

The Effect of Different Resolution Solar Radiation Data on the Radiation Exposure

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Measurement site and instrument

● Measurement site

CMA Integrated meteorological Observation Training and Practice Base (Nanjing) located in Nanjing Information Engineering University (NUIST) (32.21°N, 118.72°E) in the northern suburb of Nanjing.

● Radiation Instrument

Global Horizontal Irradiance(GHI) : MS-802F
Diffuse Horizontal Irradiance(DHI) : MS-802F
Direct Normal Irradiance (DNI) : MS-56
Radiation data with a minute resolution (EKO Instruments)
Period: October 2015- May 2016



Results and discussion

According to table 1 and 2, there was no obvious difference between the results of minute-resolution data and the hour-resolution data. The total of GHI and DNI exposures of minute-resolution data were greater than that of the hour-resolution data. The DHI exposures are opposite feature.

Table 1. The statistics results on the minute-resolution data

	Global radiation exposure MJ/m ²	Direct radiation exposure MJ/m ²	diffuse radiation exposure MJ/m ²
Max values	20.6	18.7	11.0
Date of max value	2016/5/16	2016/5/16	2016/5/24
Average values	8.6±5.0	4.9±5.2	5.2±2.4
Total of exposure	2039.6	1151.7	1217.9

Table 2. The statistics results on the hour-resolution data

	Global radiation exposure MJ/m ²	Direct radiation exposure MJ/m ²	diffuse radiation exposure MJ/m ²
Max values	20.5	18.3	10.9
Date of max value	2016/5/16	2016/5/16	2016/4/25
Average values	8.6±5.0	4.9±5.2	5.1±2.5
Total of exposure	2027.1	1150.6	1209.9

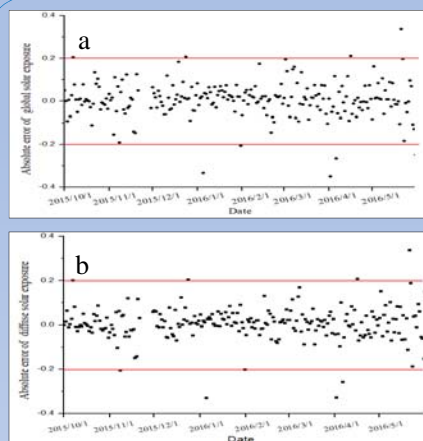


Fig 1. Absolute errors of GHI exposures (a) and DHI exposures(b)

The range of error:
34.9%~33.7%.
The absolute errors of 96.2% of GHI exposure were less than 20%.

The range of error:
32.9%~33.9%.
The absolute errors of 96.2% of DHI exposure were less than 20%.

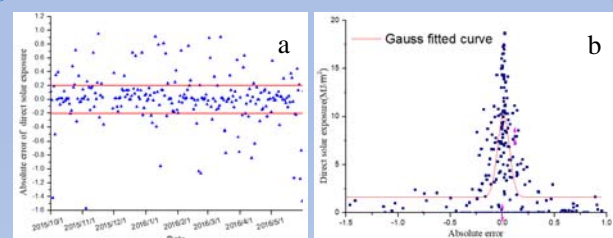


Fig 2. Absolute errors of DNI exposures (a) and fitted curve between the absolute errors and DNI exposures (b)

The absolute errors of 66.1% of DNI exposures were less than 20%. The distribution of the absolute errors presented ideally normal. The errors data which were greater than 50% mainly appeared in cloudy day.

Summary

According to the comparison of exposures on different solution, it showed that we could use hour-resolution replace minute-resolution observation for GHI and DHI exposure. They kept very small errors. But this was not suitable for DNI exposure although they had the similar maximum, average value and summation. The absolute errors and the DNI exposures took on a Gauss distribution. Cloud was the main factor for the large errors .

This research was funded by National Natural Science Foundation of China (Grant Nos. 41505136)