

# FORGESOLAR GLARE ANALYSIS

Project: **Beacon Fen DCO**

Site configuration: **Beacon Fen DCO OP1-40**

Created 30 Jun, 2023

Updated 26 Jul, 2023

Time-step 1 minute

Timezone offset UTC0

Minimum sun altitude 0.0 deg

DNI peaks at 1,000.0 W/m<sup>2</sup>

Category 10 MW to 100 MW

Site ID 94361.16549

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 potential for temporary after-image predicted

PV Array	Tilt °	Orient °	Annual Green Glare		Annual Yellow Glare		Energy kWh	Peak Luminance
			min	hr	min	hr		cd/m <sup>2</sup>
PV array 1	17.5	180.0	6,682	111.4	2,116	35.3	-	571,619
PV array 2	17.5	180.0	9,604	160.1	0	0.0	-	254,809
PV array 3	17.5	180.0	12,731	212.2	9,196	153.3	-	697,927
PV array 4	17.5	180.0	1,864	31.1	0	0.0	-	142,334

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
OP 1	3,811	63.5	2,029	33.8
OP 2	598	10.0	915	15.2
OP 3	4,481	74.7	1,423	23.7
OP 4	5,529	92.2	2,826	47.1
OP 5	2,314	38.6	800	13.3
OP 6	3,519	58.6	92	1.5
OP 7	1,784	29.7	1,367	22.8
OP 8	1,172	19.5	1,689	28.1
OP 9	457	7.6	55	0.9
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0
OP 29	0	0.0	0	0.0
OP 30	82	1.4	0	0.0
OP 31	1,437	23.9	0	0.0
OP 32	1,624	27.1	0	0.0
OP 33	806	13.4	31	0.5
OP 34	780	13.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	782	13.0	0	0.0
OP 39	1,070	17.8	53	0.9
OP 40	635	10.6	32	0.5

# Component Data

## PV Arrays

**Name:** PV array 1  
**Axis tracking:** Fixed (no rotation)  
**Tilt:** 17.5°  
**Orientation:** 180.0°  
**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	53.031220	-0.285520	2.26	4.50	6.76
2	53.026410	-0.281430	1.62	4.50	6.12
3	53.015080	-0.309410	13.66	4.50	18.16
4	53.016400	-0.310700	11.66	4.50	16.16
5	53.017740	-0.311170	9.93	4.50	14.43
6	53.019110	-0.310020	8.00	4.50	12.50
7	53.020790	-0.305940	6.92	4.50	11.42
8	53.021480	-0.304780	5.53	4.50	10.03
9	53.022330	-0.305120	6.00	4.50	10.50
10	53.022930	-0.305170	5.32	4.50	9.82

**Name:** PV array 2  
**Axis tracking:** Fixed (no rotation)  
**Tilt:** 17.5°  
**Orientation:** 180.0°  
**Rated power:** -  
**Panel material:** Smooth glass with AR coating  
**Reflectivity:** 0.1  
**Slope error:** correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.015650	-0.307960	10.04	4.50	14.54
2	53.024550	-0.285730	2.00	4.50	6.50
3	53.022400	-0.282910	1.51	4.50	6.01
4	53.012340	-0.305510	7.37	4.50	11.87

**Name:** PV array 3

**Axis tracking:** Fixed (no rotation)

**Tilt:** 17.5°

**Orientation:** 180.0°

**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	53.023840	-0.279330	1.56	4.50	6.06
2	53.018380	-0.292170	3.95	4.50	8.45
3	53.012240	-0.305380	7.36	4.50	11.86
4	53.011750	-0.311260	8.81	4.50	13.31
5	53.008780	-0.311130	8.19	4.50	12.69
6	53.006320	-0.310110	9.00	4.50	13.50
7	53.003110	-0.309260	10.00	4.50	14.50
8	53.003950	-0.304800	10.67	4.50	15.17
9	53.004870	-0.300310	8.81	4.50	13.31
10	53.004720	-0.298810	8.17	4.50	12.67
11	53.005650	-0.296710	6.70	4.50	11.20
12	53.006130	-0.293170	7.13	4.50	11.63
13	53.007310	-0.289980	7.96	4.50	12.46
14	53.007880	-0.287620	6.61	4.50	11.11
15	53.008850	-0.284760	6.00	4.50	10.50
16	53.009140	-0.281960	5.46	4.50	9.96
17	53.010620	-0.282870	5.00	4.50	9.50
18	53.010910	-0.281640	5.00	4.50	9.50
19	53.010410	-0.280960	5.00	4.50	9.50
20	53.015960	-0.271410	5.00	4.50	9.50
21	53.019250	-0.273780	2.10	4.50	6.60
22	53.019210	-0.274090	1.83	4.50	6.33
23	53.021210	-0.276290	1.96	4.50	6.46

**Name:** PV array 4

**Axis tracking:** Fixed (no rotation)

**Tilt:** 17.5°

**Orientation:** 180.0°

**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	53.031960	-0.286120	2.20	4.50	6.70
2	53.033380	-0.282250	3.00	4.50	7.50
3	53.031990	-0.280990	2.92	4.50	7.42
4	53.030280	-0.279770	2.44	4.50	6.94
5	53.026830	-0.277480	2.00	4.50	6.50
6	53.020210	-0.273010	2.19	4.50	6.69
7	53.019530	-0.274450	2.00	4.50	6.50
8	53.024200	-0.279700	2.09	4.50	6.59
9	53.026670	-0.281550	1.23	4.50	5.73

## Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	53.009468	-0.279603	4.13	1.80
OP 2	2	53.002891	-0.309452	11.62	1.80
OP 3	3	53.014767	-0.310349	14.98	1.80
OP 4	4	53.014664	-0.312603	17.26	1.80
OP 5	5	53.013282	-0.325971	18.95	1.80
OP 6	6	53.015477	-0.327280	16.98	1.80
OP 7	7	53.008624	-0.332517	23.00	1.80
OP 8	8	53.004806	-0.332967	22.99	1.80
OP 9	9	52.997570	-0.326856	18.98	1.80
OP 10	10	52.980281	-0.337094	17.13	1.80
OP 11	11	52.982932	-0.315416	15.28	1.80
OP 12	12	52.982299	-0.313464	15.07	1.80
OP 13	13	52.980322	-0.299667	16.18	1.80
OP 14	14	52.980296	-0.293658	15.10	1.80
OP 15	15	52.980723	-0.290568	12.98	1.80
OP 16	16	52.984857	-0.294040	13.20	1.80
OP 17	17	52.986885	-0.297066	10.90	1.80
OP 18	18	52.986278	-0.299920	12.14	1.80
OP 19	19	52.984120	-0.303997	15.19	1.80
OP 20	20	52.982040	-0.305821	16.31	1.80
OP 21	21	52.980799	-0.283986	7.52	1.80
OP 22	22	52.981807	-0.271002	7.65	1.80
OP 23	23	52.980750	-0.259298	5.00	1.80
OP 24	24	52.981964	-0.252589	5.43	1.80
OP 25	25	52.983909	-0.245744	4.47	1.80
OP 26	26	52.977623	-0.259477	5.52	1.80
OP 27	27	52.973103	-0.258961	4.67	1.80
OP 28	28	52.984115	-0.232806	2.28	1.80
OP 29	29	52.988537	-0.234330	3.00	1.80
OP 30	30	52.990500	-0.235124	2.42	1.80
OP 31	31	52.993614	-0.236154	3.96	1.80
OP 32	32	52.997185	-0.246097	3.26	1.80
OP 33	33	52.995493	-0.251526	3.51	1.80
OP 34	34	52.993233	-0.268328	5.00	1.80
OP 35	35	52.992045	-0.274979	5.00	1.80
OP 36	36	52.991128	-0.280172	5.93	1.80
OP 37	37	52.989978	-0.286996	5.00	1.80
OP 38	38	52.994807	-0.272527	5.00	1.80
OP 39	39	52.996628	-0.269545	5.00	1.80
OP 40	40	52.997507	-0.262356	6.00	1.80

# Glare Analysis Results

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

PV Array	Tilt °	Orient °	Annual Green Glare		Annual Yellow Glare		Energy kWh	Peak Luminance
			min	hr	min	hr		cd/m <sup>2</sup>
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Total glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

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OP 7	1,784	29.7	1,367	22.8
OP 8	1,172	19.5	1,689	28.1
OP 9	457	7.6	55	0.9
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0
OP 24	0	0.0	0	0.0
OP 25	0	0.0	0	0.0
OP 26	0	0.0	0	0.0
OP 27	0	0.0	0	0.0
OP 28	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 29	0	0.0	0	0.0
OP 30	82	1.4	0	0.0
OP 31	1,437	23.9	0	0.0
OP 32	1,624	27.1	0	0.0
OP 33	806	13.4	31	0.5
OP 34	780	13.0	0	0.0
OP 35	0	0.0	0	0.0
OP 36	0	0.0	0	0.0
OP 37	0	0.0	0	0.0
OP 38	782	13.0	0	0.0
OP 39	1,070	17.8	53	0.9
OP 40	635	10.6	32	0.5

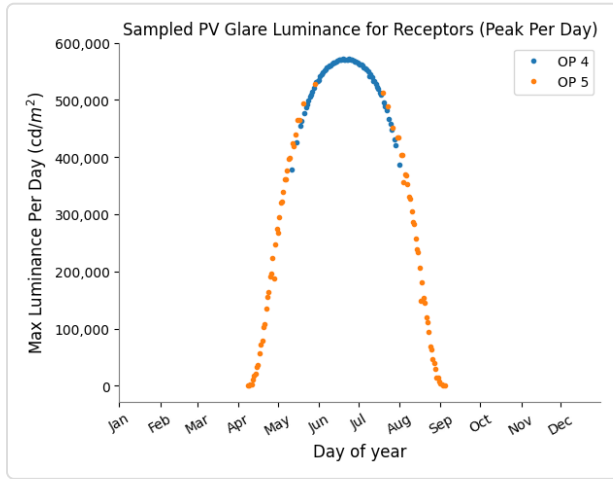


**PV: PV array 1** potential temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 4	1,074	17.9	1,653	27.6	571,619
OP 5	973	16.2	463	7.7	542,859
OP 1	1,998	33.3	0	0.0	257,843
OP 3	463	7.7	0	0.0	32,844
OP 6	29	0.5	0	0.0	133,503
OP 7	441	7.3	0	0.0	161,561
OP 31	765	12.8	0	0.0	30,686
OP 32	939	15.7	0	0.0	50,815
OP 2	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0
OP 17	0	0.0	0	0.0	0
OP 18	0	0.0	0	0.0	0
OP 19	0	0.0	0	0.0	0
OP 20	0	0.0	0	0.0	0
OP 21	0	0.0	0	0.0	0
OP 22	0	0.0	0	0.0	0
OP 23	0	0.0	0	0.0	0
OP 24	0	0.0	0	0.0	0
OP 25	0	0.0	0	0.0	0
OP 26	0	0.0	0	0.0	0
OP 27	0	0.0	0	0.0	0
OP 28	0	0.0	0	0.0	0
OP 29	0	0.0	0	0.0	0
OP 30	0	0.0	0	0.0	0
OP 33	0	0.0	0	0.0	0
OP 34	0	0.0	0	0.0	0
OP 35	0	0.0	0	0.0	0
OP 36	0	0.0	0	0.0	0

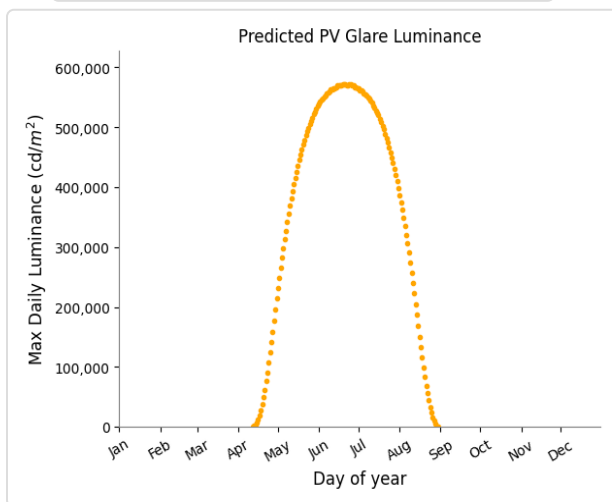
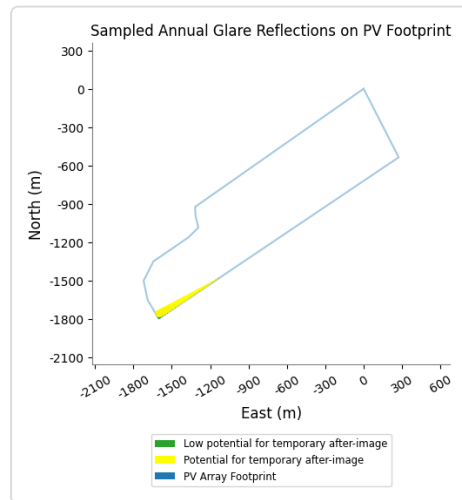
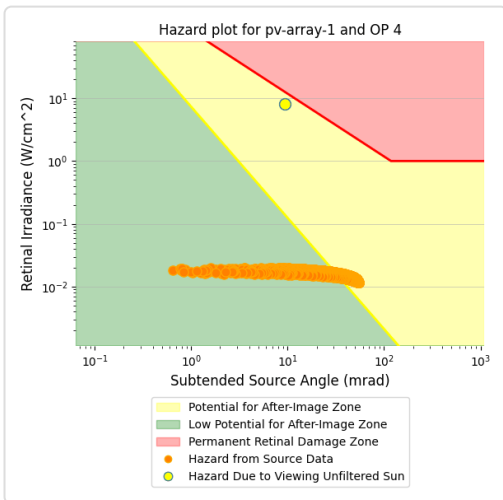
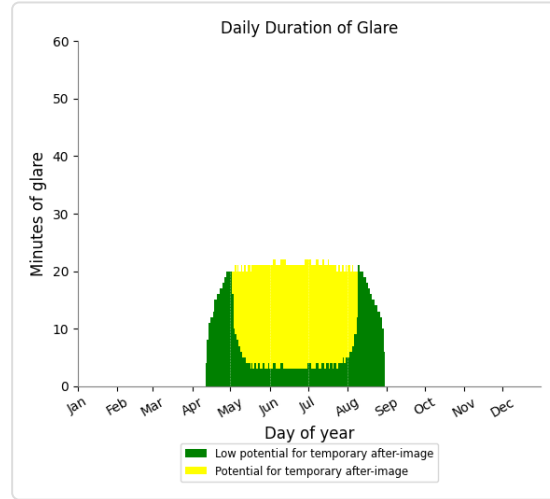
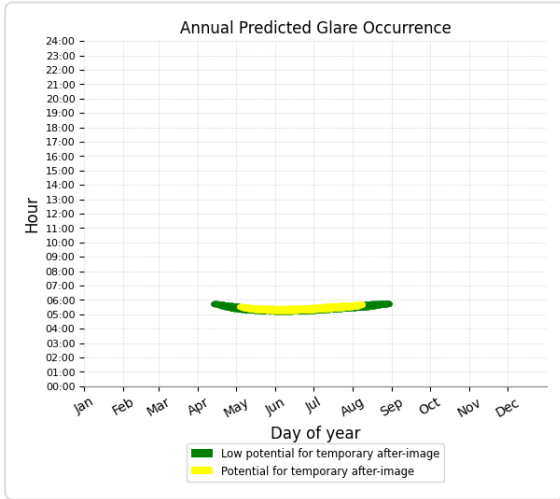
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 37	0	0.0	0	0.0	0
OP 38	0	0.0	0	0.0	0
OP 39	0	0.0	0	0.0	0
OP 40	0	0.0	0	0.0	0



# PV array 1 and OP 4

Yellow glare: 1,653 min.

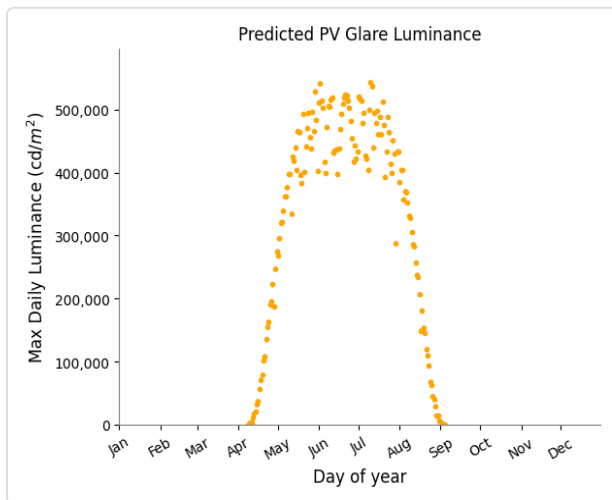
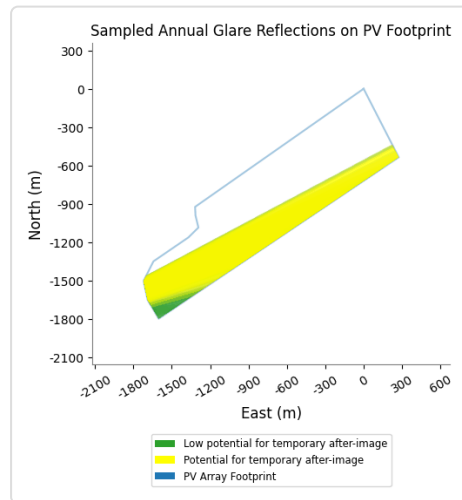
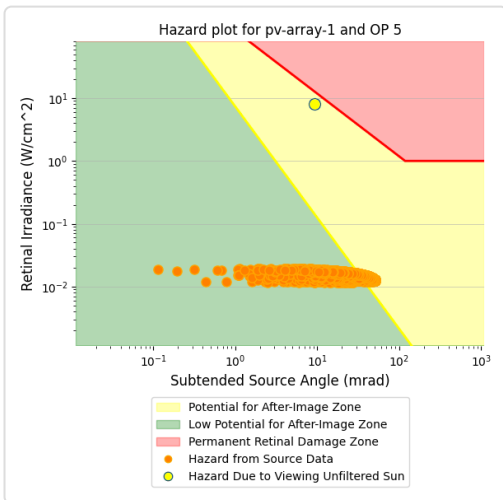
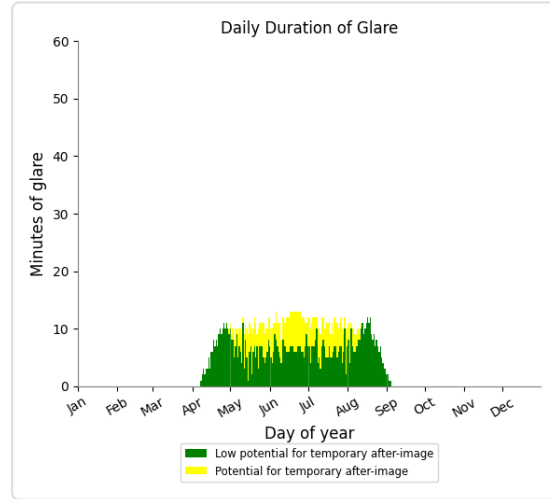
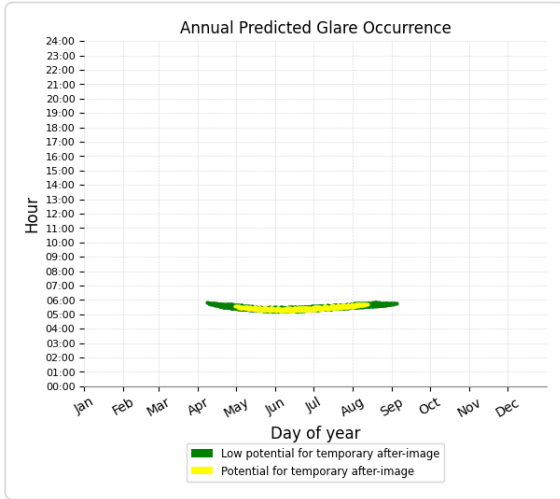
Green glare: 1,074 min.



# PV array 1 and OP 5

Yellow glare: 463 min.

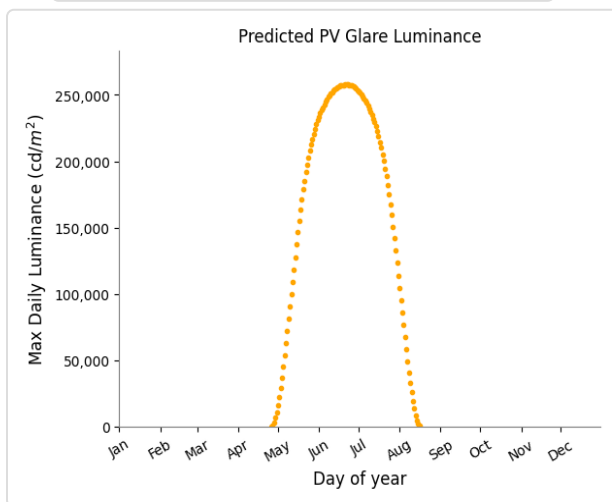
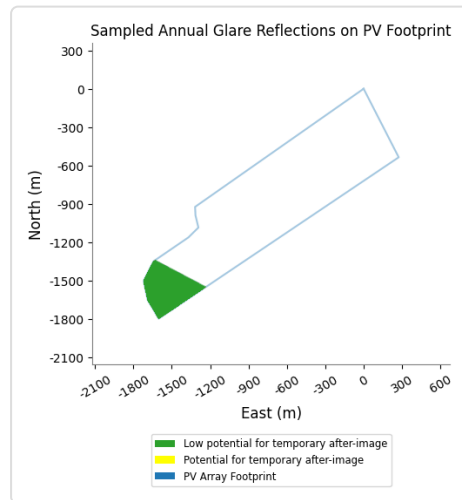
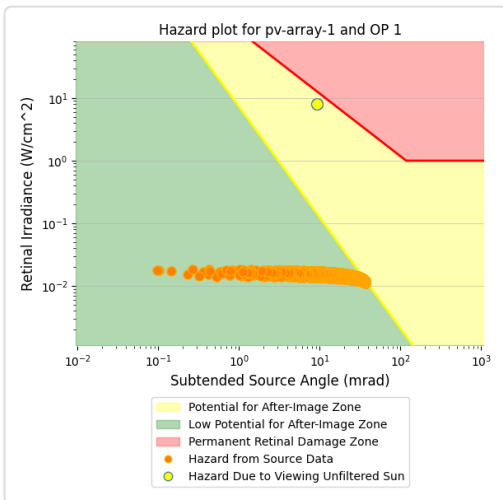
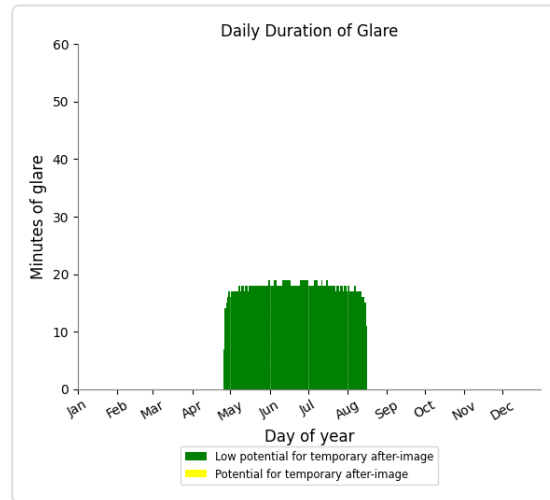
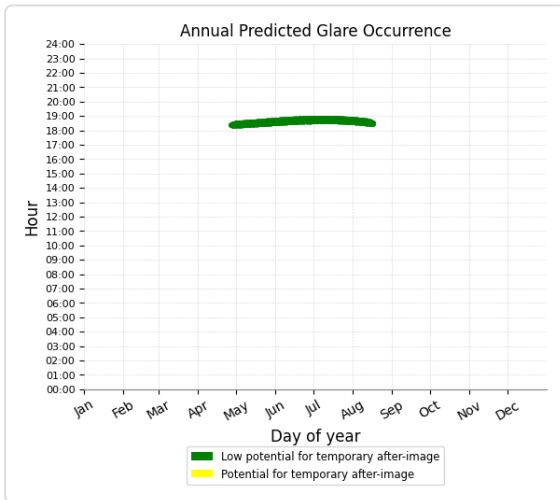
Green glare: 973 min.



# PV array 1 and OP 1

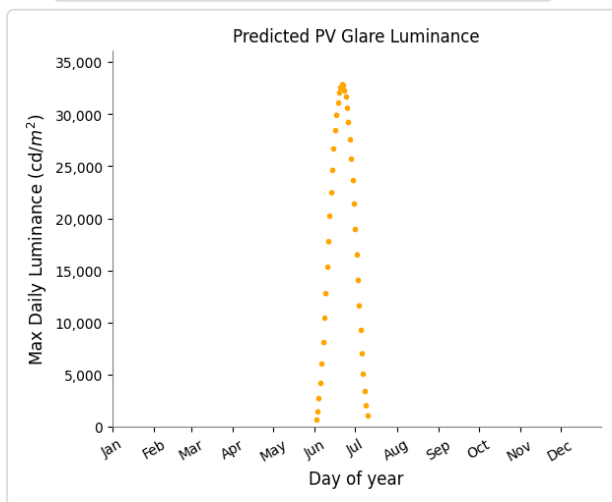
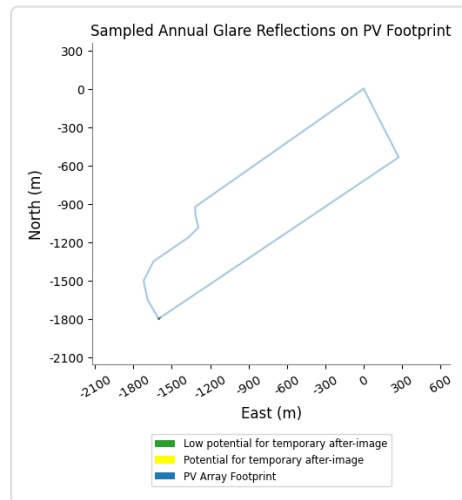
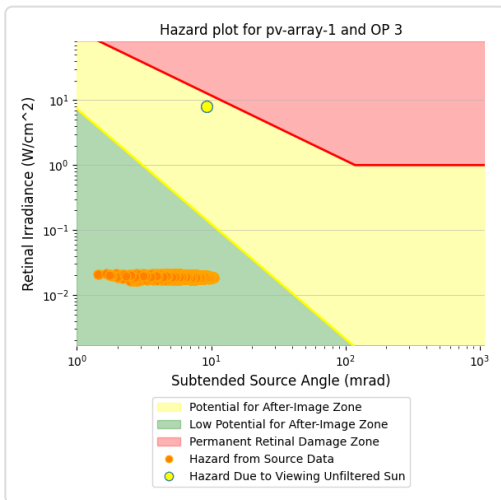
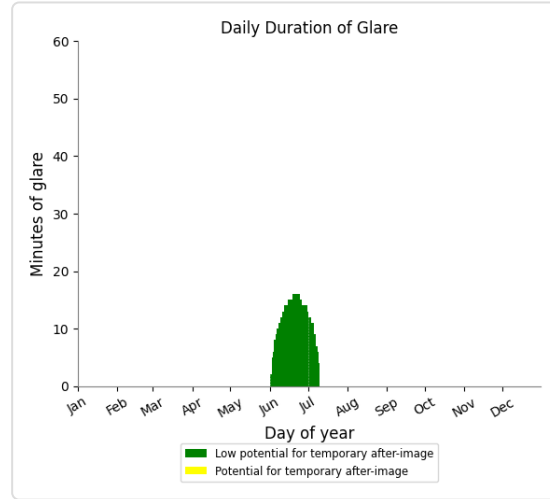
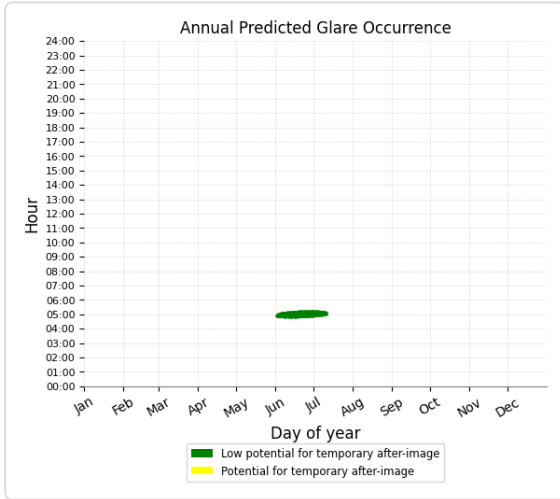
Yellow glare: none

Green glare: 1,998 min.



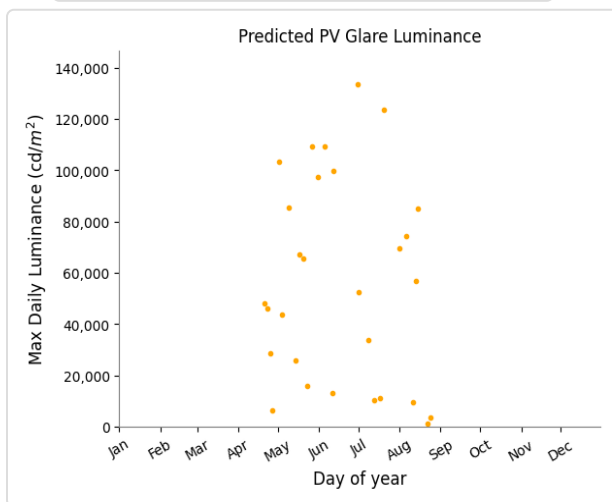
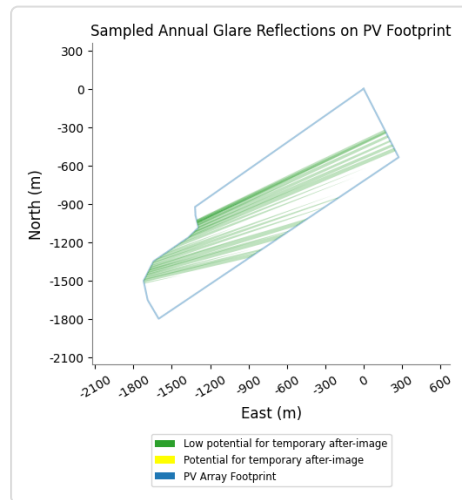
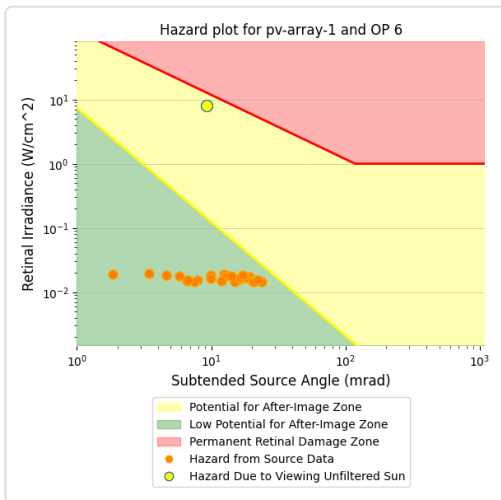
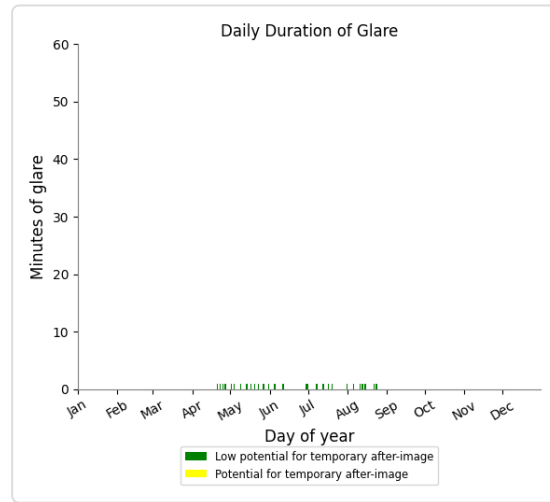
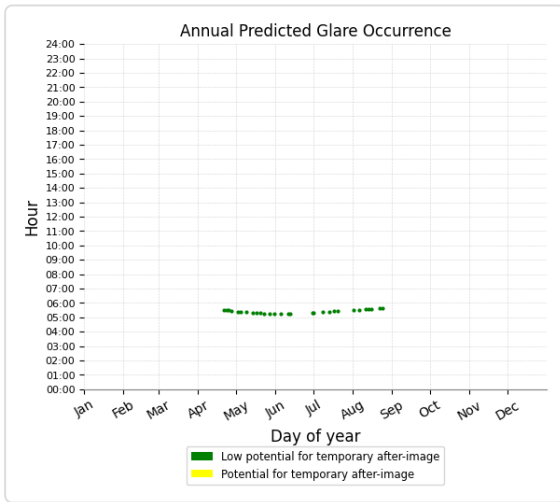
# PV array 1 and OP 3

Yellow glare: none  
 Green glare: 463 min.



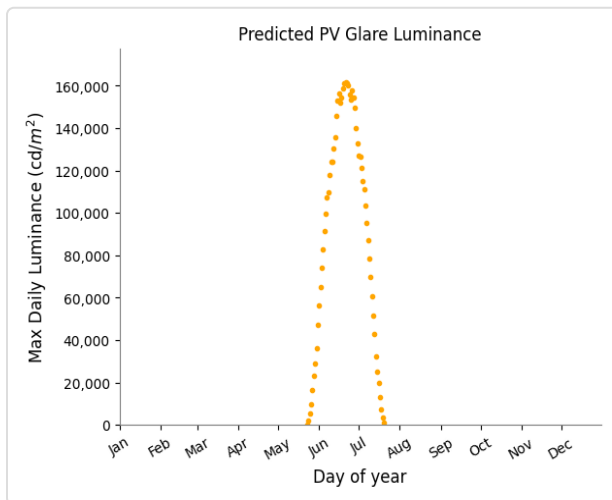
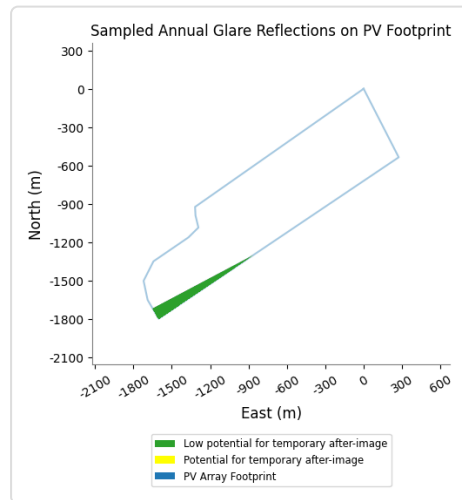
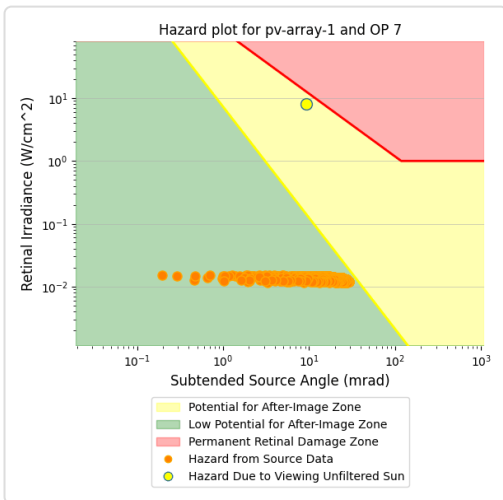
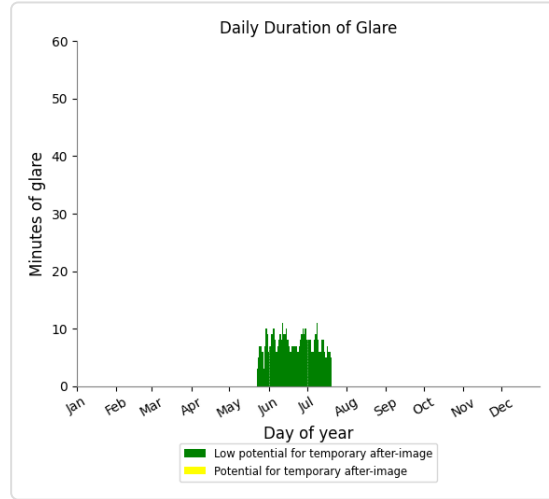
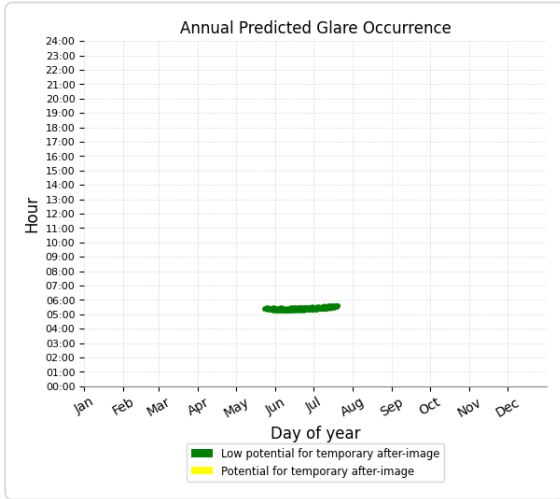
# PV array 1 and OP 6

Yellow glare: none  
 Green glare: 29 min.



# PV array 1 and OP 7

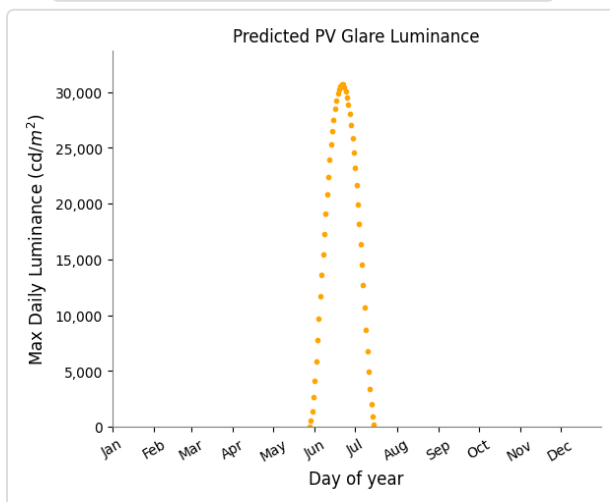
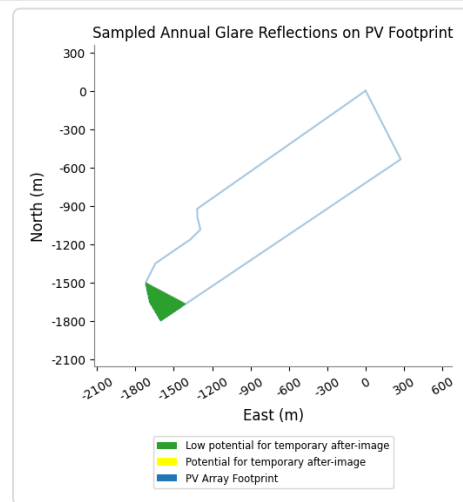
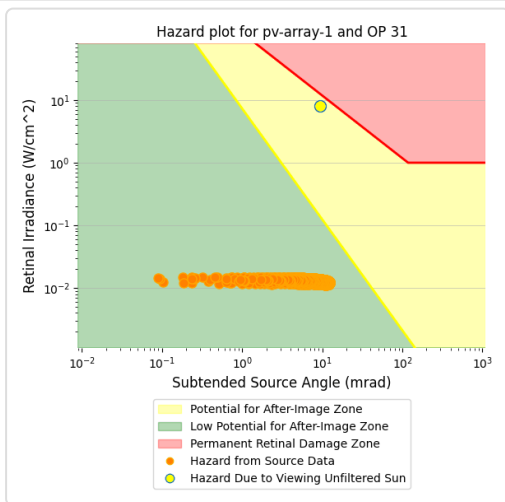
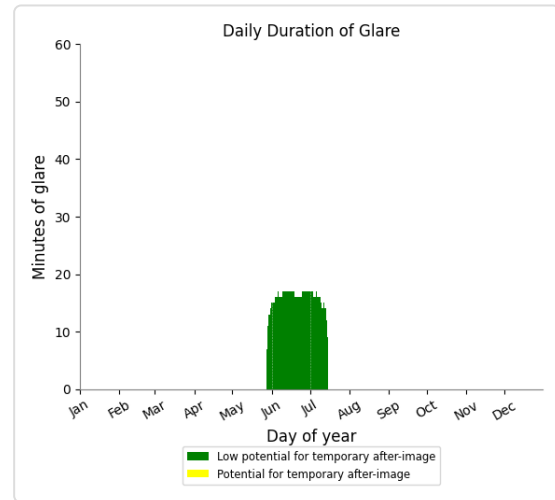
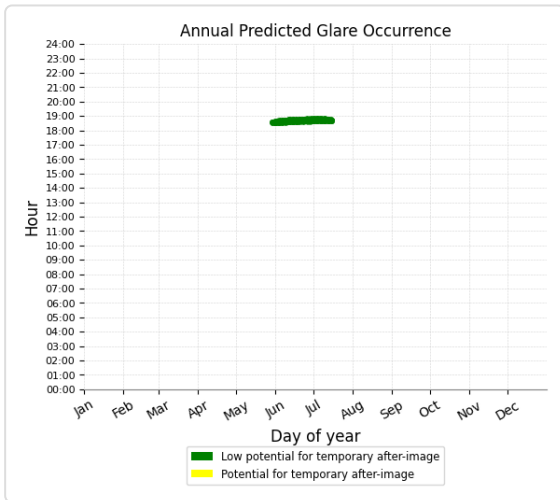
Yellow glare: none  
 Green glare: 441 min.





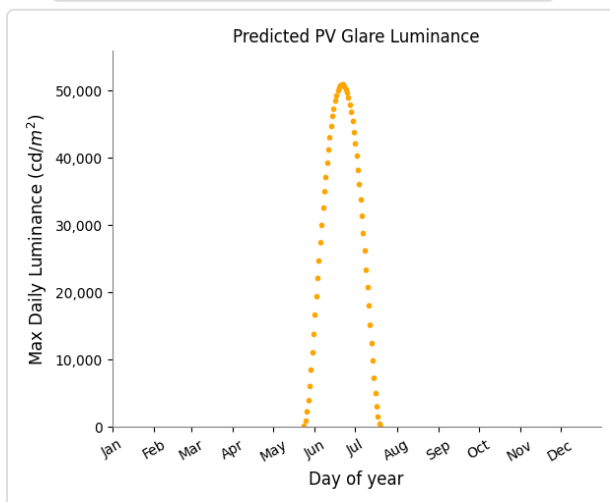
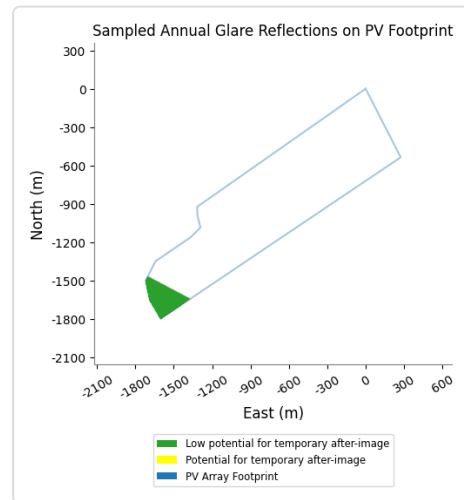
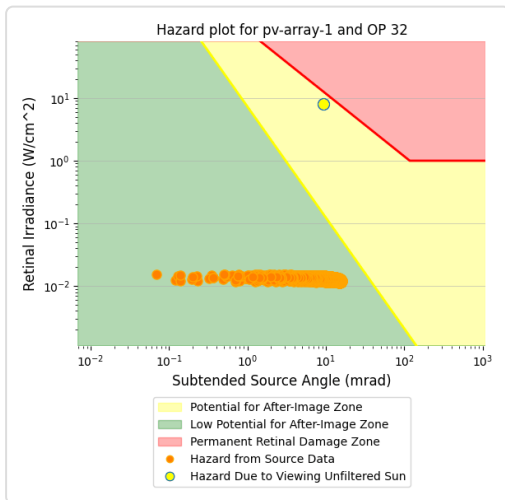
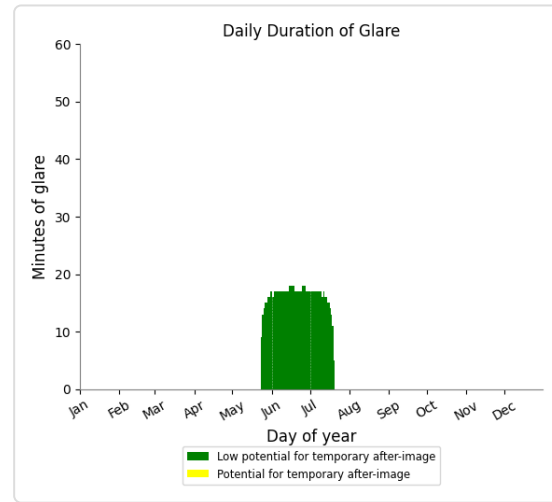
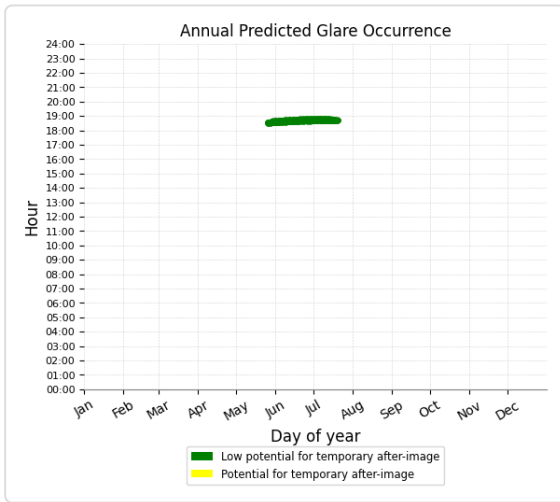
# PV array 1 and OP 31

Yellow glare: none  
 Green glare: 765 min.



## PV array 1 and OP 32

Yellow glare: none  
Green glare: 939 min.



## PV array 1 and OP 2

No glare found

**PV array 1 and OP 8**

No glare found

**PV array 1 and OP 9**

No glare found

**PV array 1 and OP 10**

No glare found

**PV array 1 and OP 11**

No glare found

**PV array 1 and OP 12**

No glare found

**PV array 1 and OP 13**

No glare found

**PV array 1 and OP 14**

No glare found

**PV array 1 and OP 15**

No glare found

**PV array 1 and OP 16**

No glare found

**PV array 1 and OP 17**

No glare found

**PV array 1 and OP 18**

No glare found

**PV array 1 and OP 19**

No glare found

**PV array 1 and OP 20**

No glare found

**PV array 1 and OP 21**

No glare found

**PV array 1 and OP 22**

No glare found

**PV array 1 and OP 23**

No glare found

**PV array 1 and OP 24**

No glare found

**PV array 1 and OP 25**

No glare found

**PV array 1 and OP 26**

No glare found

**PV array 1 and OP 27**

No glare found

**PV array 1 and OP 28**

No glare found

**PV array 1 and OP 29**

No glare found

**PV array 1 and OP 30**

No glare found

**PV array 1 and OP 33**

No glare found

**PV array 1 and OP 34**

No glare found

**PV array 1 and OP 35**

No glare found

**PV array 1 and OP 36**

No glare found

**PV array 1 and OP 37**

No glare found

**PV array 1 and OP 38**

No glare found

**PV array 1 and OP 39**

No glare found

**PV array 1 and OP 40**

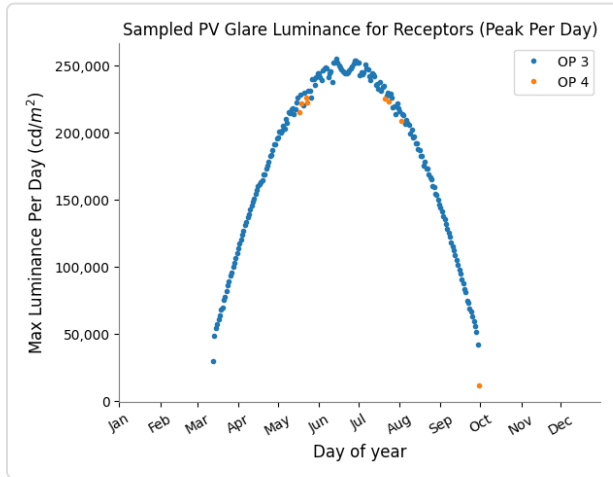
No glare found

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

Receptor results ordered by category of glare

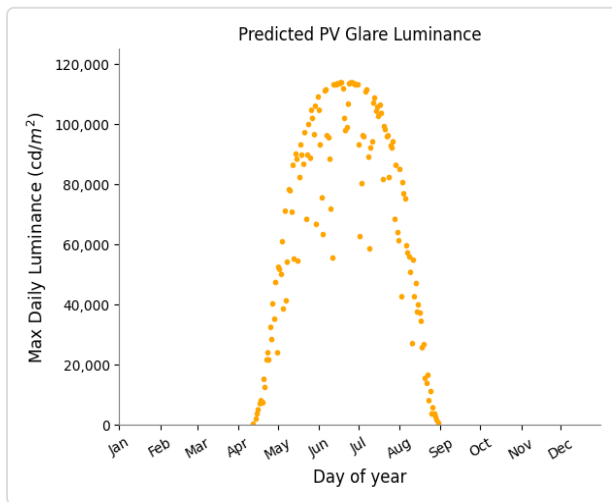
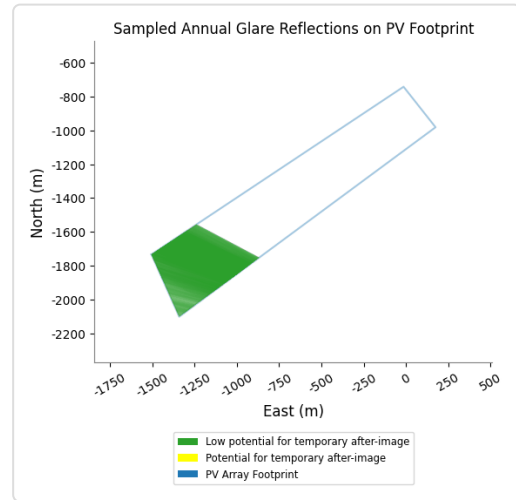
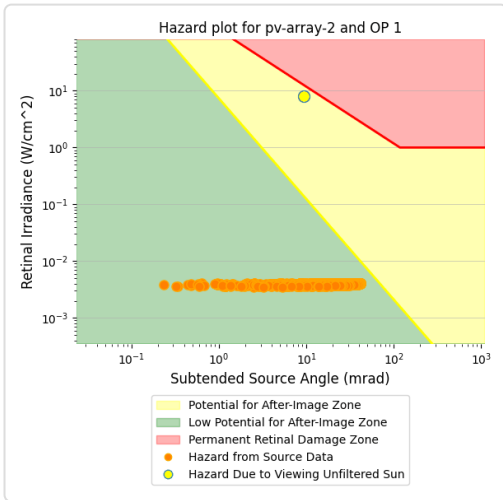
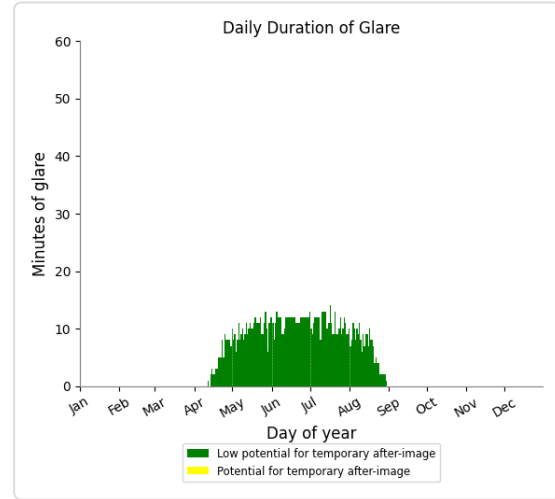
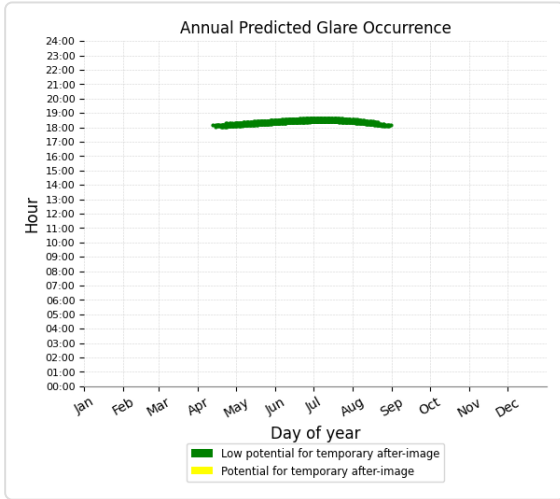
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 1	1,274	21.2	0	0.0	113,789
OP 3	2,850	47.5	0	0.0	254,809
OP 4	2,968	49.5	0	0.0	238,710
OP 6	773	12.9	0	0.0	80,810
OP 7	42	0.7	0	0.0	74,015
OP 8	225	3.8	0	0.0	42,839
OP 30	82	1.4	0	0.0	1,188
OP 31	672	11.2	0	0.0	24,037
OP 32	666	11.1	0	0.0	35,356
OP 33	52	0.9	0	0.0	821
OP 2	0	0.0	0	0.0	0
OP 5	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0
OP 17	0	0.0	0	0.0	0
OP 18	0	0.0	0	0.0	0
OP 19	0	0.0	0	0.0	0
OP 20	0	0.0	0	0.0	0
OP 21	0	0.0	0	0.0	0
OP 22	0	0.0	0	0.0	0
OP 23	0	0.0	0	0.0	0
OP 24	0	0.0	0	0.0	0
OP 25	0	0.0	0	0.0	0
OP 26	0	0.0	0	0.0	0
OP 27	0	0.0	0	0.0	0
OP 28	0	0.0	0	0.0	0
OP 29	0	0.0	0	0.0	0
OP 34	0	0.0	0	0.0	0
OP 35	0	0.0	0	0.0	0
OP 36	0	0.0	0	0.0	0
OP 37	0	0.0	0	0.0	0
OP 38	0	0.0	0	0.0	0

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 39	0	0.0	0	0.0	0
OP 40	0	0.0	0	0.0	0



# PV array 2 and OP 1

Yellow glare: none  
 Green glare: 1,274 min.

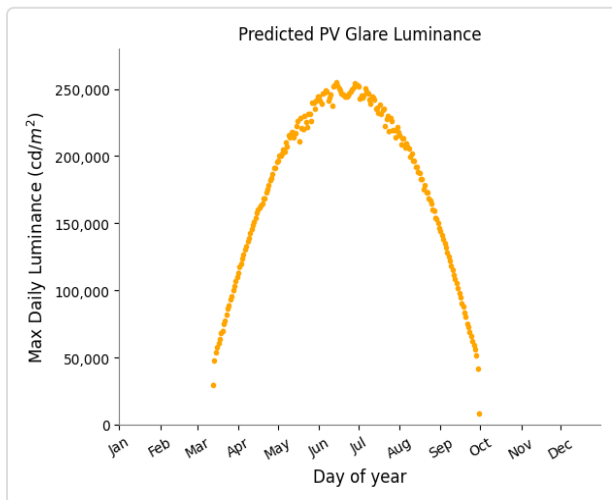
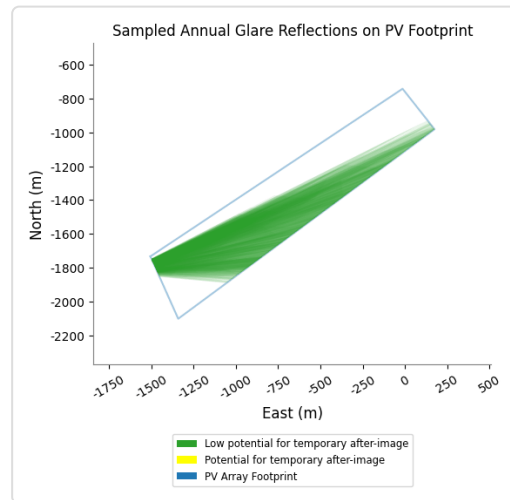
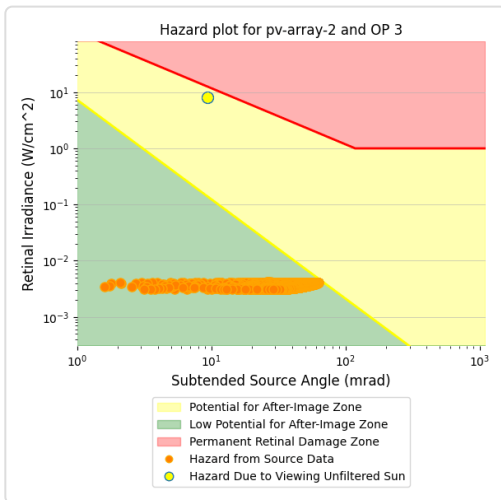
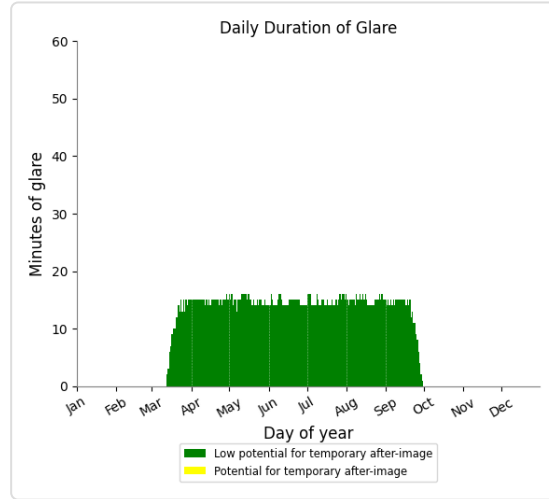
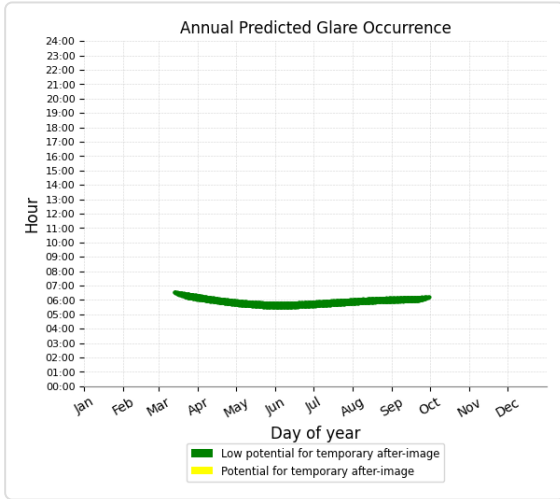




# PV array 2 and OP 3

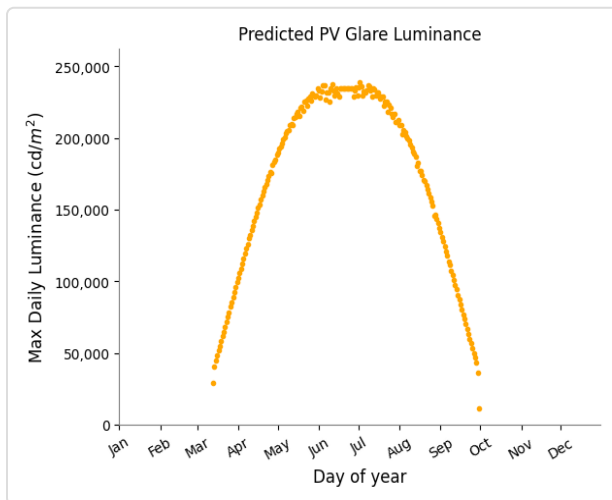
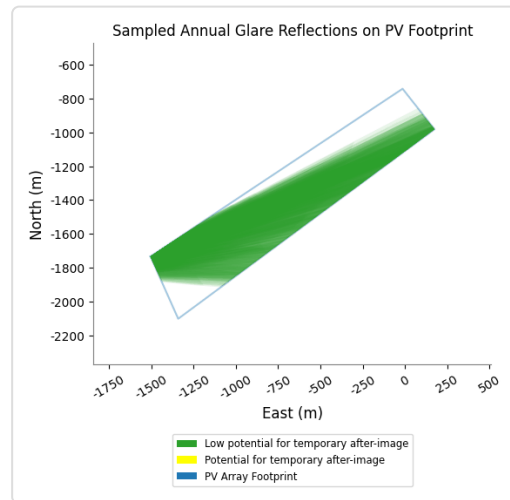
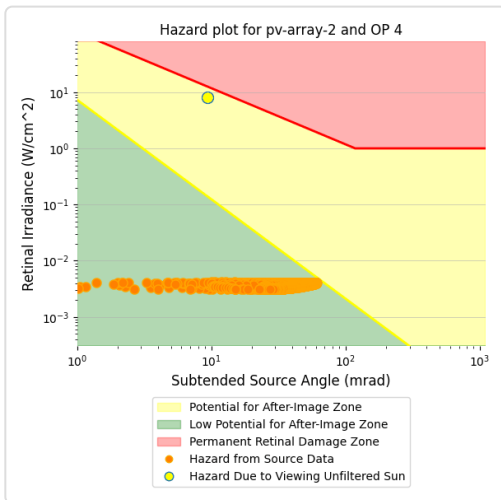
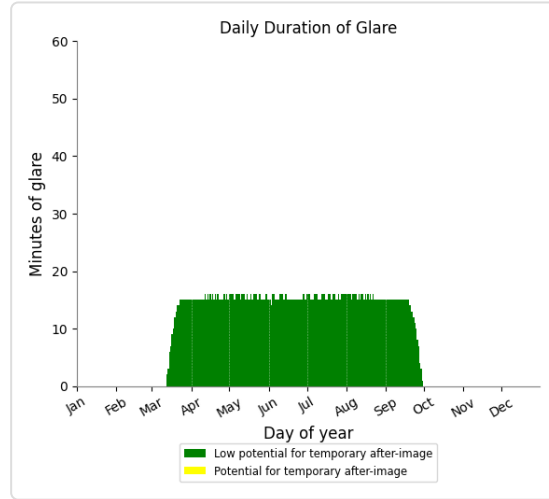
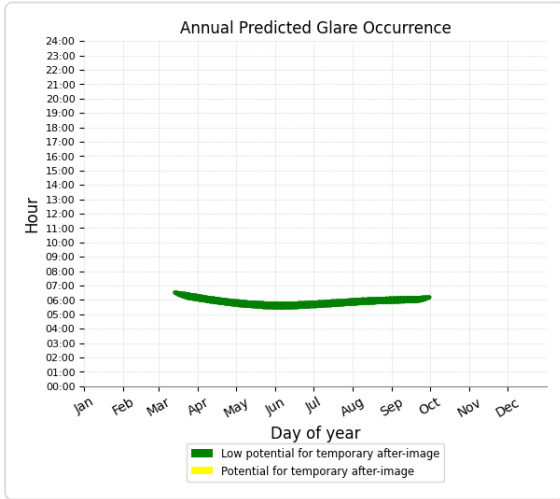
Yellow glare: none

Green glare: 2,850 min.



# PV array 2 and OP 4

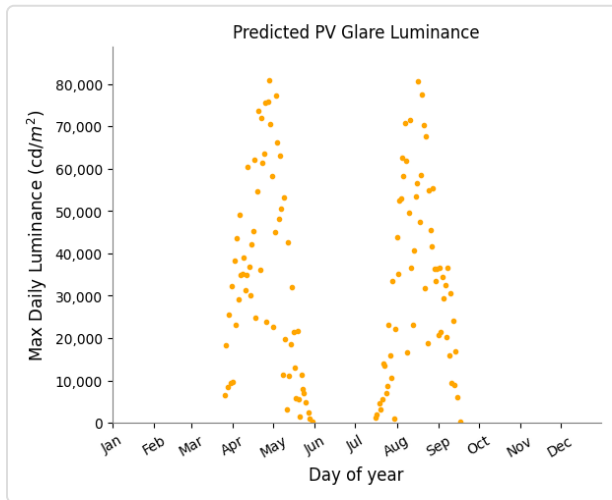
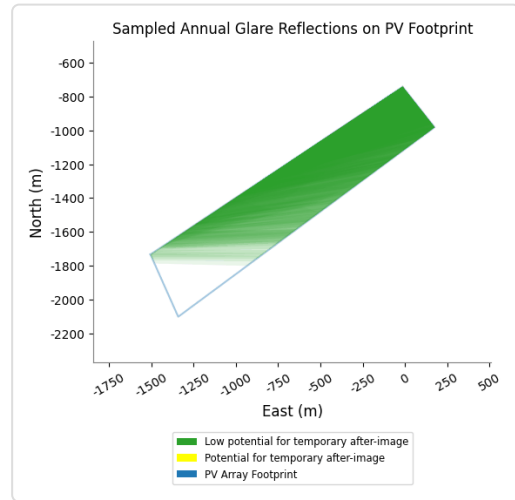
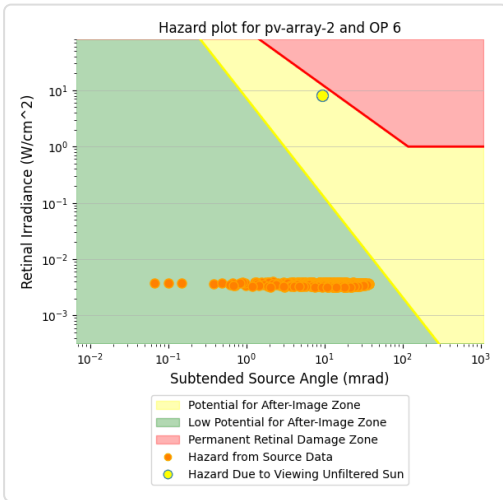
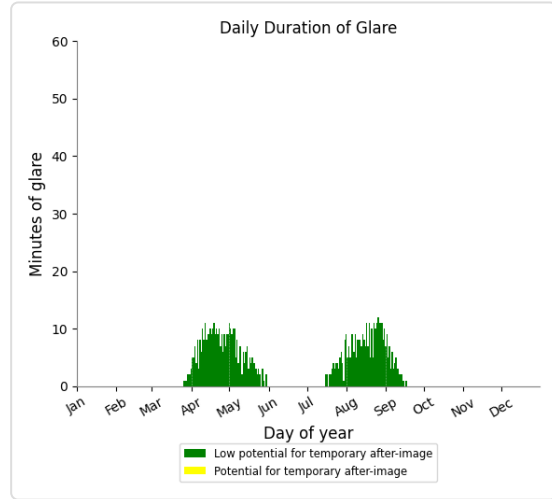
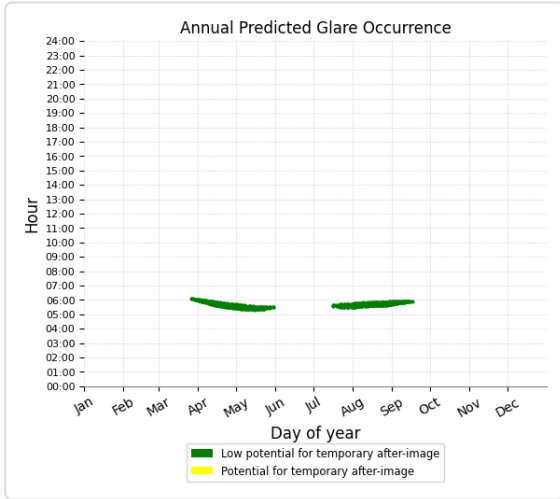
Yellow glare: none  
 Green glare: 2,968 min.



# PV array 2 and OP 6

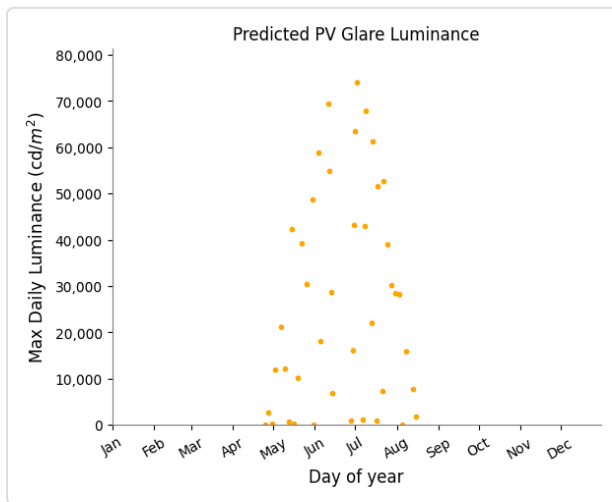
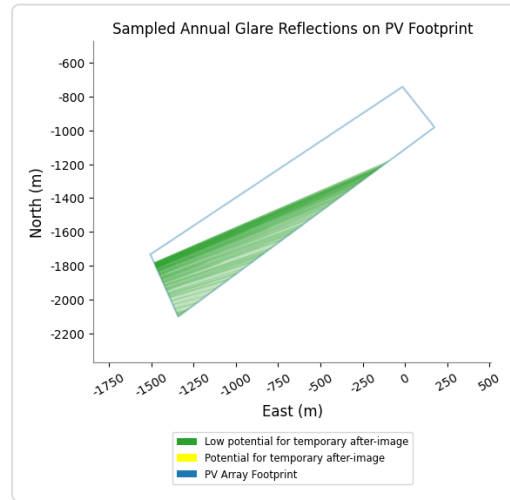
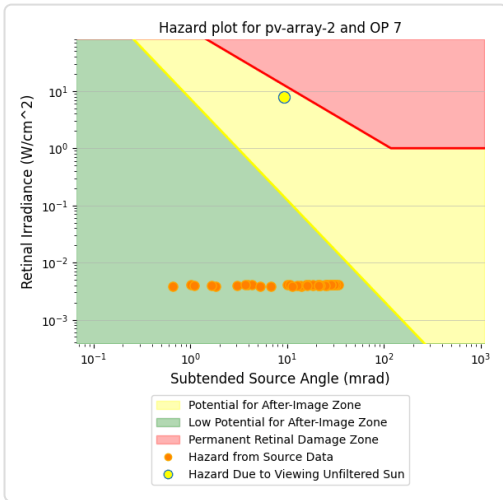
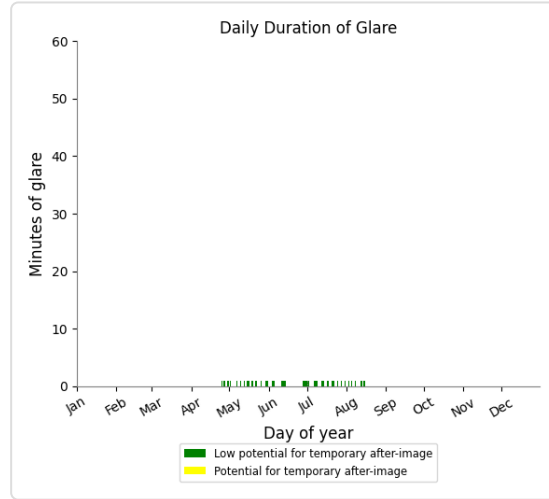
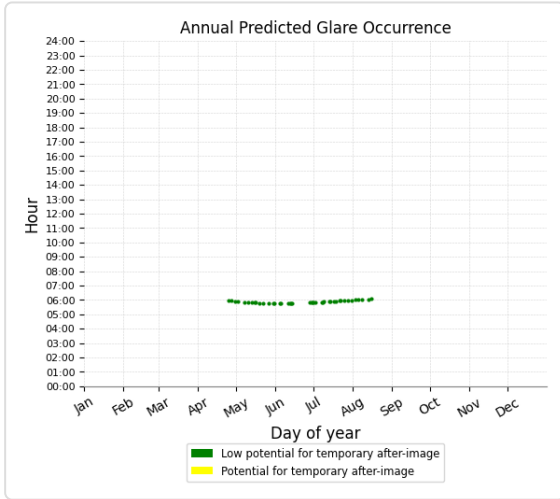
Yellow glare: none

Green glare: 773 min.



# PV array 2 and OP 7

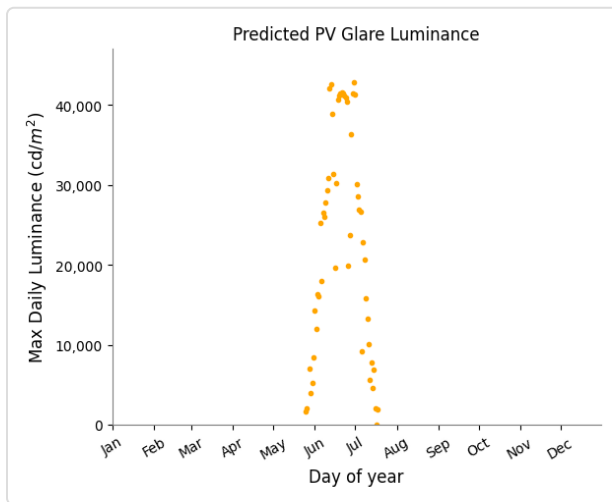
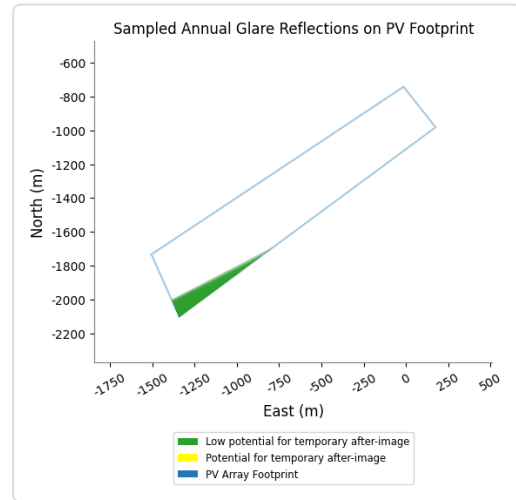
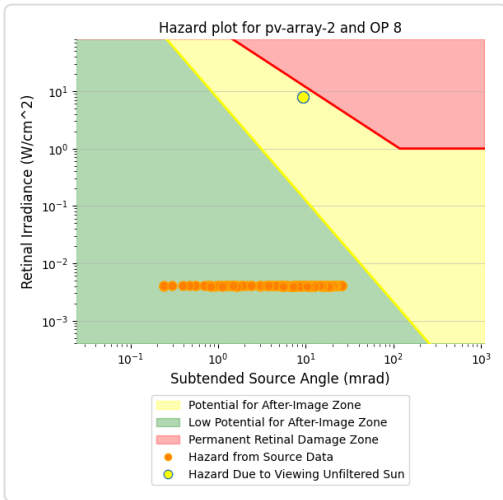
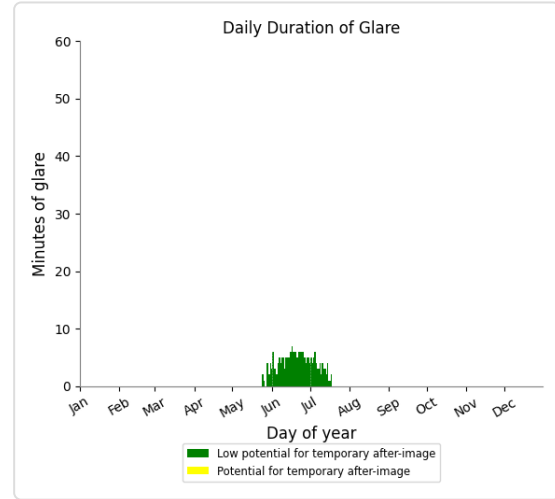
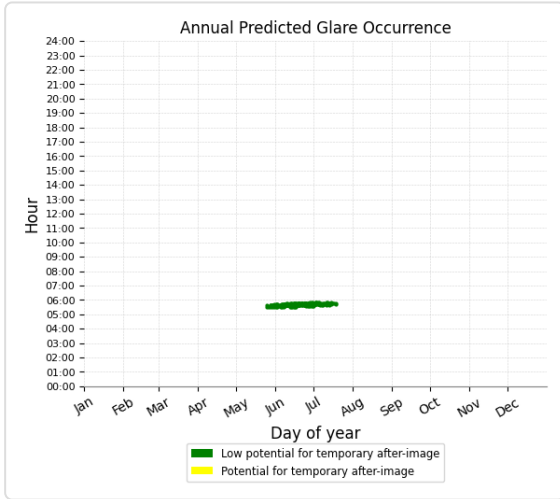
Yellow glare: none  
 Green glare: 42 min.



# PV array 2 and OP 8

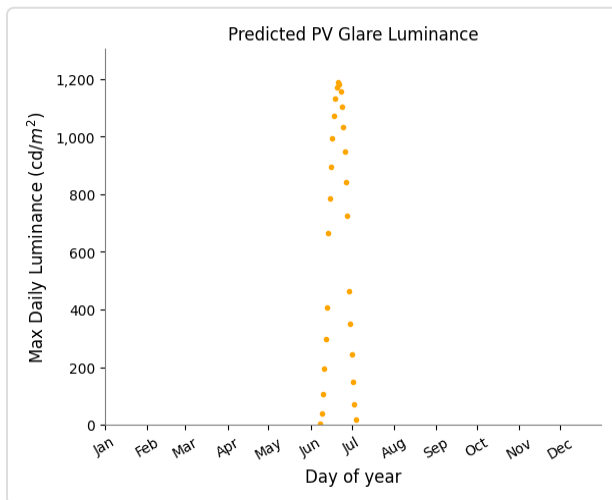
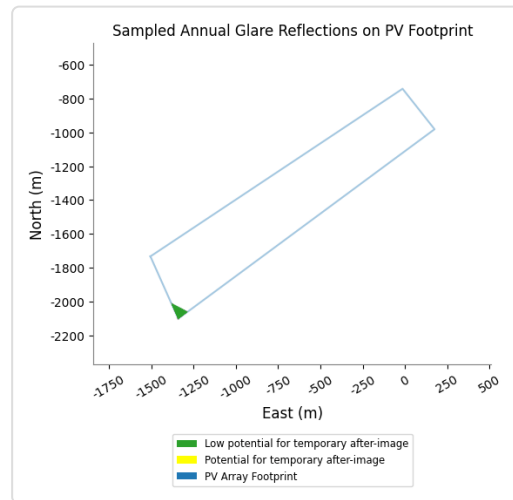
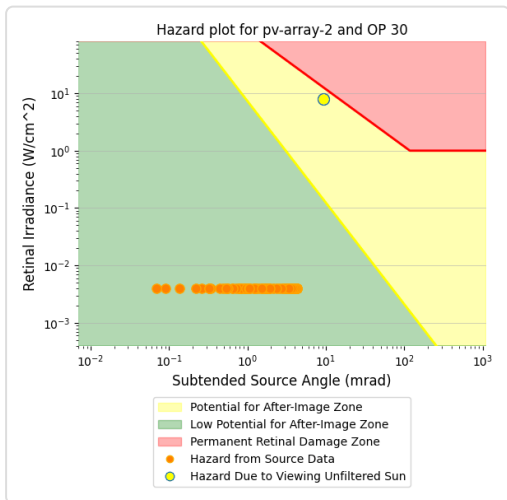
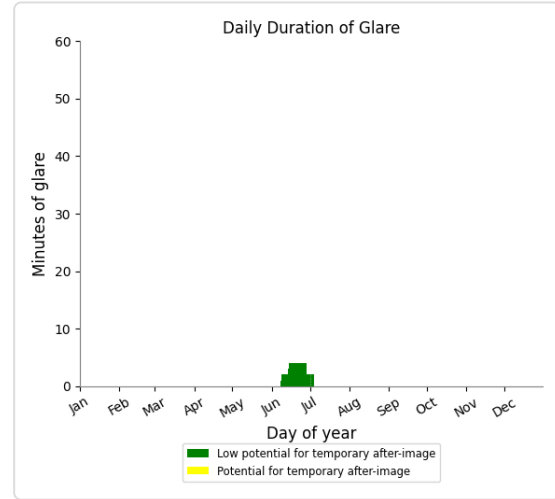
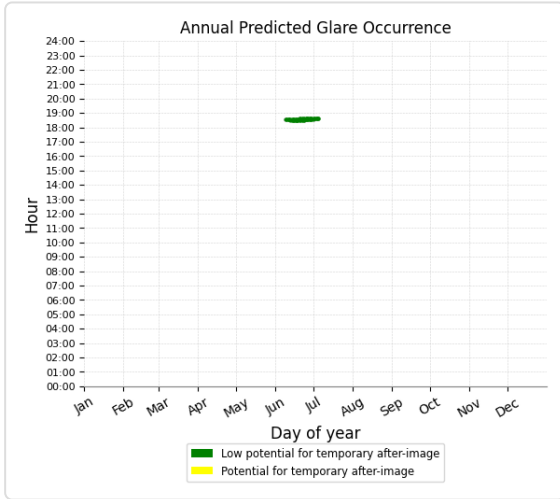
Yellow glare: none

Green glare: 225 min.



# PV array 2 and OP 30

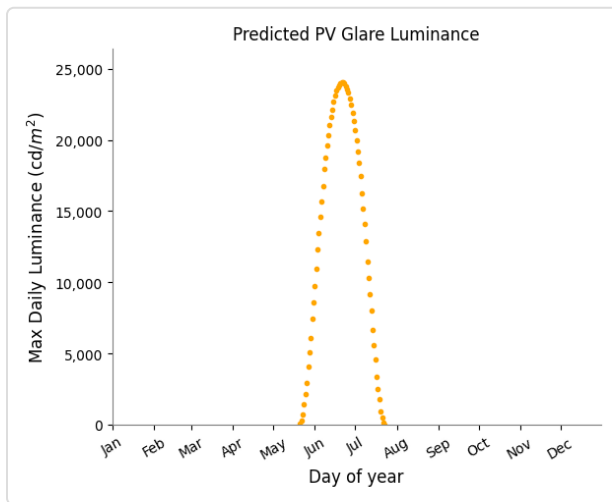
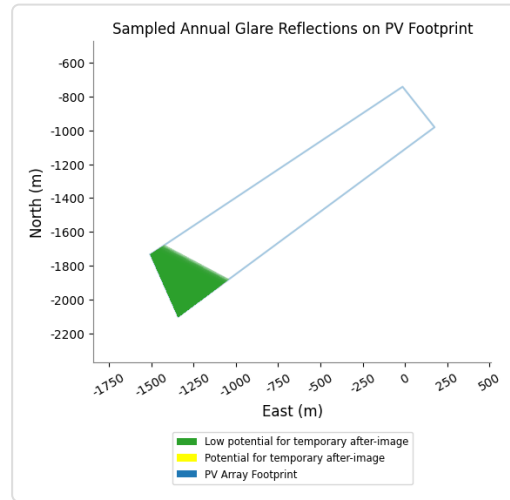
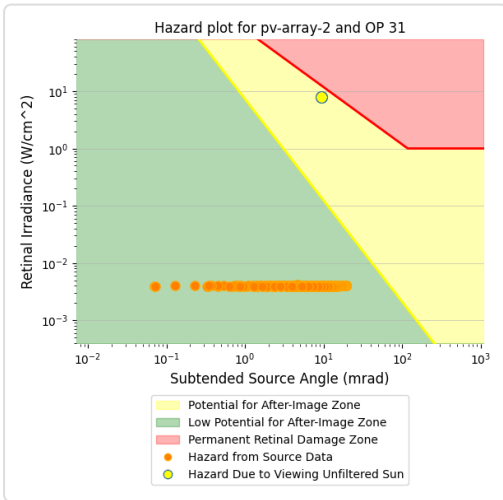
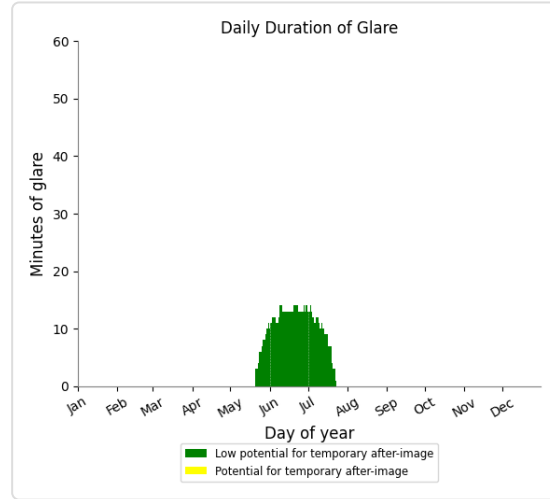
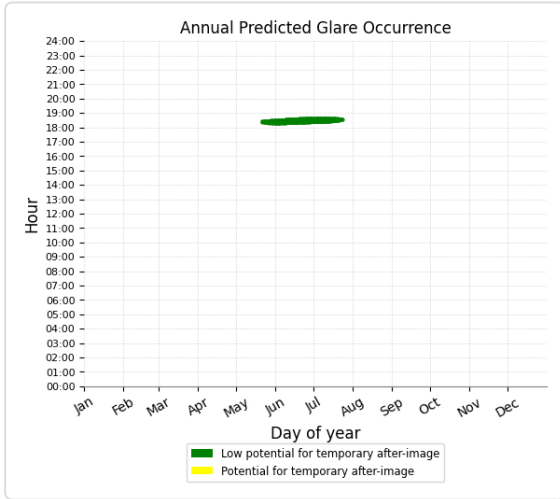
Yellow glare: none  
 Green glare: 82 min.



# PV array 2 and OP 31

Yellow glare: none

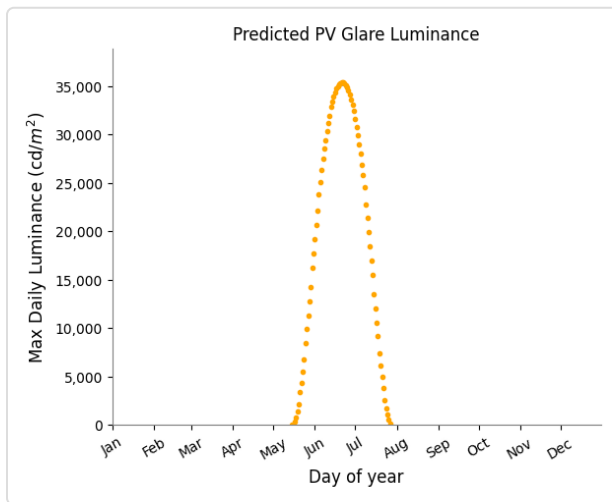
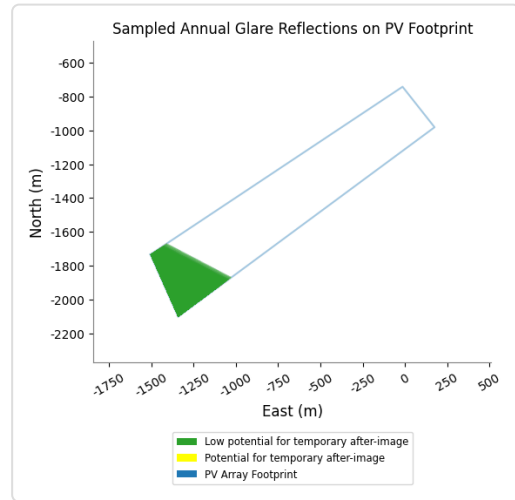
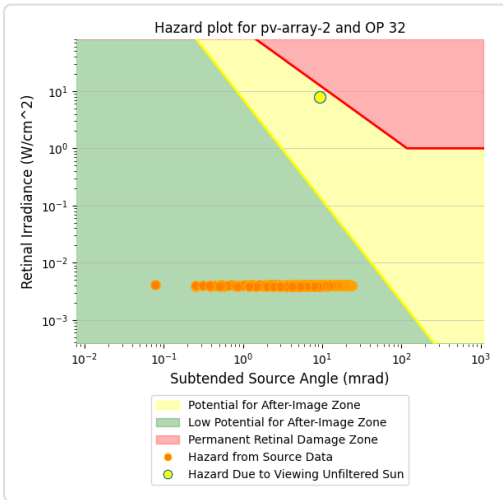
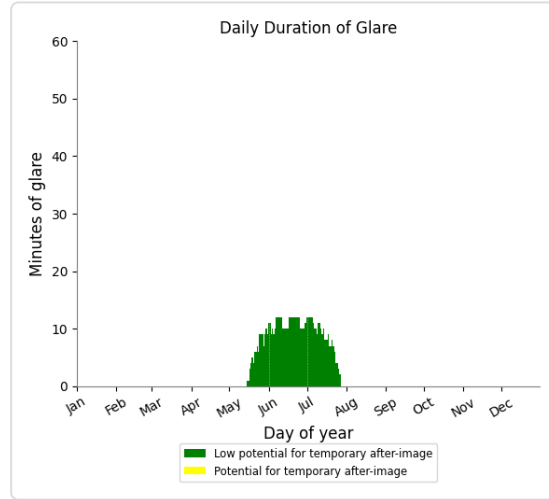
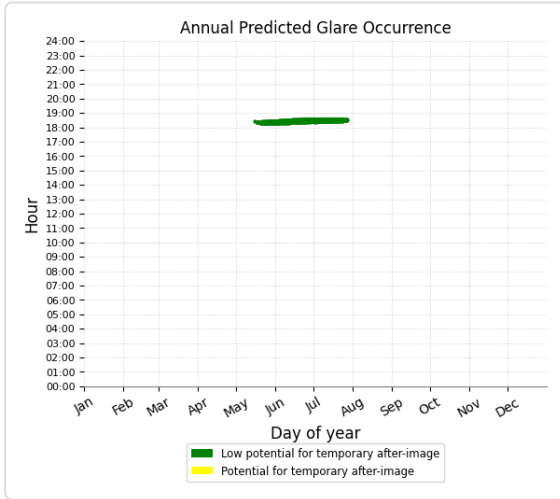
Green glare: 672 min.



# PV array 2 and OP 32

Yellow glare: none

Green glare: 666 min.

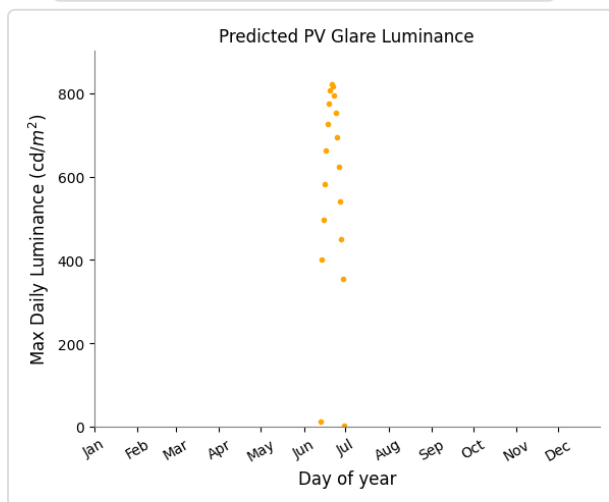
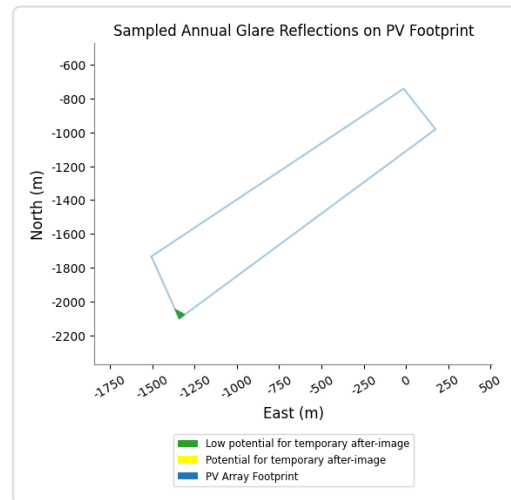
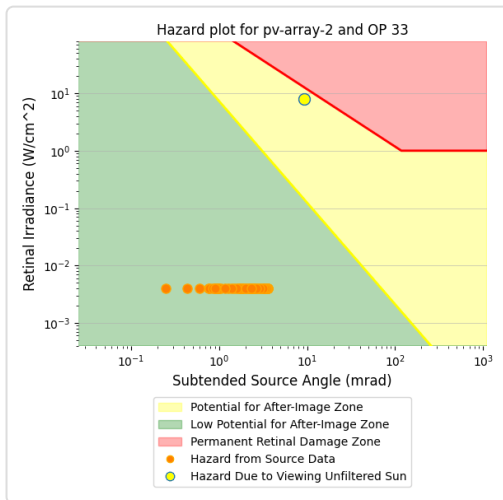
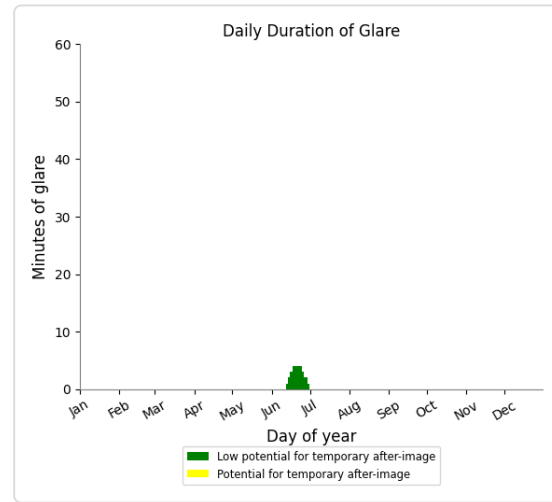
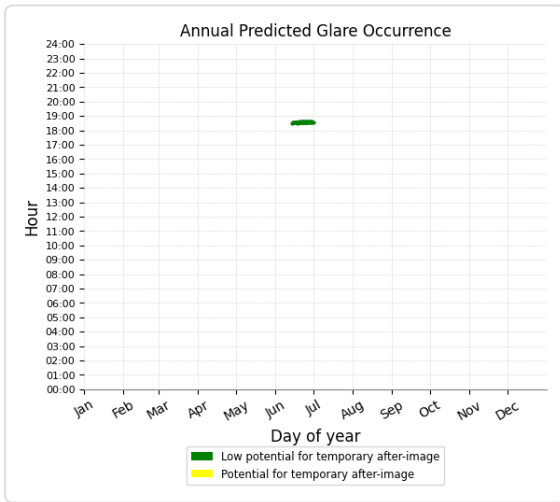




## PV array 2 and OP 33

Yellow glare: none

Green glare: 52 min.



## PV array 2 and OP 2

No glare found

**PV array 2 and OP 5**

No glare found

**PV array 2 and OP 9**

No glare found

**PV array 2 and OP 10**

No glare found

**PV array 2 and OP 11**

No glare found

**PV array 2 and OP 12**

No glare found

**PV array 2 and OP 13**

No glare found

**PV array 2 and OP 14**

No glare found

**PV array 2 and OP 15**

No glare found

**PV array 2 and OP 16**

No glare found

**PV array 2 and OP 17**

No glare found

**PV array 2 and OP 18**

No glare found

**PV array 2 and OP 19**

No glare found

**PV array 2 and OP 20**

No glare found

**PV array 2 and OP 21**

No glare found

**PV array 2 and OP 22**

No glare found

**PV array 2 and OP 23**

No glare found

**PV array 2 and OP 24**

No glare found

**PV array 2 and OP 25**

No glare found

**PV array 2 and OP 26**

No glare found

**PV array 2 and OP 27**

No glare found

**PV array 2 and OP 28**

No glare found

**PV array 2 and OP 29**

No glare found

**PV array 2 and OP 34**

No glare found

**PV array 2 and OP 35**

No glare found

**PV array 2 and OP 36**

No glare found

**PV array 2 and OP 37**

No glare found

**PV array 2 and OP 38**

No glare found

**PV array 2 and OP 39**

No glare found

## PV array 2 and OP 40

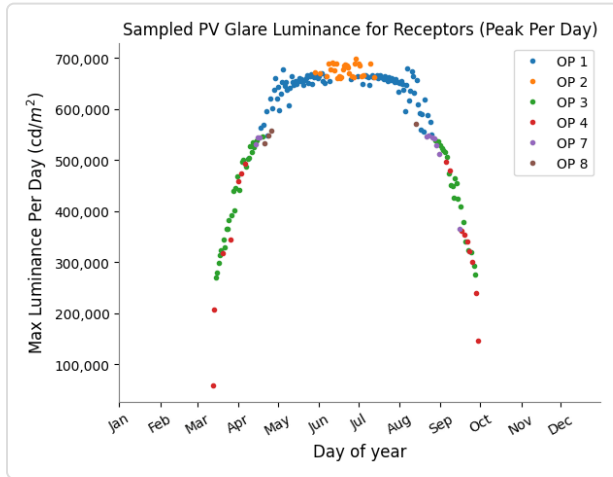
No glare found

## PV: PV array 3 potential temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 1	539	9.0	2,029	33.8	683,785
OP 2	598	10.0	915	15.2	697,927
OP 3	1,141	19.0	1,423	23.7	546,734
OP 4	1,487	24.8	1,173	19.6	518,583
OP 5	1,276	21.3	337	5.6	427,030
OP 6	960	16.0	92	1.5	335,033
OP 7	1,286	21.4	1,367	22.8	548,717
OP 8	947	15.8	1,689	28.1	599,258
OP 9	457	7.6	55	0.9	404,158
OP 33	754	12.6	31	0.5	350,315
OP 39	1,070	17.8	53	0.9	357,629
OP 40	635	10.6	32	0.5	402,081
OP 32	19	0.3	0	0.0	79,742
OP 34	780	13.0	0	0.0	164,254
OP 38	782	13.0	0	0.0	205,446
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0
OP 17	0	0.0	0	0.0	0
OP 18	0	0.0	0	0.0	0
OP 19	0	0.0	0	0.0	0
OP 20	0	0.0	0	0.0	0
OP 21	0	0.0	0	0.0	0
OP 22	0	0.0	0	0.0	0
OP 23	0	0.0	0	0.0	0
OP 24	0	0.0	0	0.0	0
OP 25	0	0.0	0	0.0	0
OP 26	0	0.0	0	0.0	0
OP 27	0	0.0	0	0.0	0
OP 28	0	0.0	0	0.0	0
OP 29	0	0.0	0	0.0	0
OP 30	0	0.0	0	0.0	0
OP 31	0	0.0	0	0.0	0
OP 35	0	0.0	0	0.0	0

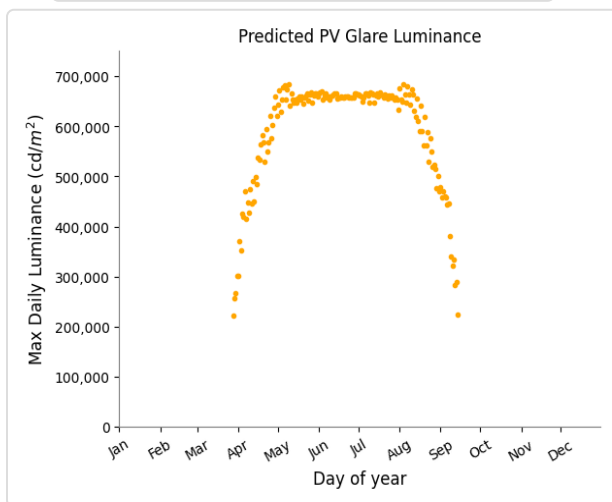
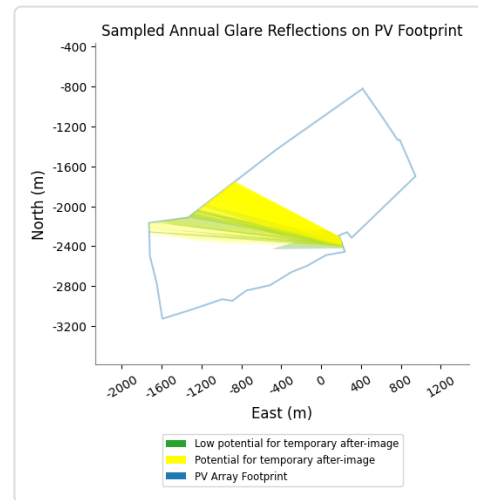
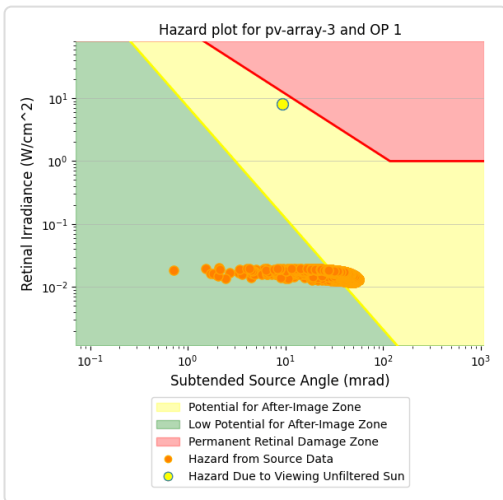
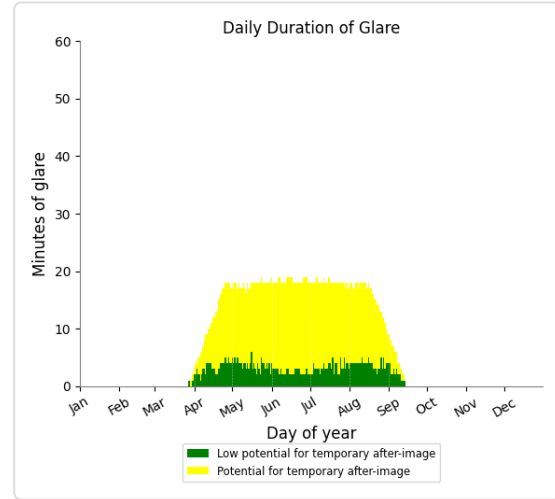
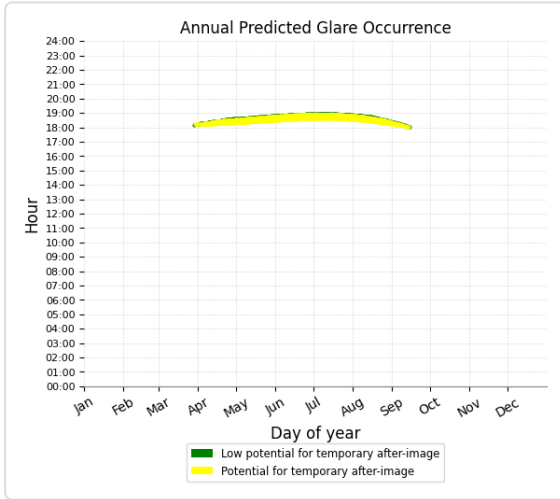
Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 36	0	0.0	0	0.0	0
OP 37	0	0.0	0	0.0	0



# PV array 3 and OP 1

Yellow glare: 2,029 min.

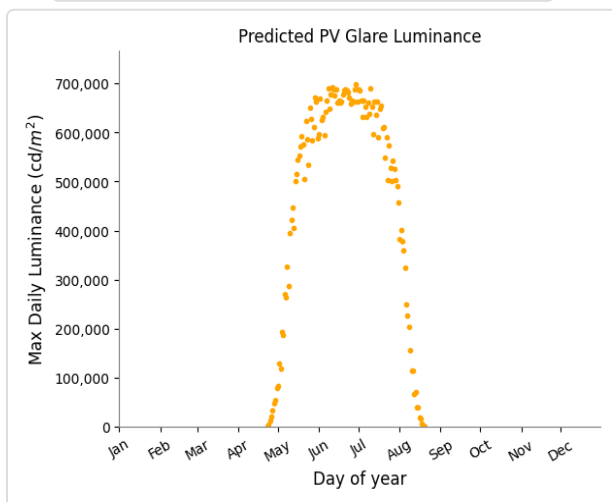
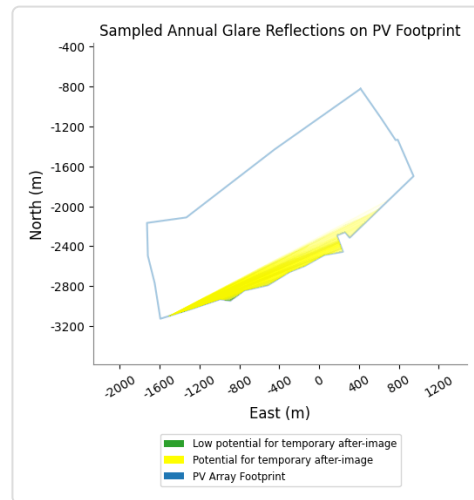
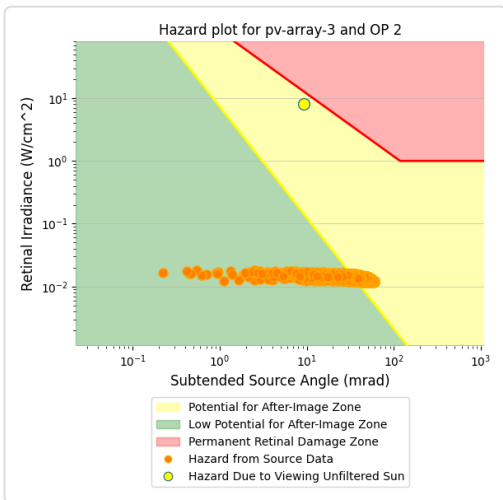
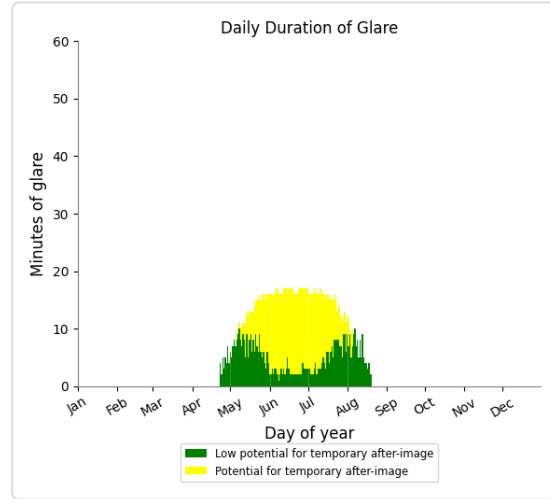
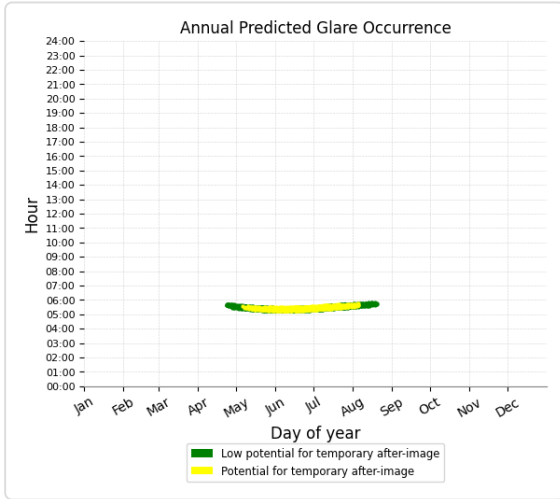
Green glare: 539 min.



## PV array 3 and OP 2

Yellow glare: 915 min.

Green glare: 598 min.

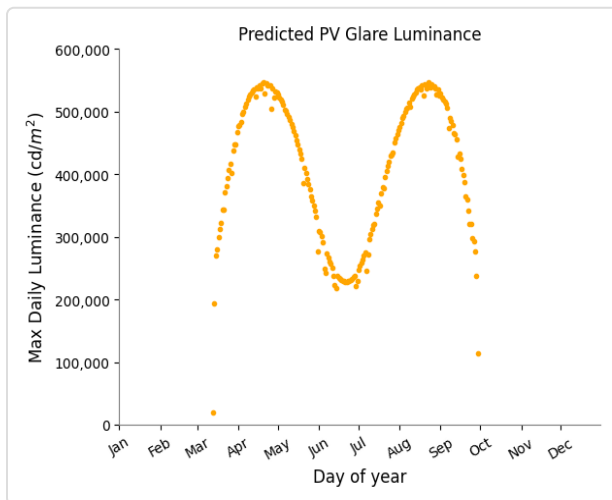
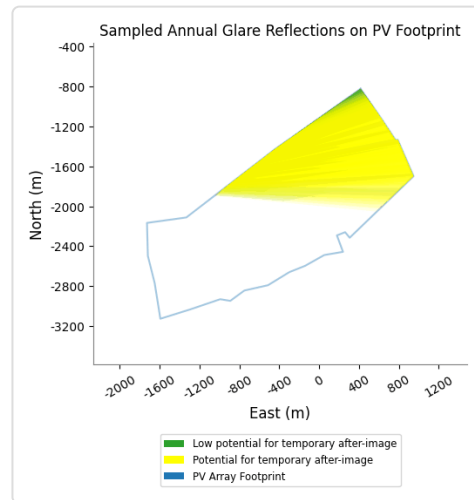
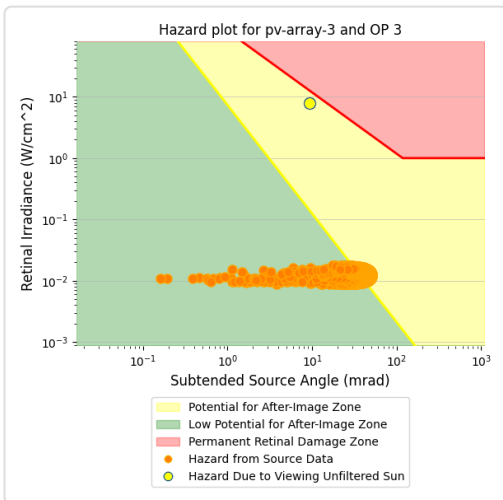
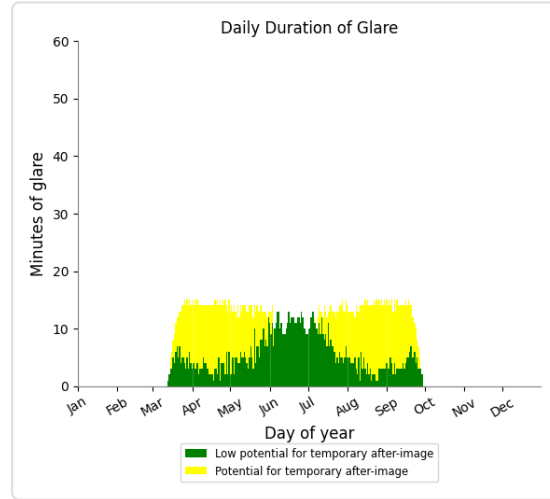
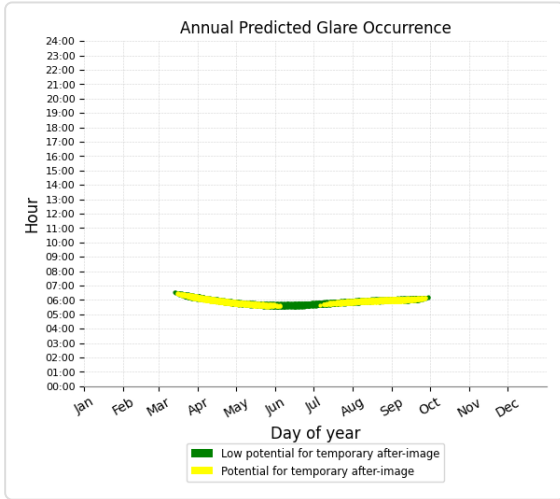




### PV array 3 and OP 3

Yellow glare: 1,423 min.

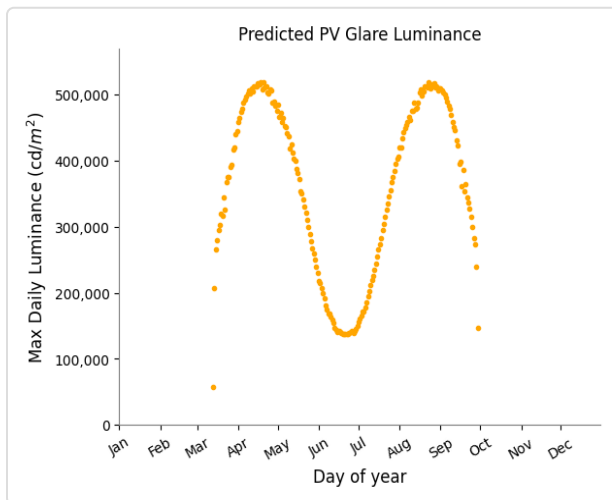
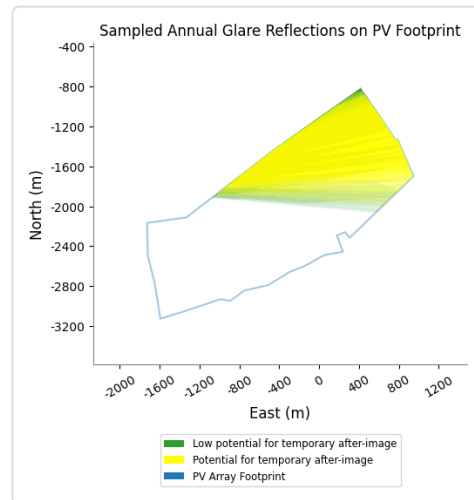
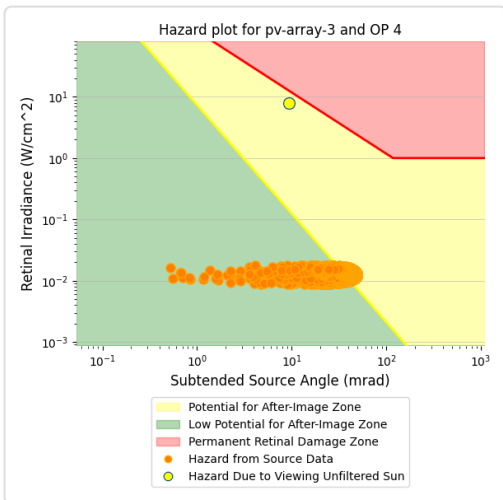
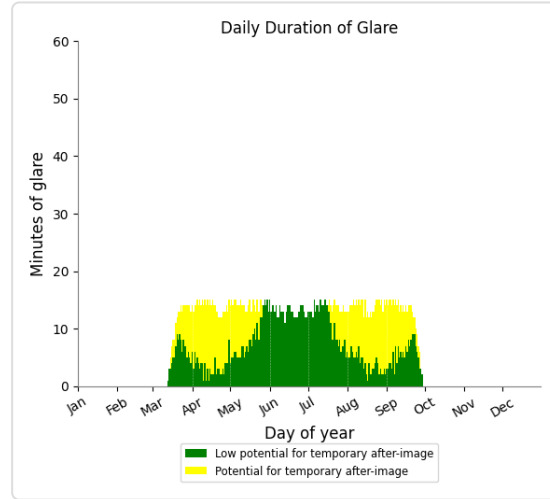
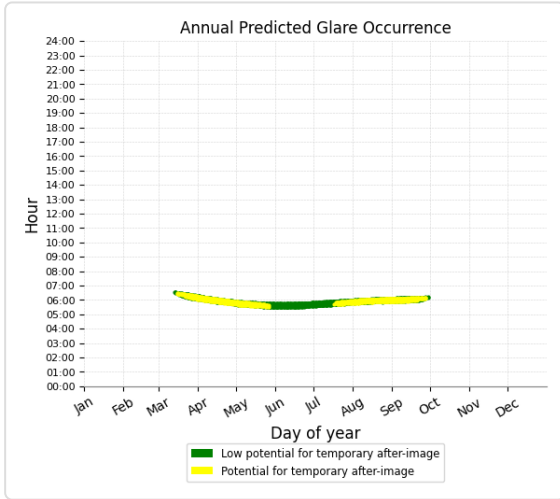
Green glare: 1,141 min.



# PV array 3 and OP 4

Yellow glare: 1,173 min.

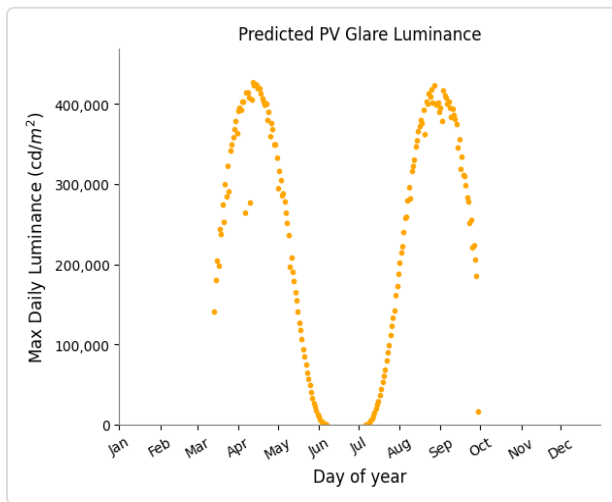
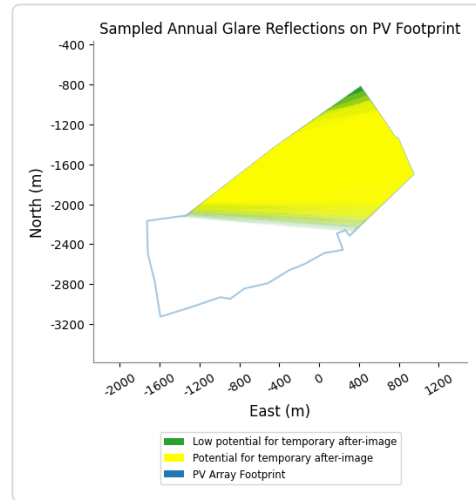
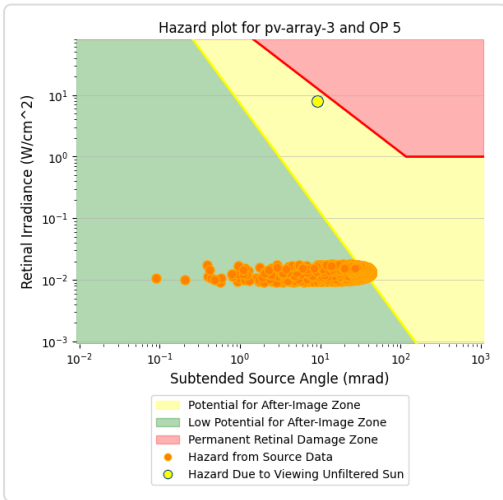
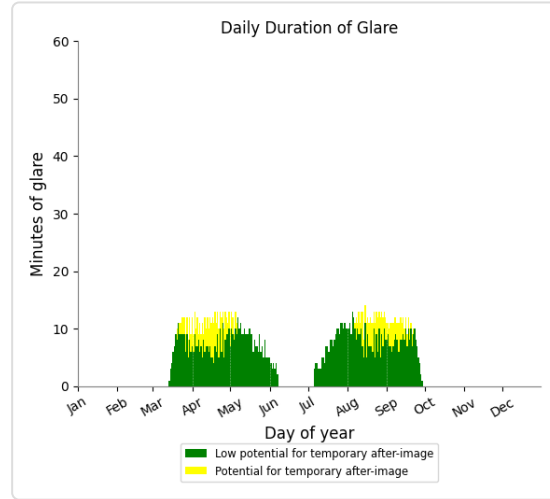
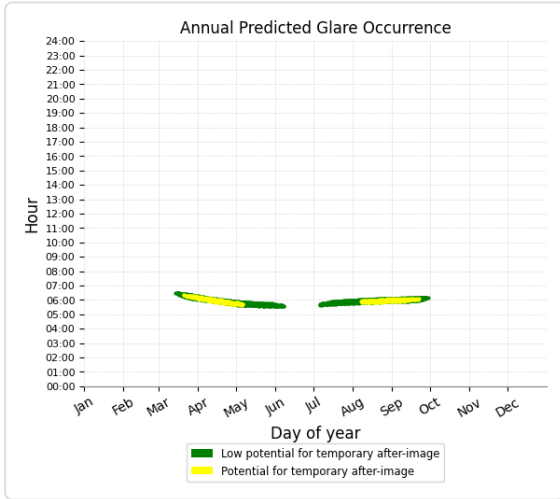
Green glare: 1,487 min.



# PV array 3 and OP 5

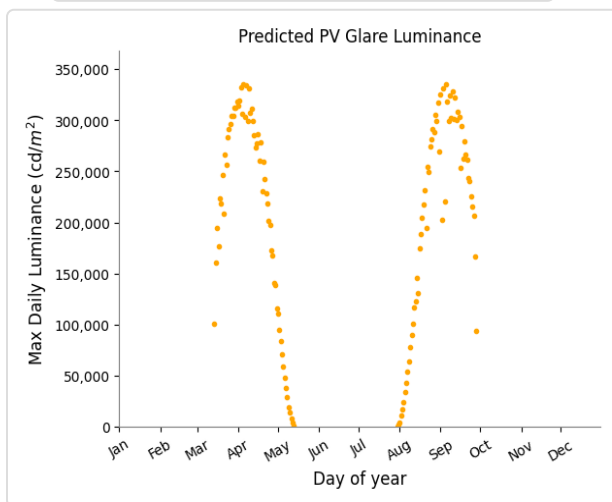
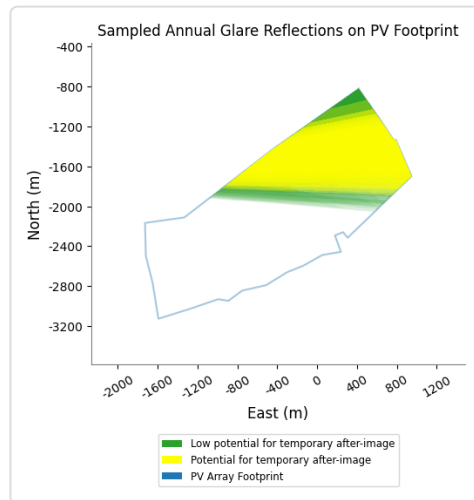
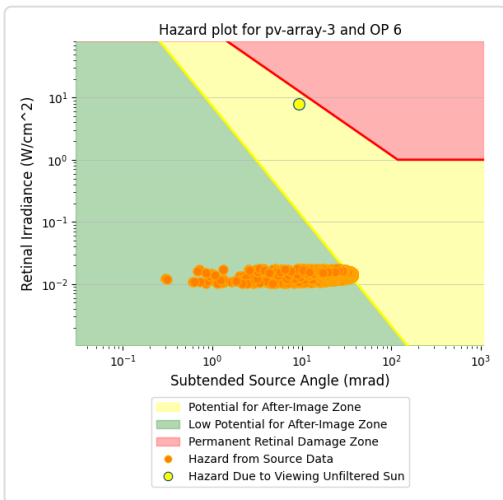
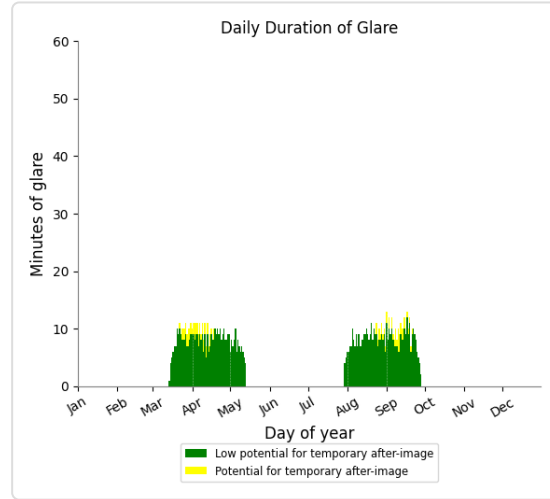
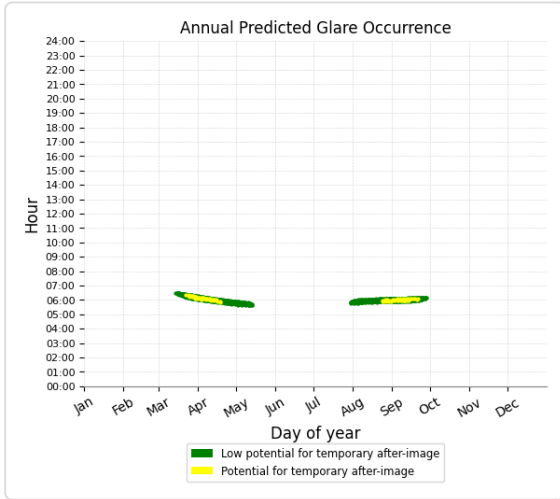
Yellow glare: 337 min.

Green glare: 1,276 min.



# PV array 3 and OP 6

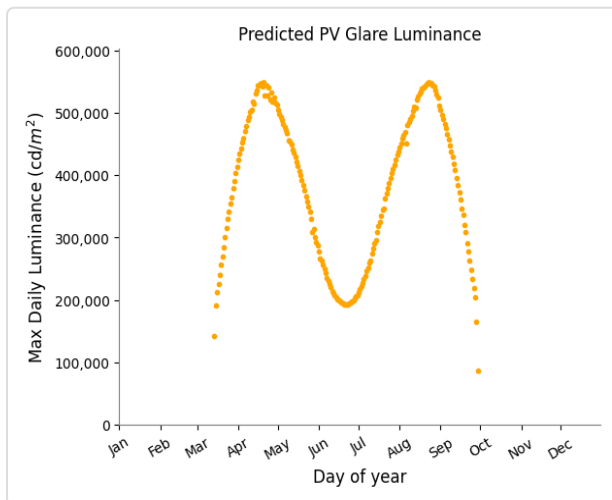
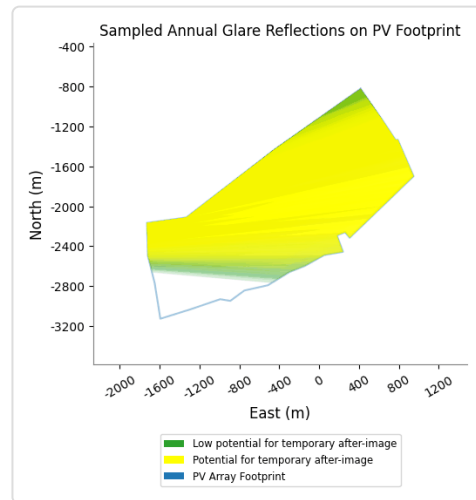
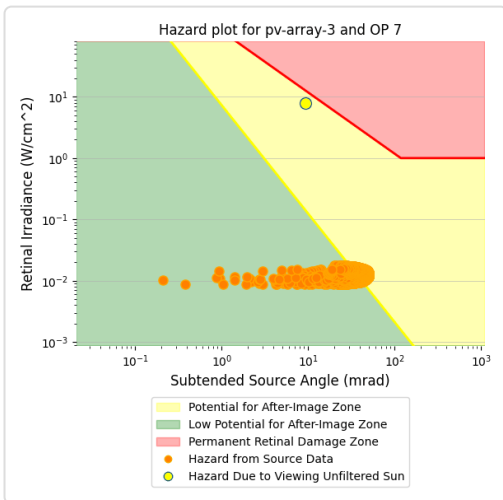
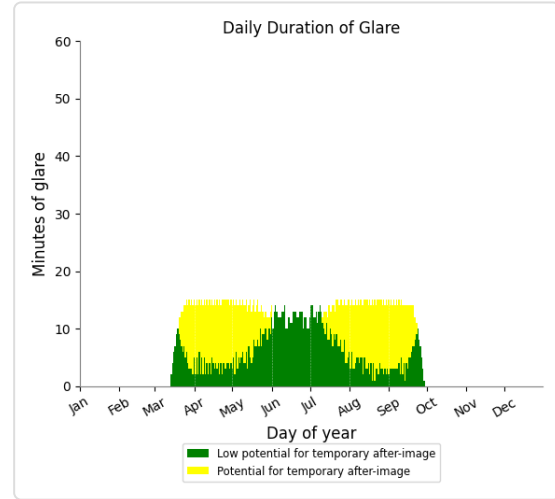
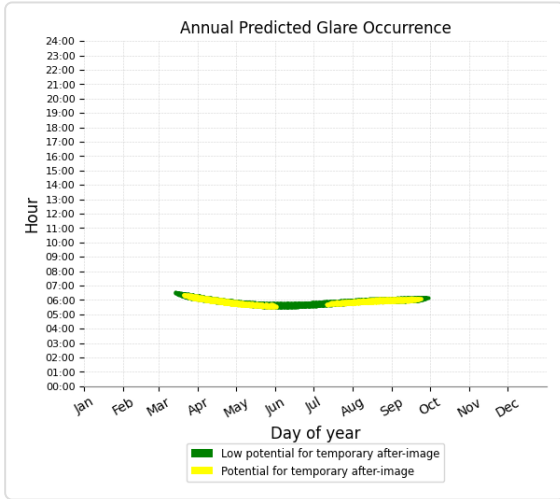
Yellow glare: 92 min.  
Green glare: 960 min.



# PV array 3 and OP 7

Yellow glare: 1,367 min.

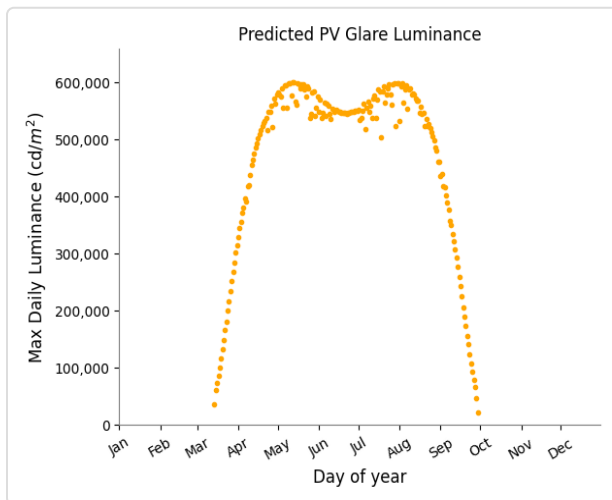
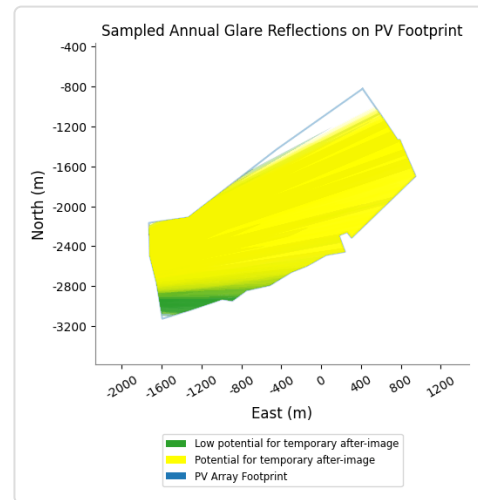
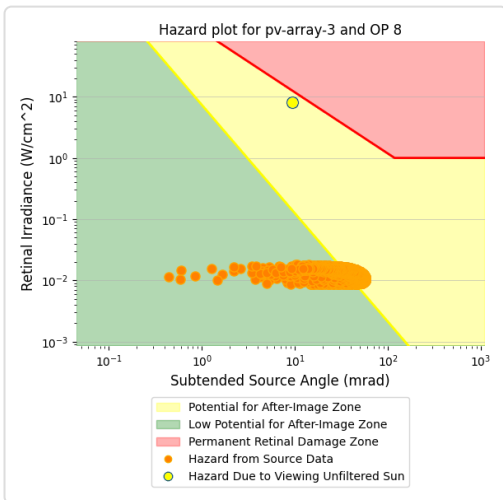
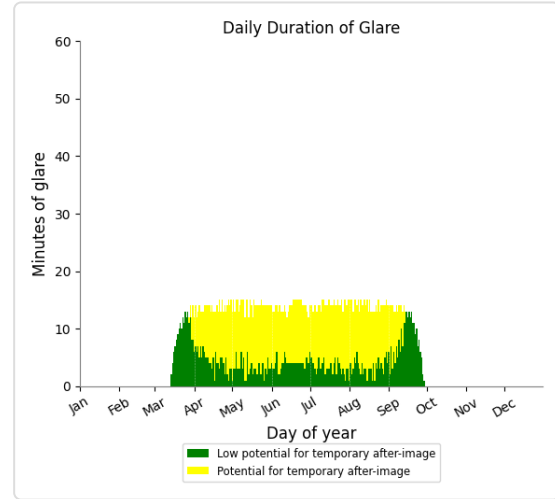
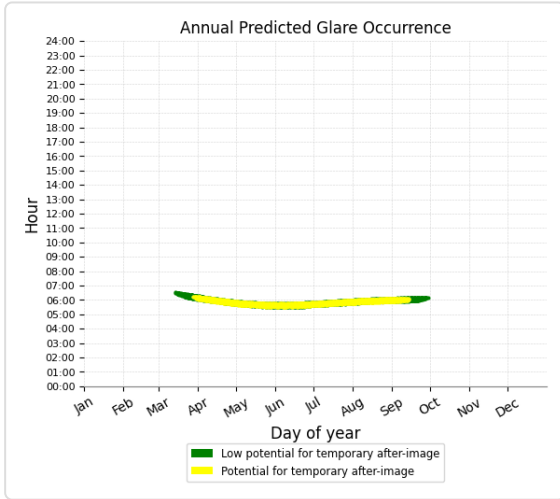
Green glare: 1,286 min.



# PV array 3 and OP 8

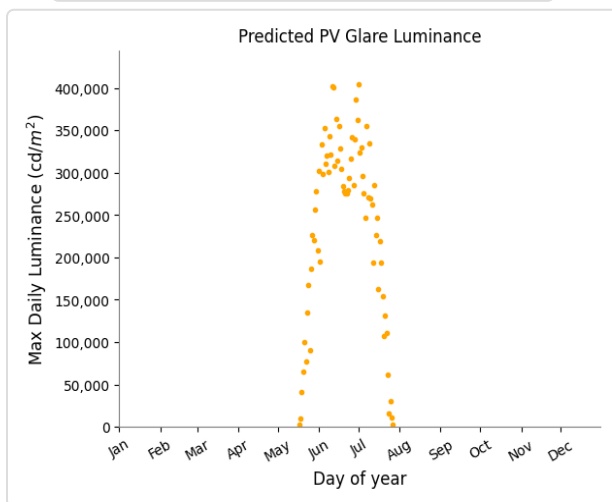
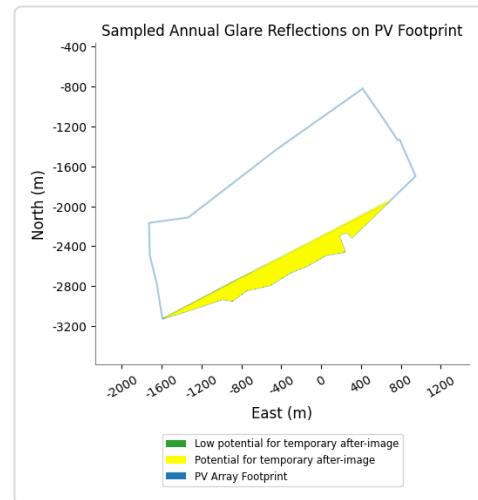
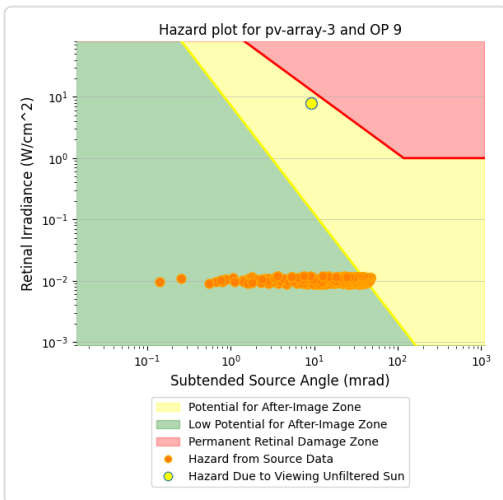
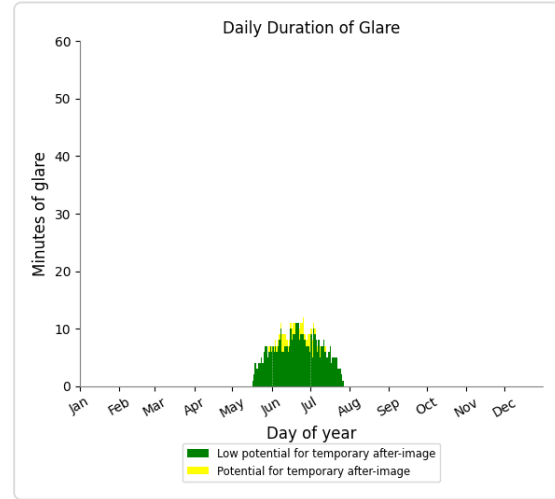
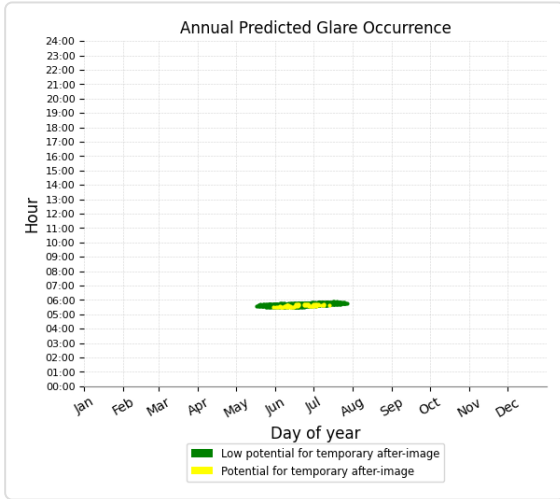
Yellow glare: 1,689 min.

Green glare: 947 min.



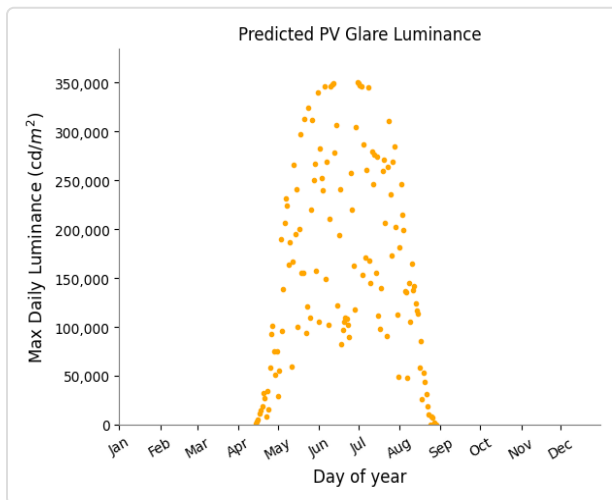
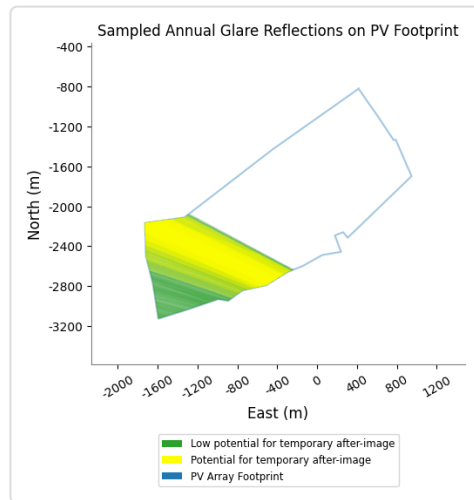
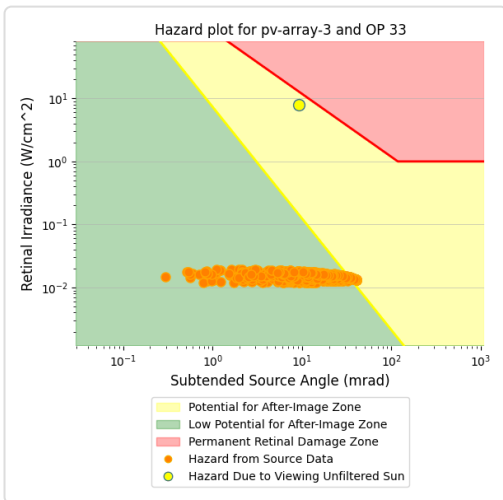
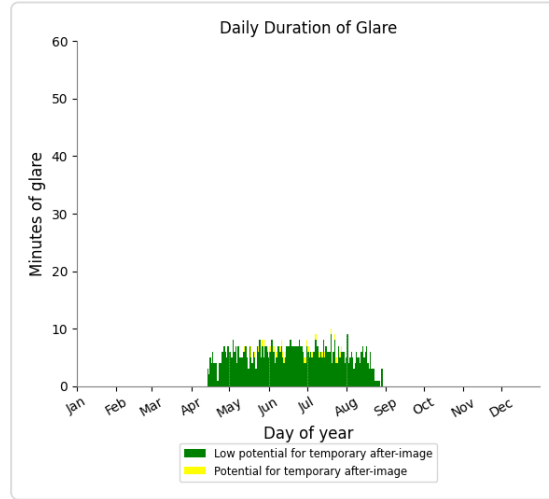
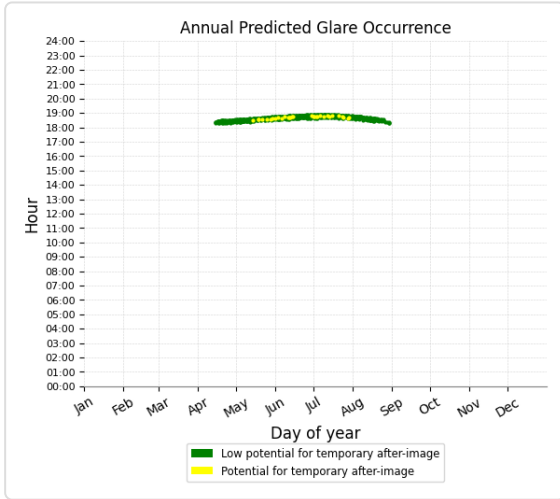
# PV array 3 and OP 9

Yellow glare: 55 min.  
 Green glare: 457 min.



# PV array 3 and OP 33

Yellow glare: 31 min.  
Green glare: 754 min.

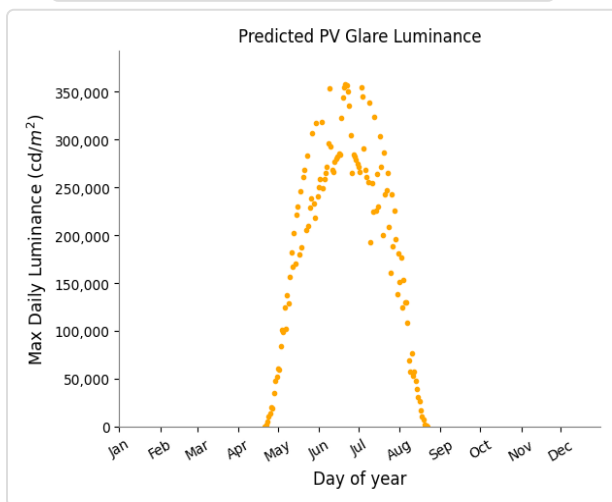
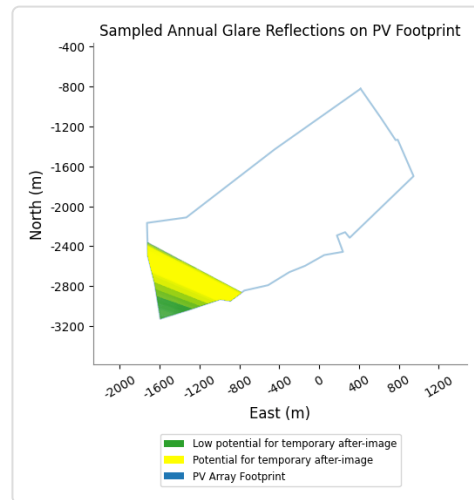
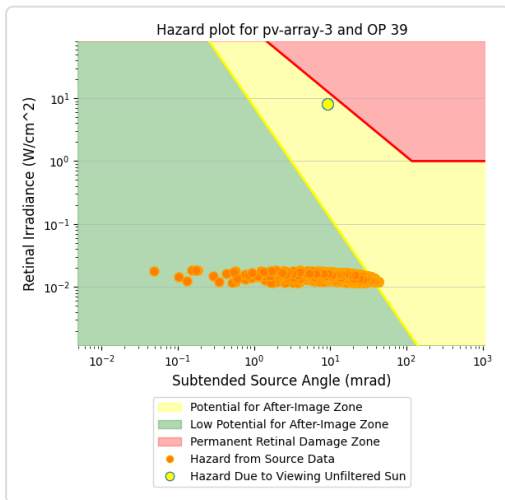
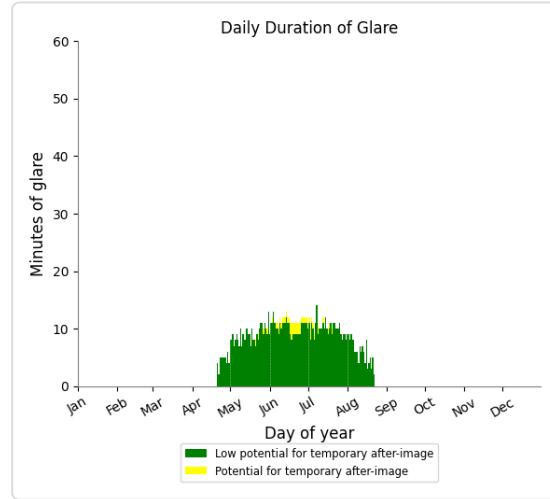
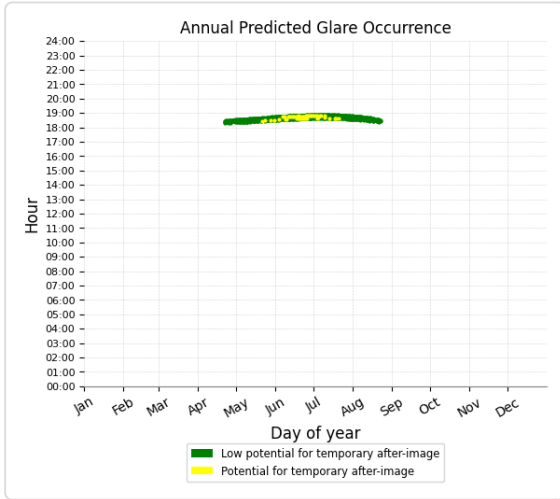




# PV array 3 and OP 39

Yellow glare: 53 min.

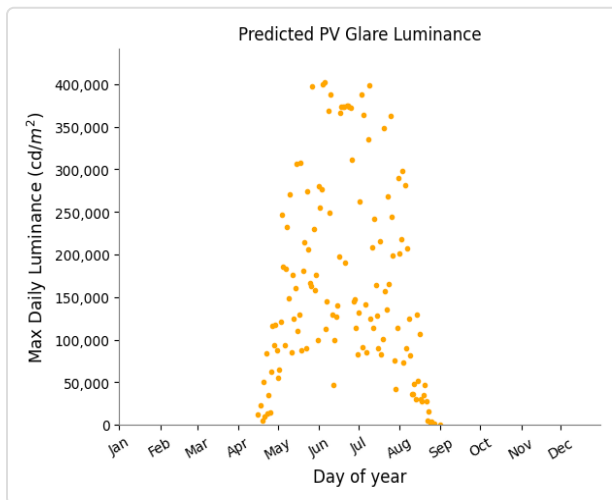
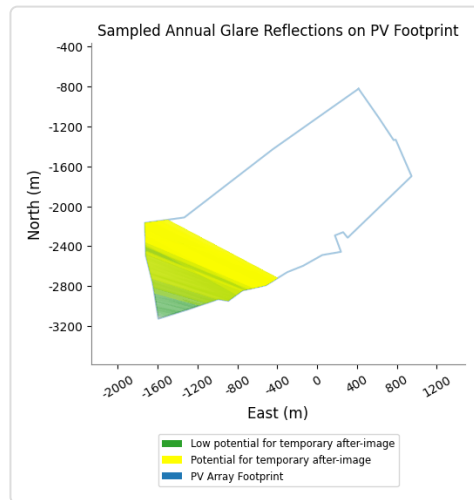
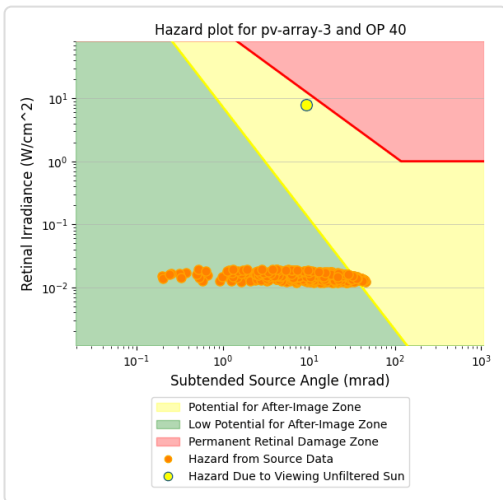
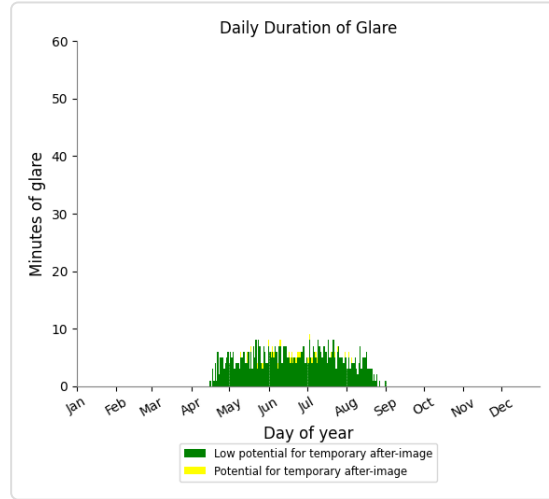
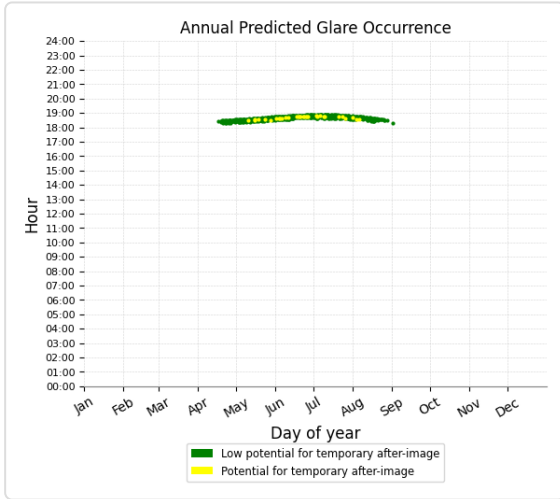
Green glare: 1,070 min.



# PV array 3 and OP 40

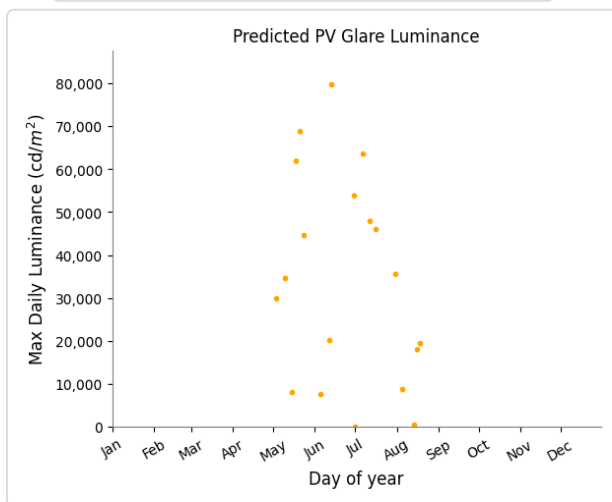
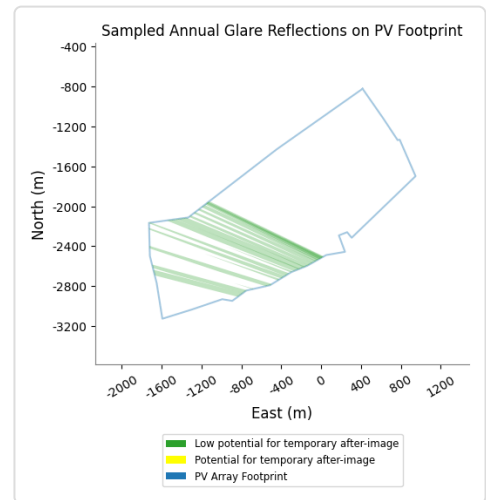
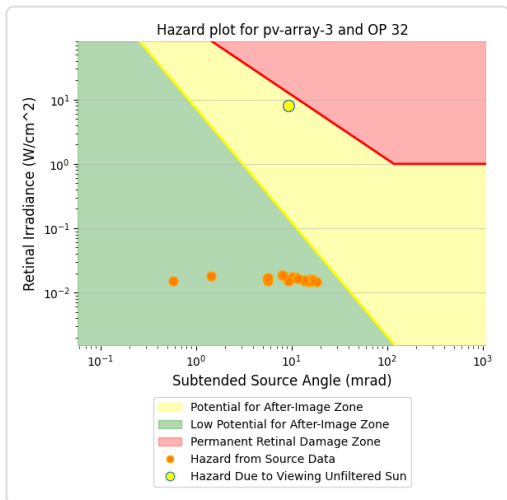
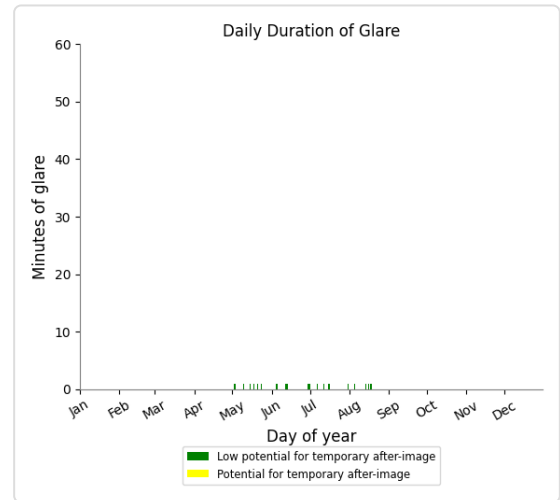
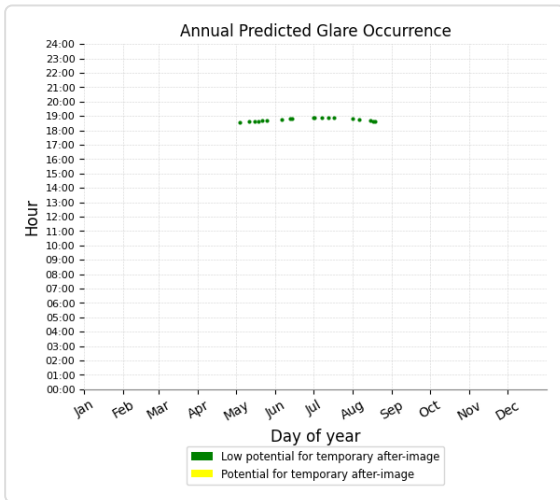
Yellow glare: 32 min.

Green glare: 635 min.



# PV array 3 and OP 32

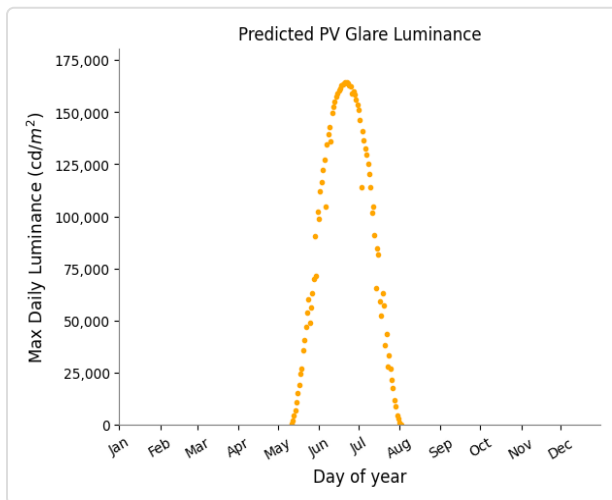
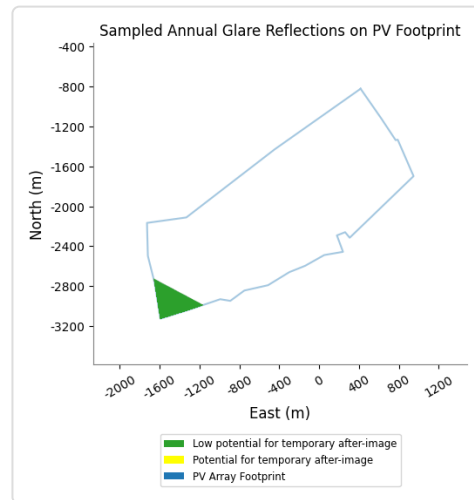
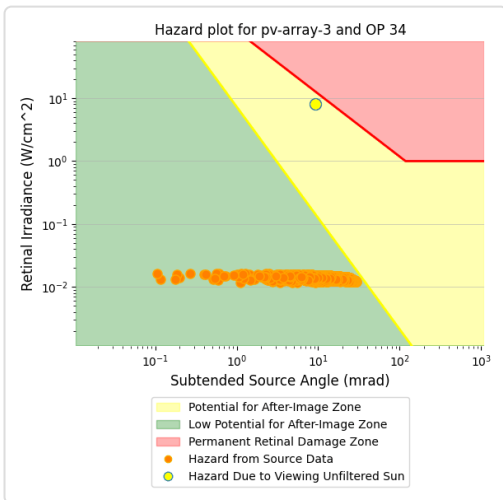
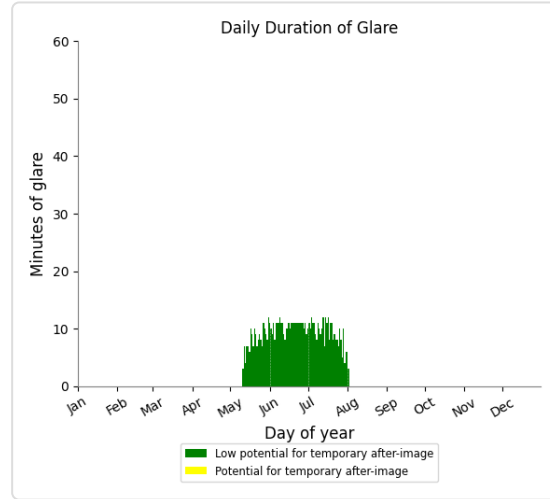
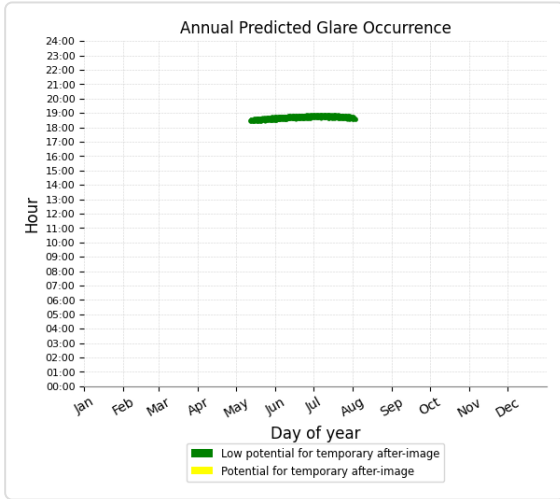
Yellow glare: none  
 Green glare: 19 min.



# PV array 3 and OP 34

Yellow glare: none

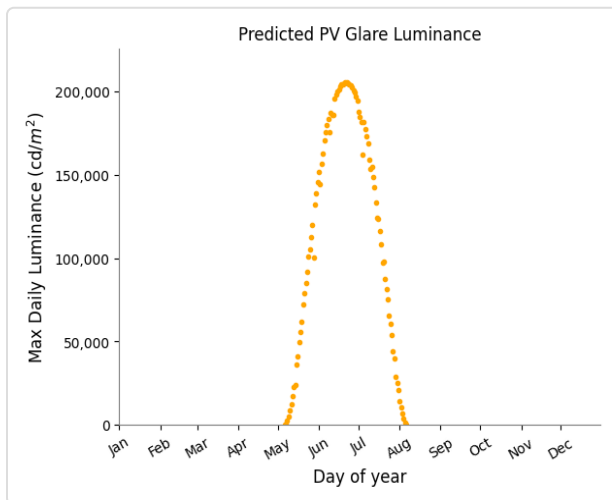
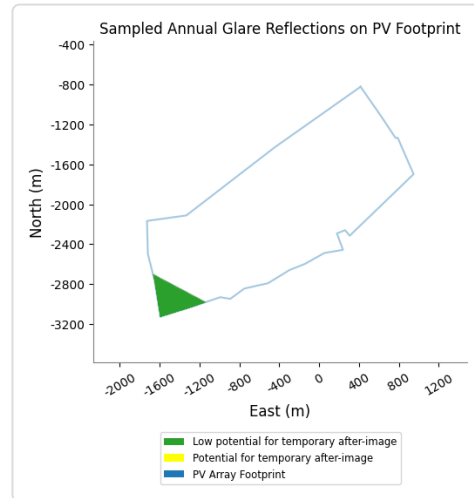
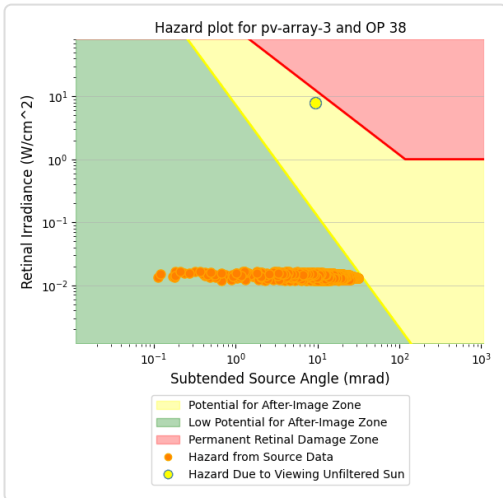
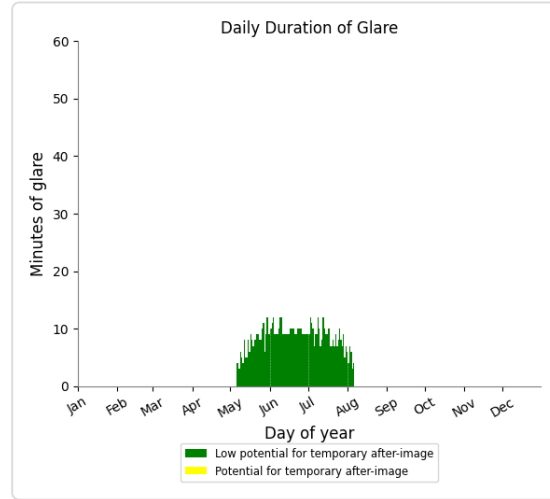
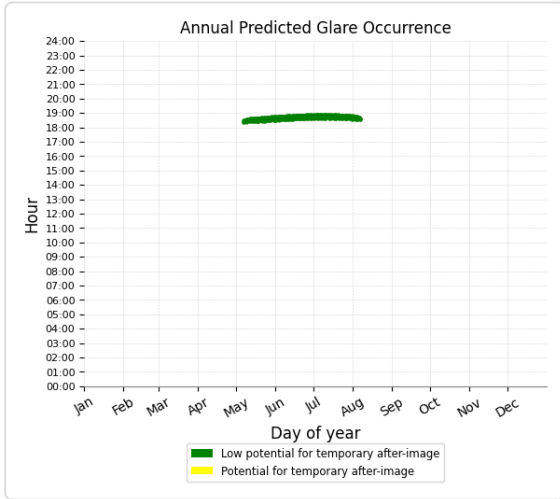
Green glare: 780 min.



## PV array 3 and OP 38

Yellow glare: none

Green glare: 782 min.



## PV array 3 and OP 10

No glare found

**PV array 3 and OP 11**

No glare found

**PV array 3 and OP 12**

No glare found

**PV array 3 and OP 13**

No glare found

**PV array 3 and OP 14**

No glare found

**PV array 3 and OP 15**

No glare found

**PV array 3 and OP 16**

No glare found

**PV array 3 and OP 17**

No glare found

**PV array 3 and OP 18**

No glare found

**PV array 3 and OP 19**

No glare found

**PV array 3 and OP 20**

No glare found

**PV array 3 and OP 21**

No glare found

**PV array 3 and OP 22**

No glare found

**PV array 3 and OP 23**

No glare found

**PV array 3 and OP 24**

No glare found

**PV array 3 and OP 25**

No glare found

**PV array 3 and OP 26**

No glare found

**PV array 3 and OP 27**

No glare found

**PV array 3 and OP 28**

No glare found

**PV array 3 and OP 29**

No glare found

**PV array 3 and OP 30**

No glare found

**PV array 3 and OP 31**

No glare found

**PV array 3 and OP 35**

No glare found

**PV array 3 and OP 36**

No glare found

**PV array 3 and OP 37**

No glare found

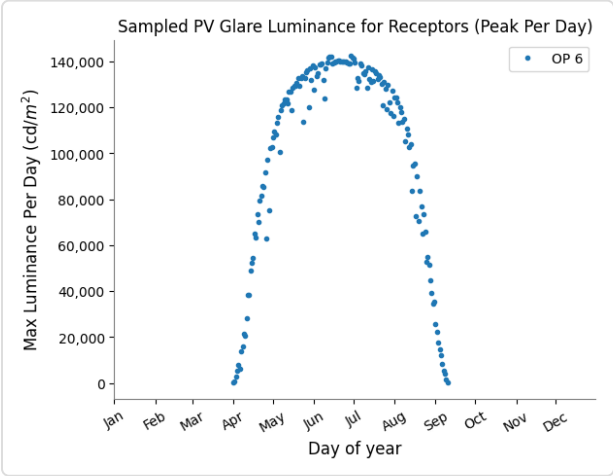
**PV: PV array 4** low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 3	27	0.5	0	0.0	36,204
OP 5	65	1.1	0	0.0	23,768
OP 6	1,757	29.3	0	0.0	142,334
OP 7	15	0.2	0	0.0	16,030
OP 1	0	0.0	0	0.0	0
OP 2	0	0.0	0	0.0	0
OP 4	0	0.0	0	0.0	0
OP 8	0	0.0	0	0.0	0
OP 9	0	0.0	0	0.0	0
OP 10	0	0.0	0	0.0	0
OP 11	0	0.0	0	0.0	0
OP 12	0	0.0	0	0.0	0
OP 13	0	0.0	0	0.0	0
OP 14	0	0.0	0	0.0	0
OP 15	0	0.0	0	0.0	0
OP 16	0	0.0	0	0.0	0
OP 17	0	0.0	0	0.0	0
OP 18	0	0.0	0	0.0	0
OP 19	0	0.0	0	0.0	0
OP 20	0	0.0	0	0.0	0
OP 21	0	0.0	0	0.0	0
OP 22	0	0.0	0	0.0	0
OP 23	0	0.0	0	0.0	0
OP 24	0	0.0	0	0.0	0
OP 25	0	0.0	0	0.0	0
OP 26	0	0.0	0	0.0	0
OP 27	0	0.0	0	0.0	0
OP 28	0	0.0	0	0.0	0
OP 29	0	0.0	0	0.0	0
OP 30	0	0.0	0	0.0	0
OP 31	0	0.0	0	0.0	0
OP 32	0	0.0	0	0.0	0
OP 33	0	0.0	0	0.0	0
OP 34	0	0.0	0	0.0	0
OP 35	0	0.0	0	0.0	0
OP 36	0	0.0	0	0.0	0
OP 37	0	0.0	0	0.0	0
OP 38	0	0.0	0	0.0	0

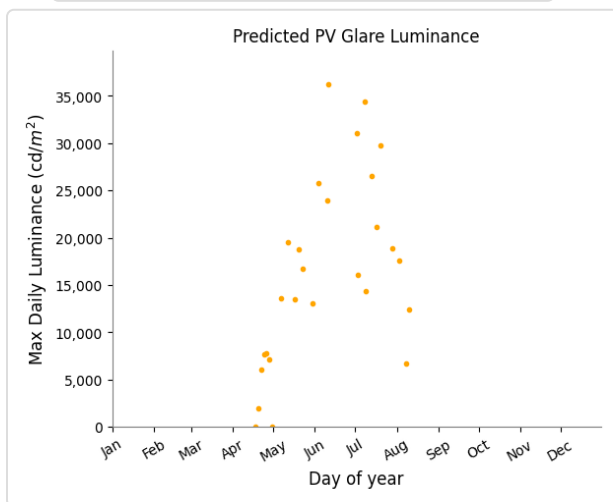
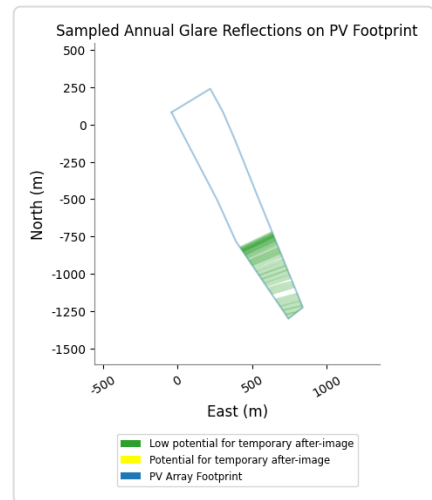
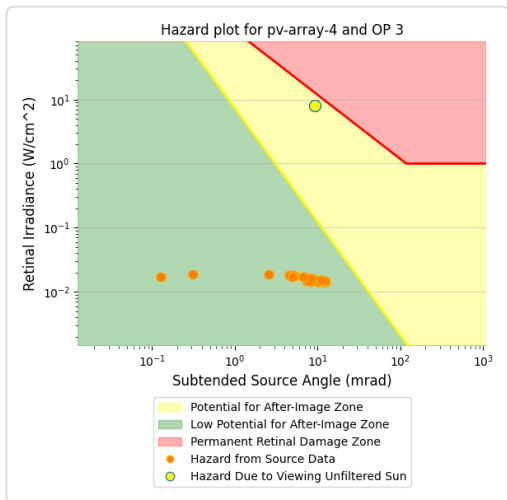
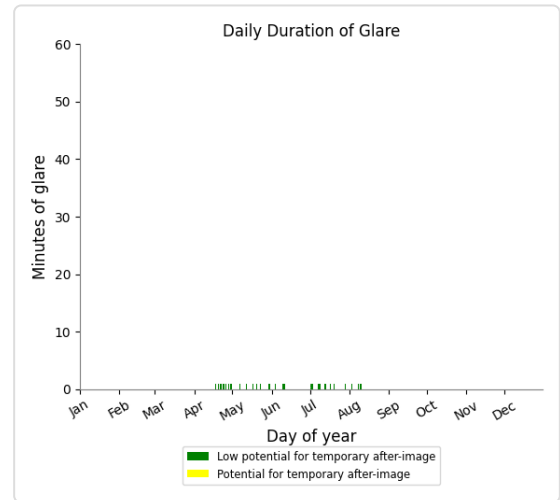
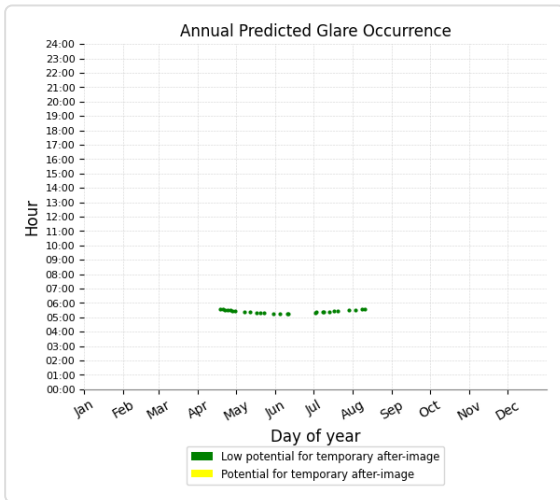


Receptor	Annual Green Glare		Annual Yellow Glare		Peak Luminance
	min	hr	min	hr	cd/m <sup>2</sup>
OP 39	0	0.0	0	0.0	0
OP 40	0	0.0	0	0.0	0



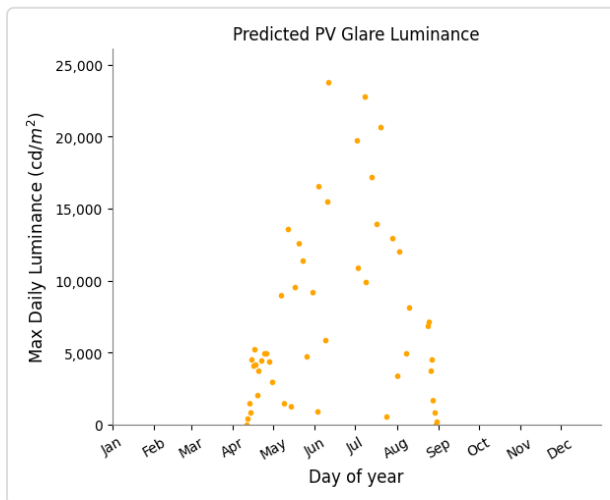
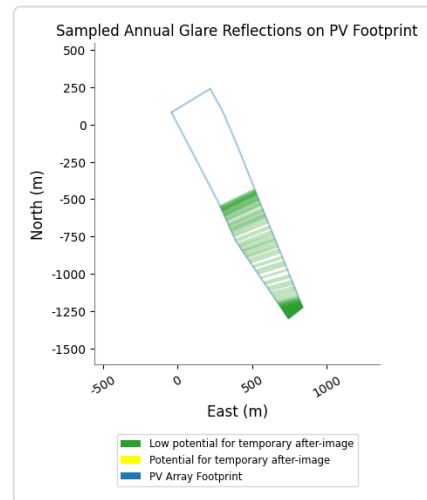
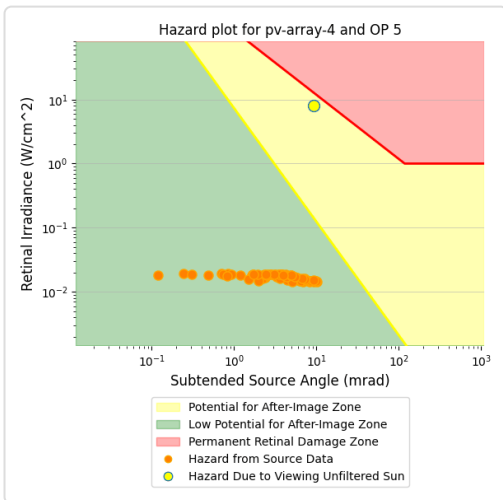
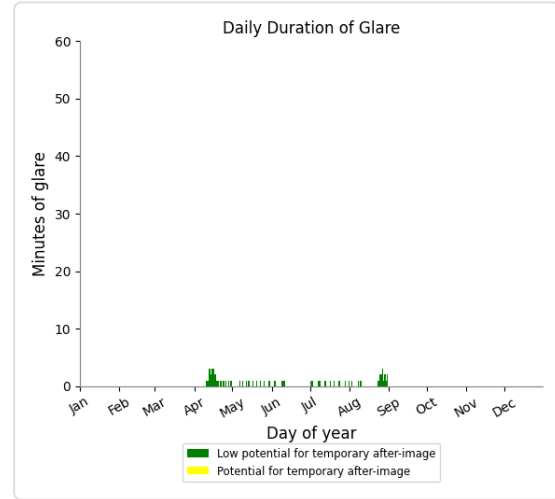
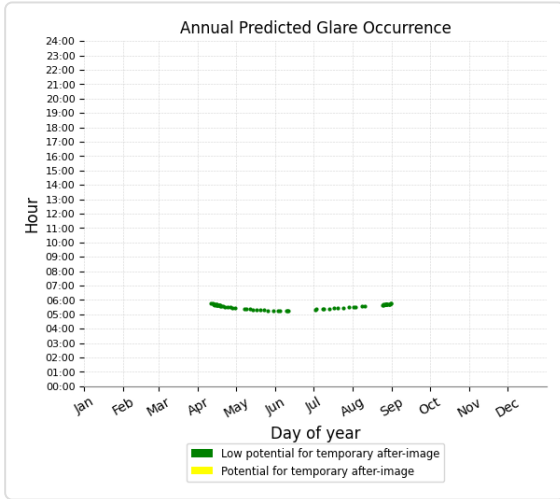
### PV array 4 and OP 3

Yellow glare: none  
 Green glare: 27 min.



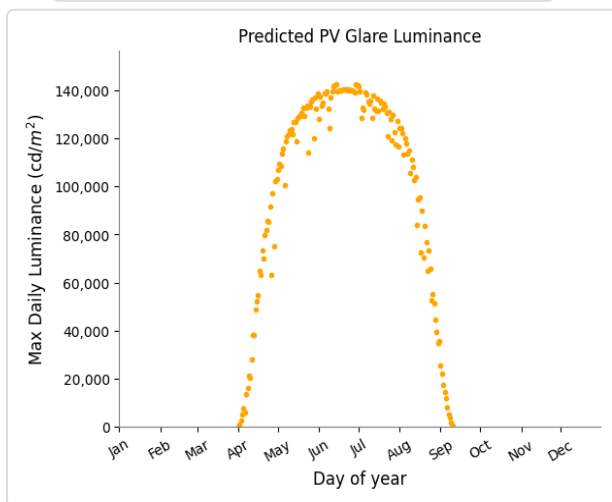
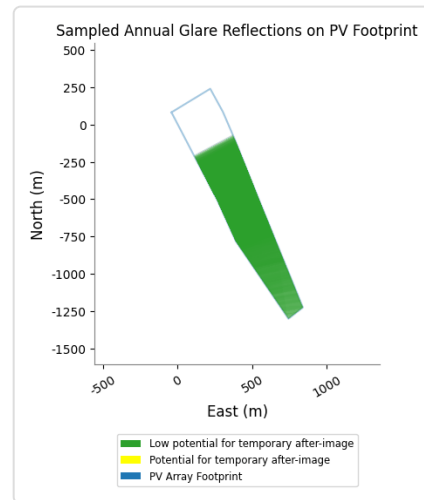
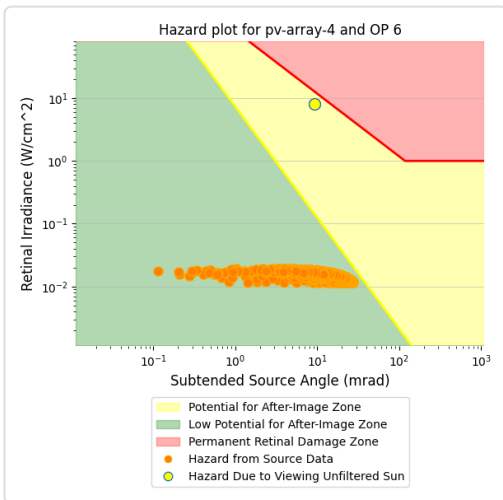
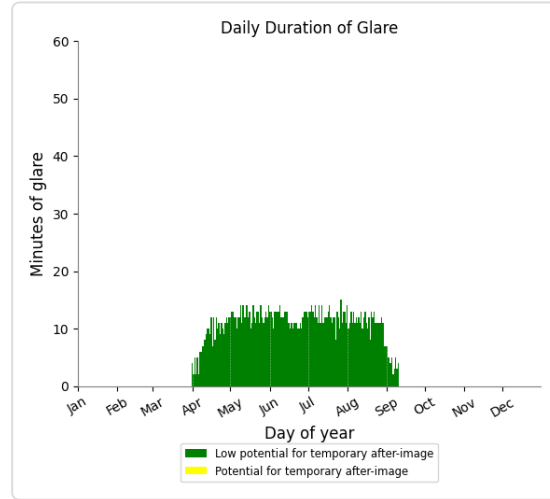
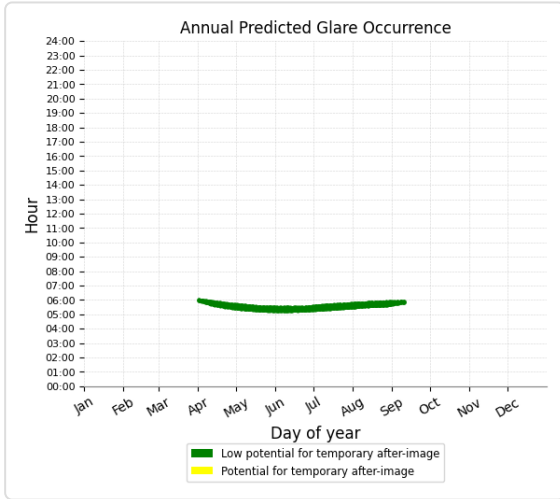
# PV array 4 and OP 5

Yellow glare: none  
 Green glare: 65 min.



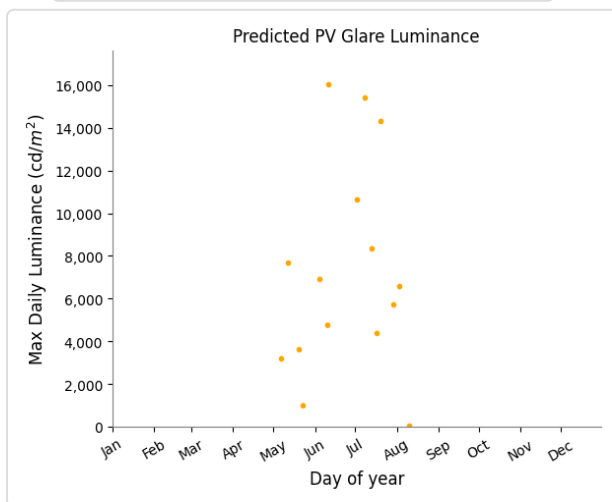
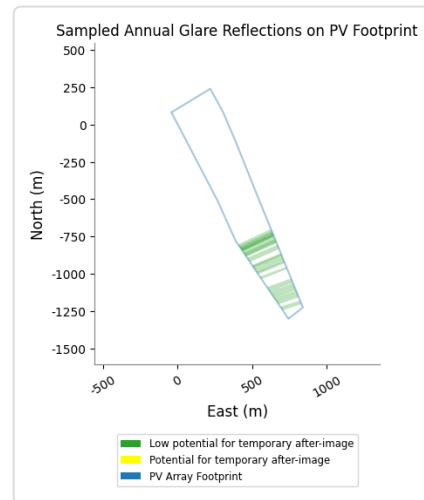
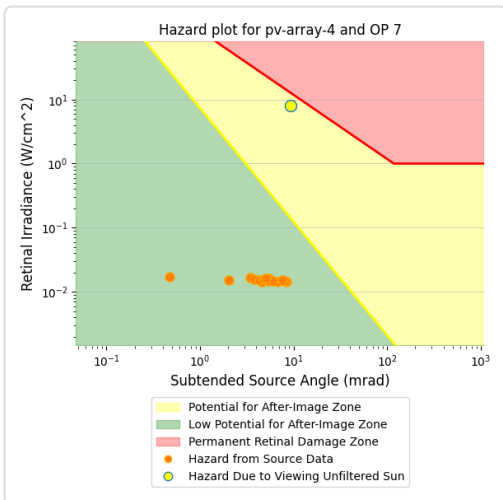
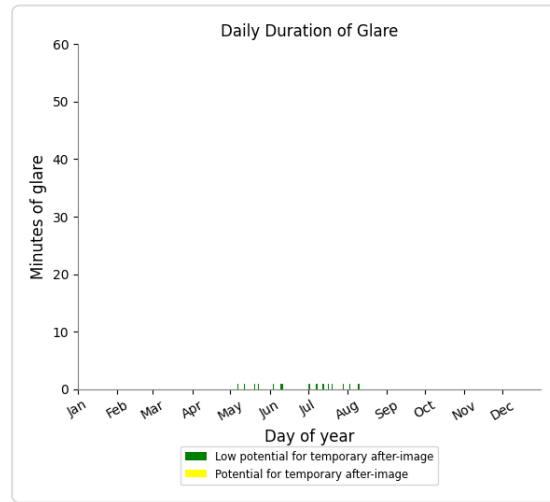
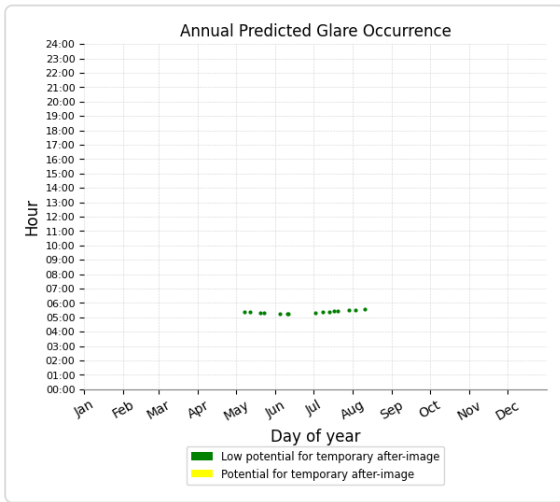
# PV array 4 and OP 6

Yellow glare: none  
 Green glare: 1,757 min.



## PV array 4 and OP 7

Yellow glare: none  
Green glare: 15 min.



## PV array 4 and OP 1

No glare found

**PV array 4 and OP 2**

No glare found

**PV array 4 and OP 4**

No glare found

**PV array 4 and OP 8**

No glare found

**PV array 4 and OP 9**

No glare found

**PV array 4 and OP 10**

No glare found

**PV array 4 and OP 11**

No glare found

**PV array 4 and OP 12**

No glare found

**PV array 4 and OP 13**

No glare found

**PV array 4 and OP 14**

No glare found

**PV array 4 and OP 15**

No glare found

**PV array 4 and OP 16**

No glare found

**PV array 4 and OP 17**

No glare found

**PV array 4 and OP 18**

No glare found

**PV array 4 and OP 19**

No glare found

**PV array 4 and OP 20**

No glare found

**PV array 4 and OP 21**

No glare found

**PV array 4 and OP 22**

No glare found

**PV array 4 and OP 23**

No glare found

**PV array 4 and OP 24**

No glare found

**PV array 4 and OP 25**

No glare found

**PV array 4 and OP 26**

No glare found

**PV array 4 and OP 27**

No glare found

**PV array 4 and OP 28**

No glare found

**PV array 4 and OP 29**

No glare found

**PV array 4 and OP 30**

No glare found

**PV array 4 and OP 31**

No glare found

**PV array 4 and OP 32**

No glare found

**PV array 4 and OP 33**

No glare found

**PV array 4 and OP 34**

No glare found

**PV array 4 and OP 35**

No glare found

**PV array 4 and OP 36**

No glare found

**PV array 4 and OP 37**

No glare found

**PV array 4 and OP 38**

No glare found

**PV array 4 and OP 39**

No glare found

**PV array 4 and OP 40**

No glare found



# Assumptions

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"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/](http://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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