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Assessment of TMY generation methods for solar power production estimation

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This paper deals with the evaluation of different methods commonly employed in the solar power industry for the generation of representative data sets with solar resource information and further climate parameters.

The quality of energy yield simulation data sets is defined by the accuracy of the data source (e. g. measurement device or calculation model) and its representativeness for the typical meteorological conditions at the location of the investigated power plant site. Supposing that data with high accuracy is available the next challenge is to prepare a best-possible input data set for the energy production simulation software. Such programs are often limited to the simulation of one-year data sets with hourly frequency (i. e. 8760 values). The data set shall therefore contain values which are most representative for each hour of the year and reflect the dynamical behaviour of the resource. As simple averaging of long-term data would not fulfil these requirements, certain methods for selecting such a typical meteorological year (TMY) have been developed in recent years. Presently, there are three to four different methods recommended in scientific literature or suggested by practitioners in the solar industry.

The evaluation in this paper seeks to test the most commonly used methods with high precision data from the baseline surface radiation network (BSRN). From a long-term time series retrieved from a station in a region suitable for the development of solar power plants a TMY is created by utilizing different generation methods. The resulting data set is then compared to the average over all years in order to evaluate the general representativeness. As the plant operator is interested in the average production over the life time of a plant the result of an energy yield simulation performed with each of the different data set is then compared to the mean production gained by simulating the yield of for each single year and then averaging the results obtained for the individual years.

As outcome of this evaluation information on the meteorological representativeness and suitability for energy production estimation of each method is achieved. This is regarded as an important step in assuring the validity of production forecasts based on TMYs in the context of solar power plant development – an area which is characterised by very specific needs for solar input values (e. g. DNI) and lack in the concurrent availability of additional parameters such as temperature and humidity.