

FORGESOLAR GLARE ANALYSIS

Project: **Cobbett House**

A 84.8kWp solar PV system installed in an East West Orientation on Cobbett House for MFT. The array will sit in central roof areas with a parapet wall surrounding the array to a height of 1.1m.

Site configuration: **Untitled**

Client: Dalkia

Created 05 Feb, 2026

Updated 05 Feb, 2026

Time-step 1 minute

Timezone offset UTC0

Minimum sun altitude 0.0 deg

DNI peaks at 1,000.0 W/m²

Category 10 to 100 kW

(1,000 kW / 32,400 m² limit)

Site ID 170324.28353

Ocular transmission coefficient 0.5

Pupil diameter 0.002 m

Eye focal length 0.017 m

Sun subtended angle 9.3 mrad

PV analysis 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
	°	°	min	hr	min	hr	kWh
East Array 1	10.0	85.0	28,778	479.6	0	0.0	-
East array 2	0.0	85.0	34,977	583.0	0	0.0	-
West Array 1	10.0	265.0	51,513	858.5	0	0.0	-
West Array 2	10.0	265.0	32,733	545.5	0	0.0	-

Total 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
Route 1	16,507	275.1	0	0.0
Route 2	26,884	448.1	0	0.0
Route 3	14,964	249.4	0	0.0
Route 4	89,646	1,494.1	0	0.0

Component Data

PV Arrays

Name: East Array 1

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 85.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.460980	-2.227393	42.85	12.00	54.85
2	53.460849	-2.227916	43.00	12.00	55.00
3	53.460600	-2.227755	43.00	12.00	55.00
4	53.460623	-2.227661	43.00	12.00	55.00
5	53.460827	-2.227801	43.00	12.00	55.00
6	53.460936	-2.227361	42.80	12.00	54.80

Name: East array 2

Axis tracking: Fixed (no rotation)

Tilt: 0.0°

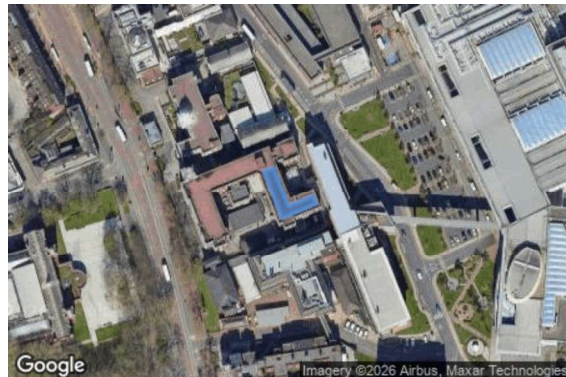
Orientation: 85.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.460918	-2.227283	42.68	12.00	54.68
2	53.460681	-2.227130	42.74	12.00	54.74
3	53.460752	-2.226838	42.33	12.00	54.33
4	53.460790	-2.226865	42.25	12.00	54.25
5	53.460739	-2.227074	42.59	12.00	54.59
6	53.460937	-2.227207	42.56	12.00	54.56

Name: West Array 1

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 265.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.460852	-2.227932	43.00	12.00	55.00
2	53.460591	-2.227763	43.00	12.00	55.00
3	53.460619	-2.227645	43.00	12.00	55.00
4	53.460824	-2.227788	43.00	12.00	55.00
5	53.460934	-2.227345	42.77	12.00	54.77
6	53.460988	-2.227384	42.83	12.00	54.83

Name: West Array 2

Axis tracking: Fixed (no rotation)

Tilt: 10.0°

Orientation: 265.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.460921	-2.227302	42.71	12.00	54.71
2	53.460670	-2.227134	42.75	12.00	54.75
3	53.460749	-2.226822	42.31	12.00	54.31
4	53.460797	-2.226859	42.22	12.00	54.22
5	53.460749	-2.227067	42.57	12.00	54.57
6	53.460946	-2.227200	42.53	12.00	54.53

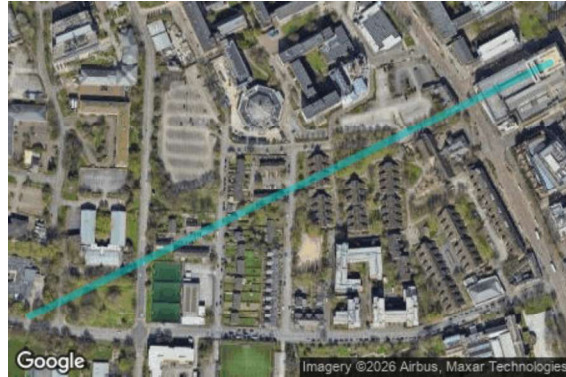
Route Receptors

Name: Route 1

Path type: Two-way

Azimuthal view angle: 50.0°

Downward view angle: 90.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.463214	-2.228579	44.11	90.00	134.11
2	53.460621	-2.237505	36.80	90.00	126.80

Name: Route 2

Path type: Two-way

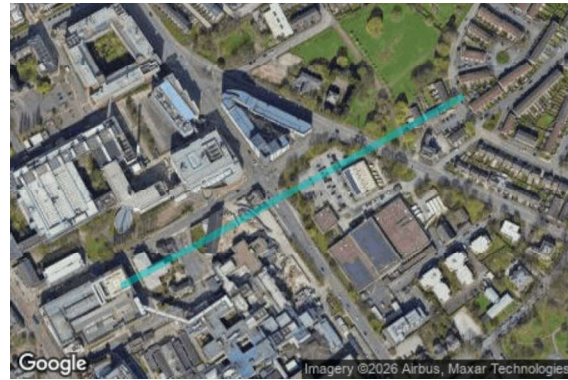
Azimuthal view angle: 50.0°

Downward view angle: 90.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.463278	-2.228429	44.37	90.00	134.37
2	53.466535	-2.232055	44.61	90.00	134.61

Name: Route 3
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.463217	-2.228440	44.24	90.00	134.24
2	53.465133	-2.222657	43.47	90.00	133.47

Name: Route 4
Path type: Two-way
Azimuthal view angle: 50.0°
Downward view angle: 90.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.463130	-2.228510	43.99	90.00	133.99
2	53.459068	-2.224369	45.95	90.00	135.95

Obstruction Components

Name: Lift motor room

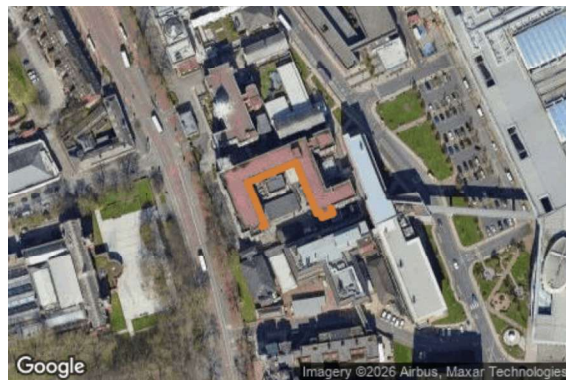
Top height: 15.0 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.460977	-2.227355	42.78
2	53.460990	-2.227301	42.69
3	53.460944	-2.227266	42.66
4	53.460932	-2.227309	42.73
5	53.460940	-2.227330	42.75
6	53.460977	-2.227355	42.78

Name: Parapet 1

Top height: 11.1 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.460590	-2.227617	43.00
2	53.460594	-2.227589	43.00
3	53.460814	-2.227743	43.00
4	53.460917	-2.227326	42.76
5	53.460654	-2.227147	42.79
6	53.460660	-2.227118	42.76
7	53.460634	-2.227102	42.80
8	53.460654	-2.227007	42.71
9	53.460680	-2.227027	42.66

Name: parapet 2
Top height: 11.1 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.460683	-2.227020	42.66
2	53.460736	-2.226798	42.32
3	53.460826	-2.226857	42.14
4	53.460779	-2.227056	42.51
5	53.460985	-2.227200	42.51

Name: Parapet 3
Top height: 11.1 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.461008	-2.227212	42.52
2	53.461044	-2.227240	42.56
3	53.460894	-2.227854	43.03

Name: Tower
Top height: 18.0 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.460926	-2.228006	43.09
2	53.460949	-2.227899	43.09
3	53.460894	-2.227858	43.04
4	53.460871	-2.227955	43.02
5	53.460926	-2.228006	43.09

Name: West facade parapet
Top height: 14.0 m



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)
1	53.460867	-2.227965	43.03
2	53.460862	-2.227991	43.02
3	53.460541	-2.227787	43.00
4	53.460561	-2.227721	43.00
5	53.460530	-2.227702	43.00
6	53.460554	-2.227595	43.00
7	53.460590	-2.227630	43.00

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
East Array 1	10.0	85.0	28,778	479.6	0	0.0	-
East array 2	0.0	85.0	34,977	583.0	0	0.0	-
West Array 1	10.0	265.0	51,513	858.5	0	0.0	-
West Array 2	10.0	265.0	32,733	545.5	0	0.0	-

Total 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
Route 1	16,507	275.1	0	0.0
Route 2	26,884	448.1	0	0.0
Route 3	14,964	249.4	0	0.0
Route 4	89,646	1,494.1	0	0.0

PV: East Array 1 low potential for temporary after-image

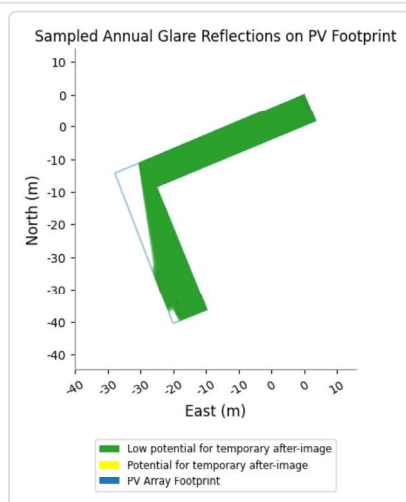
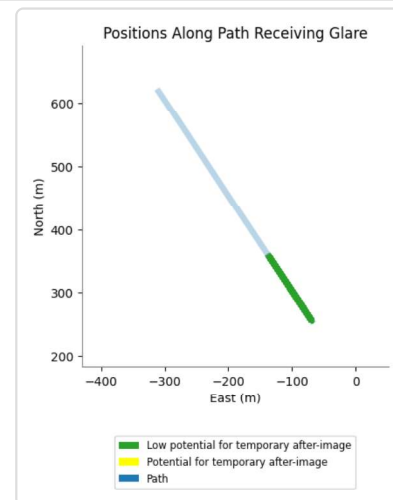
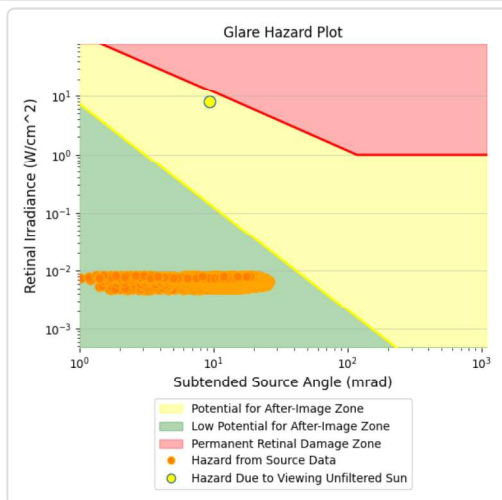
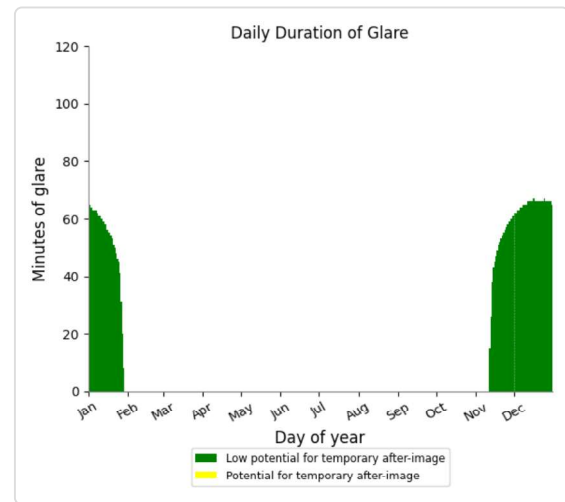
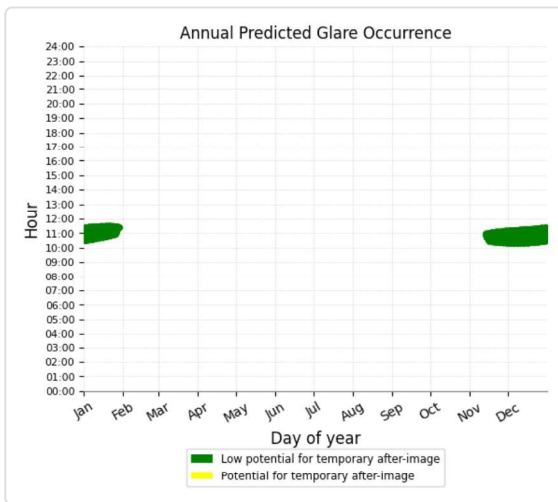
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 2	4,498	75.0	0	0.0
Route 3	6,756	112.6	0	0.0
Route 4	17,524	292.1	0	0.0
Route 1	0	0.0	0	0.0

East Array 1 and Route: Route 2

Yellow glare: none

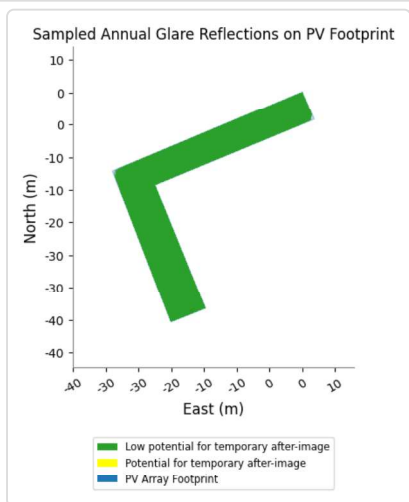
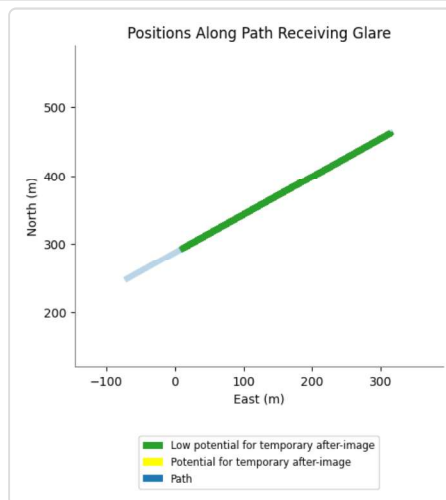
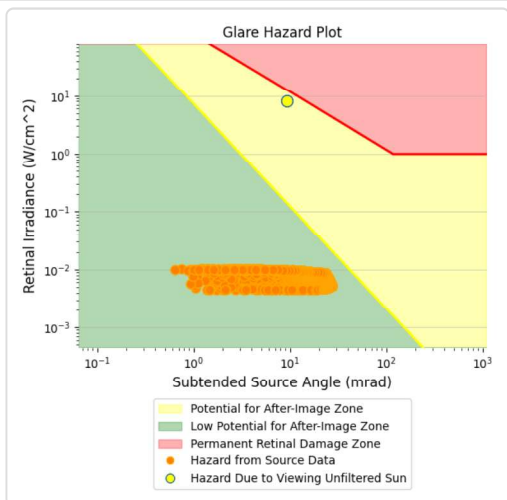
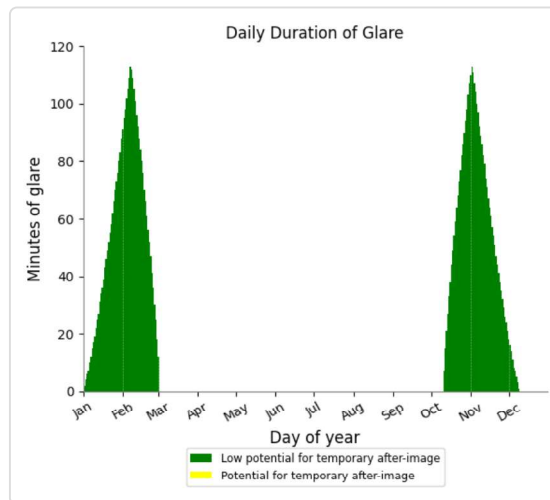
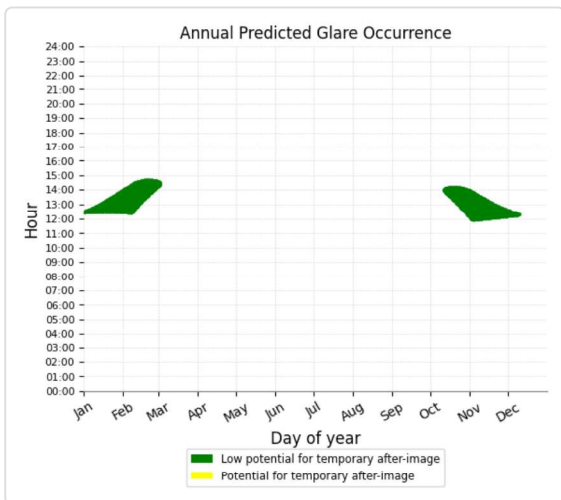
Green glare: 4,498 min.



East Array 1 and Route: Route 3

Yellow glare: none

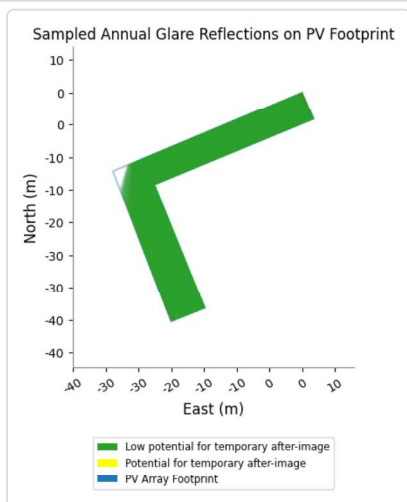
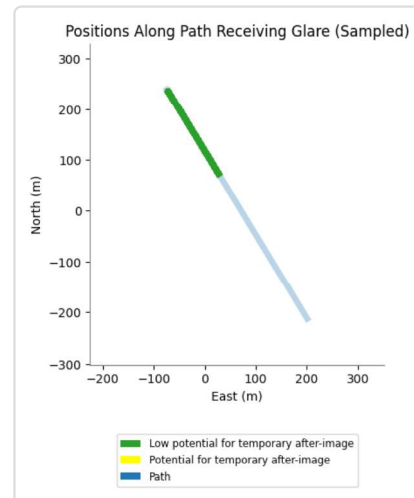
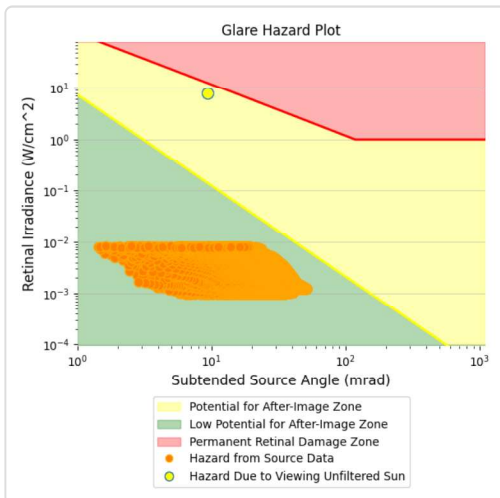
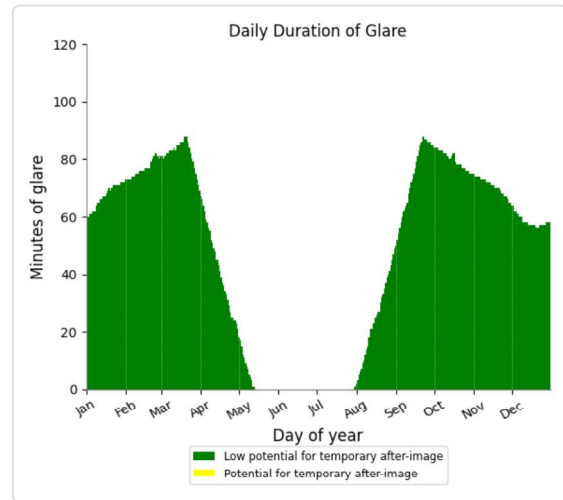
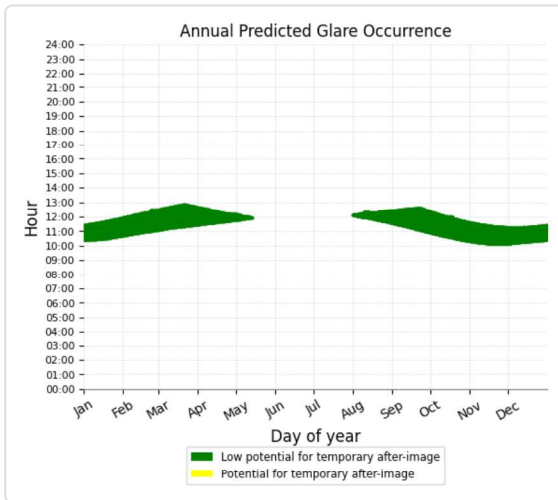
Green glare: 6,756 min.



East Array 1 and Route: Route 4

Yellow glare: none

Green glare: 17,524 min.



East Array 1 and Route: Route 1

No glare found

PV: East array 2 low potential for temporary after-image

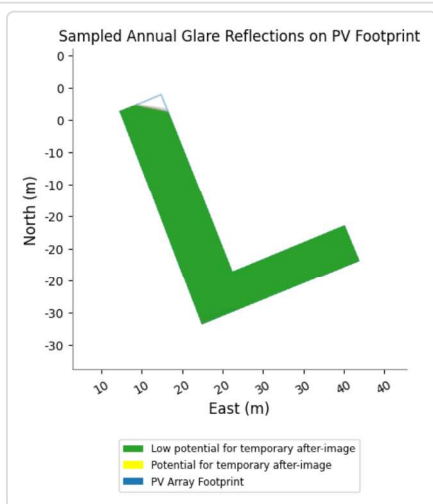
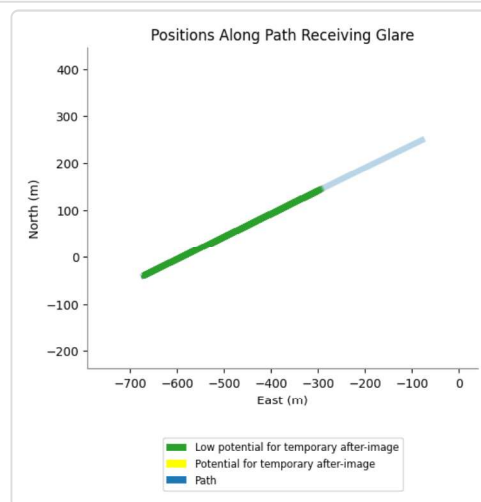
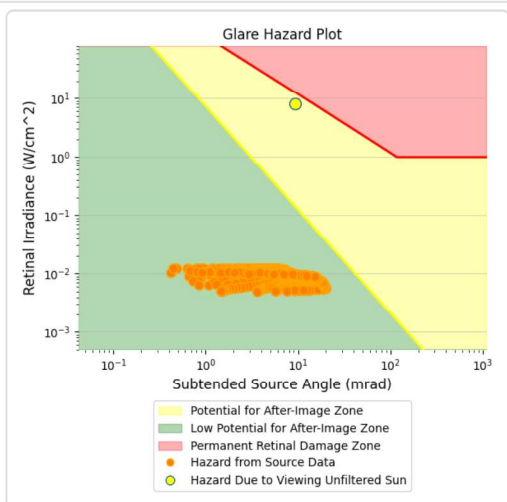
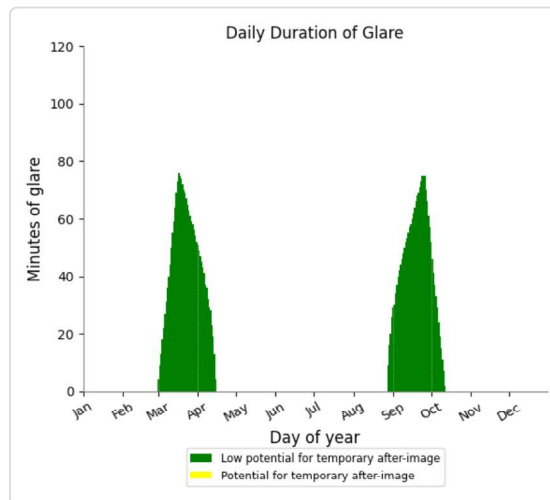
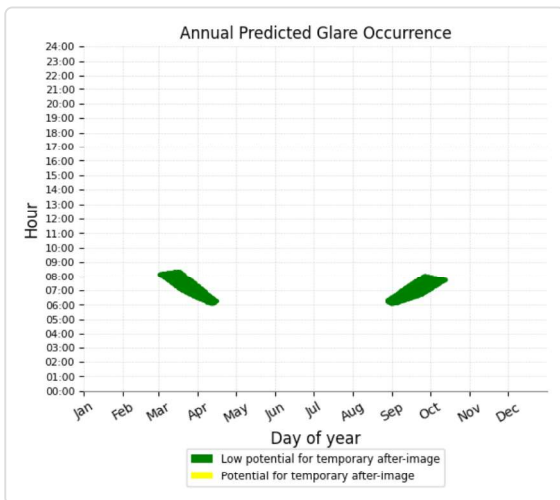
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	4,156	69.3	0	0.0
Route 2	5,826	97.1	0	0.0
Route 3	8,208	136.8	0	0.0
Route 4	16,787	279.8	0	0.0

East array 2 and Route: Route 1

Yellow glare: none

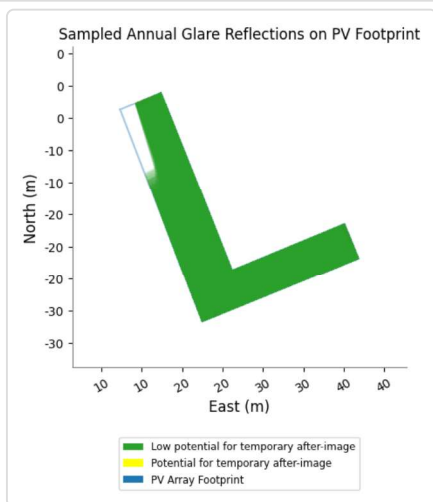
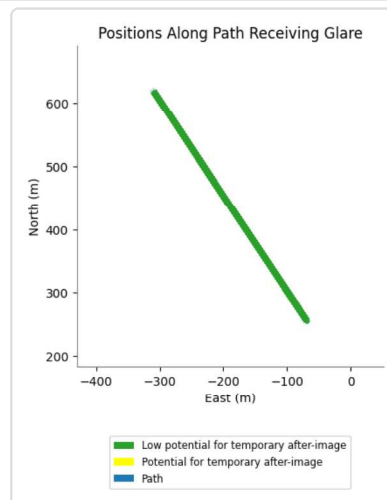
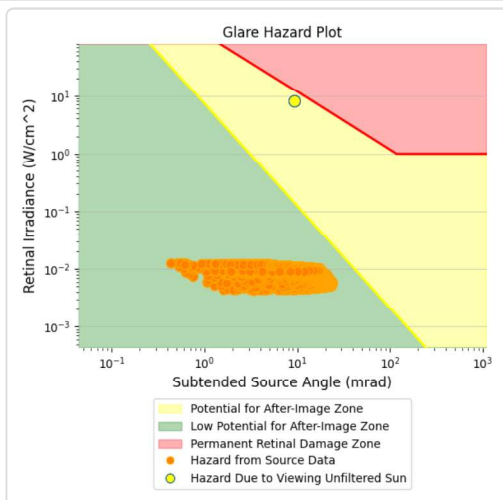
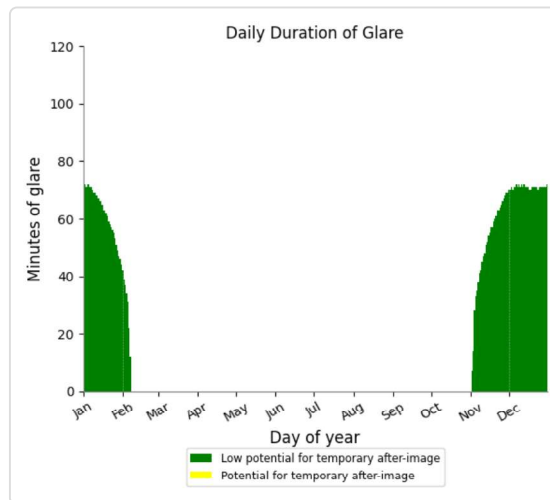
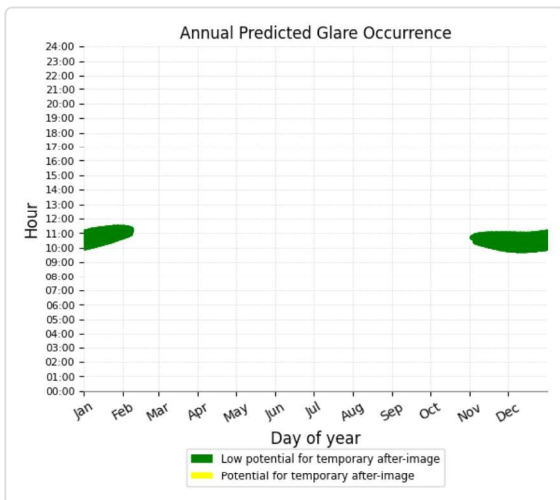
Green glare: 4,156 min.



East array 2 and Route: Route 2

Yellow glare: none

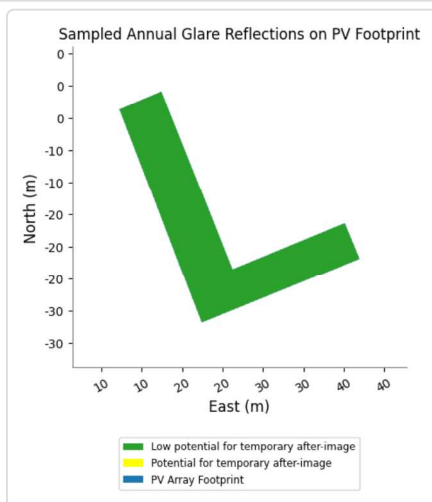
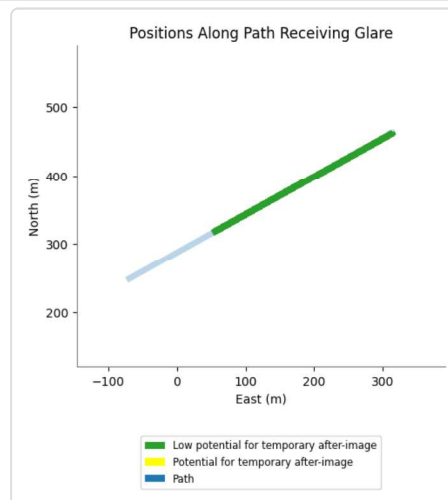
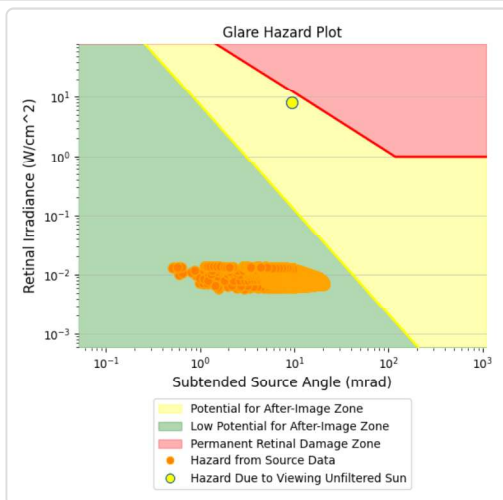
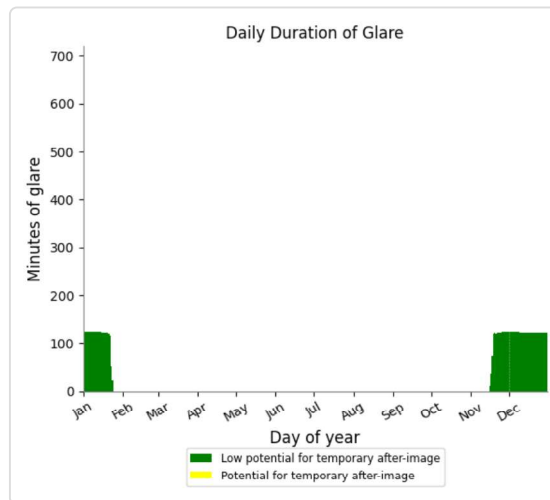
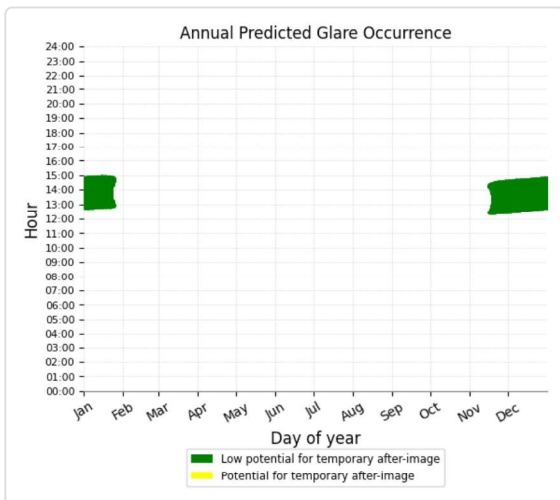
Green glare: 5,826 min.



East array 2 and Route: Route 3

Yellow glare: none

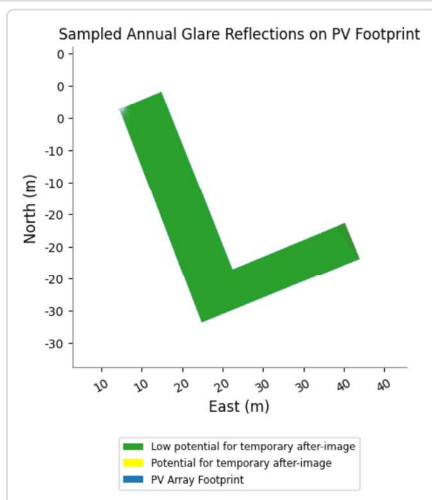
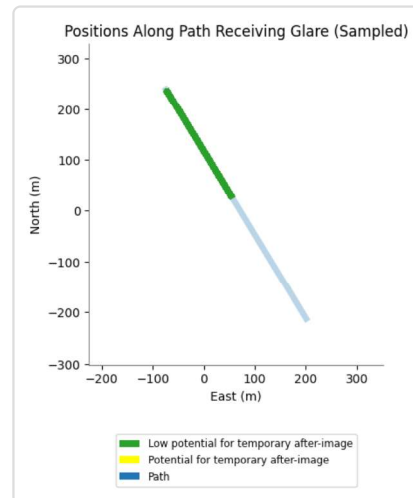
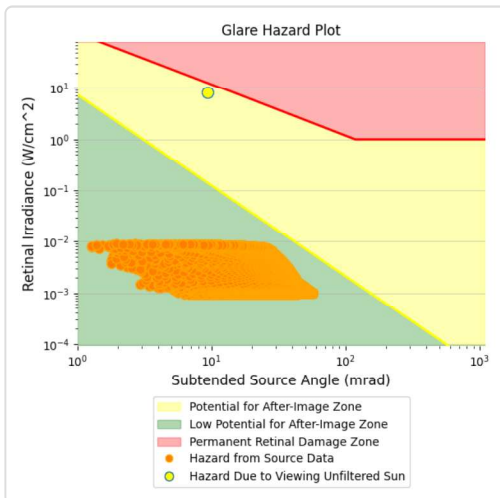
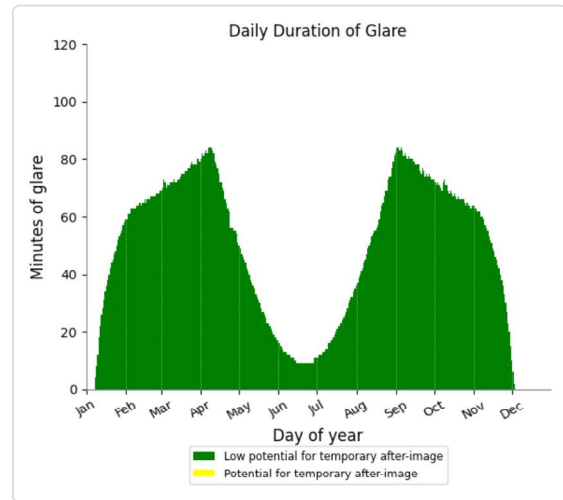
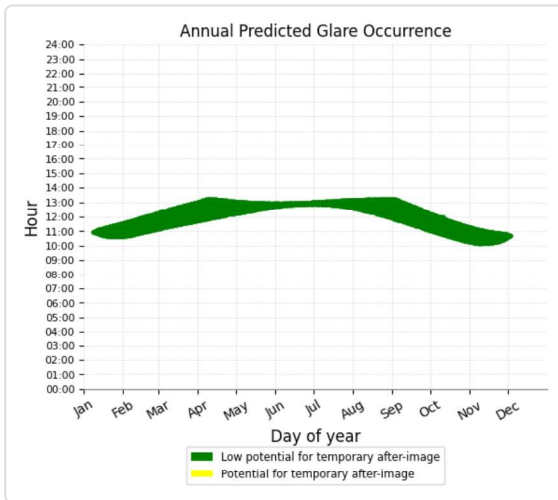
Green glare: 8,208 min.



East array 2 and Route: Route 4

Yellow glare: none

Green glare: 16,787 min.



PV: West Array 1 low potential for temporary after-image

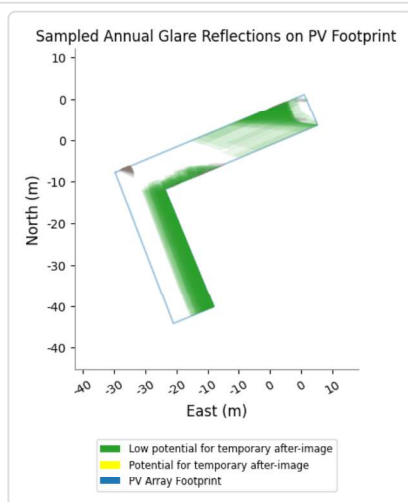
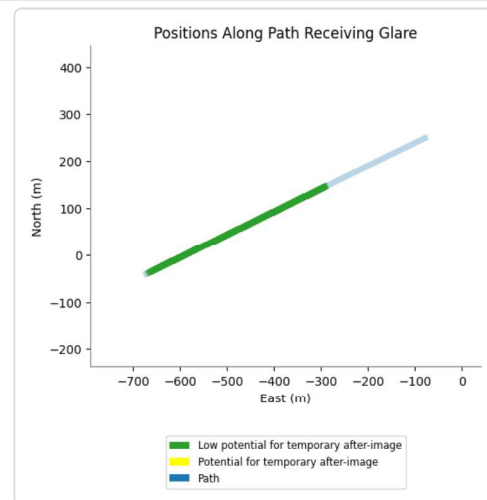
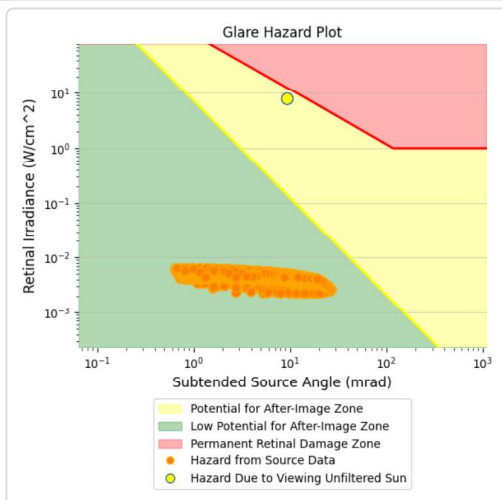
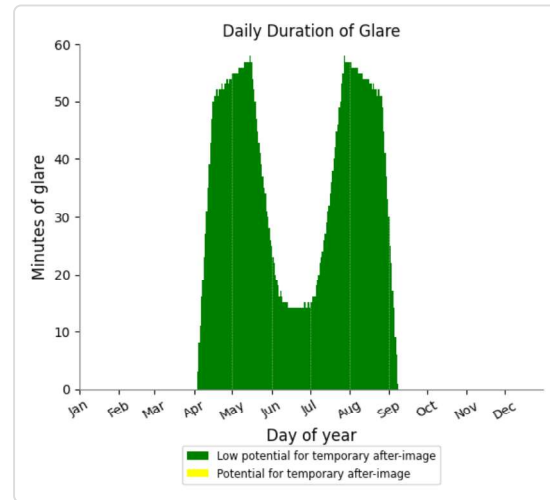
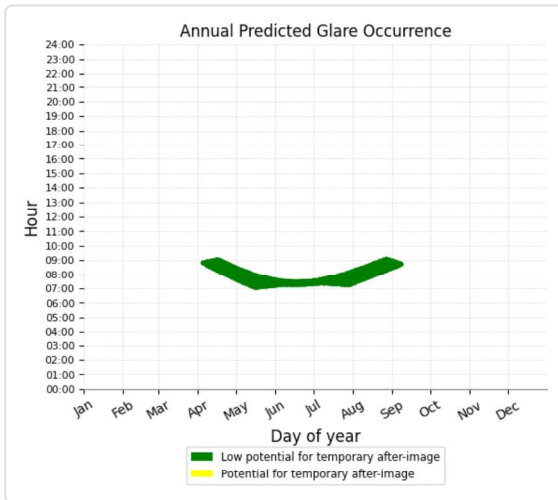
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	5,851	97.5	0	0.0
Route 2	10,584	176.4	0	0.0
Route 4	35,078	584.6	0	0.0
Route 3	0	0.0	0	0.0

West Array 1 and Route: Route 1

Yellow glare: none

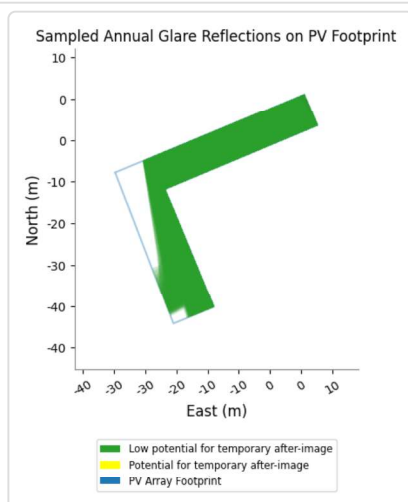
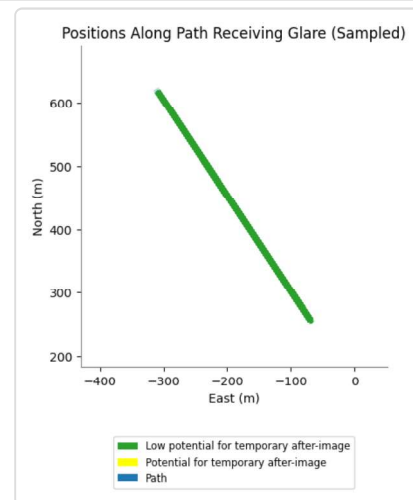
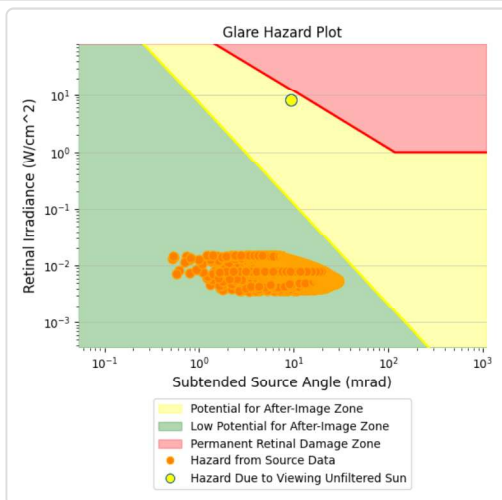
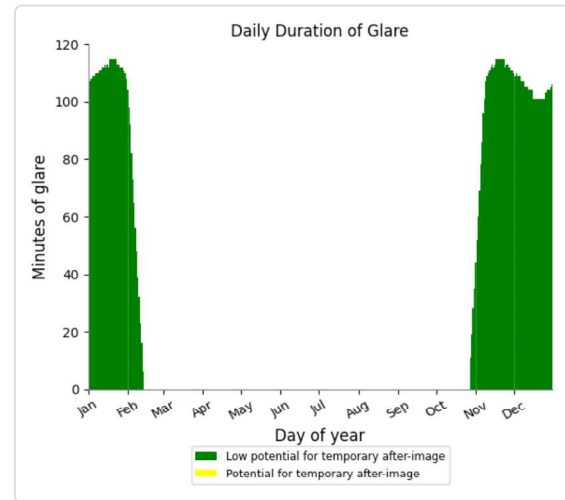
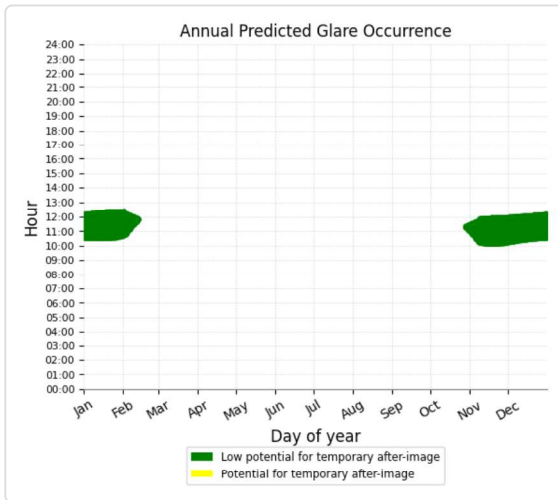
Green glare: 5,851 min.



West Array 1 and Route: Route 2

Yellow glare: none

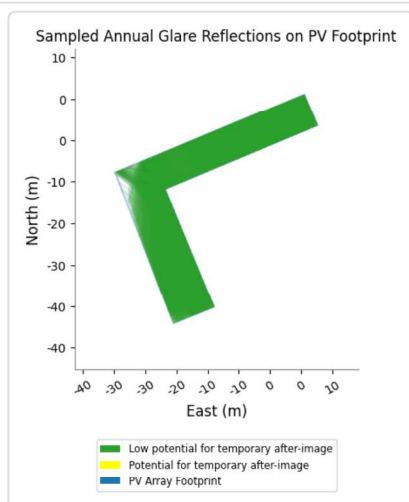
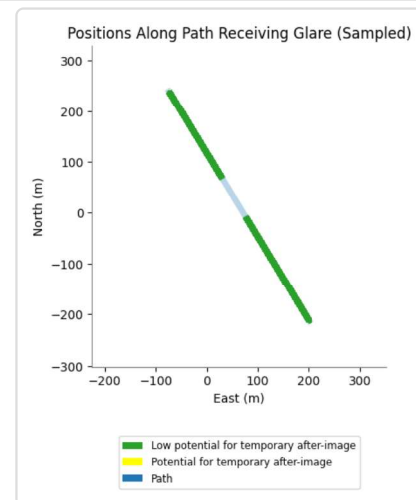
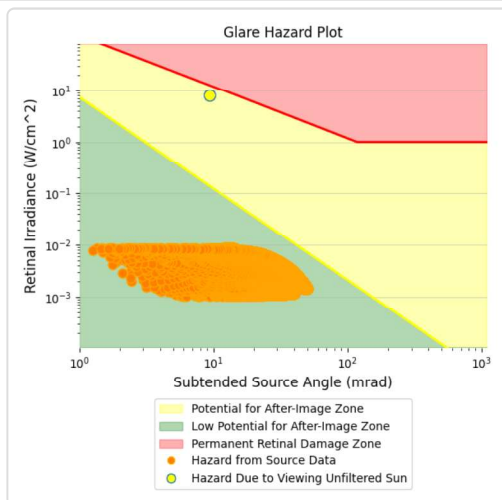
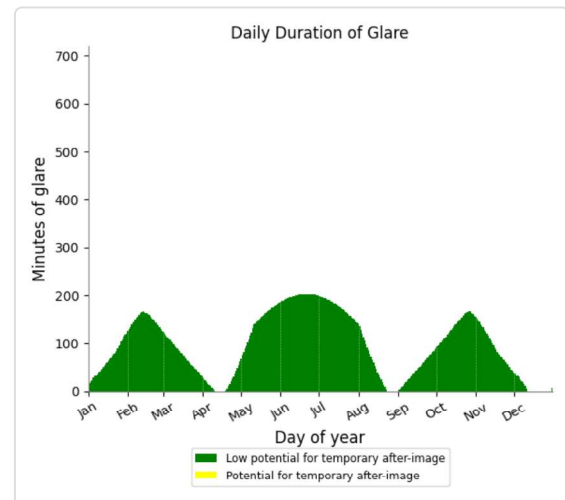
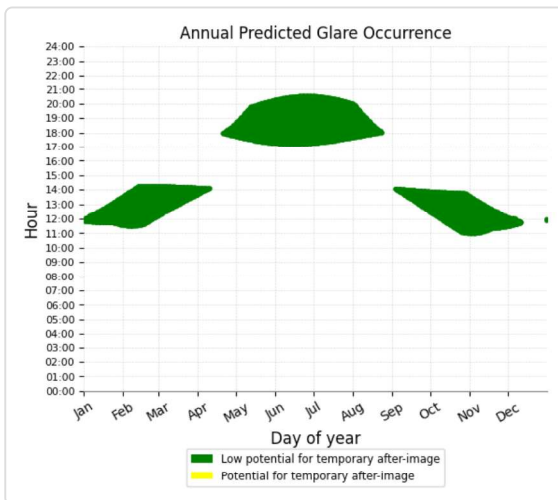
Green glare: 10,584 min.



West Array 1 and Route: Route 4

Yellow glare: none

Green glare: 35,078 min.



West Array 1 and Route: Route 3

No glare found

PV: West Array 2 low potential for temporary after-image

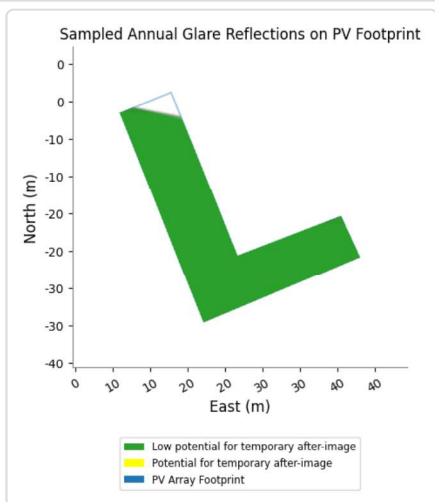
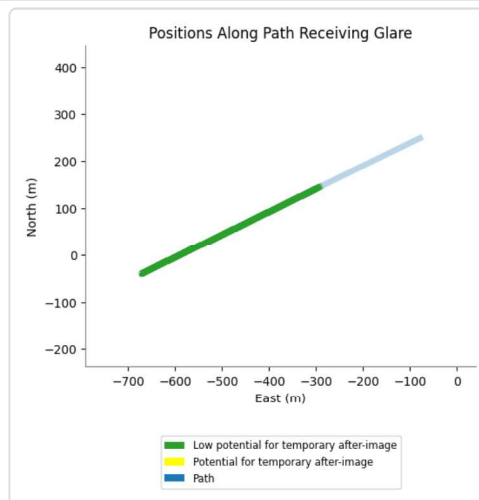
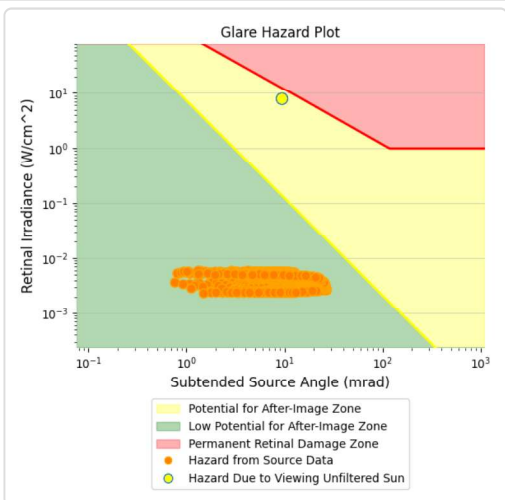
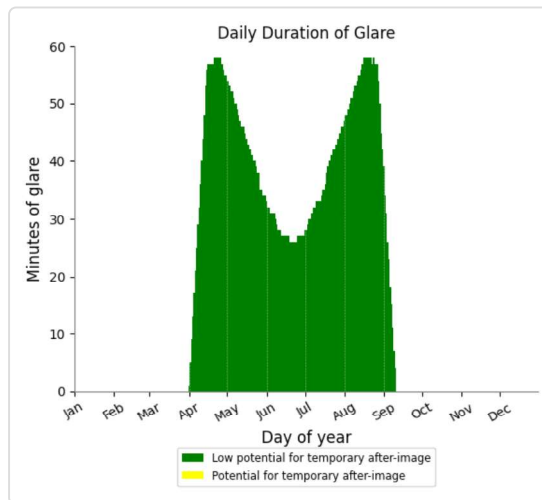
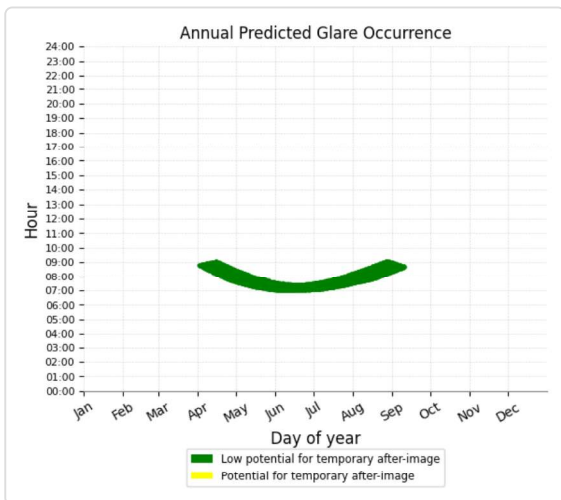
Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Route 1	6,500	108.3	0	0.0
Route 2	5,976	99.6	0	0.0
Route 4	20,257	337.6	0	0.0
Route 3	0	0.0	0	0.0

West Array 2 and Route: Route 1

Yellow glare: none

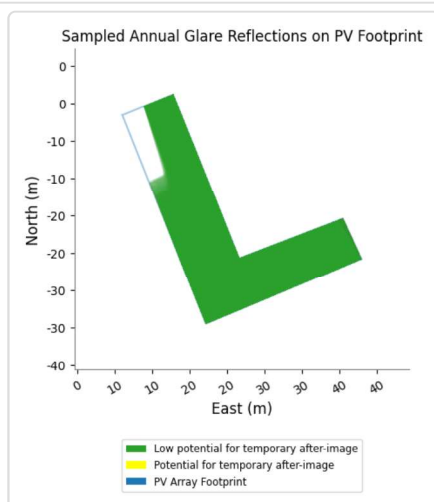
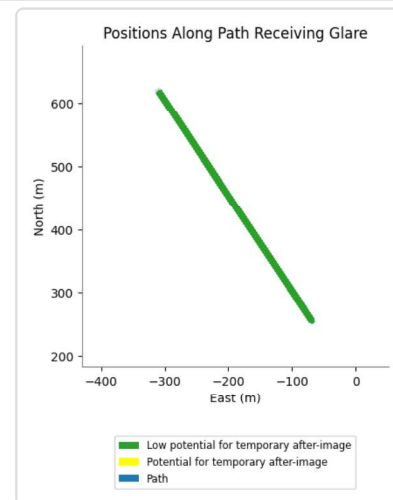
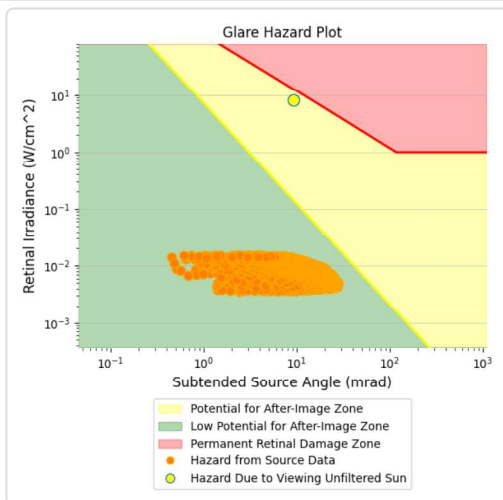
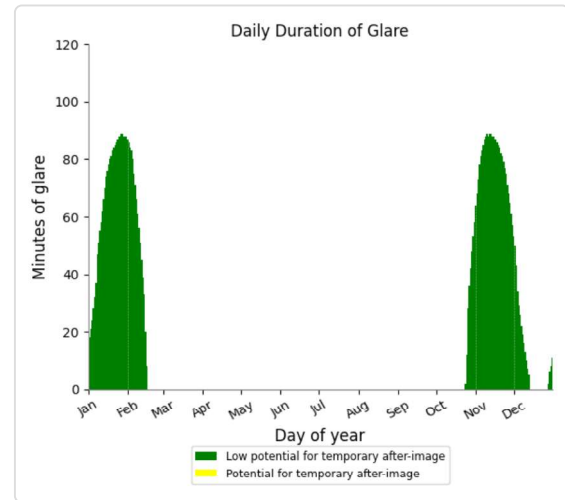
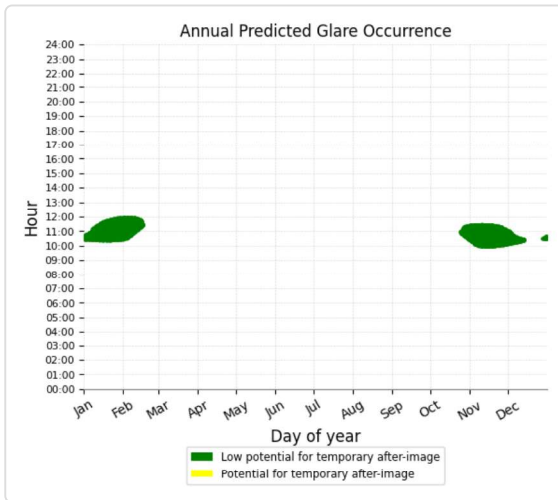
Green glare: 6,500 min.



West Array 2 and Route: Route 2

Yellow glare: none

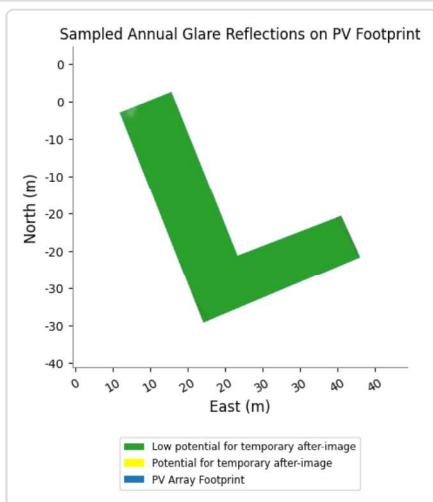
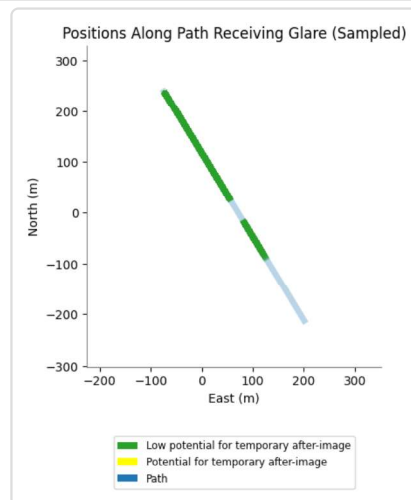
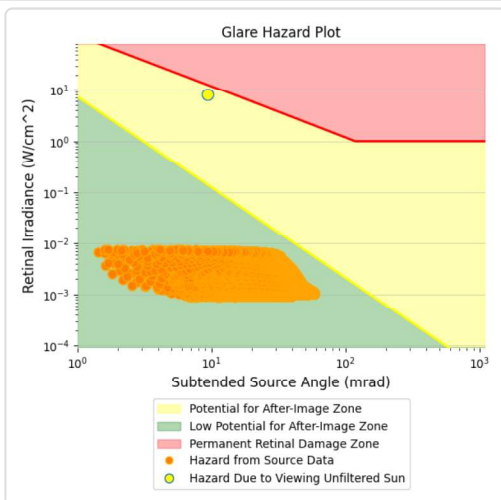
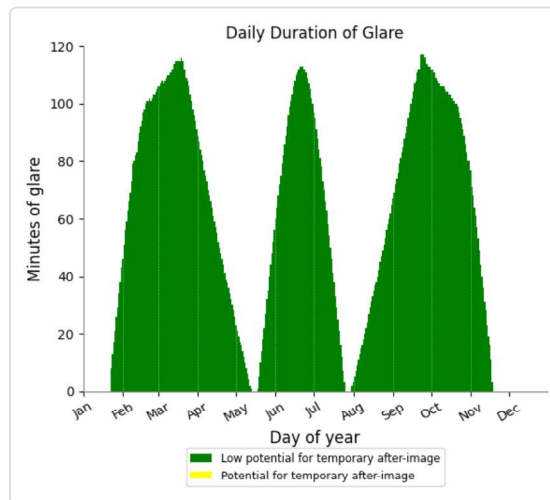
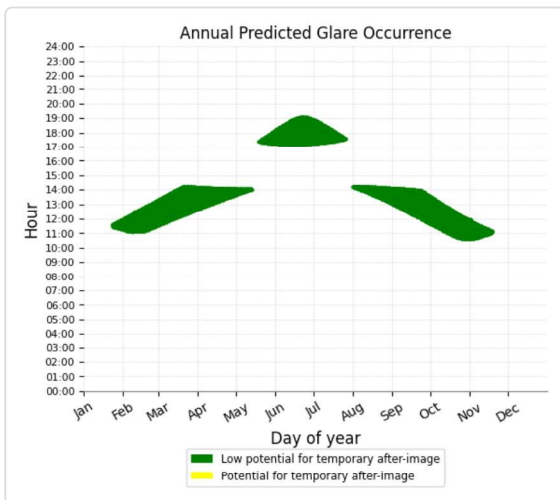
Green glare: 5,976 min.



West Array 2 and Route: Route 4

Yellow glare: none

Green glare: 20,257 min.



West Array 2 and Route: Route 3

No glare found

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 automatically 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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