar data validation such as the report (Beyer et al., 2009) produced by a collaboration of the European MESoR project and Task 36 of the International Energy Agency's Solar Heating and Cooling programme.

References

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