

ASSIGNMENT 1

Based on the weather report generated from Climate Consultant, there are a series of passive design strategies that one can do to mitigate the consumption of energy by a building in the Philadelphia area.

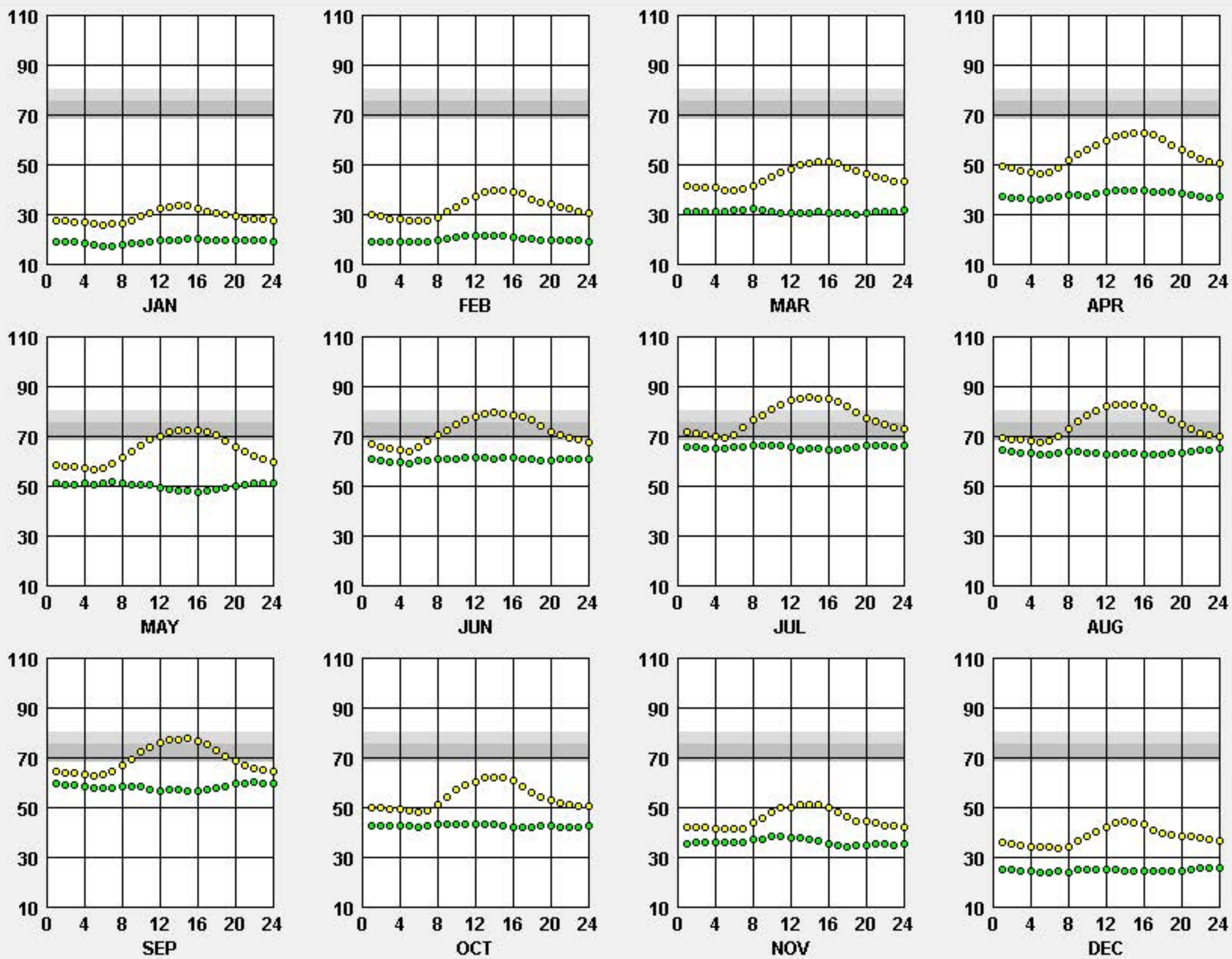
Of all the passive design strategies available to architects and designers to alleviate the strain of the surrounding environment on the building, and of course visa versa, there are a few in particular that are especially effective in this specific climate.

1. **Sun Shading of Windows:** Based on the Sun Shading Chart, for both the first half and second half of a given year, sun shading of windows could prove to be an extremely effective passive design strategy. The shades, some of which are heat/light sensitive so they are triggered automatically by the environment, rather than by human discomfort, in which case the interior temperatures of the building have already started to rise, reduce the sun's ability to penetrate the interior of the structure. This reduces the amount of energy used by the heating and cooling systems of the building to maintain a comfortable temperature for inhabitants. These shades can also help in the winter for passive heating, as there are over 3,000 hours in the year in the Philadelphia area where the exterior is too cool for human comfort, and heating places strain on the environment and the building systems. In this case, the shades can be retracted to allow the sunlight in and passively heat the building to a comfortable level. In either case, sun shades can help regulate temperature in a passive way that places less burden on the environment and building systems.
2. **Wind Protection and Natural Ventilation:** Wind, while only a small percentage impacts the comfortable hours of a building, is an important factor when it comes to building design, particularly when it comes to exterior spaces. There are a few key architectural decisions that can mitigate wind impact on a building, one key passive design strategy is building orientation. Facing the building a certain direction can increase or decrease its aerodynamics as the wind wraps around it, reducing the role that the wind plays on the interior/exterior spaces of the structure. Unfortunately the weather data I generated does not denote (I believe) the direction the wind most commonly blows from, but that would be a key piece of information to determine orientation. Other strategic architectural features can also direct wind away from parts of the building.
3. Although Philadelphia is not a tropical climate, the humidity can be rather high, particularly in the summer months. Humidity is one of the key factors in terms of comfort, and can be improved in a building through the introduction of ventilation. Passive ventilation strategies use naturally occurring airflow to improve the comfort within a structure. Operable windows are one of the primary passive design techniques used to lessen the humidity in a building. Also, double facades, or buffer zones, essentially building elements that increase the distance between the interior and the exterior can also lessen the amount of humidity felt on the interior.

DRY BULB X DEW POINT
ASHRAE Standard 55-2004 using PMV

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

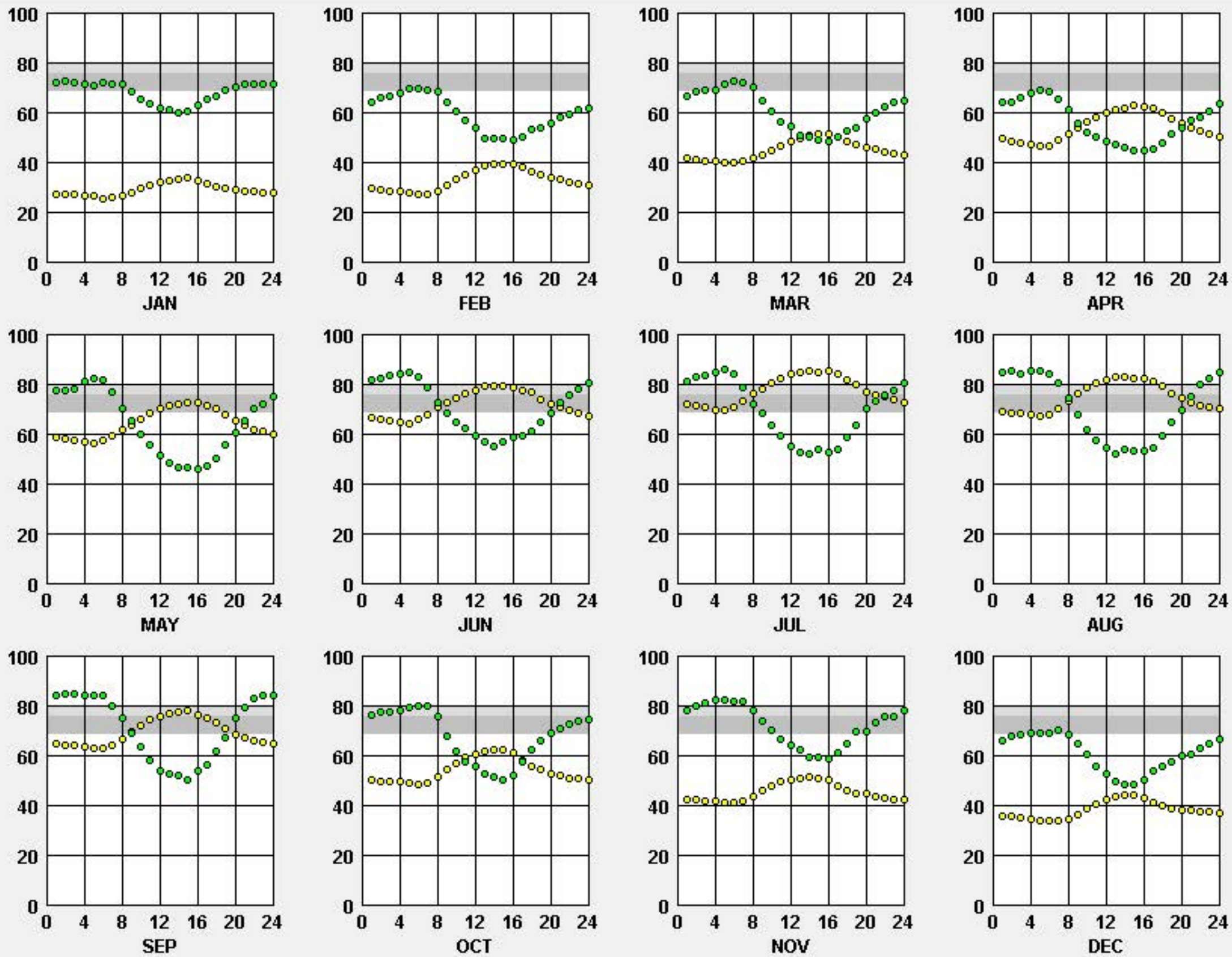


DRY BULB X RELATIVE HUMIDITY
ASHRAE Standard 55-2004 using PMV

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

- Dry Bulb
- Humidity
- Comfort Zone
- Summer
- Winter
- At 50%
Relative Humidity



GROUND TEMPERATURE (MONTHLY AVERAGE)

LOCATION: Philadelphia International Ap, PA, USA

Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5

Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

DEPTH
(feet)

1.64

6.56

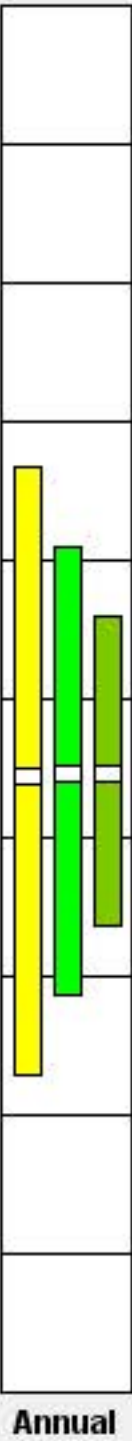
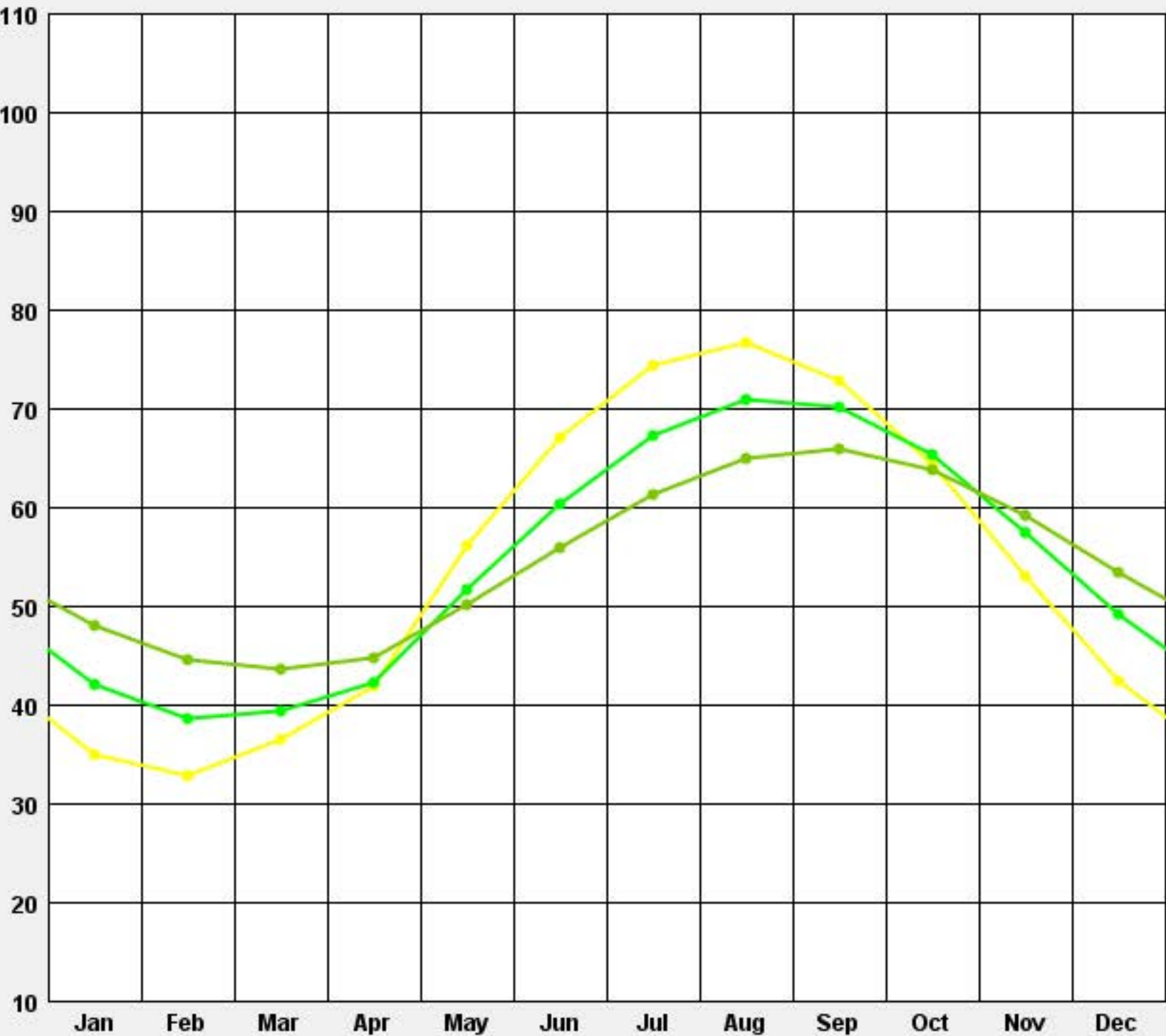
13.12

(Surface is freshly
mown grass.)

TEMPERATURE RANGE:

☒ 10 to 110 °F

☐ Fit to Data



ILLUMINATION RANGE

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

HOURLY ILLUMINATION
DAYLIT HOURS ONLY

RECORDED HIGH - ○

AVERAGE HIGH - [yellow bar]

MEAN - [white bar]

AVERAGE LOW - [yellow bar]

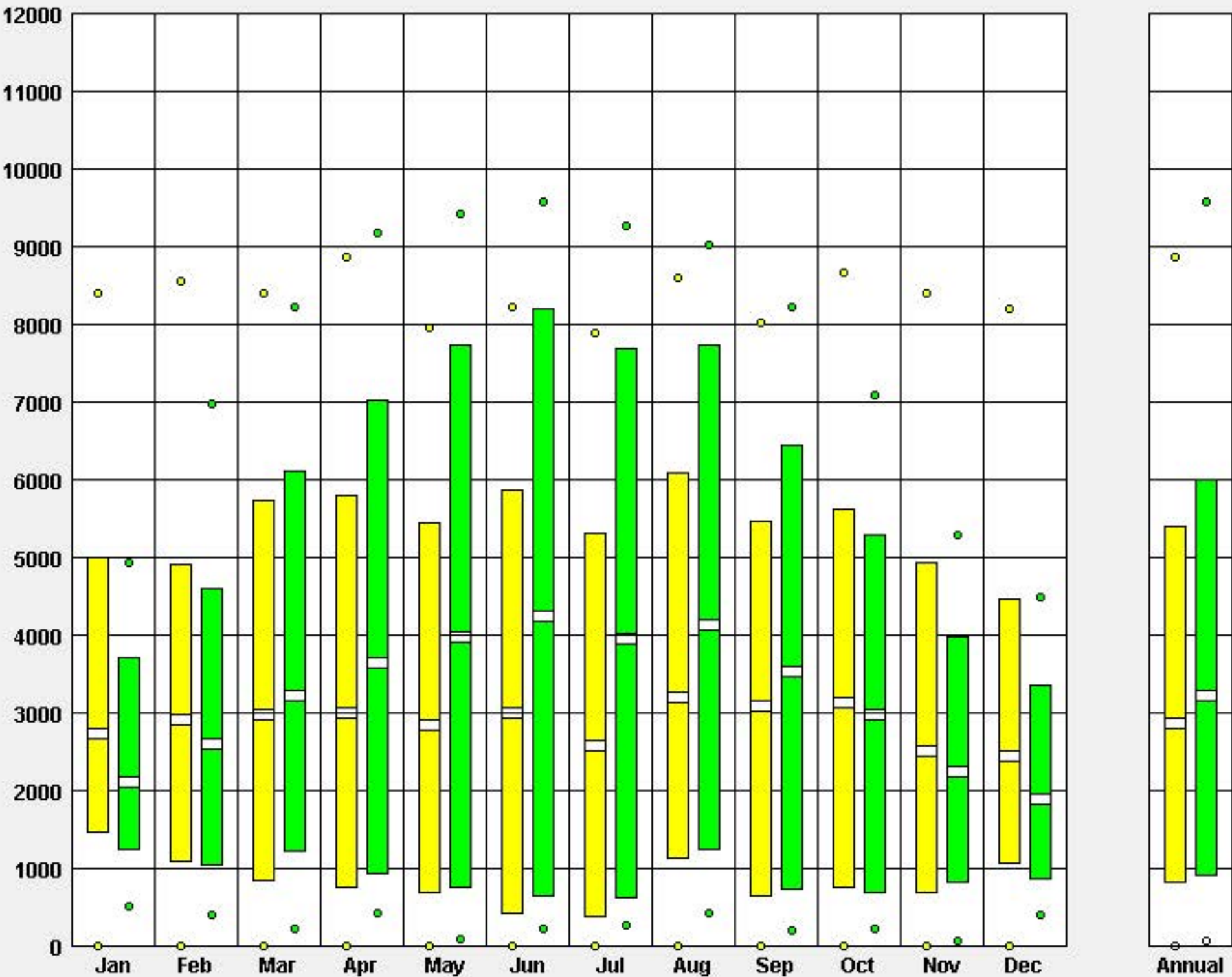
RECORDED LOW - ○

RECORDED:

[yellow bar] DIRECT NORMAL

[green bar] GLOBAL HORIZONTAL

(footcandles)



MONTHLY DIURNAL AVERAGES
ASHRAE Standard 55-2004 using PMV

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

HOURLY AVERAGES

TEMPERATURE: (degrees F)

- DRY BULB MEAN
- WET BULB MEAN
- DRY BULB (all hours)

COMFORT ZONE

- SUMMER
- WINTER

(At 50% Relative Humidity)

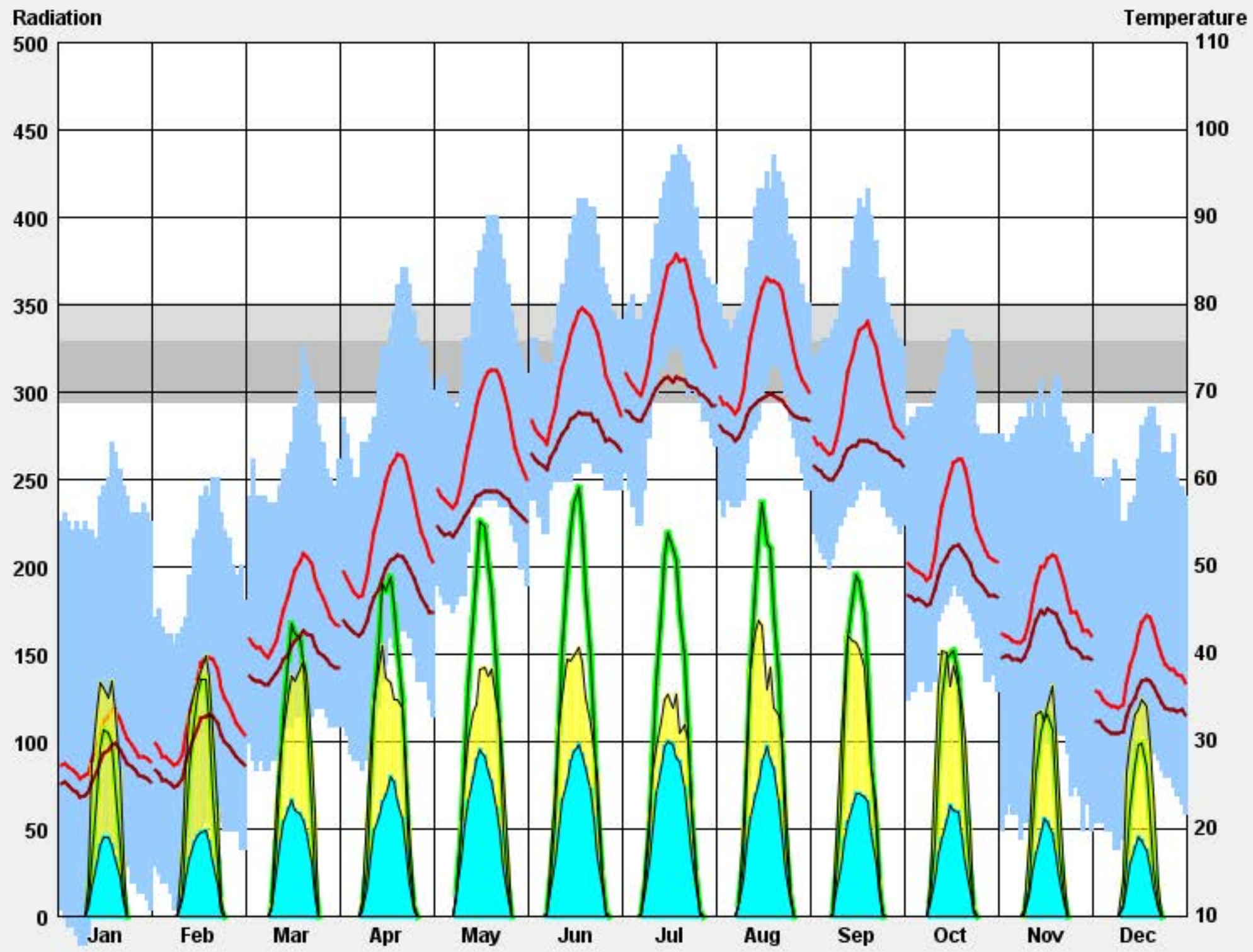
RADIATION: (Btu/sq.ft)

- GLOBAL HORIZ
- DIRECT NORMAL
- DIFFUSE

☒ Display Dry Bulb Temp
(all hours)

TEMPERATURE RANGE:

- ☒ 10 to 110 °F
- ☐ Fit to Data



RADIATION RANGE

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

HOURLY AVERAGES
DAYLIT HOURS ONLY

RECORDED HIGH -

AVERAGE HIGH -

MEAN -

AVERAGE LOW -

RECORDED LOW -

RECORDED:

DIRECT NORMAL

GLOBAL HORIZONTAL

TOTAL SURFACE

(Btu/sq.ft per hour)

THEORETICAL:

Tilted Surface Radiation Input:

0.0

Tilt degrees from Horizontal
(Vertical = 90°)

0.0

Bearing degrees from South
(South = 0°, West = +90°)

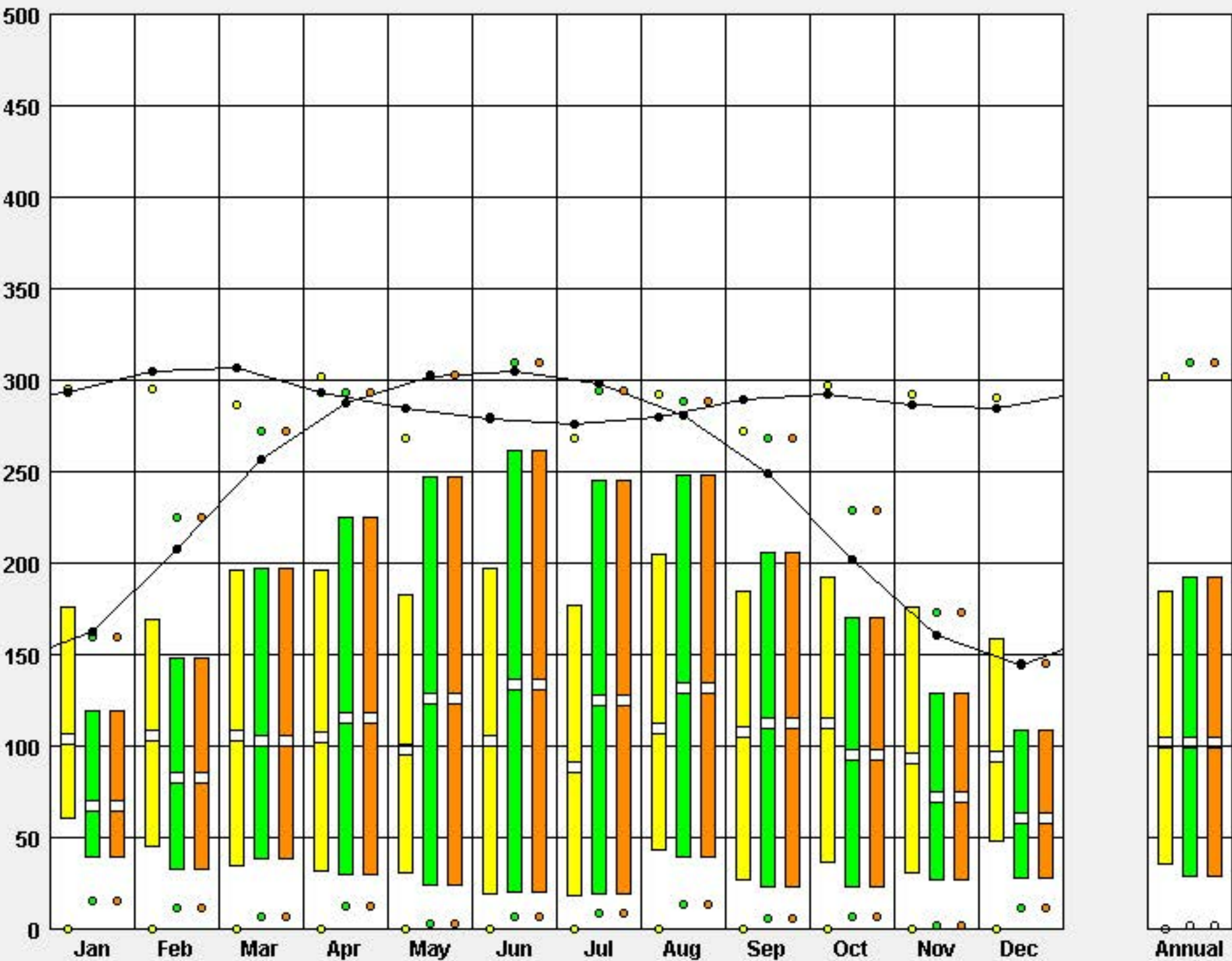
20.0

% Ground Reflectance
(20% = grass)

PLOT:

☒ Hourly Avg

☐ Daily Total



Hit ENTER to replot if you change Tilted Surface Radiation parameters.

SKY COVER RANGE

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

Total Cloud Cover100%

RECORDED HIGH -

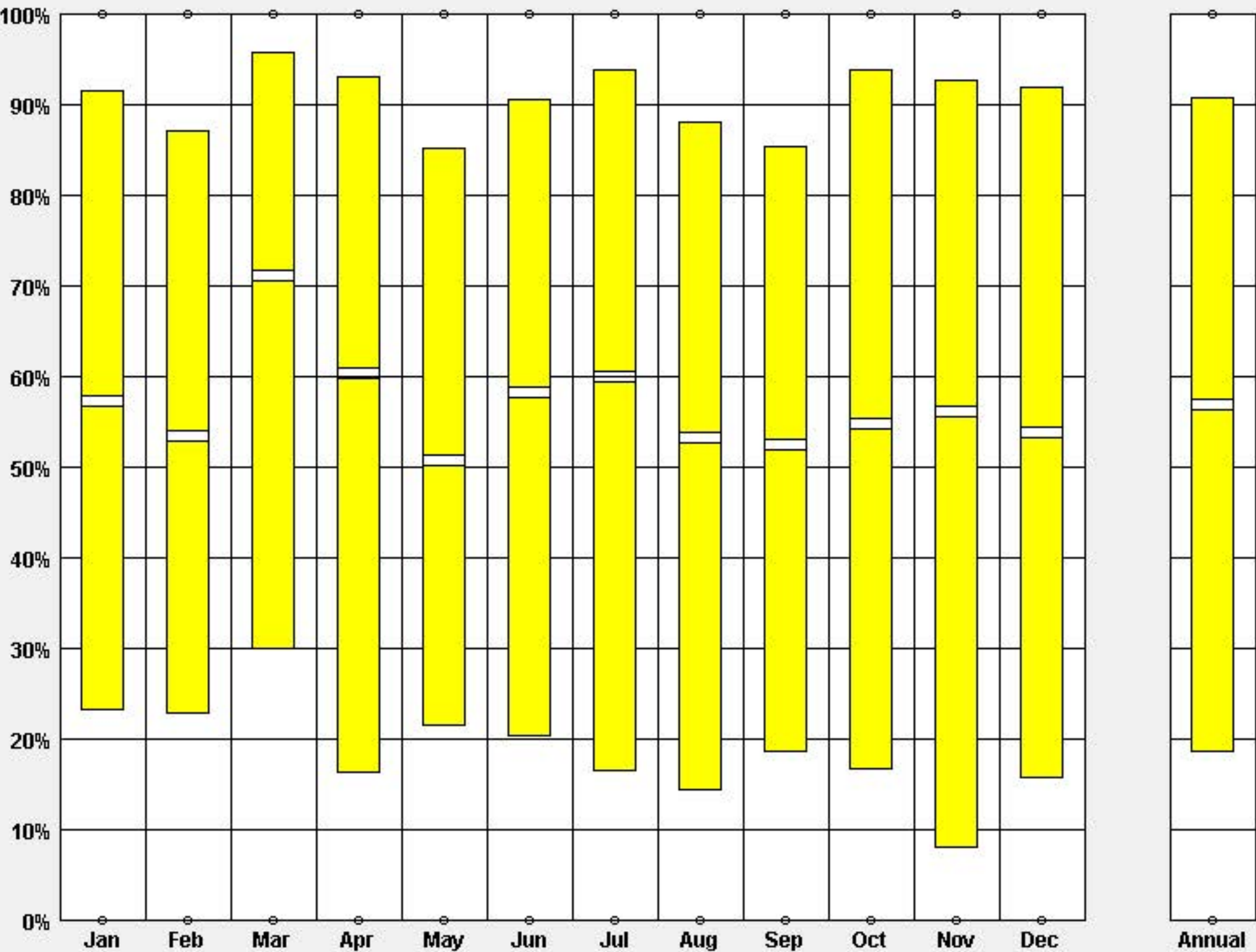
AVERAGE HIGH -

MEAN -

AVERAGE LOW -

RECORDED LOW -

Clear Skies0



SUN CHART

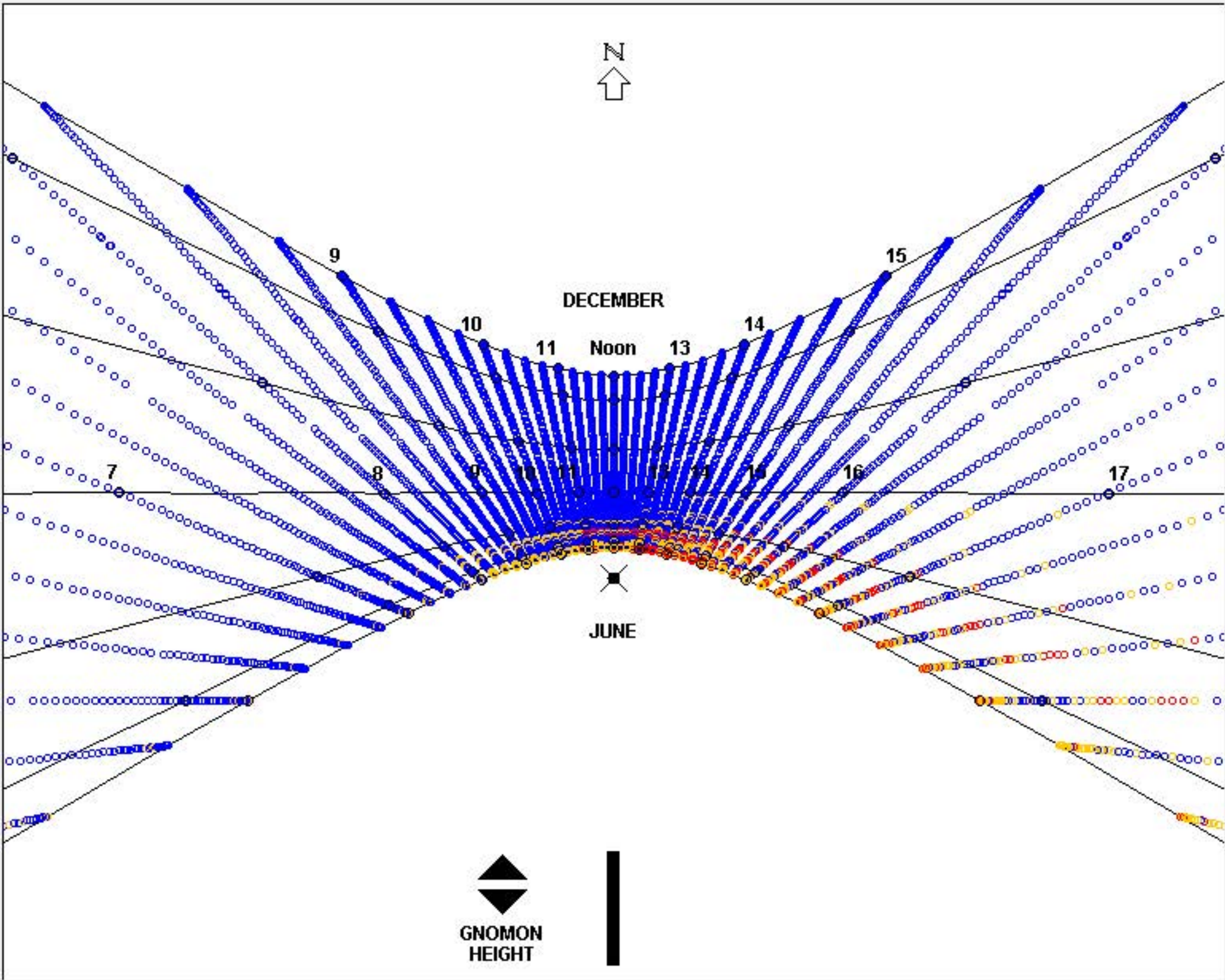
LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

- WARM/HOT > 80°F
(SHADE NEEDED)
- COMFORT > 68°F
(SHADE HELPS)
- COOL/COLD < 68°F
(SUN NEEDED)

✱ GNOMON POSITION

- PLOT MONTHS:
- WINTER SPRING
- December 21 to June 21
- SUMMER FALL
- June 21 to December 21



Click on arrows to increase or decrease gnomon height.

SUN SHADING CHART

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

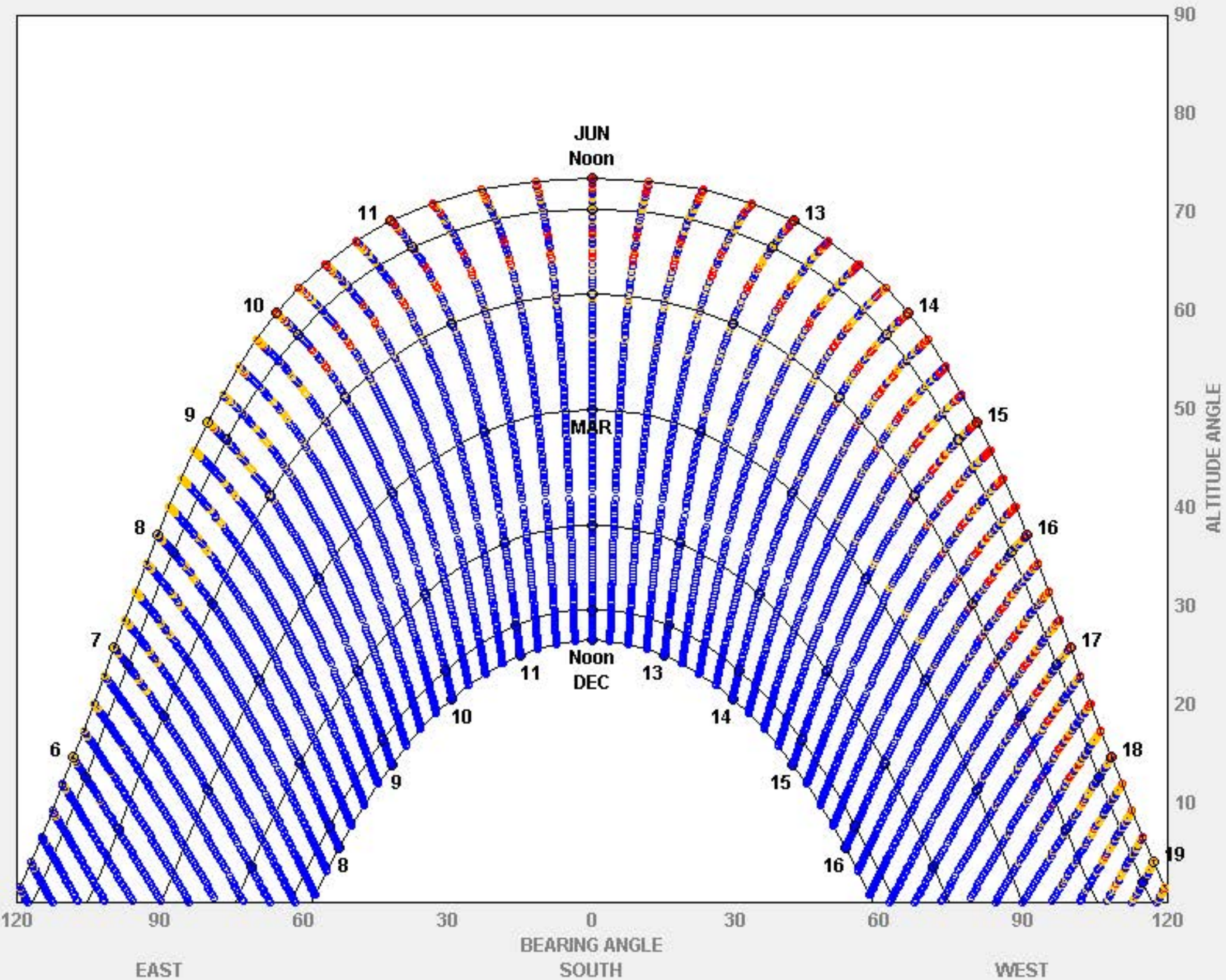
LEGEND

- WARM/HOT > 80°F
(SHADE NEEDED)
163 Hours Exposed
0 Hours Shaded
- COMFORT > 68°F
(SHADE HELPS)
433 Hours Exposed
0 Hours Shaded
- COOL/COLD < 68°F
(SUN NEEDED)
1914 Hours Exposed
0 Hours Shaded

PLOT MONTHS:
WINTER SPRING
● December 21 to June 21
SUMMER FALL
○ June 21 to December 21

- ☐ Display Grid
- ☐ Display Shading Calculator
- ☐ Display Obstruction Elevation

Input Obstructions



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SUN SHADING CHART

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

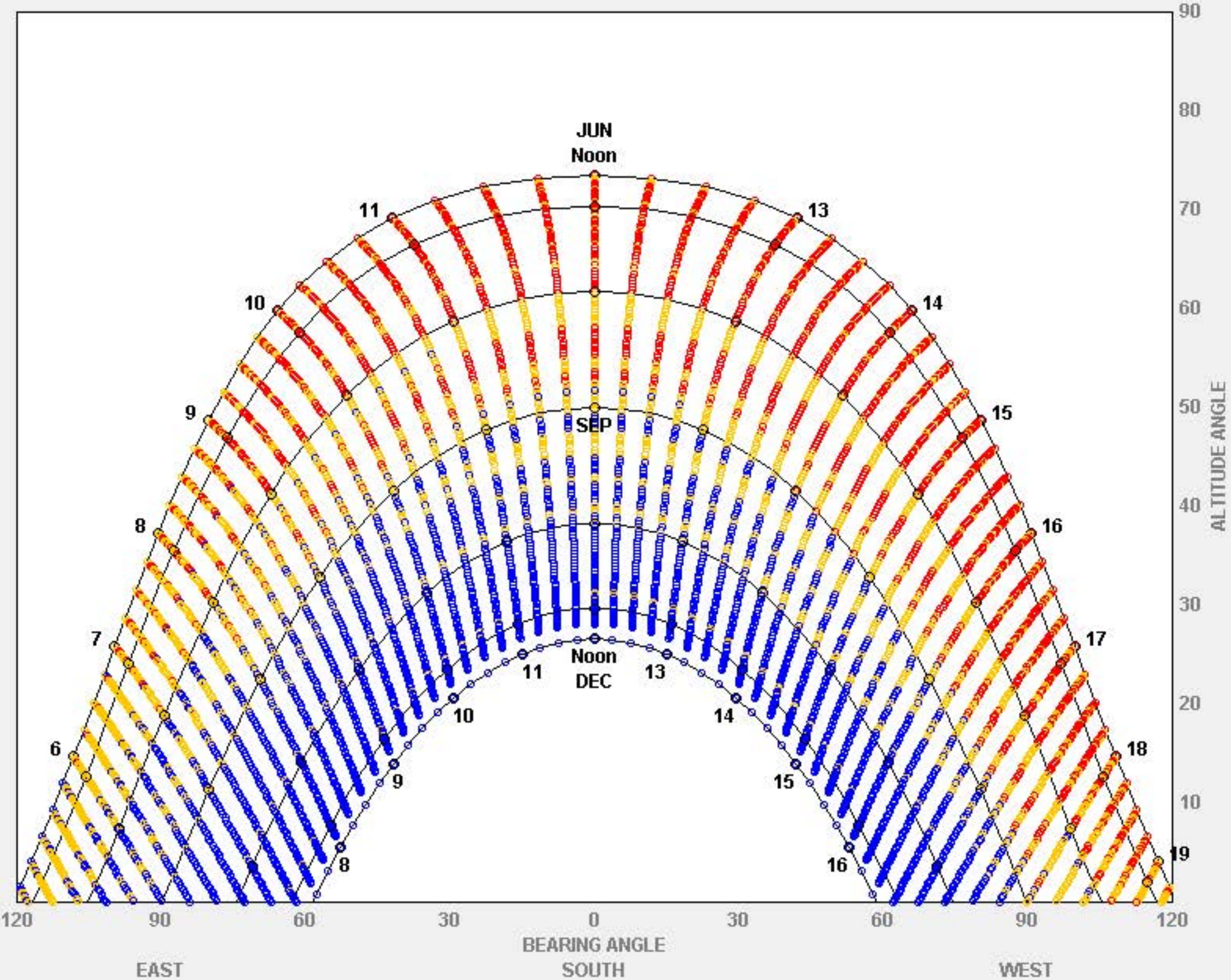
LEGEND

- WARM/HOT > 80°F
(SHADE NEEDED)
600 Hours Exposed
0 Hours Shaded
- COMFORT > 68°F
(SHADE HELPS)
920 Hours Exposed
0 Hours Shaded
- COOL/COLD < 68°F
(SUN NEEDED)
1080 Hours Exposed
0 Hours Shaded

- PLOT MONTHS:
- WINTER SPRING
- December 21 to June 21
- SUMMER FALL
- June 21 to December 21

- ☐ Display Grid
- ☐ Display Shading Calculator
- ☐ Display Obstruction Elevation

Input Obstructions









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TEMPERATURE RANGE
ASHRAE Standard 55-2004 using PMV

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

RECORDED HIGH - 
DESIGN HIGH - 
AVERAGE HIGH - 
MEAN - 
AVERAGE LOW - 
DESIGN LOW - 
RECORDED LOW - 

COMFORT ZONE
SUMMER 
WINTER 
(At 50% Relative Humidity)

DESIGN HIGH: Residential

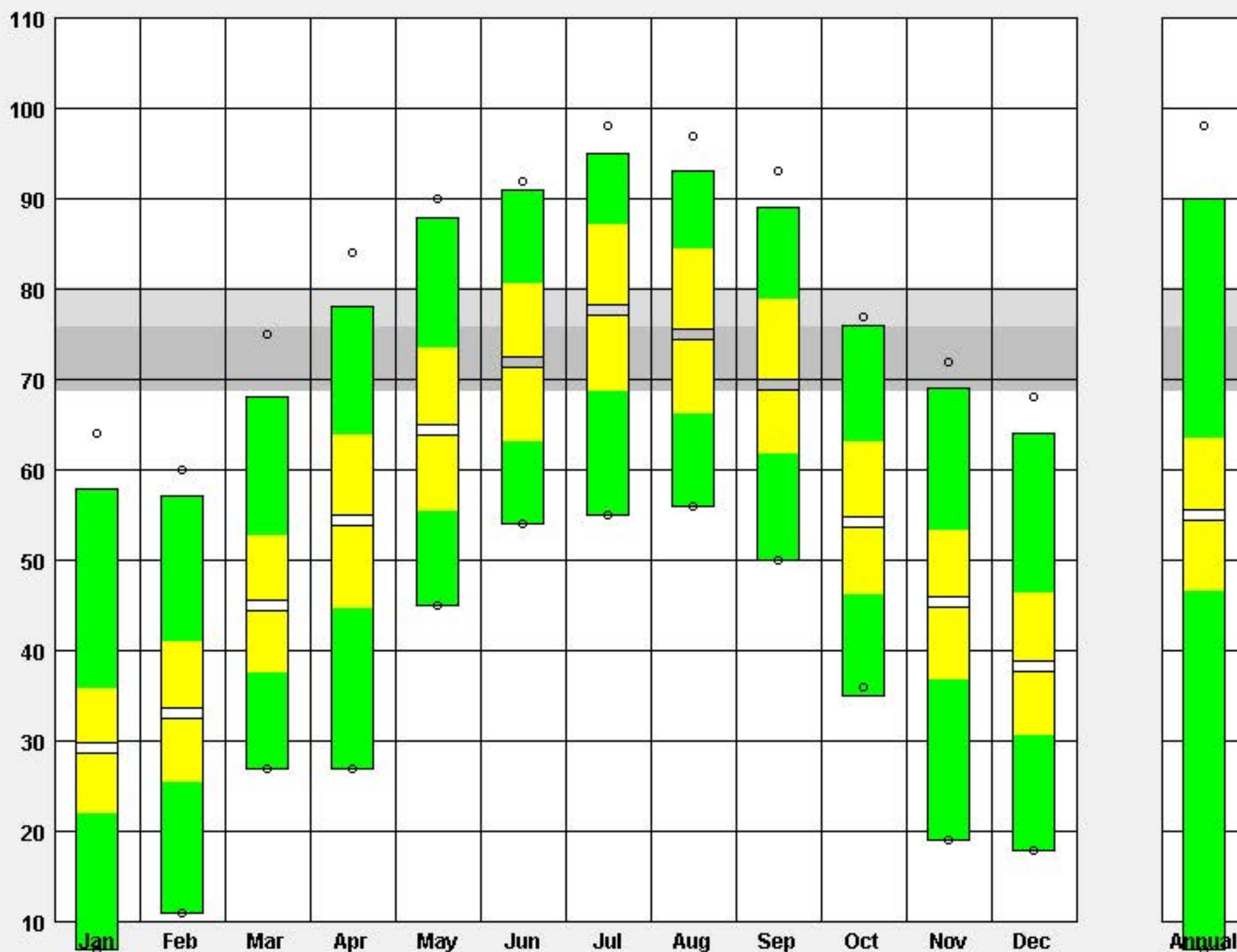
- ☒ 1% of Hours Above
- ☐ .5% of Hours Above
- ☐ 0% of Hours Above

DESIGN LOW: Residential

- ☐ 1% of Hours Below
- ☐ .5% of Hours Below
- ☒ 0% of Hours Below

TEMPERATURE RANGE:

- ☒ 10 to 110 °F
- ☐ Fit to Data



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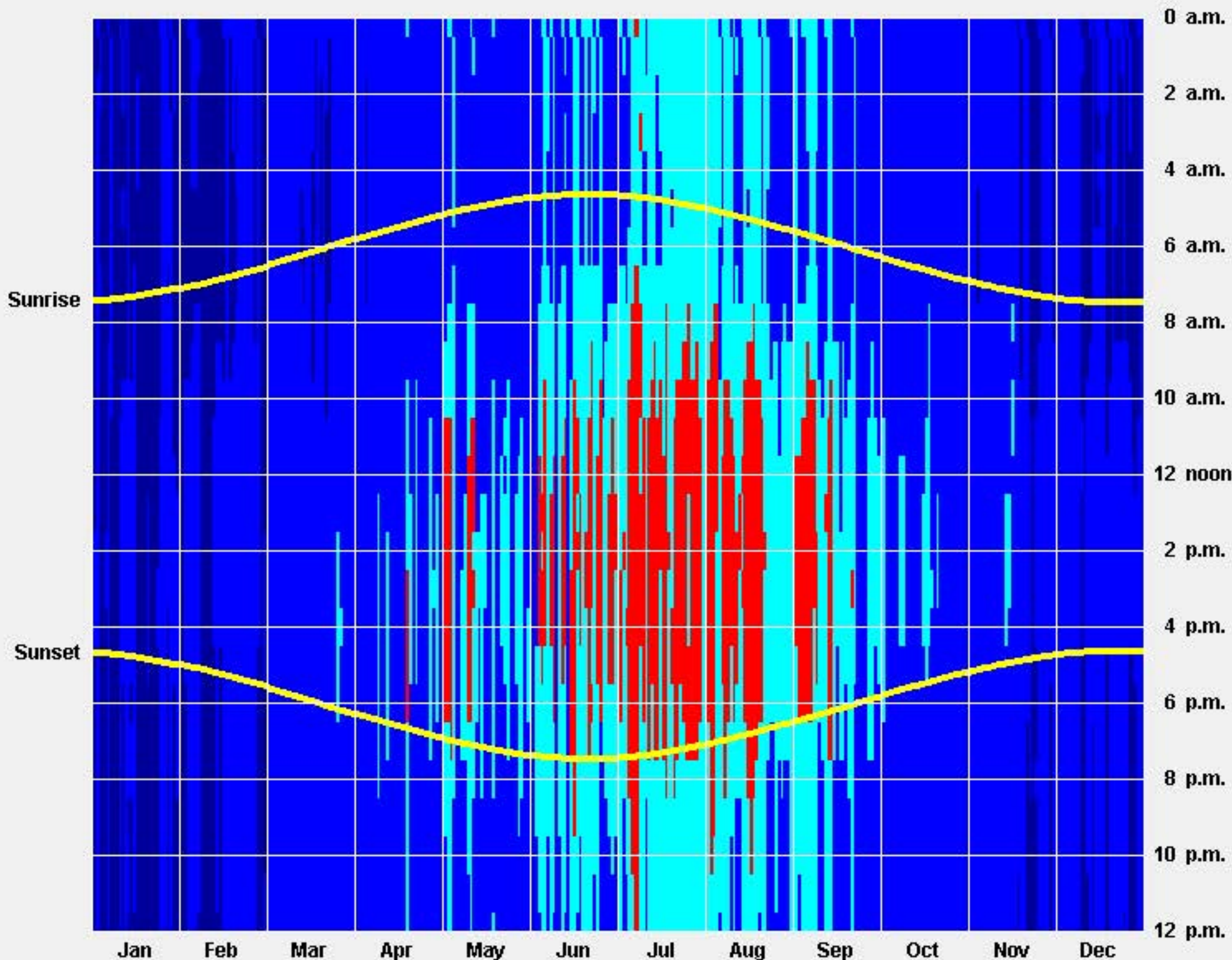
TIME TABLE PLOT

LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5
Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft

LEGEND

DRY BULB TEMP (degrees F)

12%	■	< 32
60%	■	32 - 69
20%	■	69 - 81
8%	■	81 - 100
0%	■	> 100



PLOT:

DRY BULB TEMP



☐ Monthly Avg ☒ Daily

Select colored squares on LEGEND to change plot colors (see Help).

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WIND VELOCITY RANGE


LOCATION: Philadelphia International Ap, PA, USA


Latitude/Longitude: 39.87° North, 75.23° West, Time Zone from Greenwich -5


Data Source: TMY3 724080 WMO Station Number, Elevation 6 ft


LEGEND

RECORDED HIGH - 

AVERAGE HIGH - 

MEAN - 

AVERAGE LOW - 

RECORDED LOW - 

(mph)

PLOT:

☒ mph ☐ fpm

WIND VELOCITY:

☒ 0 to 60 mph ☐ Fit to Data

