



# Superpower your solar meteorological data with advanced quality control

Solar meteorological data is only as useful as it is accurate. The quality control process is critical to ensure the accuracy and reliability of the data used in solar energy analysis, forecasting and system operation. Solar power plant performance monitoring is essential to maximise return on investment, extend the lifespan of the system, ensure safety and meet production targets. It involves a combination of preventive measures, ongoing monitoring, and corrective actions to address issues promptly and efficiently.



### The growing need for accurate data

The necessity for accurate data is escalating, particularly in the renewable energy sector including solar and wind power, which plays a pivotal role in our global shift towards reducing greenhouse gas emissions and combating climate change. This shift has led to significant growth and innovation within the solar energy field, where the reduction in both equipment and operation costs has enabled the expansion into new markets and the rapid scaling of projects. However, the substantial financial investment in utility-scale solar installations leaves little room for errors and performance degradation.

Accurate solar and meteorological data is essential for the effective development, operation, and monitoring of solar power plants. It encompasses various weather parameters crucial for site selection, ongoing performance optimisation as well as energy output prediction. Automatic weather stations are indispensable throughout this process, because they provide high-quality, site-specific weather observational data.

### Is your solar data reliable?

Ensuring the accuracy of solar meteorological data is pivotal for precise solar energy assessments and PV system

performance modelling. Factors like shading, sensor errors, soiling, human and data preprocessing errors can introduce anomalies, potentially leading to inadequate system sizing, inaccurate performance analysis and financial losses.

Several factors can undermine the quality of solar meteorological data, including sensor defects such as dirt, dust, and other contaminants can impair sensor accuracy, necessitating regular maintenance and instrument calibration. Weather instruments can drift over time, making periodic recalibration essential. Installation issues are also a concern, including incorrect sensor placement in areas with shading, obstructions or reflective surfaces can lead to data inaccuracies, highlighting the need for meticulous installation and periodic checks. Automated sensor and data checks are effective way to preserve data quality and prevent errors.

In addition, data transmission gaps and time-stamping errors can result from various issues, including equipment malfunction and transmission problems, complicating data analysis and interpretation.

Addressing these challenges through diligent quality control is the key to maintaining data accuracy and enhancing solar project outcomes.

### Approaches to quality control for solar data

After solar irradiance data collection, there are several methods of validating its quality to spot inconsistencies or gaps. Each method has unique challenges. Manual review involves detailed data analysis, which, despite being customisable, is time-intensive and prone to human error.

Software solutions offer anomaly detection but may lack automation in processing multiple data files, requiring manual oversight. Automated scripts convert quality control insights into code for efficient data vetting, demanding up-to-date expertise on solar data quality control and professional software programming skills. Machine learning, both unsupervised and supervised, categorises data effectively, though its success hinges on the quality of training data, posing challenges for adapting to new datasets.

These methods can help identify and correct data anomalies, ensuring the integrity of solar energy assessments and system performance models.

### Data quality control with automatic weather stations

The most advanced weather monitoring solutions, optimised for PV plants and designed according to IEC 61724-1



guidelines, automatically measure, process and store meteorological data.

They can provide high-quality and reliable weather data to help project developers and PV plant operators monitor solar resource and key weather parameters.

Site-specific ground observations are critical to train satellite-derived solar data and reduce energy yield uncertainty in the development phase. Local observations, for example, can be fed into asset performance monitoring solution, which use the weather data for performance ratio calculation and

detect deviations by comparing theoretical power output to the real one.

The data management unit which collects and processes sensor data can perform real-time quality control tests to ensure data meets climatological limits and detects changes between successive measurements. It can flag potential errors for further processing and analysis.

Self-diagnostics can help to ensure uptime and proactive system management including supply voltages, internal temperature and sensor statuses, plus

continuous network sensor monitoring and automated error notification.

### The future of data quality control

To ensure high-quality data quality control for solar and meteorological data, various strategies are employed along with the use of automatic weather stations. This includes manual inspections and software for identifying anomalies in data. Advanced scripts and machine learning further refine quality checks, with specific measures like threshold settings to flag data outside expected ranges.

Integrating on-site ground measurements with historical satellite weather data gives the most accurate view of the solar and meteorological data of a solar power plant and can highly improve data sets for solar energy resource assessments and performance monitoring.

As solar energy projects continue to scale globally, the importance of advanced, reliable data quality control mechanisms becomes even more important. Innovations in sensor technology, data processing software, and automated quality control scripts are paving the way for more accurate, efficient, and resilient solar energy systems.

The strategic importance of quality control in solar meteorological data cannot be overstated. It is a cornerstone upon which the reliability, efficiency, and economic viability of solar energy investments rest. As the renewable energy sector continues to evolve, so too will the tools and methods for ensuring data quality, driving the global transition to a more sustainable and clean energy future.

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