

FORGESOLAR GLARE ANALYSIS

Project: **Mills Peninsula Medical Center**

1MW of Carports proposed near a Future Development.

Site configuration: **Mills Peninsula Medical Center**

Client: Sutter Health

Site description: Preliminary Glare Analysis

Created 14 Jun, 2022

Updated 21 Jun, 2022

Time-step 1 minute

Timezone offset UTC-8

Site ID 71089.12465

Category 500 kW to 1 MW

(1,000 kW / 8 acre limit)

DNI peaks at 1,000.0 W/m²

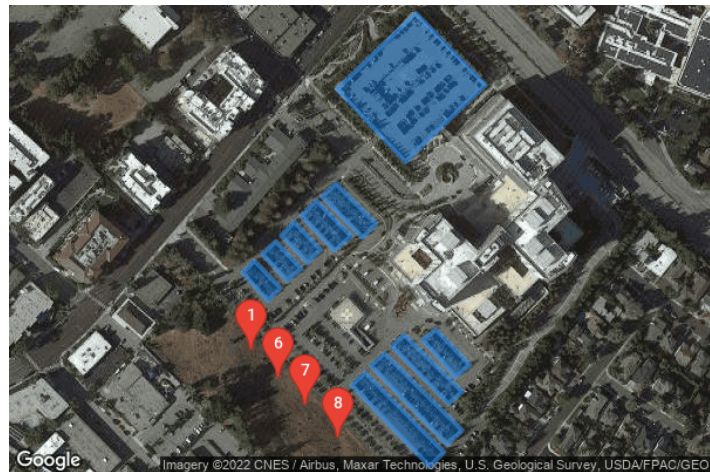
Ocular transmission coefficient 0.5

Pupil diameter 0.002 m

Eye focal length 0.017 m

Sun subtended angle 9.3 mrad

Methodology V2



Summary of Results Glare with low potential for temporary after-image predicted

PV Array	Tilt °	Orient °	Annual Green Glare		Annual Yellow Glare		Energy kWh
			min	hr	min	hr	
Array 1	7.0	225.0	0	0.0	0	0.0	-
Array 10	7.0	225.0	22,279	371.3	0	0.0	-
Array 2	7.0	225.0	0	0.0	0	0.0	-
Array 3	7.0	225.0	0	0.0	0	0.0	-
Array 4	7.0	225.0	0	0.0	0	0.0	-
Array 5	7.0	225.0	0	0.0	0	0.0	-
Array 6	7.0	225.0	0	0.0	0	0.0	-
Array 7	7.0	225.0	69,641	1,160.7	0	0.0	-
Array 8	7.0	225.0	53,693	894.9	0	0.0	-
Array 9	7.0	225.0	35,188	586.5	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	15,756	262.6	0	0.0
OP 2	25,567	426.1	0	0.0
OP 3	27,971	466.2	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 4	17,805	296.8	0	0.0
OP 5	18,375	306.2	0	0.0
OP 6	28,365	472.8	0	0.0
OP 7	29,022	483.7	0	0.0
OP 8	17,940	299.0	0	0.0

Component Data

PV Arrays

Name: Array 1

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

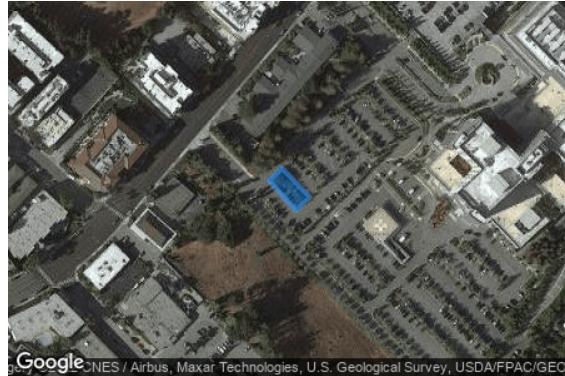
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: 9.16 mrad



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.592116	-122.384780	0.00	12.00	12.00
2	37.592203	-122.384670	0.00	12.00	12.00
3	37.592005	-122.384432	0.00	12.00	12.00
4	37.591912	-122.384547	0.00	12.00	12.00

Name: Array 10

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.591631	-122.383133	0.00	12.00	12.00
2	37.591703	-122.383007	0.00	12.00	12.00
3	37.591448	-122.382698	0.00	12.00	12.00
4	37.591359	-122.382826	0.00	12.00	12.00

Name: Array 2

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.592249	-122.384598	0.00	12.00	12.00
2	37.592343	-122.384474	0.00	12.00	12.00
3	37.592145	-122.384241	0.00	12.00	12.00
4	37.592056	-122.384370	0.00	12.00	12.00

Name: Array 3

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

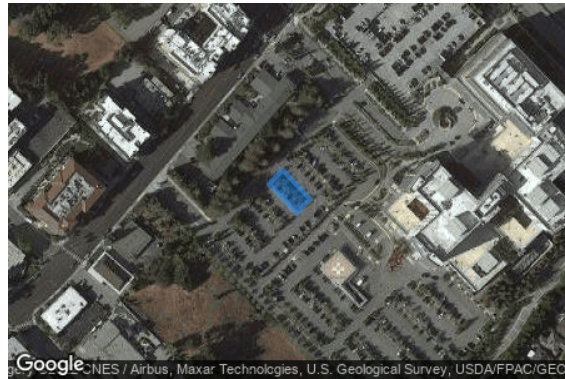
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.592386	-122.384423	0.00	12.00	12.00
2	37.592483	-122.384304	0.00	12.00	12.00
3	37.592284	-122.384065	0.00	12.00	12.00
4	37.592187	-122.384182	0.00	12.00	12.00

Name: Array 4

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

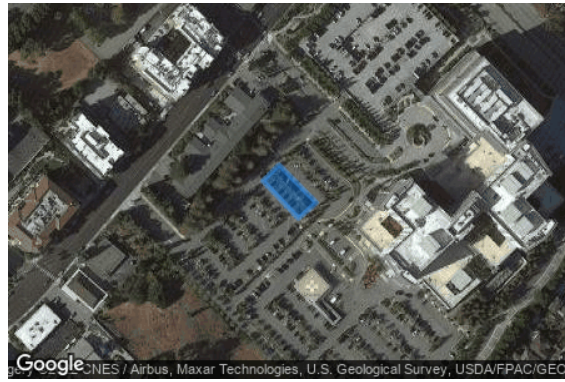
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.592529	-122.384242	0.00	12.00	12.00
2	37.592638	-122.384103	0.00	12.00	12.00
3	37.592381	-122.383782	0.00	12.00	12.00
4	37.592275	-122.383937	0.00	12.00	12.00

Name: Array 5

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

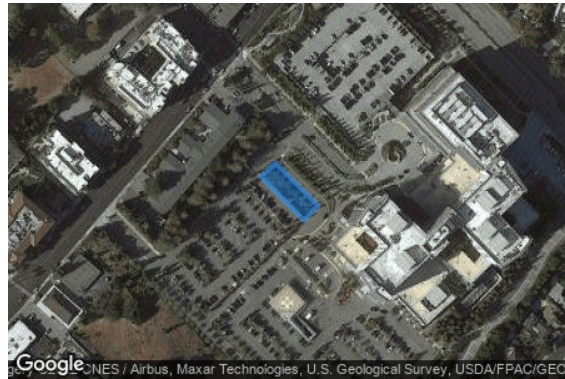
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.592669	-122.384052	0.00	12.00	12.00
2	37.592763	-122.383925	0.00	12.00	12.00
3	37.592471	-122.383556	0.00	12.00	12.00
4	37.592370	-122.383680	0.00	12.00	12.00

Name: Array 6

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.593446	-122.383914	0.00	25.00	25.00
2	37.593998	-122.383193	0.00	25.00	25.00
3	37.593478	-122.382554	0.00	25.00	25.00
4	37.592919	-122.383287	0.00	25.00	25.00

Name: Array 7

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

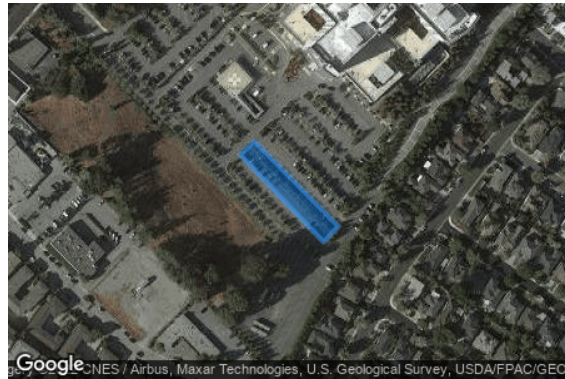
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.591300	-122.383780	0.00	12.00	12.00
2	37.591392	-122.383656	0.00	12.00	12.00
3	37.590816	-122.382935	0.00	12.00	12.00
4	37.590710	-122.383064	0.00	12.00	12.00

Name: Array 8

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

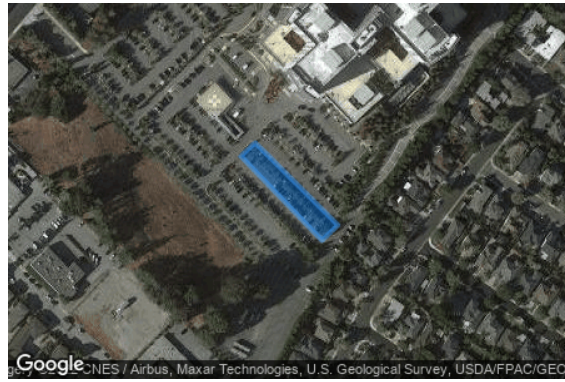
Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.591441	-122.383603	0.00	12.00	12.00
2	37.591532	-122.383479	0.00	12.00	12.00
3	37.590973	-122.382769	0.00	12.00	12.00
4	37.590869	-122.382905	0.00	12.00	12.00

Name: Array 9

Axis tracking: Fixed (no rotation)

Tilt: 7.0°

Orientation: 225.0°

Rated power: -

Panel material: Light textured glass with AR coating

Reflectivity: 0.0535

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	37.591581	-122.383412	0.00	12.00	12.00
2	37.591666	-122.383300	0.00	12.00	12.00
3	37.591254	-122.382766	0.00	12.00	12.00
4	37.591164	-122.382892	0.00	12.00	12.00

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	37.591554	-122.384697	0.00	35.00
OP 2	2	37.591350	-122.384445	0.00	35.00
OP 3	3	37.591154	-122.384201	0.00	35.00
OP 4	4	37.590918	-122.383897	0.00	35.00
OP 5	5	37.591556	-122.384697	0.00	50.00
OP 6	6	37.591347	-122.384445	0.00	50.00
OP 7	7	37.591152	-122.384203	0.00	50.00
OP 8	8	37.590916	-122.383897	0.00	50.00

Glare Analysis Results

Summary of Results Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
Array 1	7.0	225.0	0	0.0	0	0.0	-
Array 10	7.0	225.0	22,279	371.3	0	0.0	-
Array 2	7.0	225.0	0	0.0	0	0.0	-
Array 3	7.0	225.0	0	0.0	0	0.0	-
Array 4	7.0	225.0	0	0.0	0	0.0	-
Array 5	7.0	225.0	0	0.0	0	0.0	-
Array 6	7.0	225.0	0	0.0	0	0.0	-
Array 7	7.0	225.0	69,641	1,160.7	0	0.0	-
Array 8	7.0	225.0	53,693	894.9	0	0.0	-
Array 9	7.0	225.0	35,188	586.5	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	15,756	262.6	0	0.0
OP 2	25,567	426.1	0	0.0
OP 3	27,971	466.2	0	0.0
OP 4	17,805	296.8	0	0.0
OP 5	18,375	306.2	0	0.0
OP 6	28,365	472.8	0	0.0
OP 7	29,022	483.7	0	0.0
OP 8	17,940	299.0	0	0.0

PV: Array 1 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 1 and OP 1

Receptor type: Observation Point
No glare found

Array 1 and OP 2

Receptor type: Observation Point
No glare found

Array 1 and OP 3

Receptor type: Observation Point
No glare found

Array 1 and OP 4

Receptor type: Observation Point
No glare found

Array 1 and OP 5

Receptor type: Observation Point
No glare found

Array 1 and OP 6

Receptor type: Observation Point
No glare found

Array 1 and OP 7

Receptor type: Observation Point
No glare found

Array 1 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 10 low potential for temporary after-image

Receptor results ordered by category of glare

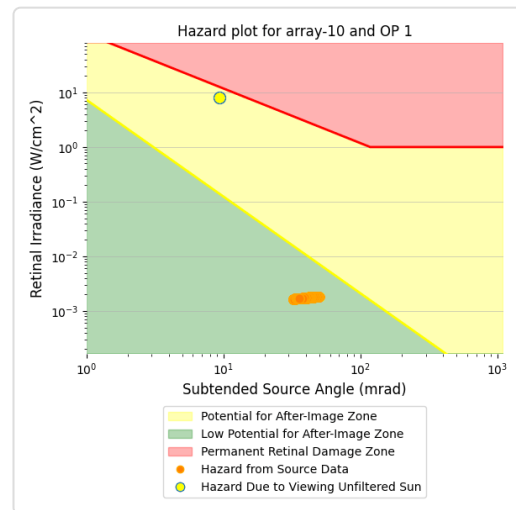
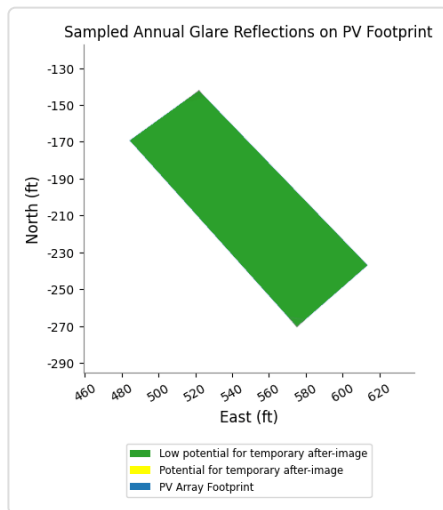
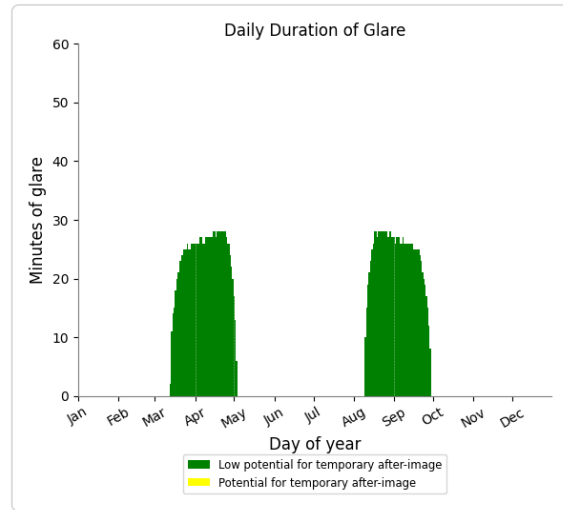
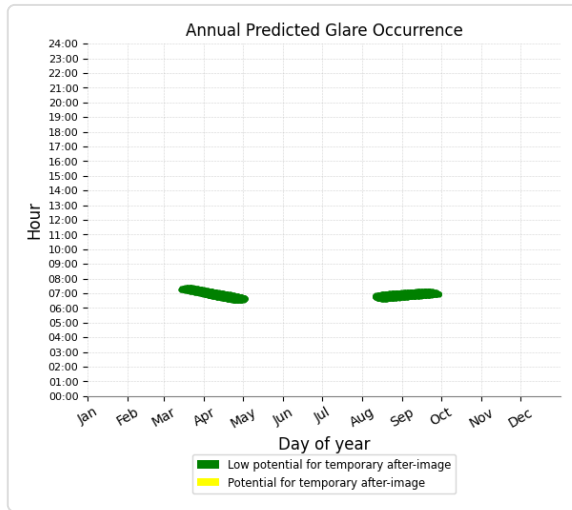
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	2,465	41.1	0	0.0
OP 2	4,682	78.0	0	0.0
OP 3	3,452	57.5	0	0.0
OP 5	2,953	49.2	0	0.0
OP 6	5,142	85.7	0	0.0
OP 7	3,585	59.8	0	0.0
OP 4	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 10 and OP 1

Receptor type: Observation Point

0 minutes of yellow glare

2,465 minutes of green glare

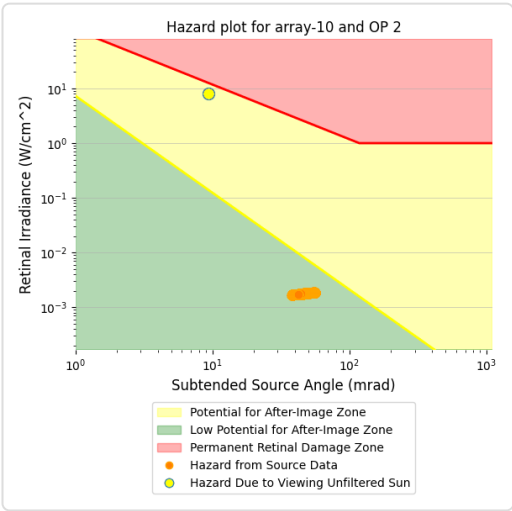
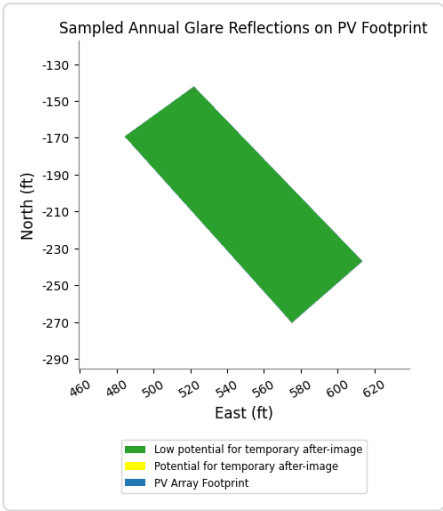
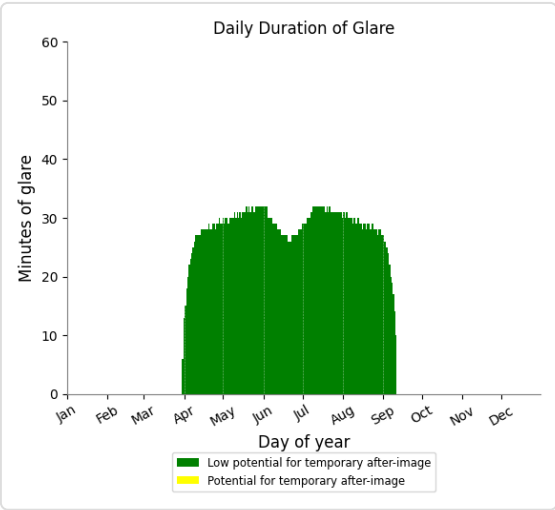
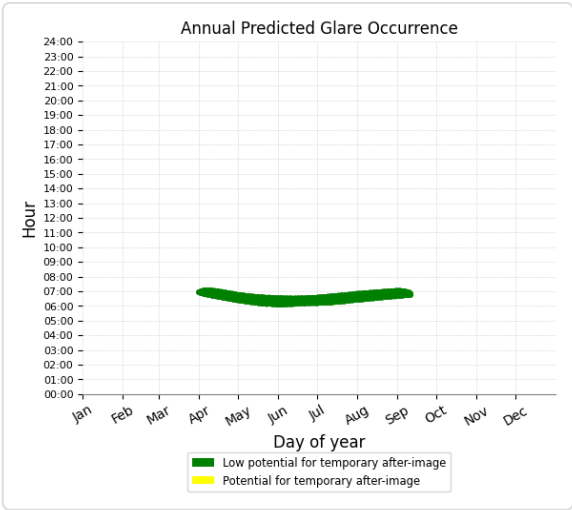


Array 10 and OP 2

Receptor type: Observation Point

0 minutes of yellow glare

4,682 minutes of green glare

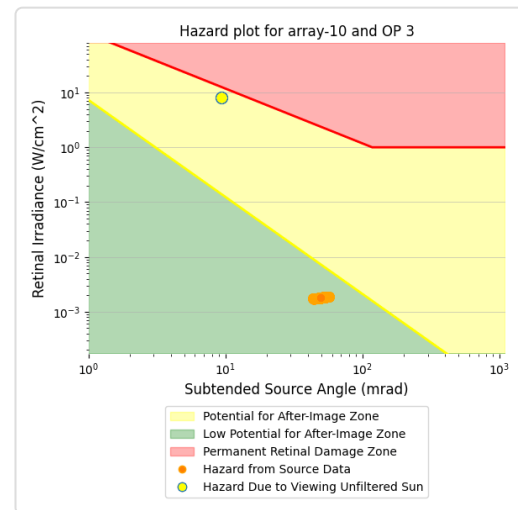
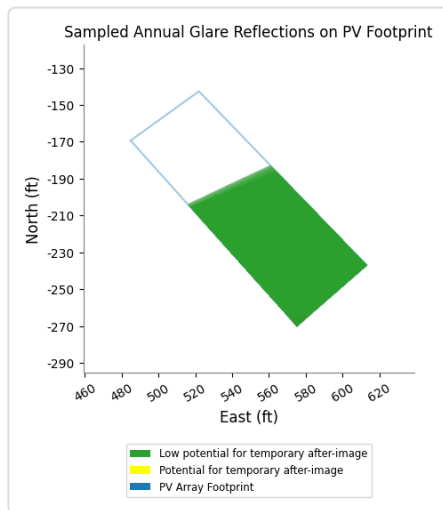
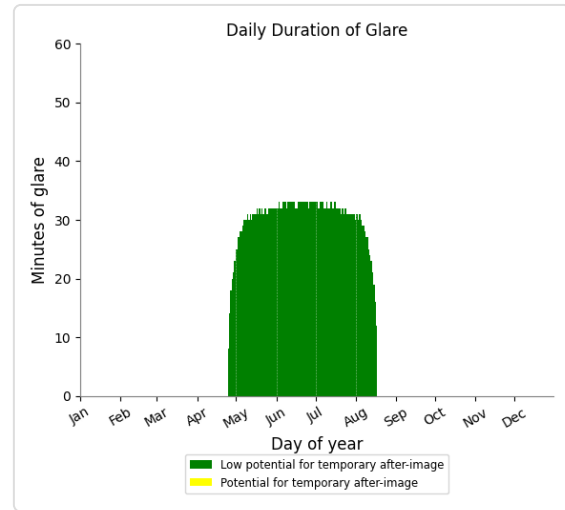
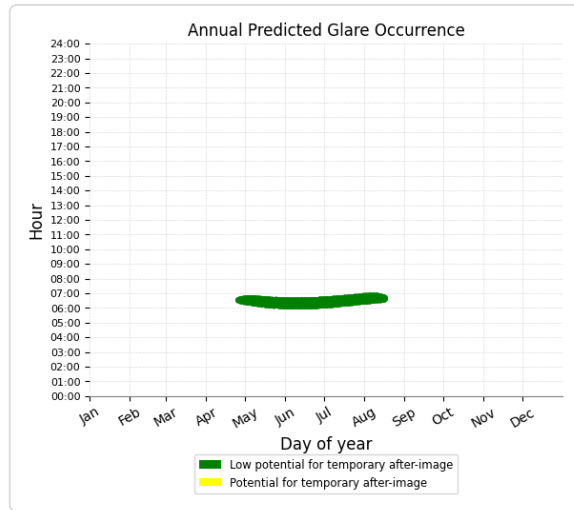


Array 10 and OP 3

Receptor type: Observation Point

0 minutes of yellow glare

3,452 minutes of green glare

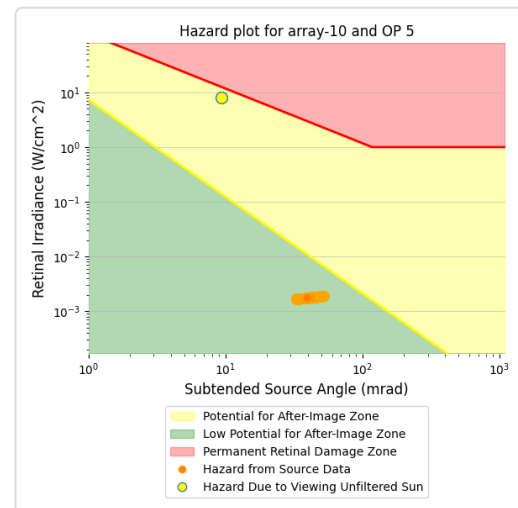
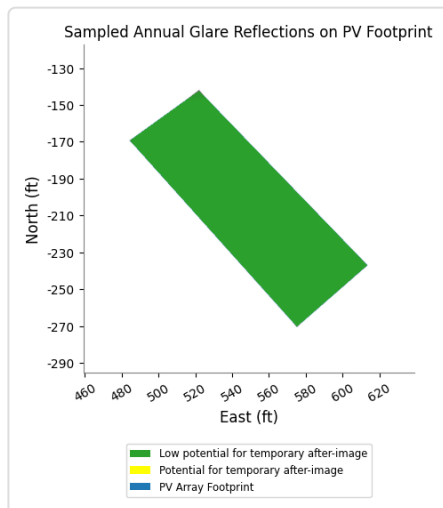
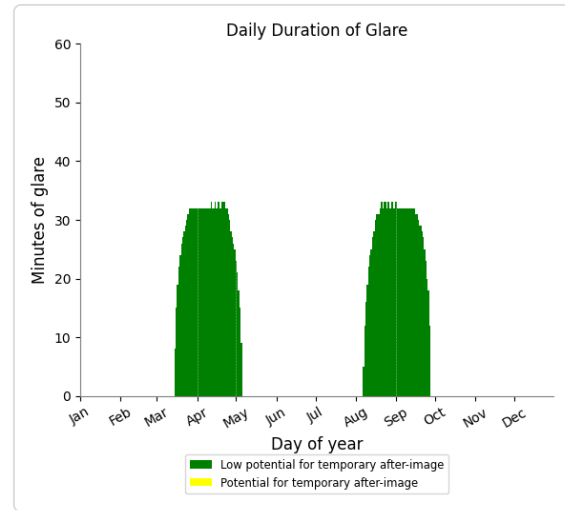
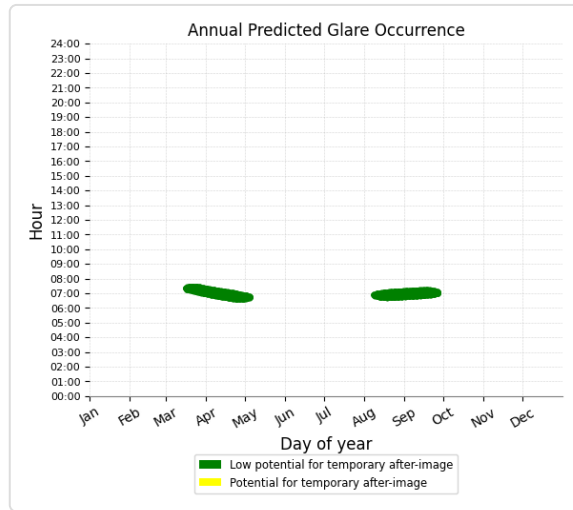


Array 10 and OP 5

Receptor type: Observation Point

0 minutes of yellow glare

2,953 minutes of green glare

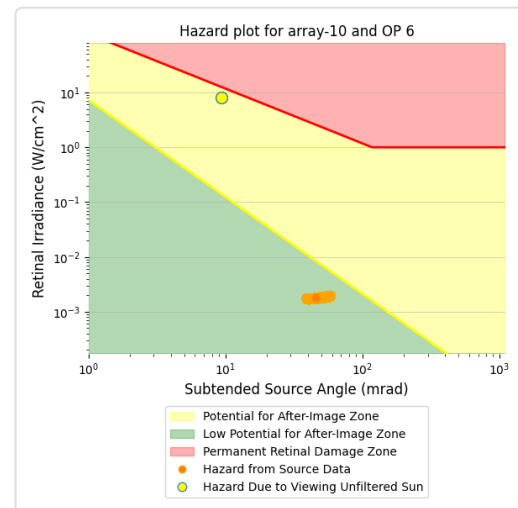
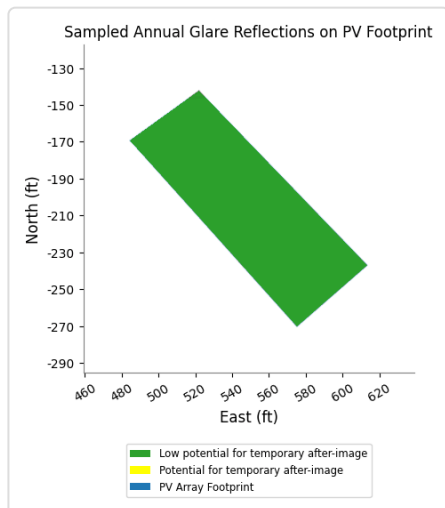
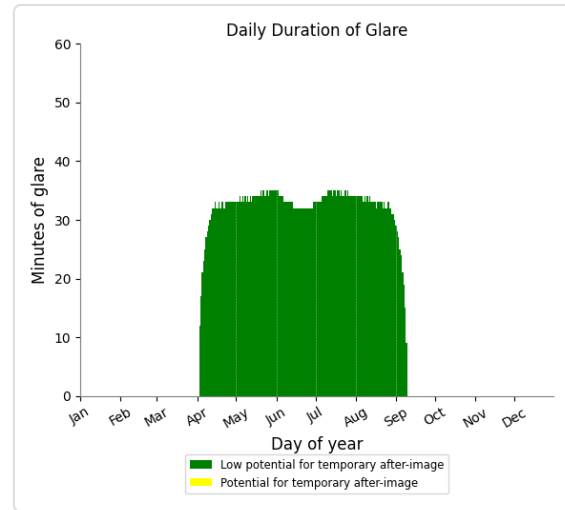
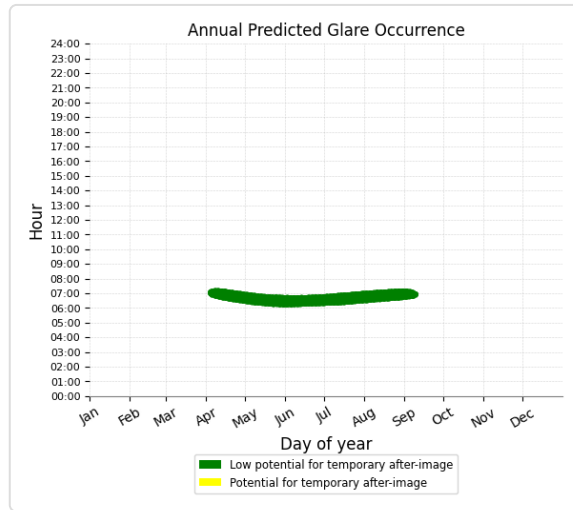


Array 10 and OP 6

Receptor type: Observation Point

0 minutes of yellow glare

5,142 minutes of green glare

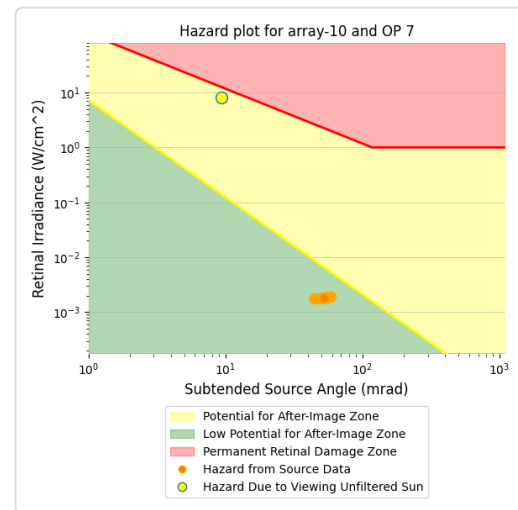
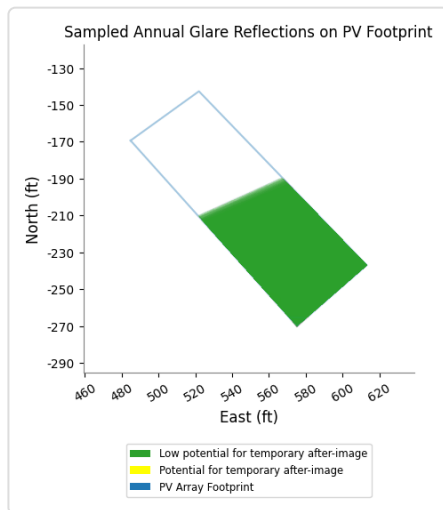
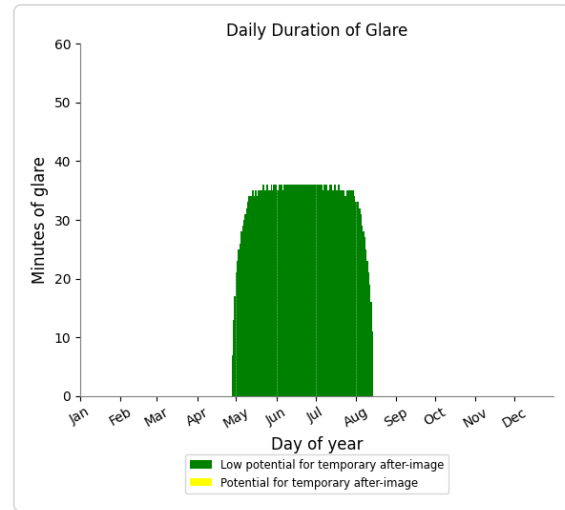
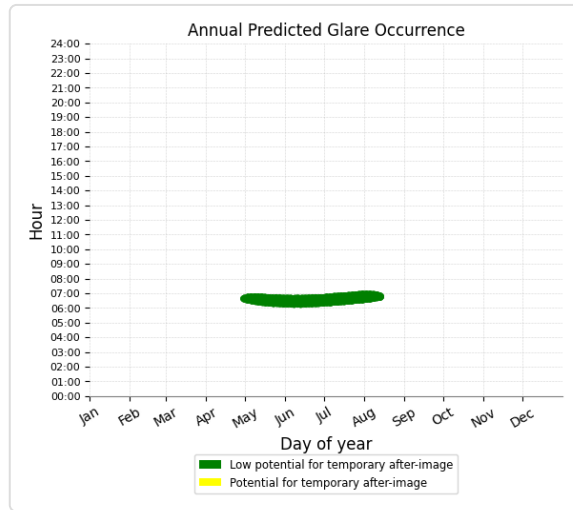


Array 10 and OP 7

Receptor type: Observation Point

0 minutes of yellow glare

3,585 minutes of green glare



Array 10 and OP 4

Receptor type: Observation Point

No glare found

Array 10 and OP 8

Receptor type: Observation Point

No glare found

PV: Array 2 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 2 and OP 1

Receptor type: Observation Point
No glare found

Array 2 and OP 2

Receptor type: Observation Point
No glare found

Array 2 and OP 3

Receptor type: Observation Point
No glare found

Array 2 and OP 4

Receptor type: Observation Point
No glare found

Array 2 and OP 5

Receptor type: Observation Point
No glare found

Array 2 and OP 6

Receptor type: Observation Point
No glare found

Array 2 and OP 7

Receptor type: Observation Point
No glare found

Array 2 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 3 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 3 and OP 1

Receptor type: Observation Point
No glare found

Array 3 and OP 2

Receptor type: Observation Point
No glare found

Array 3 and OP 3

Receptor type: Observation Point
No glare found

Array 3 and OP 4

Receptor type: Observation Point
No glare found

Array 3 and OP 5

Receptor type: Observation Point
No glare found

Array 3 and OP 6

Receptor type: Observation Point
No glare found

Array 3 and OP 7

Receptor type: Observation Point
No glare found

Array 3 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 4 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 4 and OP 1

Receptor type: Observation Point
No glare found

Array 4 and OP 2

Receptor type: Observation Point
No glare found

Array 4 and OP 3

Receptor type: Observation Point
No glare found

Array 4 and OP 4

Receptor type: Observation Point
No glare found

Array 4 and OP 5

Receptor type: Observation Point
No glare found

Array 4 and OP 6

Receptor type: Observation Point
No glare found

Array 4 and OP 7

Receptor type: Observation Point
No glare found

Array 4 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 5 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 5 and OP 1

Receptor type: Observation Point
No glare found

Array 5 and OP 2

Receptor type: Observation Point
No glare found

Array 5 and OP 3

Receptor type: Observation Point
No glare found

Array 5 and OP 4

Receptor type: Observation Point
No glare found

Array 5 and OP 5

Receptor type: Observation Point
No glare found

Array 5 and OP 6

Receptor type: Observation Point
No glare found

Array 5 and OP 7

Receptor type: Observation Point
No glare found

Array 5 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 6 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0

Array 6 and OP 1

Receptor type: Observation Point
No glare found

Array 6 and OP 2

Receptor type: Observation Point
No glare found

Array 6 and OP 3

Receptor type: Observation Point
No glare found

Array 6 and OP 4

Receptor type: Observation Point
No glare found

Array 6 and OP 5

Receptor type: Observation Point
No glare found

Array 6 and OP 6

Receptor type: Observation Point
No glare found

Array 6 and OP 7

Receptor type: Observation Point
No glare found

Array 6 and OP 8

Receptor type: Observation Point
No glare found

PV: Array 7 low potential for temporary after-image

Receptor results ordered by category of glare

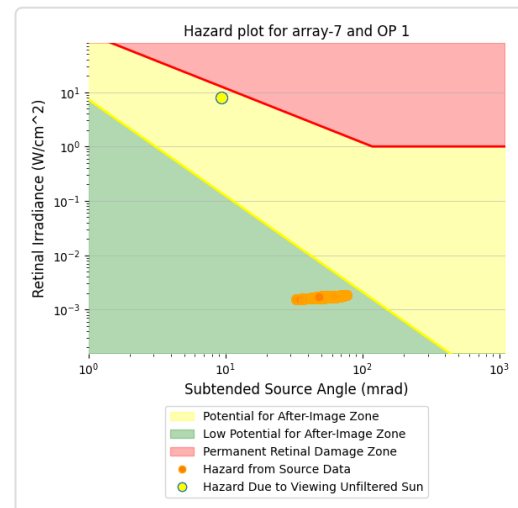
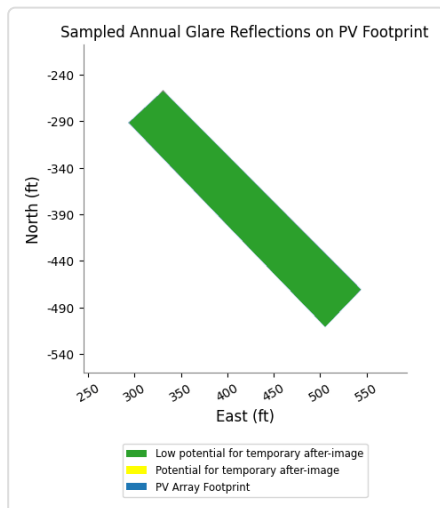
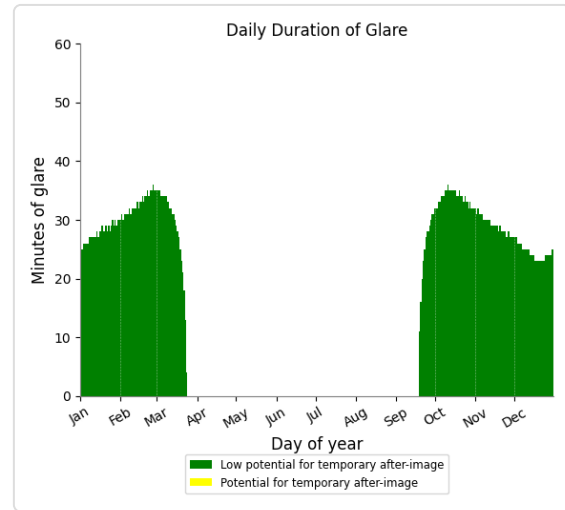
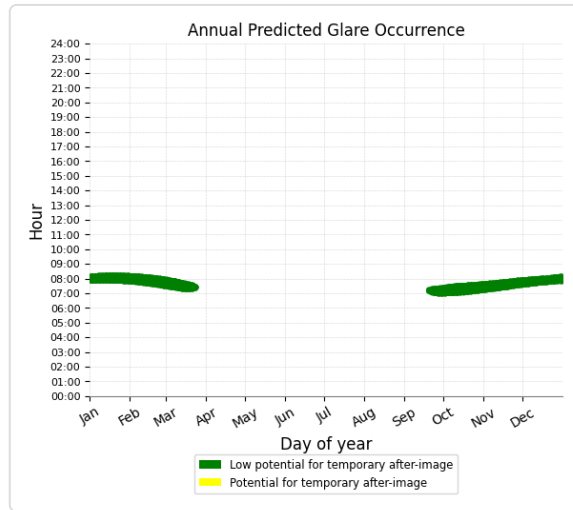
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	5,438	90.6	0	0.0
OP 2	7,443	124.0	0	0.0
OP 3	11,182	186.4	0	0.0
OP 4	9,379	156.3	0	0.0
OP 5	6,333	105.5	0	0.0
OP 6	8,082	134.7	0	0.0
OP 7	11,809	196.8	0	0.0
OP 8	9,975	166.2	0	0.0

Array 7 and OP 1

Receptor type: Observation Point

0 minutes of yellow glare

5,438 minutes of green glare

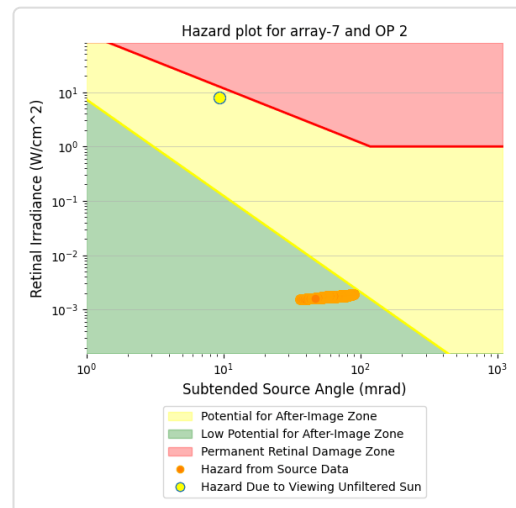
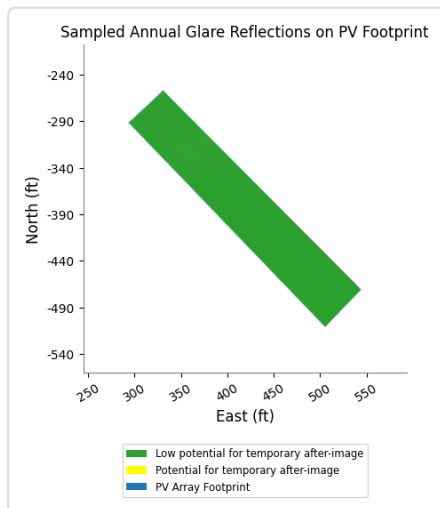
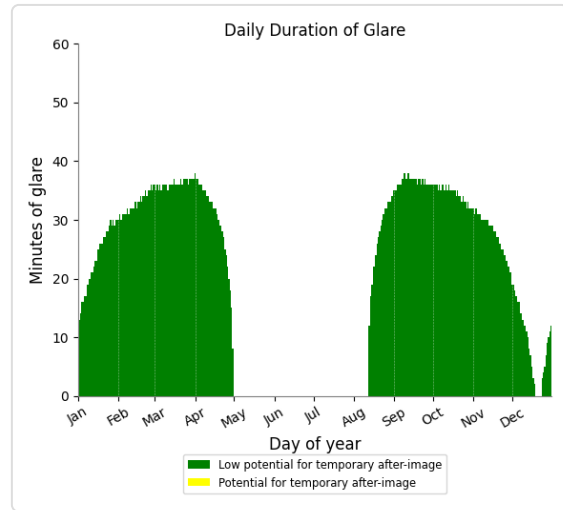
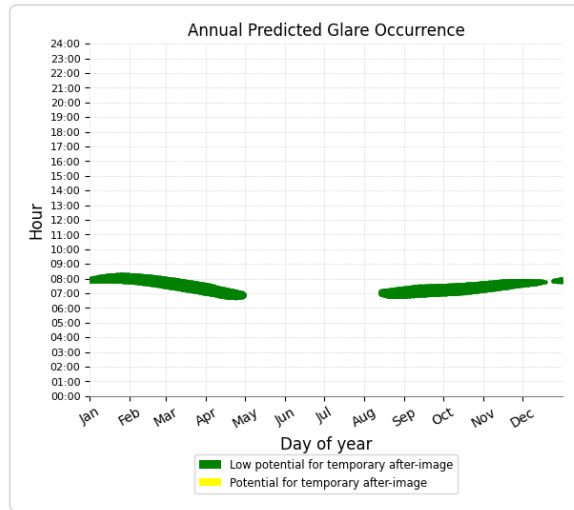


Array 7 and OP 2

Receptor type: Observation Point

0 minutes of yellow glare

7,443 minutes of green glare

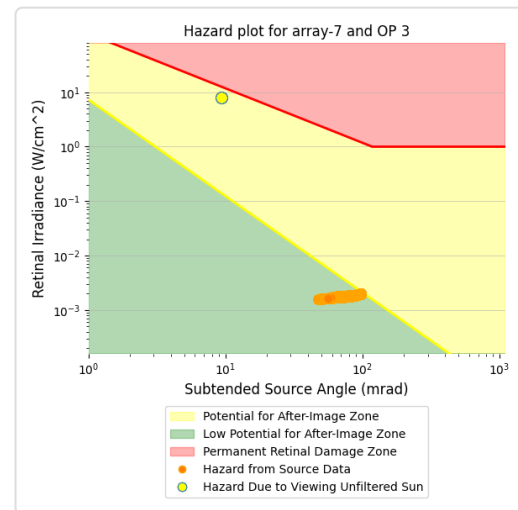
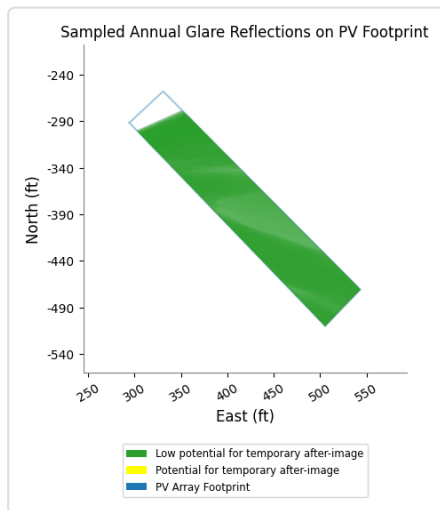
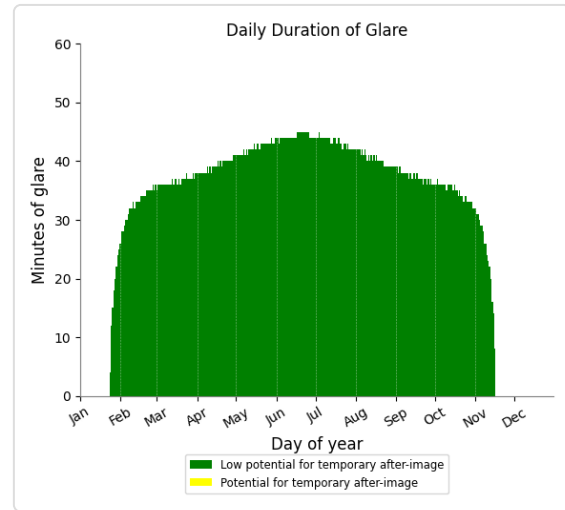
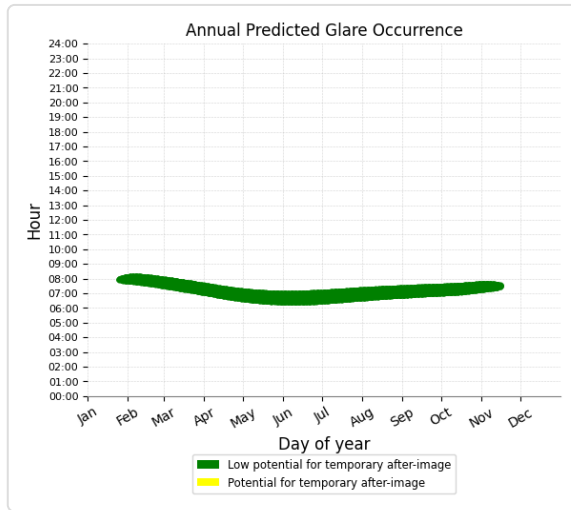


Array 7 and OP 3

Receptor type: Observation Point

0 minutes of yellow glare

11,182 minutes of green glare

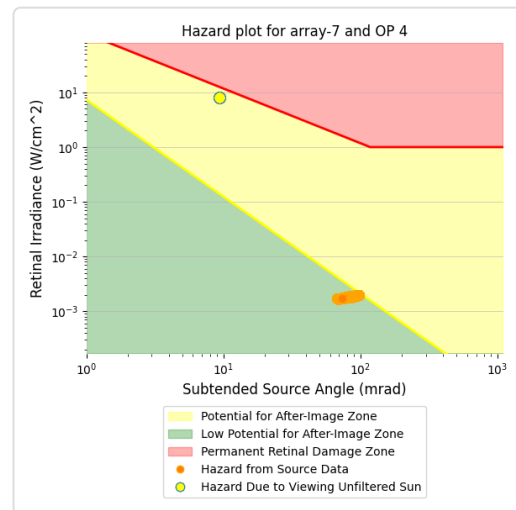
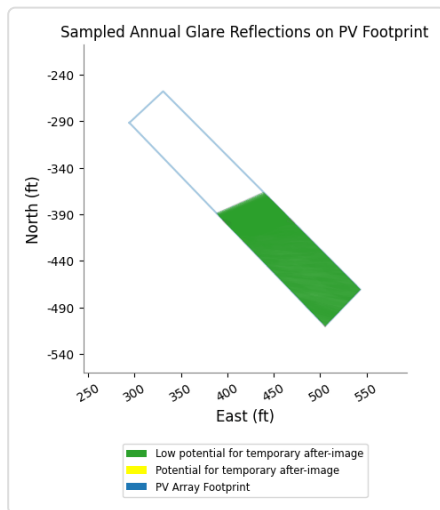
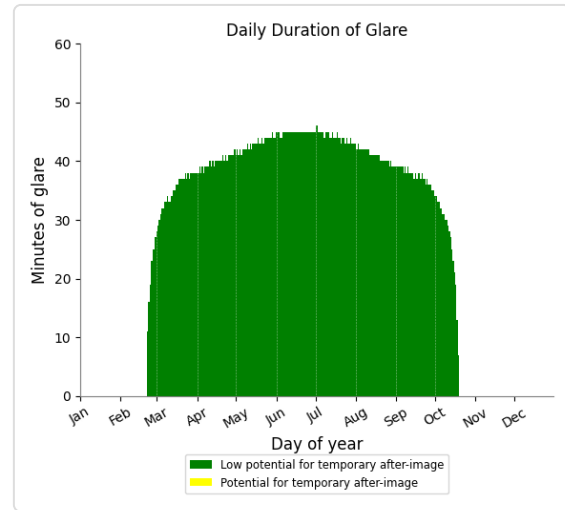
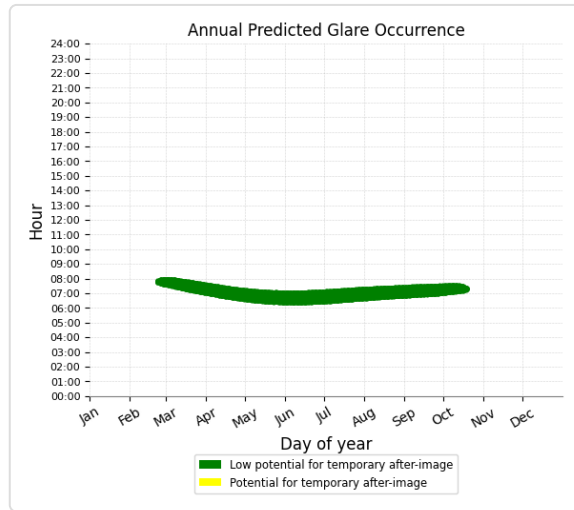


Array 7 and OP 4

Receptor type: Observation Point

0 minutes of yellow glare

9,379 minutes of green glare

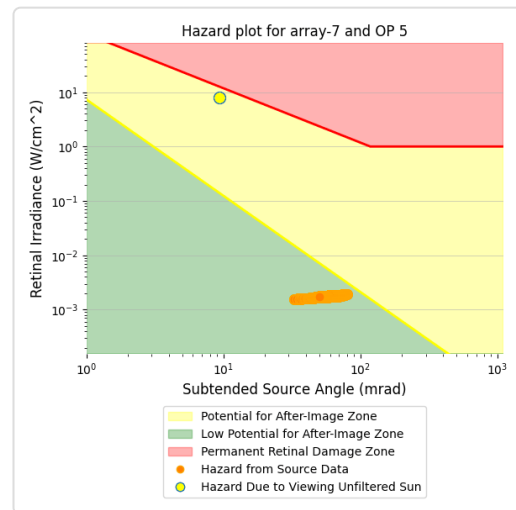
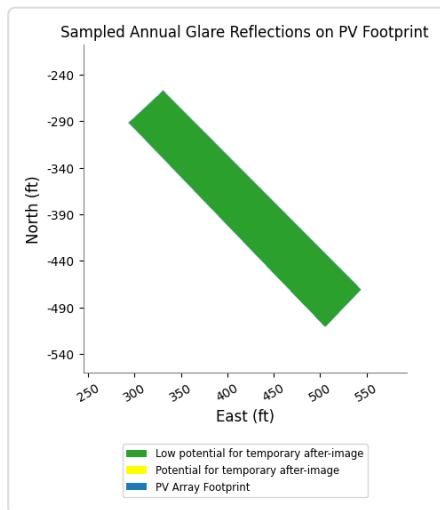
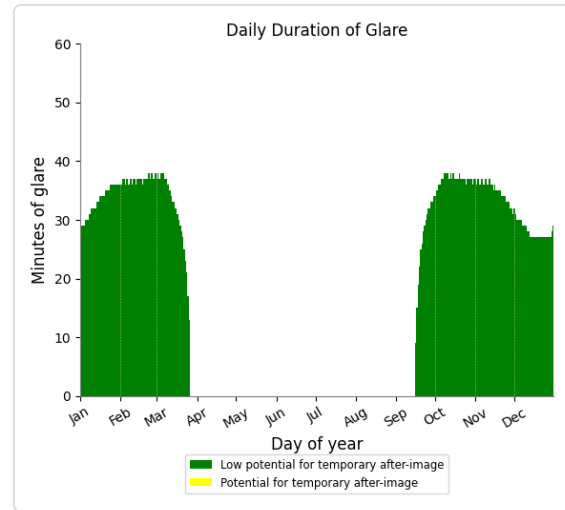
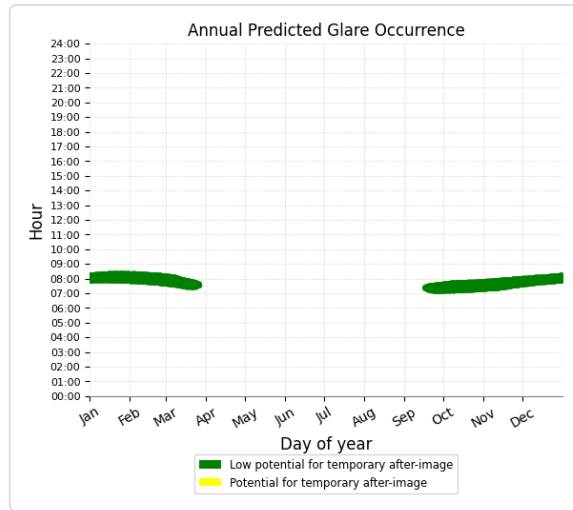


Array 7 and OP 5

Receptor type: Observation Point

0 minutes of yellow glare

6,333 minutes of green glare

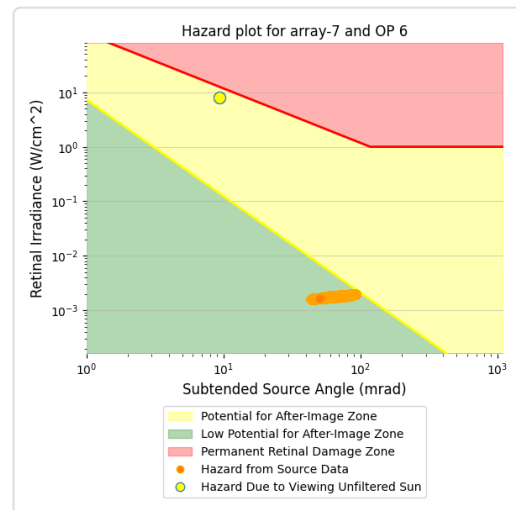
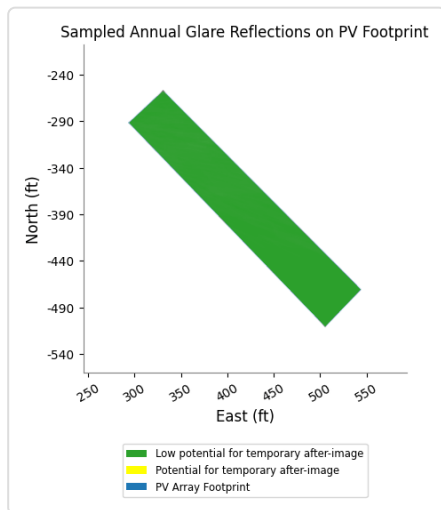
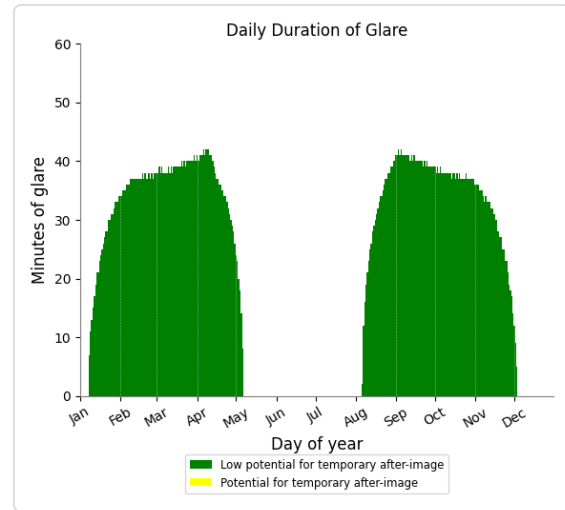
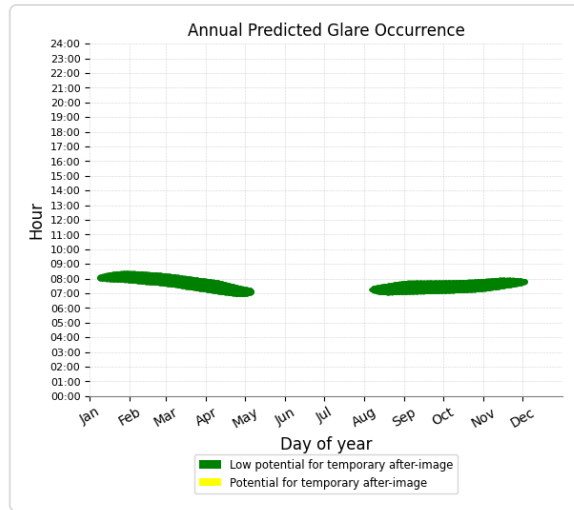


Array 7 and OP 6

Receptor type: Observation Point

0 minutes of yellow glare

8,082 minutes of green glare

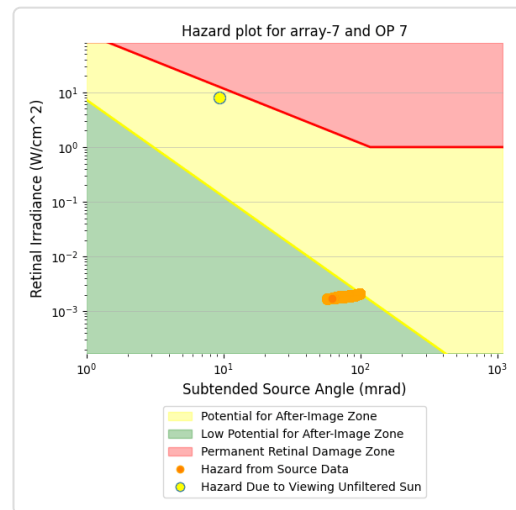
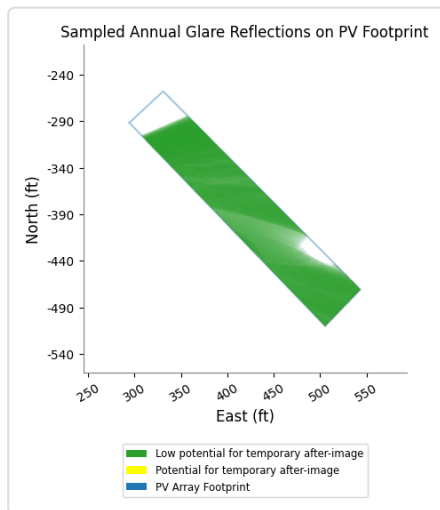
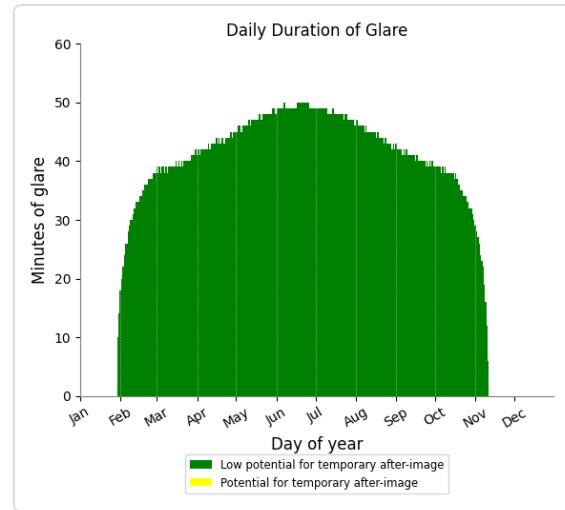
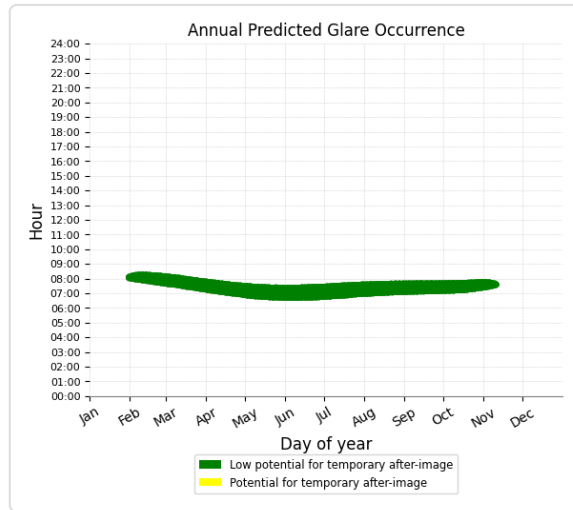


Array 7 and OP 7

Receptor type: Observation Point

0 minutes of yellow glare

11,809 minutes of green glare

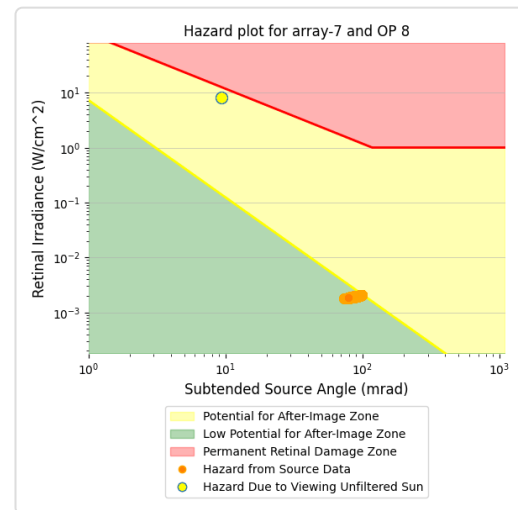
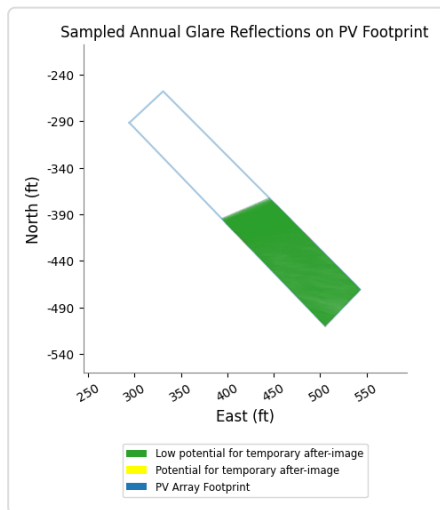
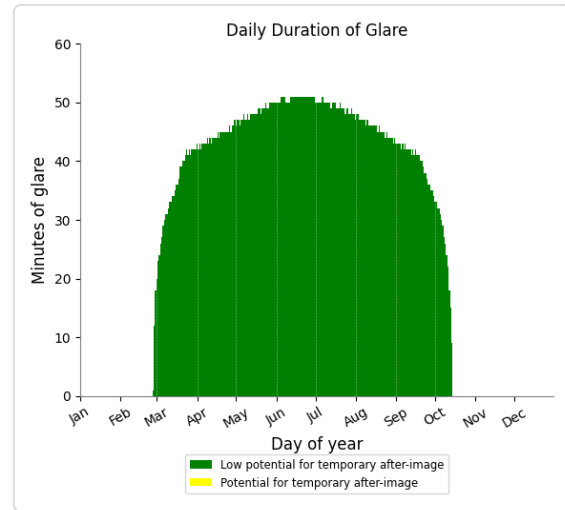
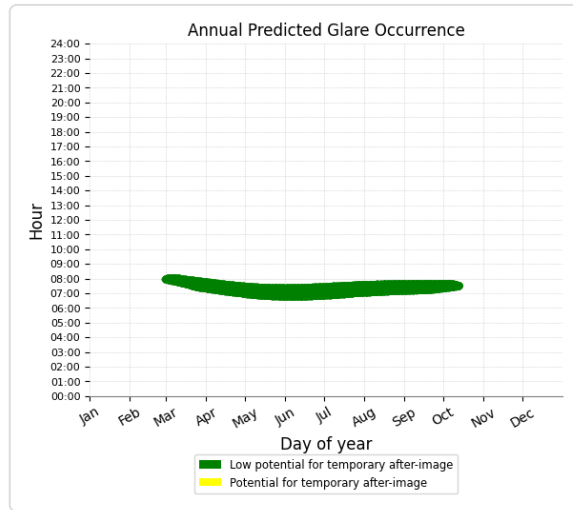


Array 7 and OP 8

Receptor type: Observation Point

0 minutes of yellow glare

9,975 minutes of green glare



PV: Array 8 low potential for temporary after-image

Receptor results ordered by category of glare

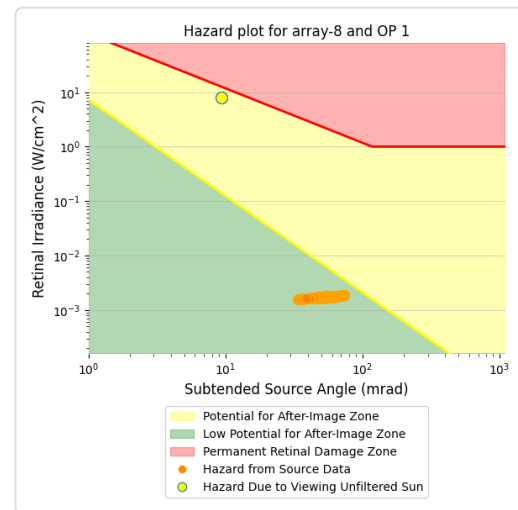
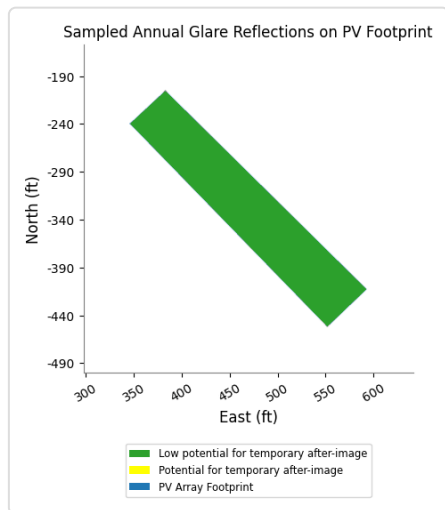
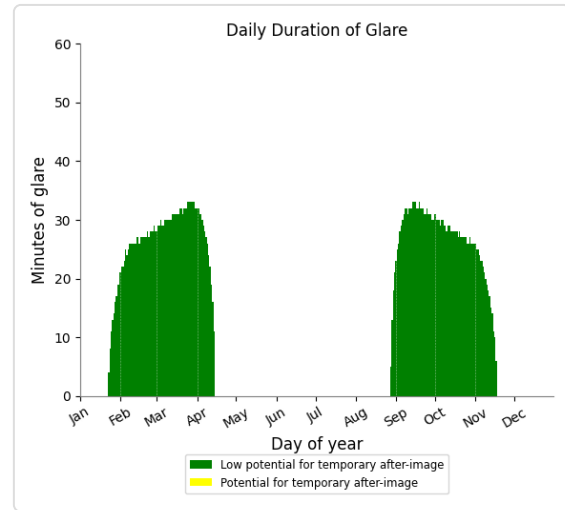
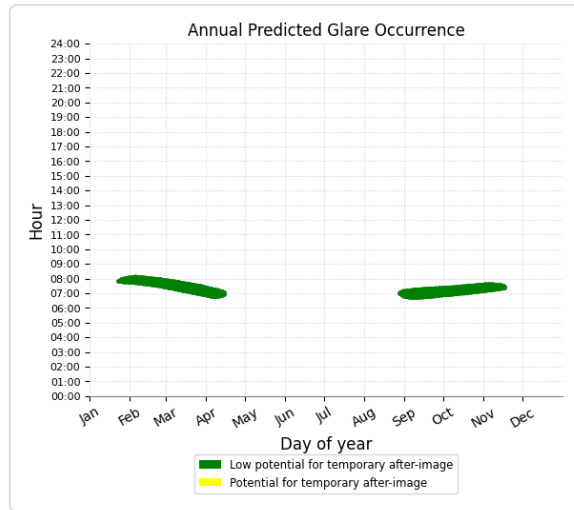
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	4,335	72.2	0	0.0
OP 2	7,016	116.9	0	0.0
OP 3	8,028	133.8	0	0.0
OP 4	6,257	104.3	0	0.0
OP 5	4,997	83.3	0	0.0
OP 6	8,403	140.1	0	0.0
OP 7	8,281	138.0	0	0.0
OP 8	6,376	106.3	0	0.0

Array 8 and OP 1

Receptor type: Observation Point

0 minutes of yellow glare

4,335 minutes of green glare

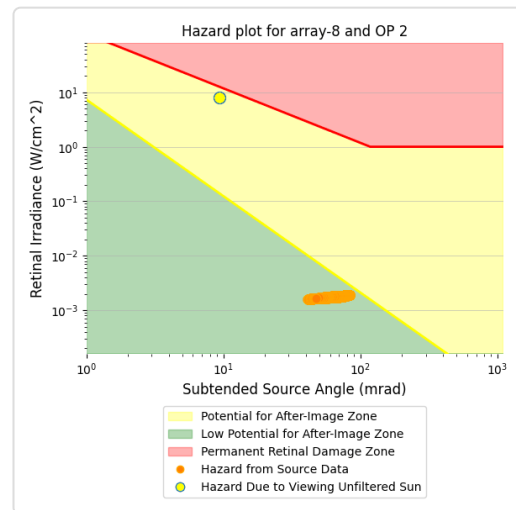
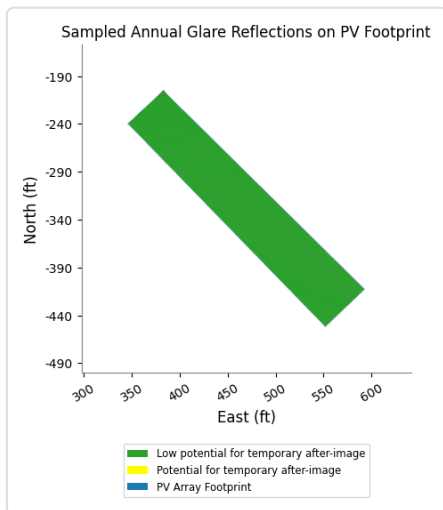
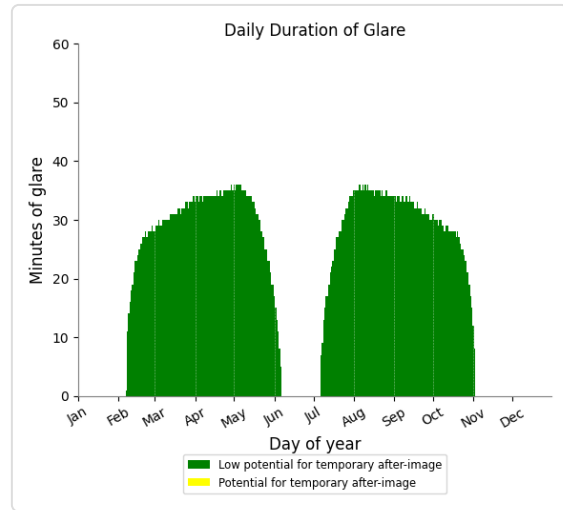
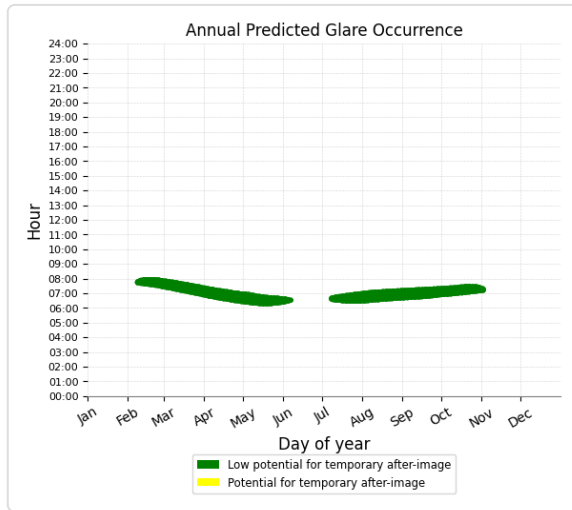


Array 8 and OP 2

Receptor type: Observation Point

0 minutes of yellow glare

7,016 minutes of green glare

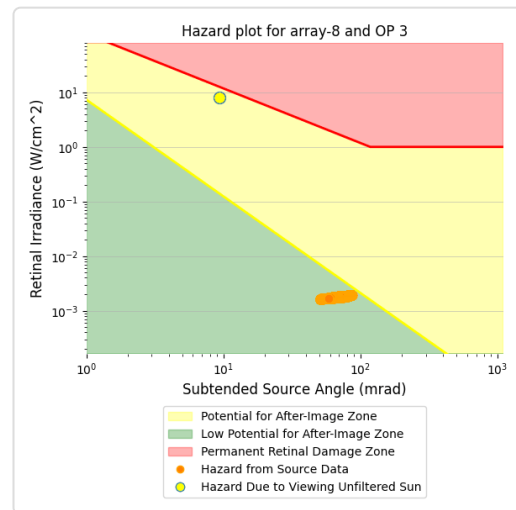
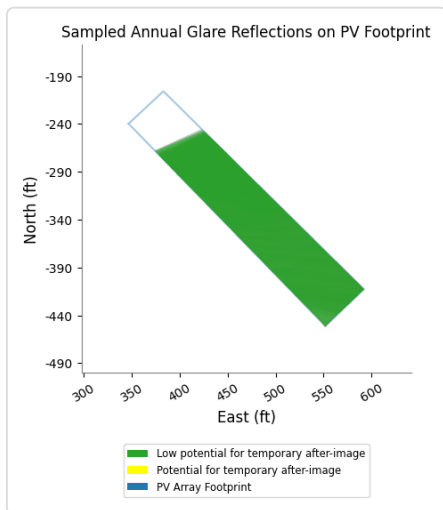
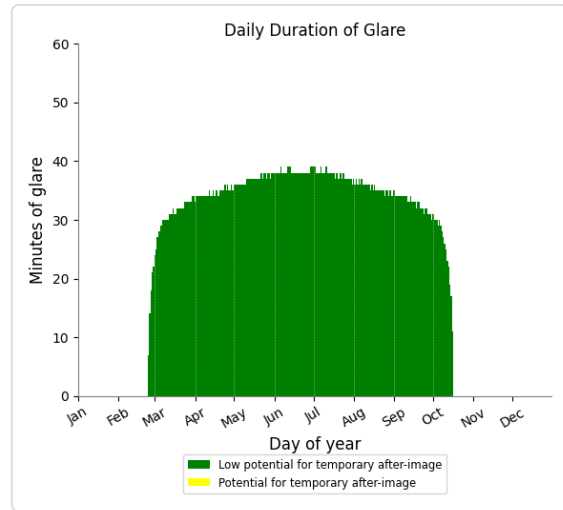
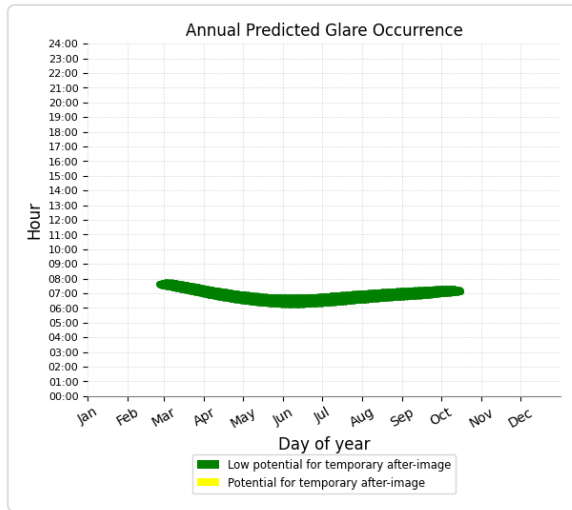


Array 8 and OP 3

Receptor type: Observation Point

0 minutes of yellow glare

8,028 minutes of green glare

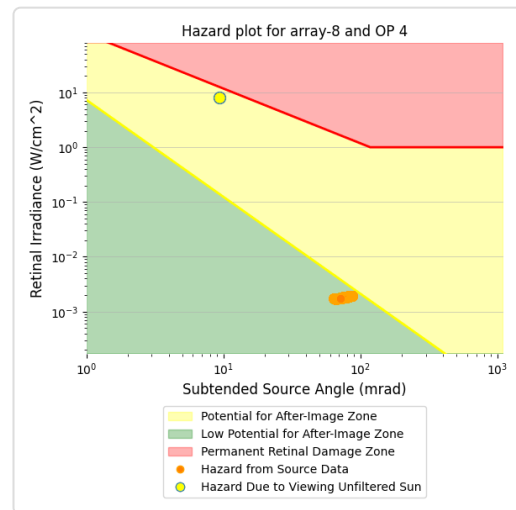
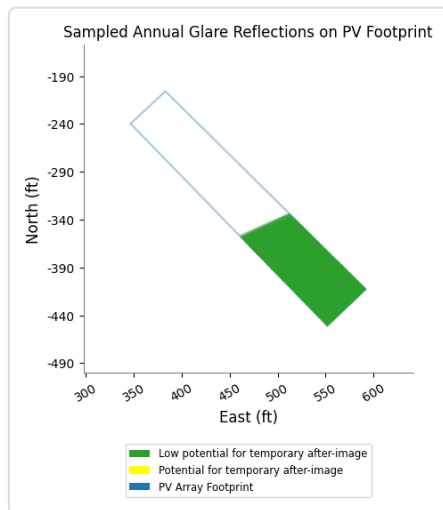
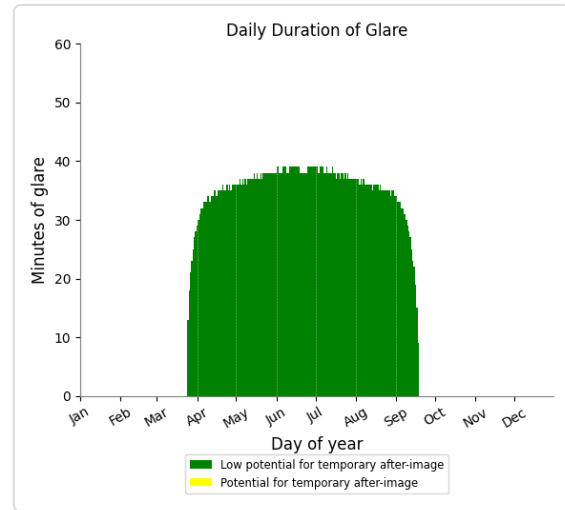
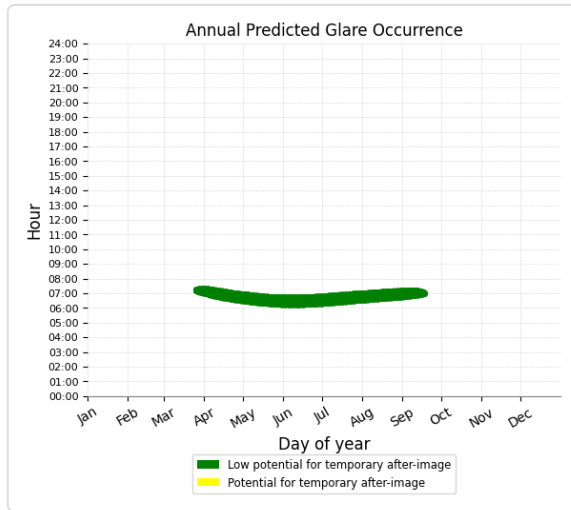


Array 8 and OP 4

Receptor type: Observation Point

0 minutes of yellow glare

6,257 minutes of green glare

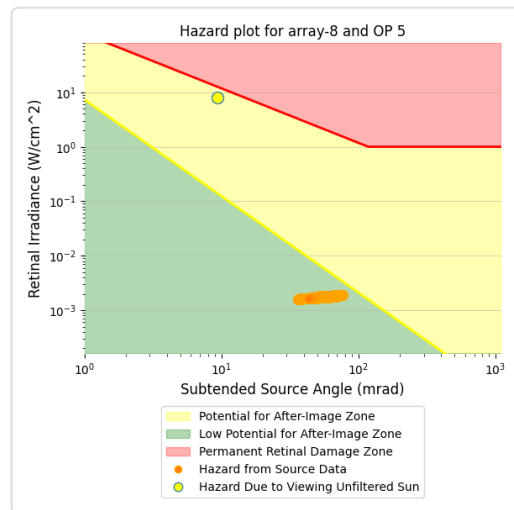
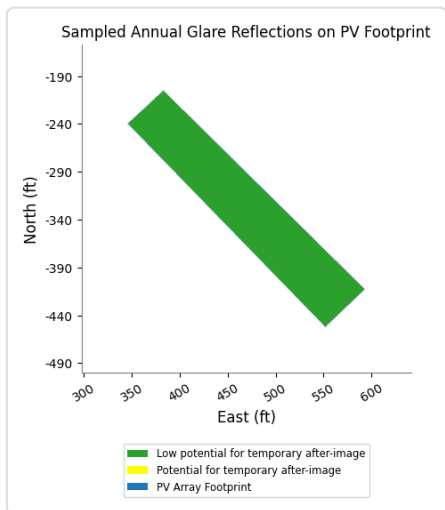
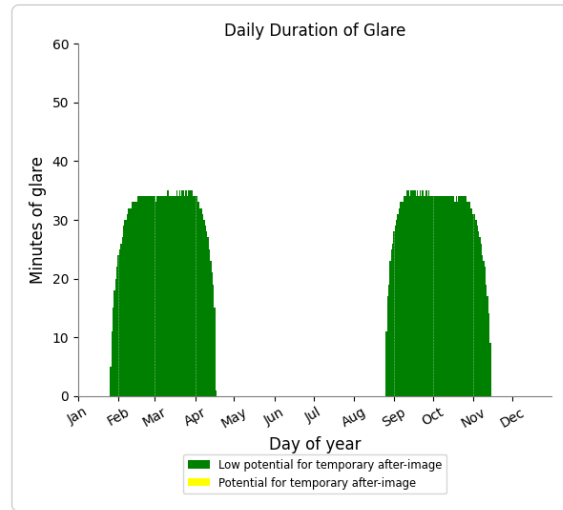
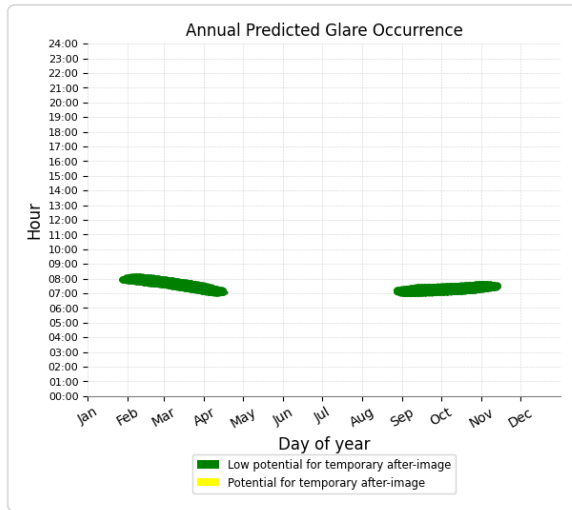


Array 8 and OP 5

Receptor type: Observation Point

0 minutes of yellow glare

4,997 minutes of green glare

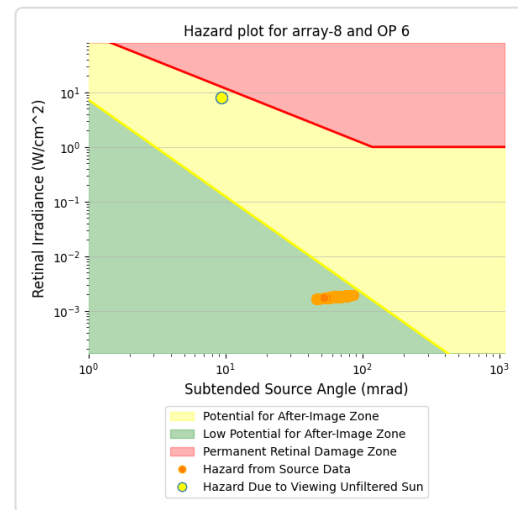
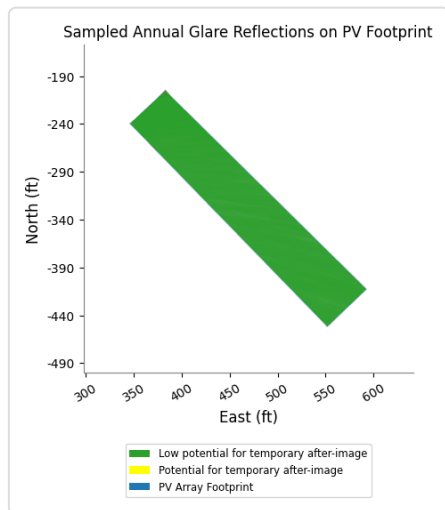
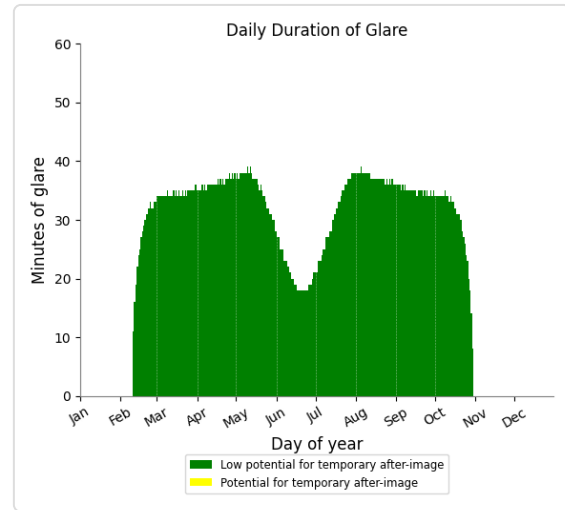
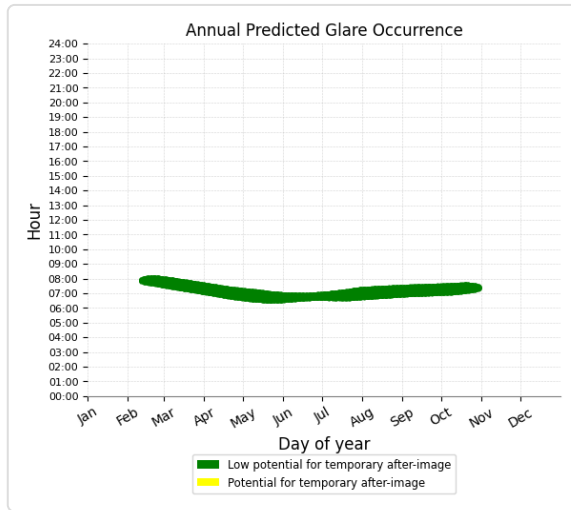


Array 8 and OP 6

Receptor type: Observation Point

0 minutes of yellow glare

8,403 minutes of green glare

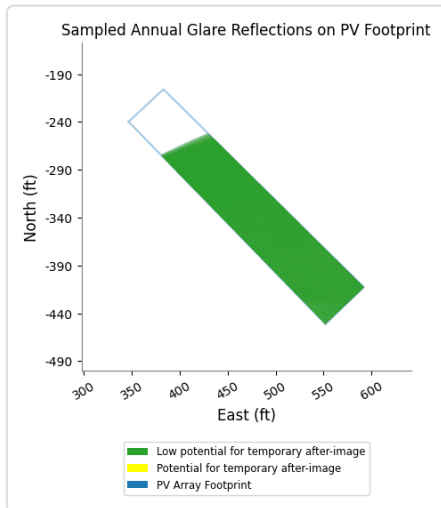
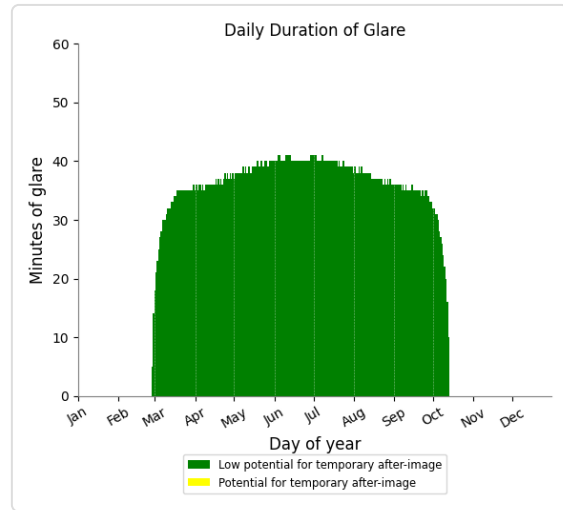
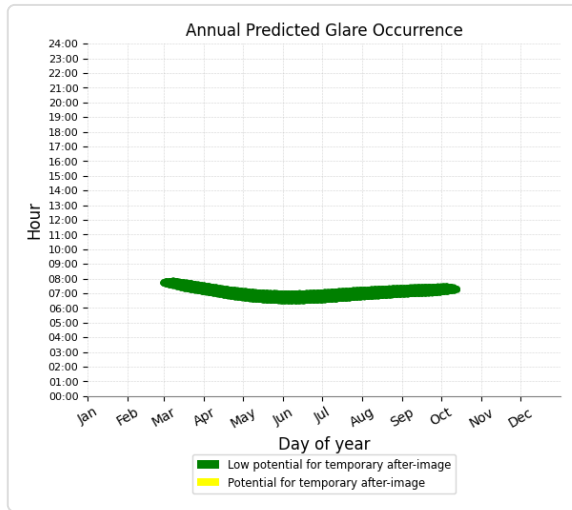


Array 8 and OP 7

Receptor type: Observation Point

0 minutes of yellow glare

8,281 minutes of green glare

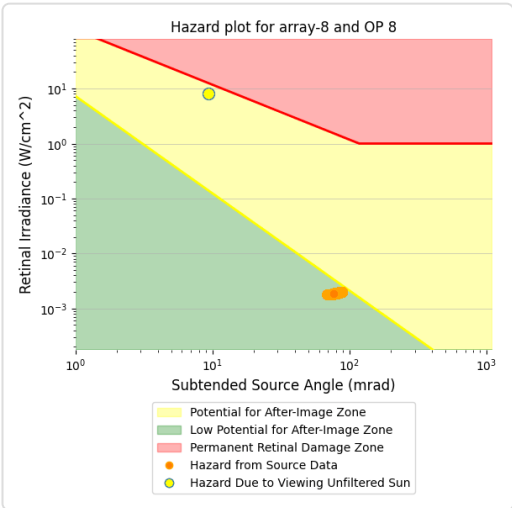
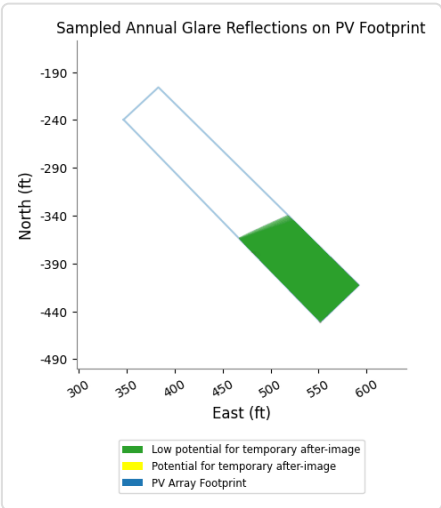
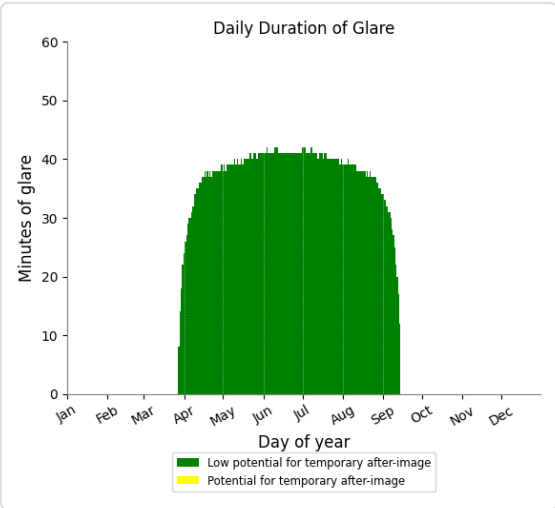
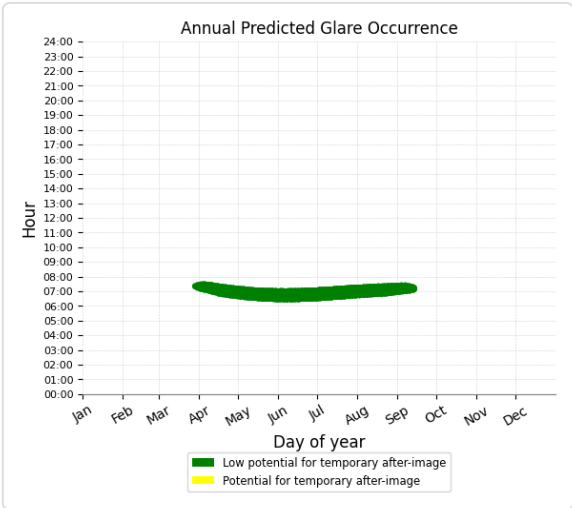


Array 8 and OP 8

Receptor type: Observation Point

0 minutes of yellow glare

6,376 minutes of green glare



PV: Array 9 low potential for temporary after-image

Receptor results ordered by category of glare

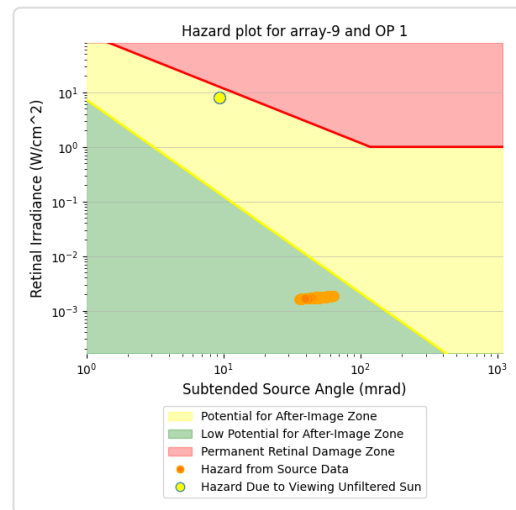
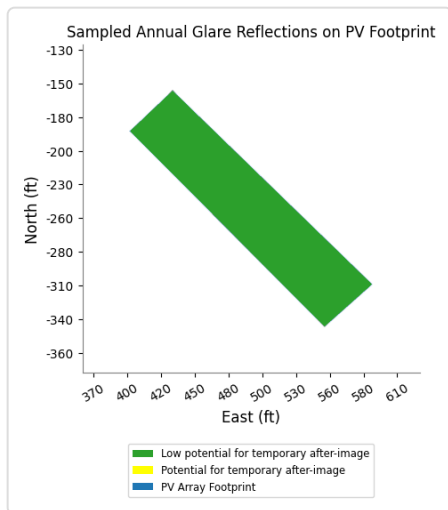
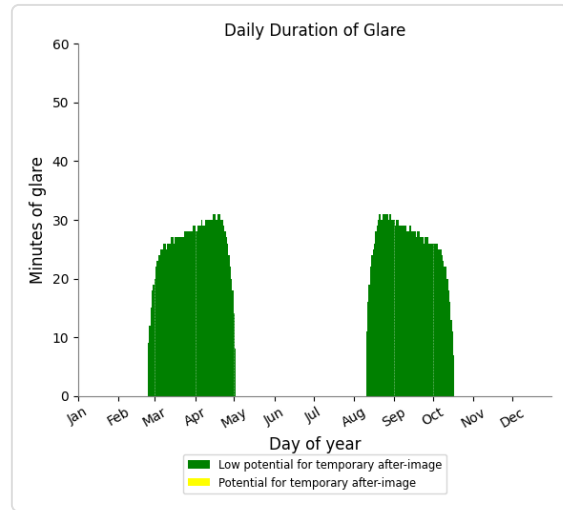
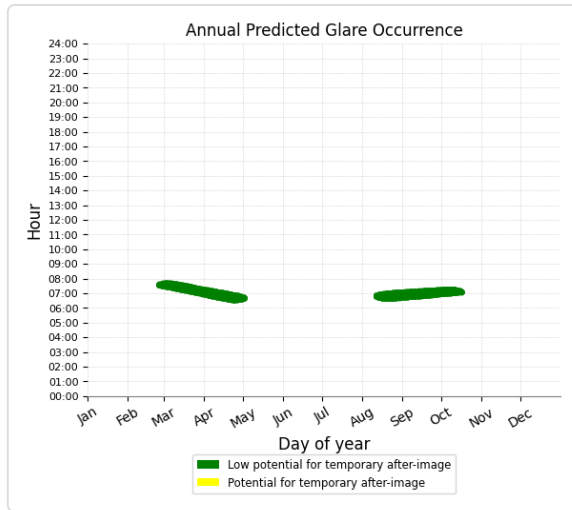
Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 1	3,518	58.6	0	0.0
OP 2	6,426	107.1	0	0.0
OP 3	5,309	88.5	0	0.0
OP 4	2,169	36.1	0	0.0
OP 5	4,092	68.2	0	0.0
OP 6	6,738	112.3	0	0.0
OP 7	5,347	89.1	0	0.0
OP 8	1,589	26.5	0	0.0

Array 9 and OP 1

Receptor type: Observation Point

0 minutes of yellow glare

3,518 minutes of green glare

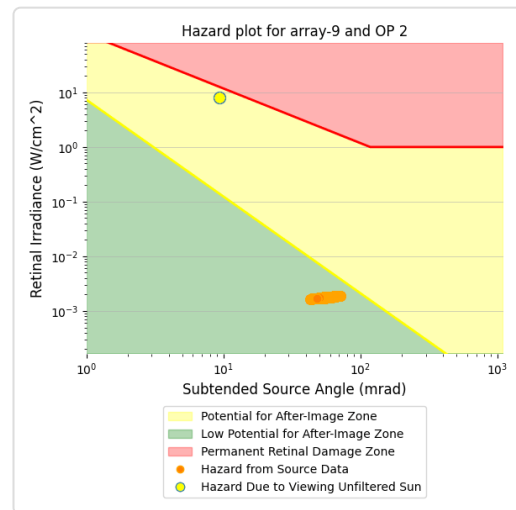
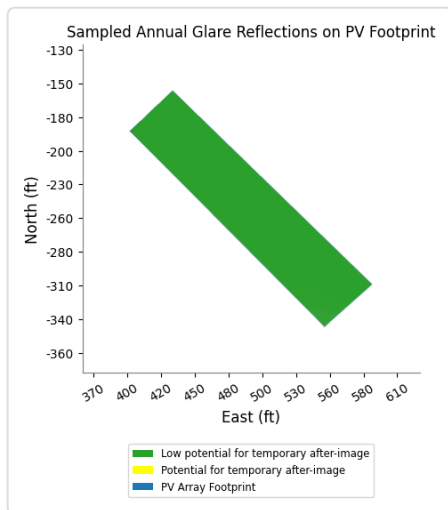
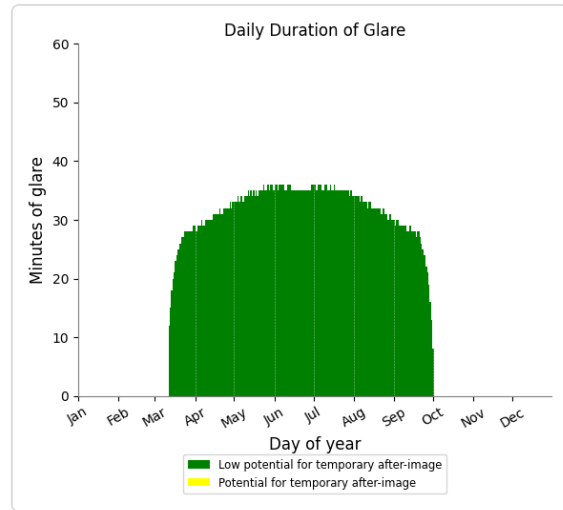
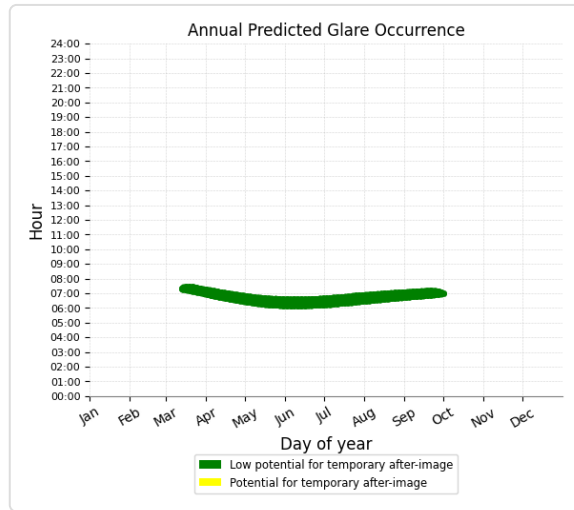


Array 9 and OP 2

Receptor type: Observation Point

0 minutes of yellow glare

6,426 minutes of green glare

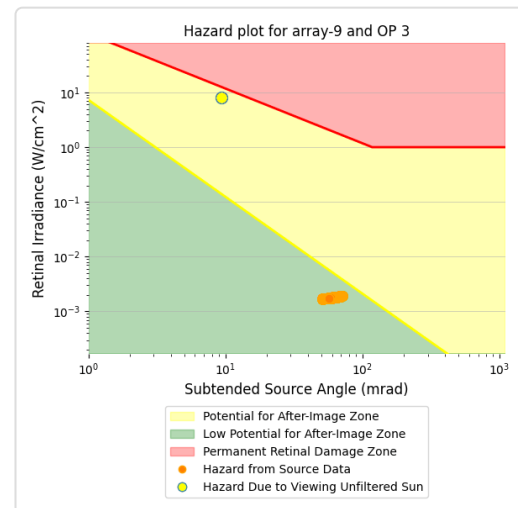
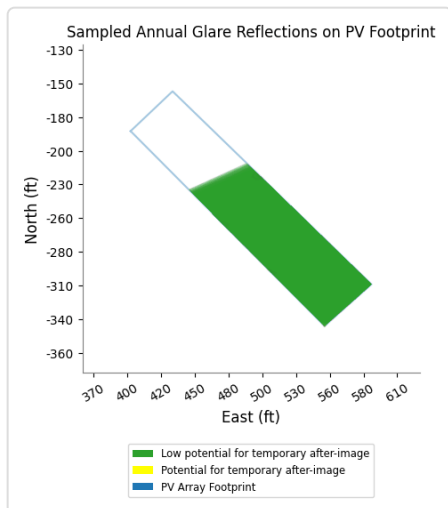
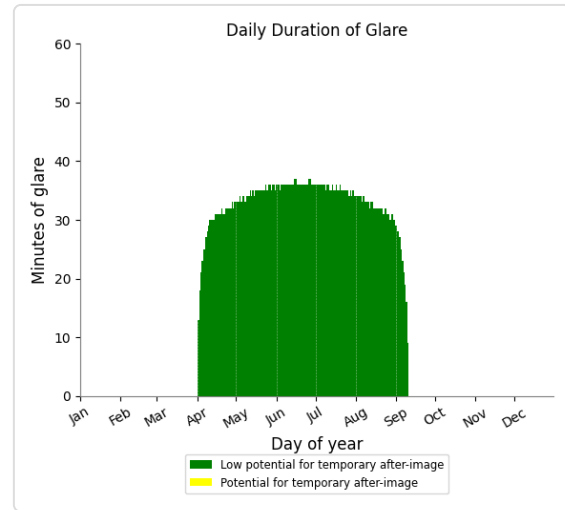
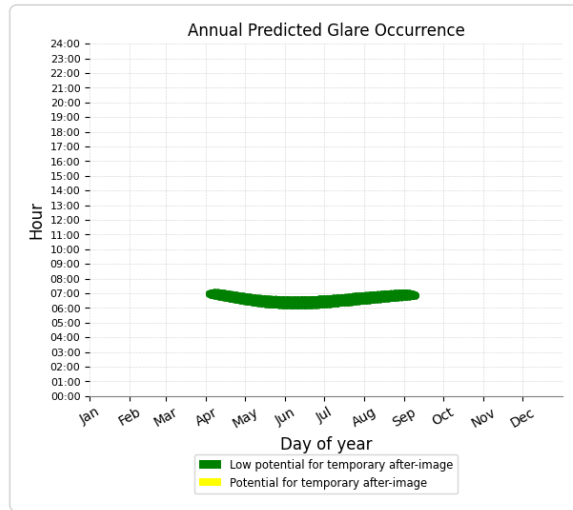


Array 9 and OP 3

Receptor type: Observation Point

0 minutes of yellow glare

5,309 minutes of green glare

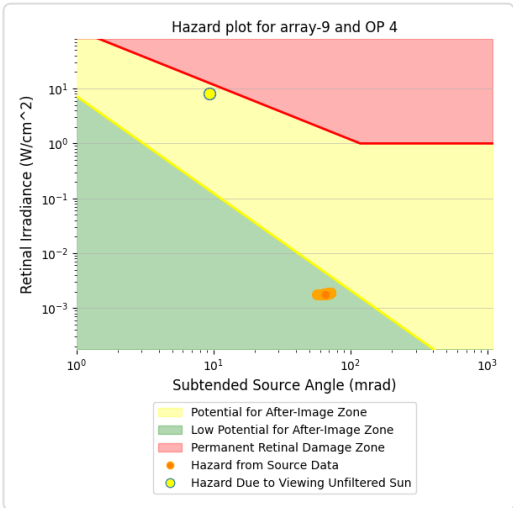
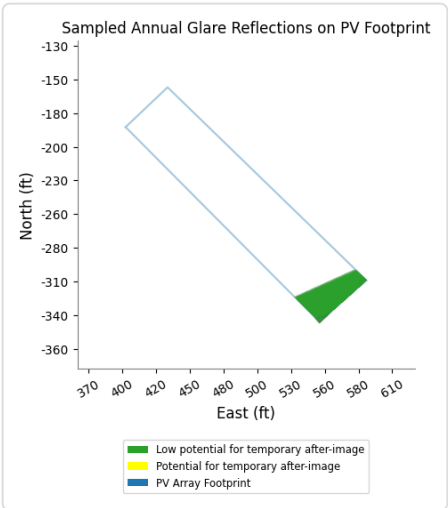
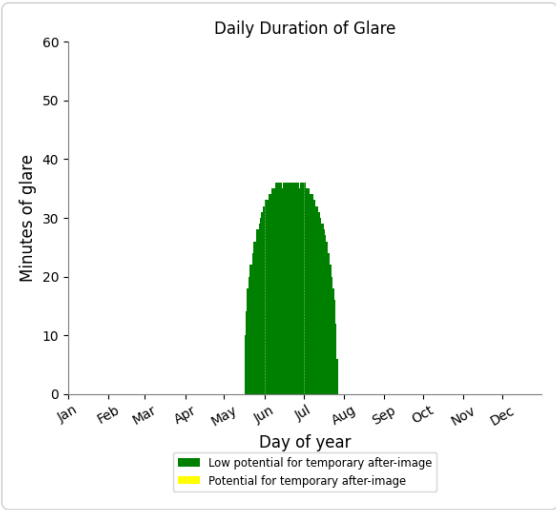
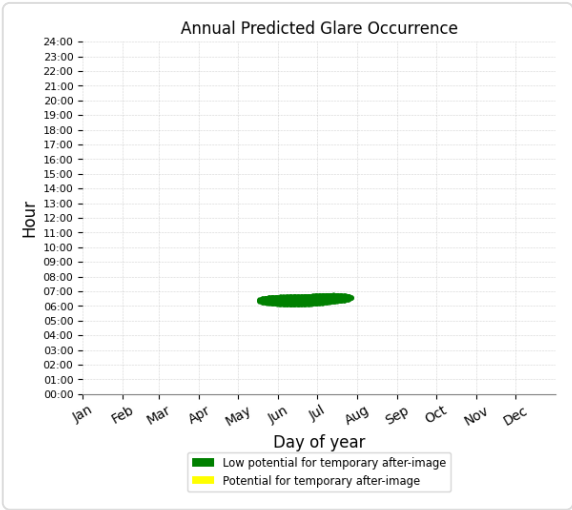


Array 9 and OP 4

Receptor type: Observation Point

0 minutes of yellow glare

2,169 minutes of green glare

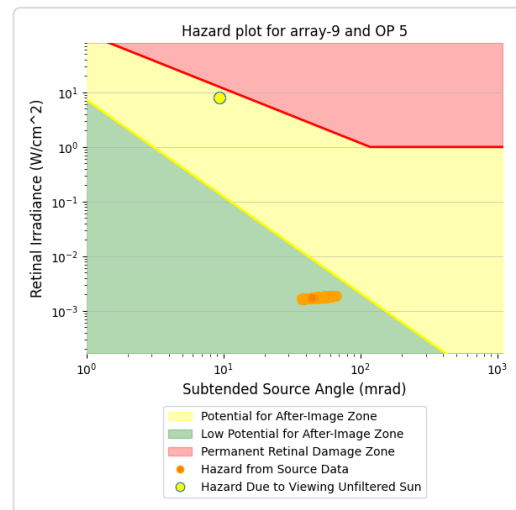
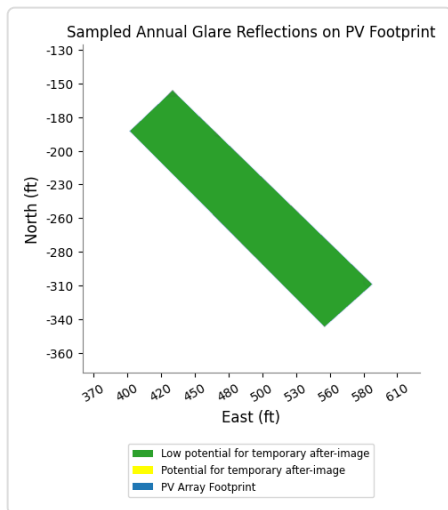
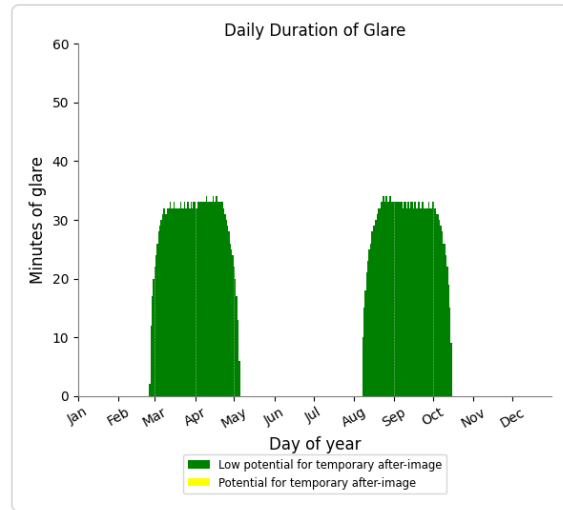
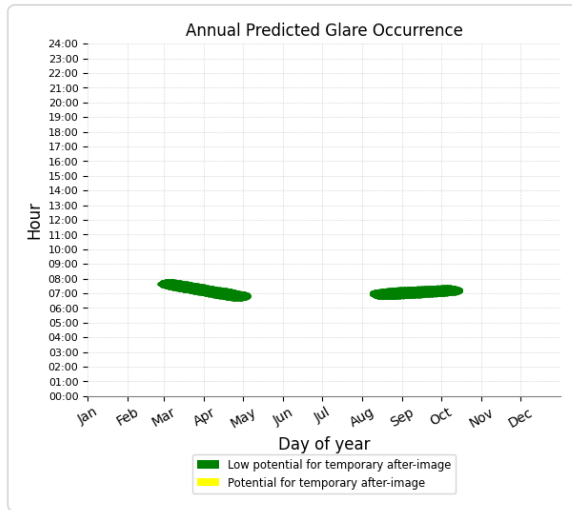


Array 9 and OP 5

Receptor type: Observation Point

0 minutes of yellow glare

4,092 minutes of green glare

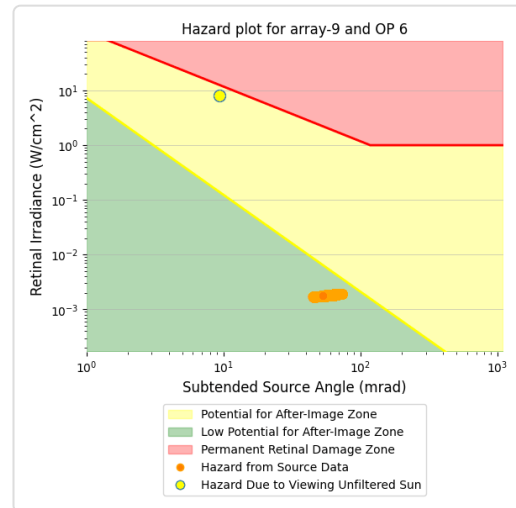
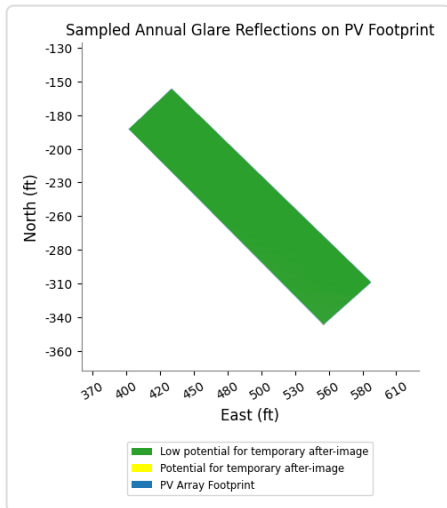
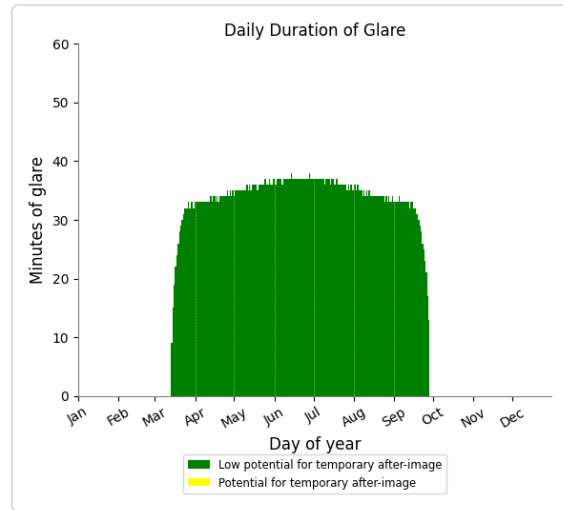
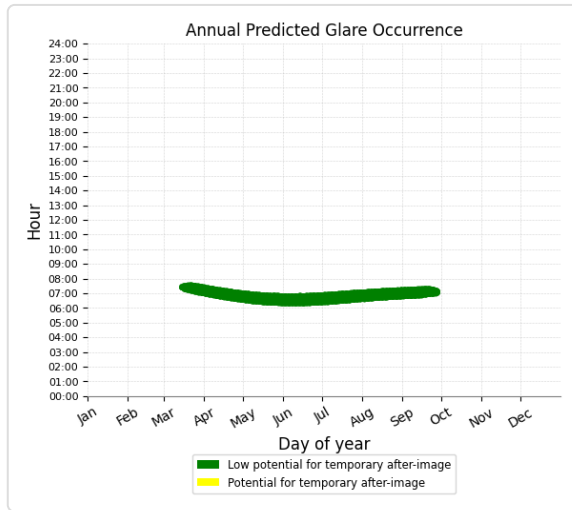


Array 9 and OP 6

Receptor type: Observation Point

0 minutes of yellow glare

6,738 minutes of green glare

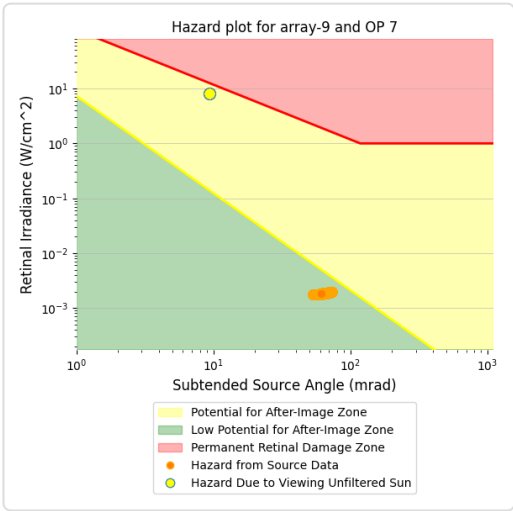
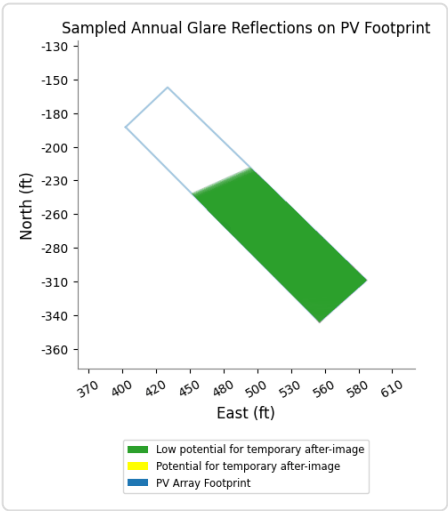
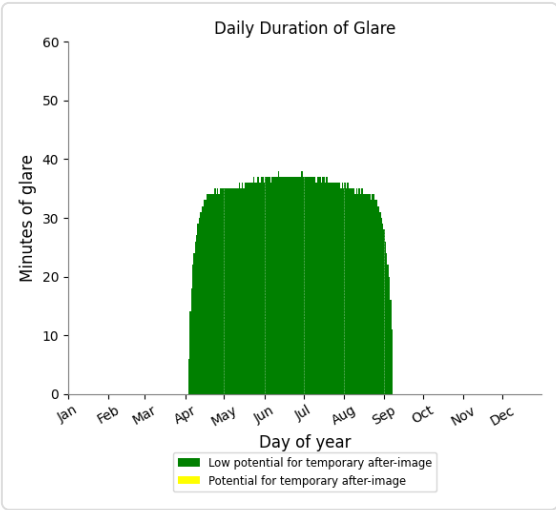
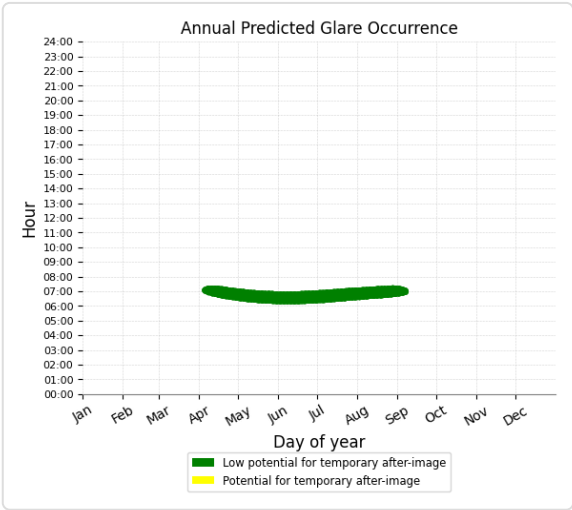


Array 9 and OP 7

Receptor type: Observation Point

0 minutes of yellow glare

5,347 minutes of green glare

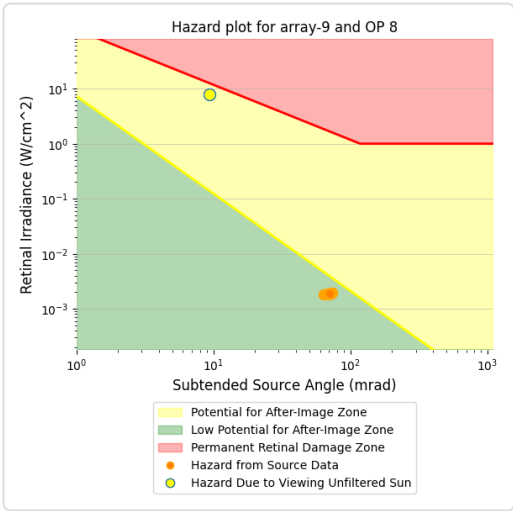
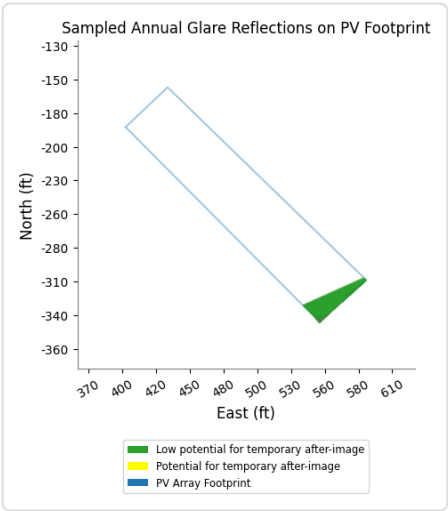
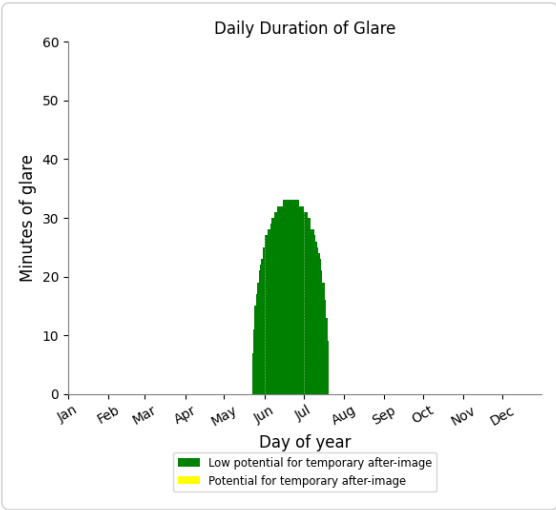
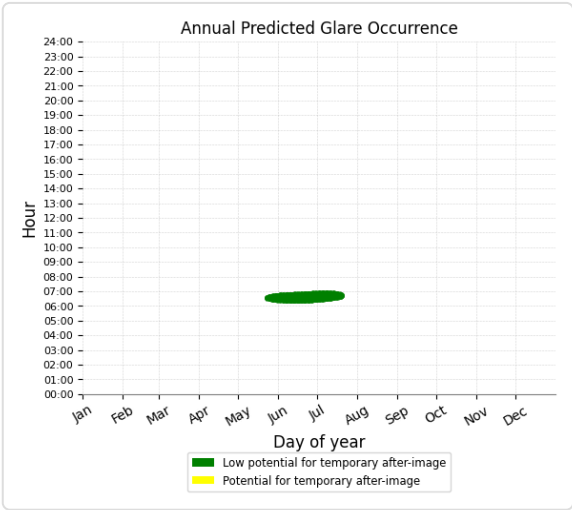


Array 9 and OP 8

Receptor type: Observation Point

0 minutes of yellow glare

1,589 minutes of green glare



Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.

Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.

Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.

The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.

The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.

The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Refer to the Help page at www.forgesolar.com/help/ for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

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