



METER
ENVIRONMENT

HOW DOES THE ATMOS 41 BIRD DETERRENT AFFECT SOLAR RADIATION DATA?

Contributors

With the [ATMOS 41](#) weather station bird deterrent installed, expect to see dips in the pyranometer data at specific times of the day during clear sky conditions. This is caused by the wire shadows that move across the pyranometer sensor throughout the day on sunny days. There are negligible wire shadow effects on diffuse days, when there is continuous cloud cover. We estimated <6% error in total daily solar radiation for a clear sky day and <1% error for a diffuse day. Check out the data below, which were taken from METER's rooftop testbed, March 2019.

SOLAR RADIATION EFFECTS FROM BIRD DETERRENT WIRES

Dips in solar radiation data are caused by the bird deterrent wire shadows on a clear sky day (see 3/9/2019 in Figure 1). The dips in solar radiation on sunny days will vary throughout the year as the sun angle changes. Solar radiation data are not affected by the bird deterrent on completely cloudy days, when no wire shadows are present (see 3/8/2019 in Figure 1).

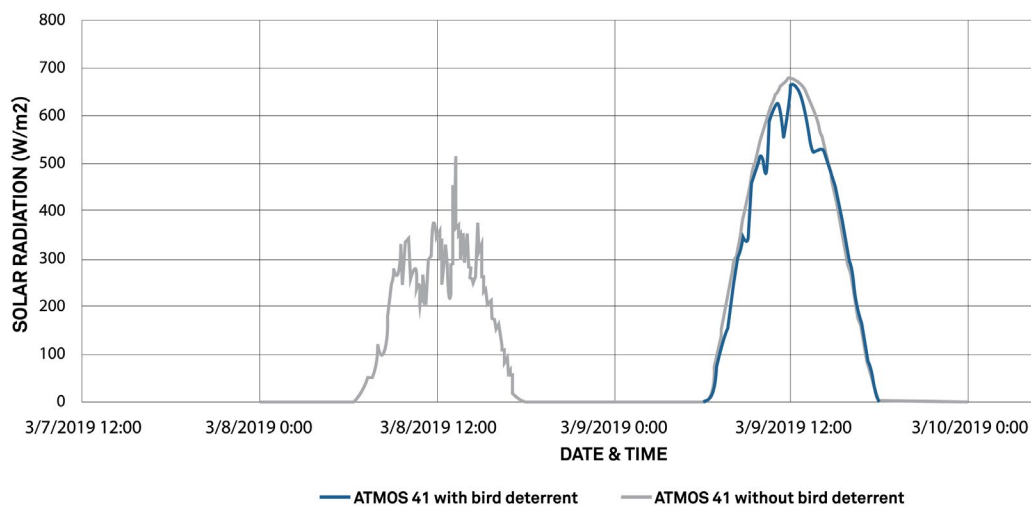


Figure 1. ATMOS 41 solar radiation data

On a mostly clear-sky day, the error caused by the bird deterrent was a decrease in total solar radiation by 3.0% and 4.7% for two ATMOS 41 pyranometer sensors (3/7/2019). On a cloudy day, the error caused by the bird deterrent was less than 1% (3/8/2019). On a clear sky day, the error caused by the bird deterrent was a decrease in total solar radiation by 2.6% and 5.7% (3/9/2019). The error was estimated by summing the daily solar radiation of ATMOS 41 units with bird deterrent (experimental) and without bird deterrent (control) and calculating the percent error. Data were collected at 5-minute intervals.

The data in Table 1 were collected from dates when there was no snow cover, and errors did not exceed 5% decrease in summed daily solar radiation.

Sky condition, Date	Percent error of summed daily solar radiation Test 1	Percent error of summed daily solar radiation Test 2*
Partly cloudy, 3/14/2019	1.8%	4.7%
Partly cloudy, 3/15/2019	2.4%	2.1%
Partly cloudy, 3/16/2019	2.0%	4.2%
Mostly sunny, 3/17/2019	2.4%	3.7%
Sunny, 3/18/2019	2.1%	4.2%
Sunny, 3/19/2019	2.3%	4.1%
Sunny, 3/20/2019	2.3%	4.1%
Mostly sunny, 3/21/2019	1.9%	4.5%

Table 1. Percent error of summed daily solar radiation by date
*Bird deterrent was not perfectly installed.

NOTE: Test 1 ATMOS was about 1% higher than the control when comparing baseline data with no bird spike; Test 2 ATMOS 41 was about -1% lower than the control when comparing baseline data with no bird spike (for summed daily radiation on a clear sky day).

INSTALLATION MATTERS

Correct bird deterrent installation (Figure 2) and incorrect installation (Figure 3) is shown below. The pyranometer sensor should be in the middle of two wires, indicated by the triangle. Expect increased error when bird deterrents are not correctly installed.



Figure 2: Correct installation: sensor is centered at the triangle.



Figure 3: Incorrect installation: sensor is slightly offset from the triangle.

Without summing daily solar radiation, the percent error when the pyranometer dips are most drastic resulted in a decrease of 13-17% solar radiation (clear sky day). At METER's testbed, this was a 83-113 W/m² decrease when the wire shadows caused the most drastic dips on 3/9/2019 (Figure 4).

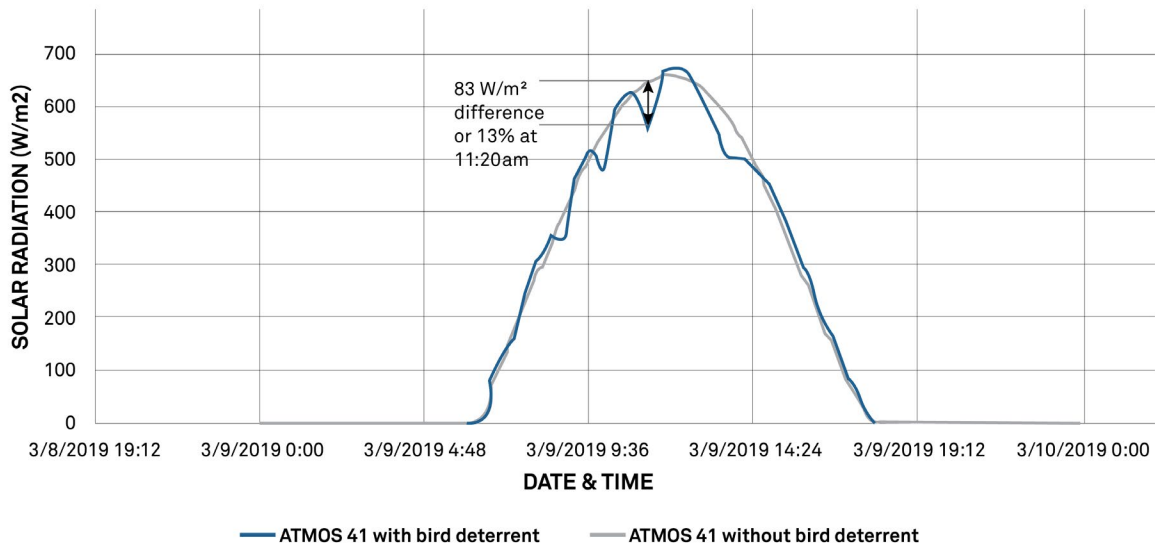


Figure 4. ATMOS 41 solar radiation data with and without bird deterrent

IS THERE A WAY TO CORRECT FOR THE WIRE SHADOW EFFECTS?

It is possible to use a clear-sky calculator to estimate solar radiation on sunny days; however, it would be challenging and not recommended to correct for bird deterrent shadow effects. The main reason is the shadows change over time, due to different cloud cover, time of day, time of year, and location.

HOW CAN YOU TELL IF THE PYRANOMETER SENSOR IS DIRTY?

Compare the data from a clear-sky day (when you know the pyranometer sensor was clean) to data on a day that should have produced clear-sky solar radiation measurements. If the comparison data indicate non-clear sky conditions on a day that should have been clear, this is an indication that the pyranometer sensor is dirty or obstructed. Collect and review a couple days of data to be sure it wasn't a bird

covering the sensor before making a field visit. When preparing for a field visit for a dirty pyranometer sensor, bring items to clean the sensor, funnel, downspout, and screen. Install a bird deterrent if bird droppings are present.

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