Radiance Workshop :: Mitigating Building Scale Solar Convergence

08.18.2015

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510 521 3800 coolshadow.com

Image and design by SOM

model rendering and design by SOM

Context

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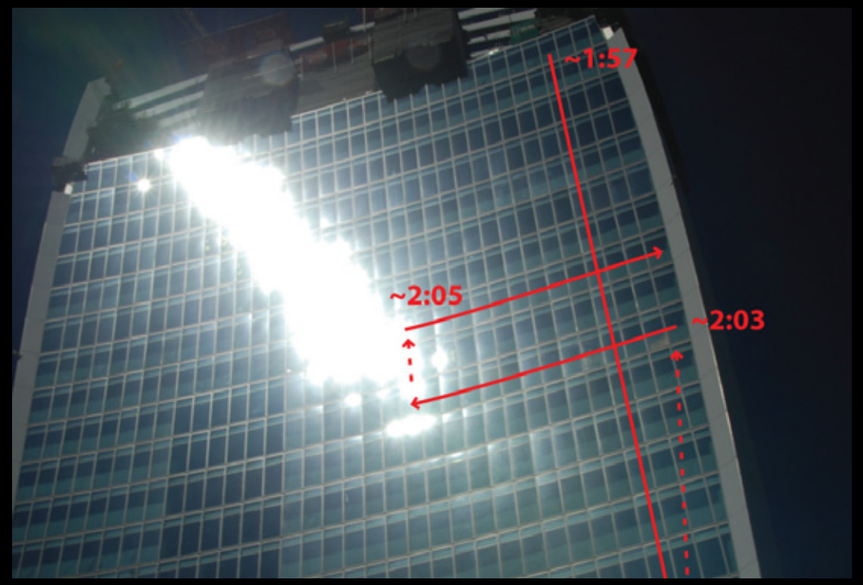
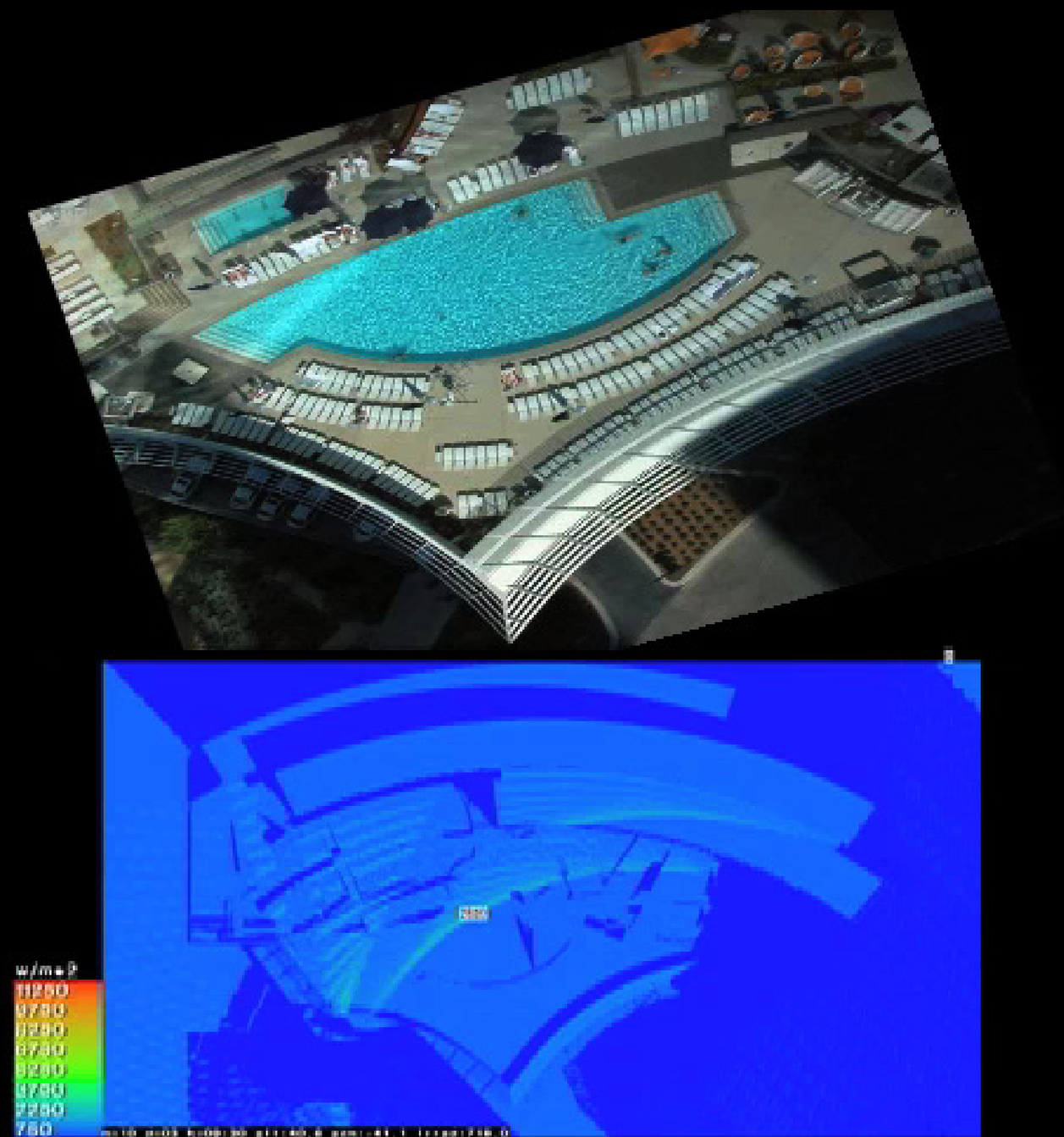
Previous Work :: Method Validation



Previous Work :: Method Validation



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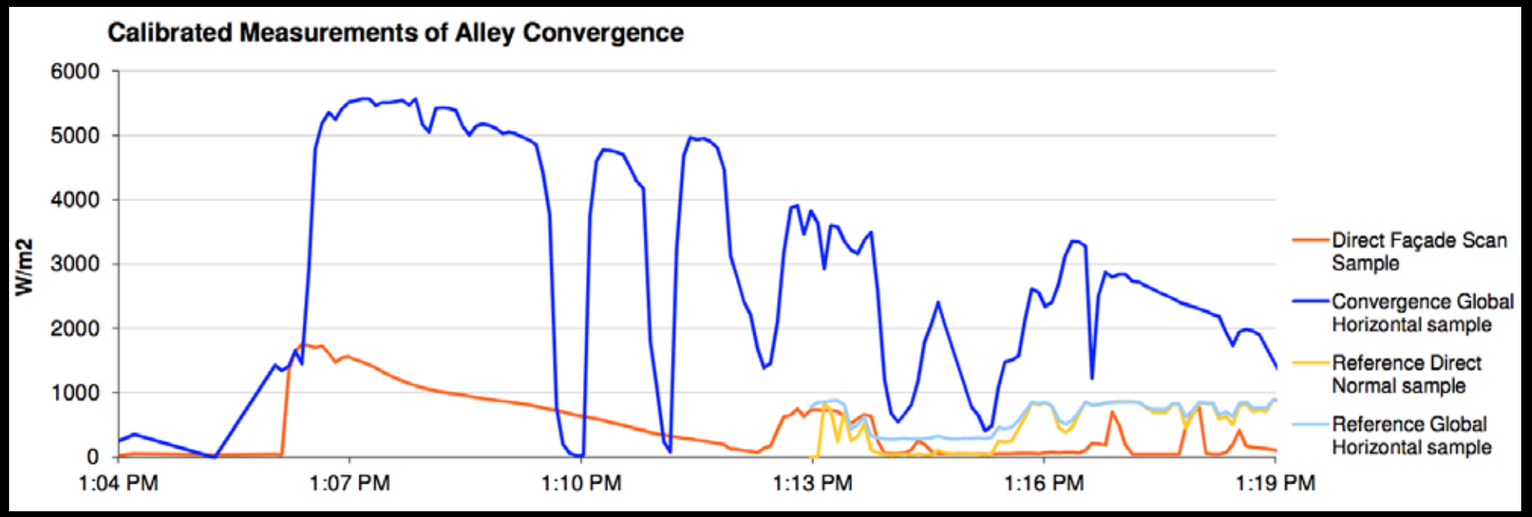

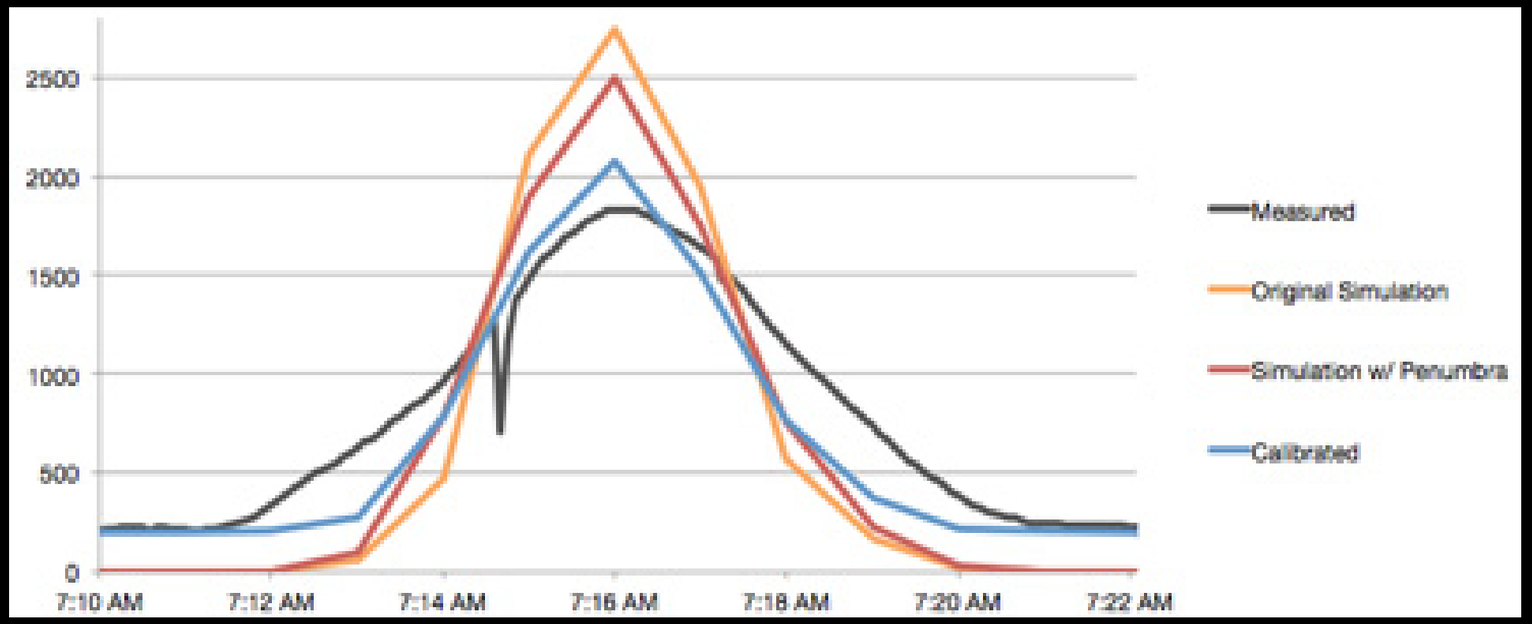

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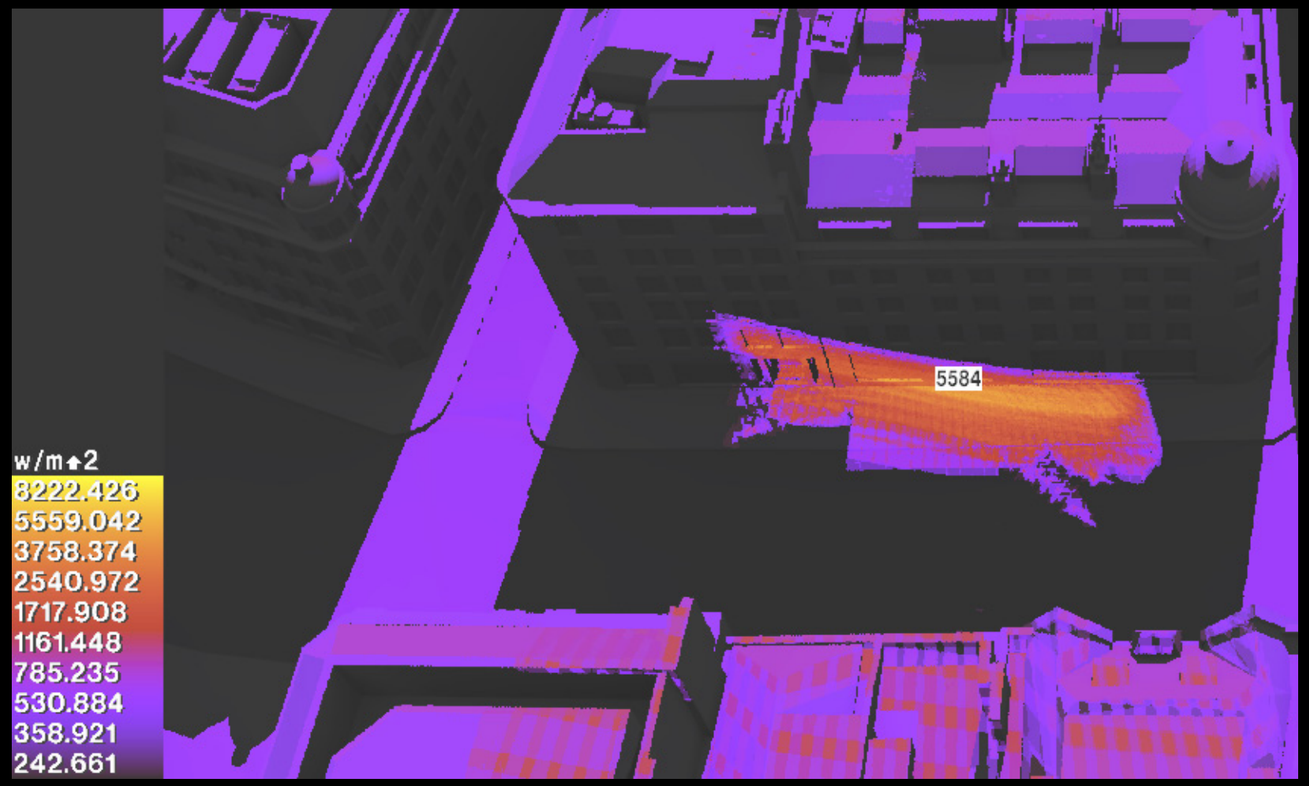
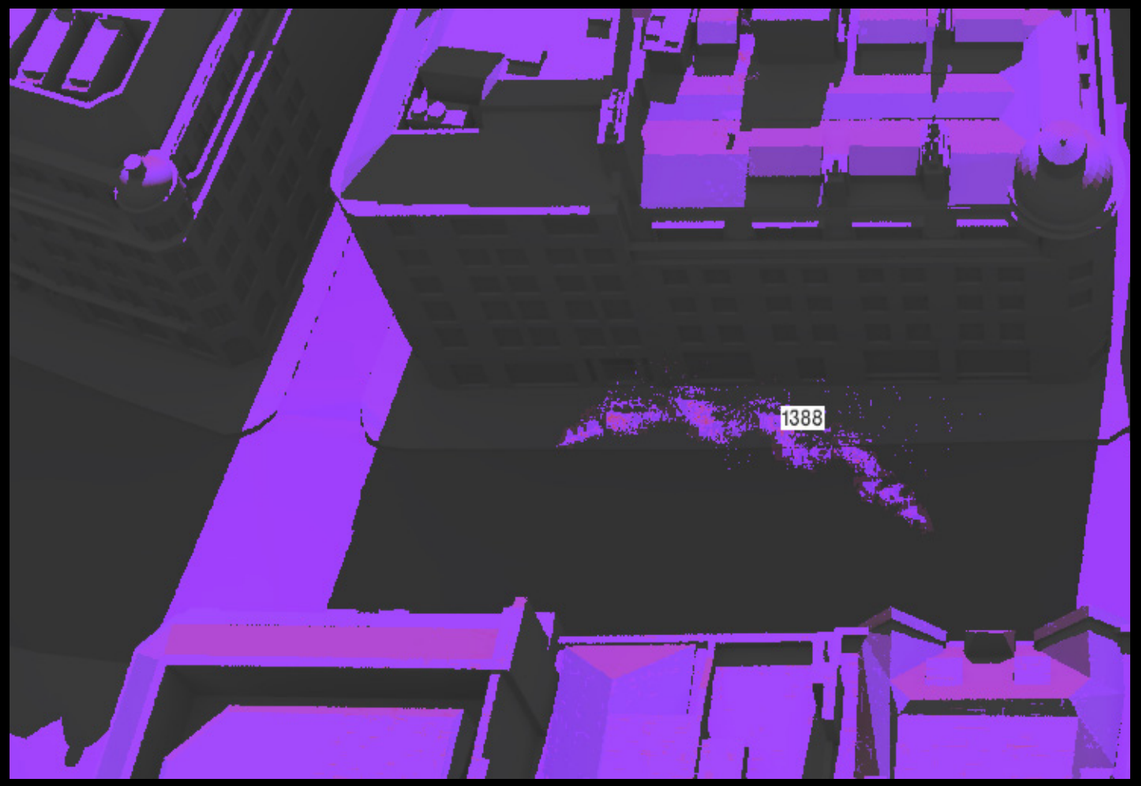
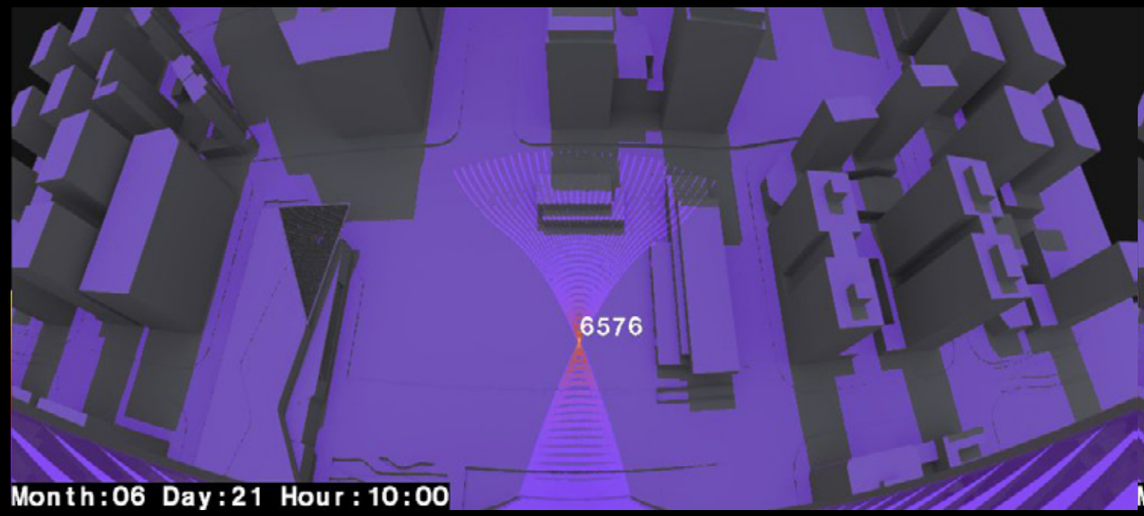


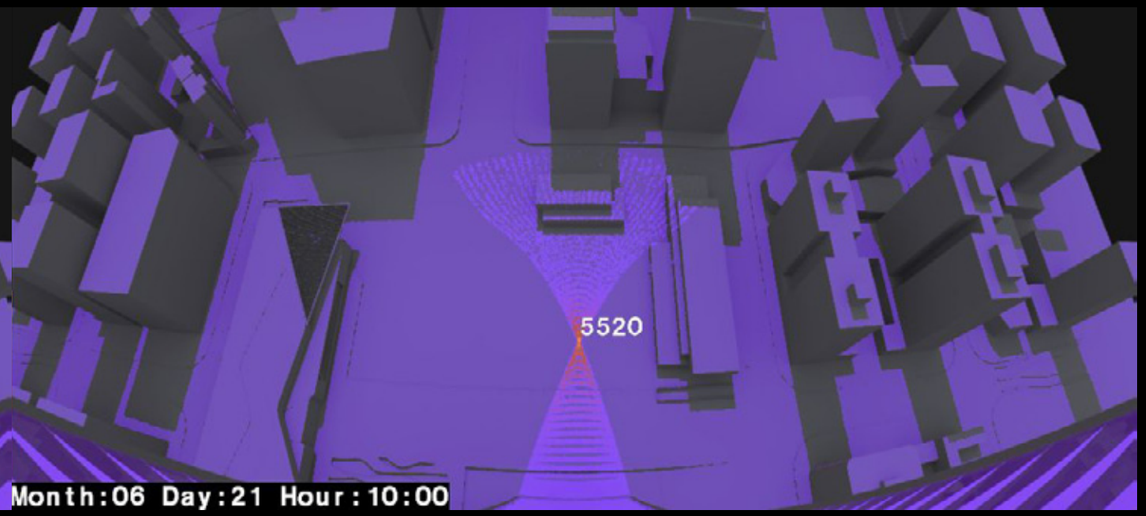


The First of Many Purple Images

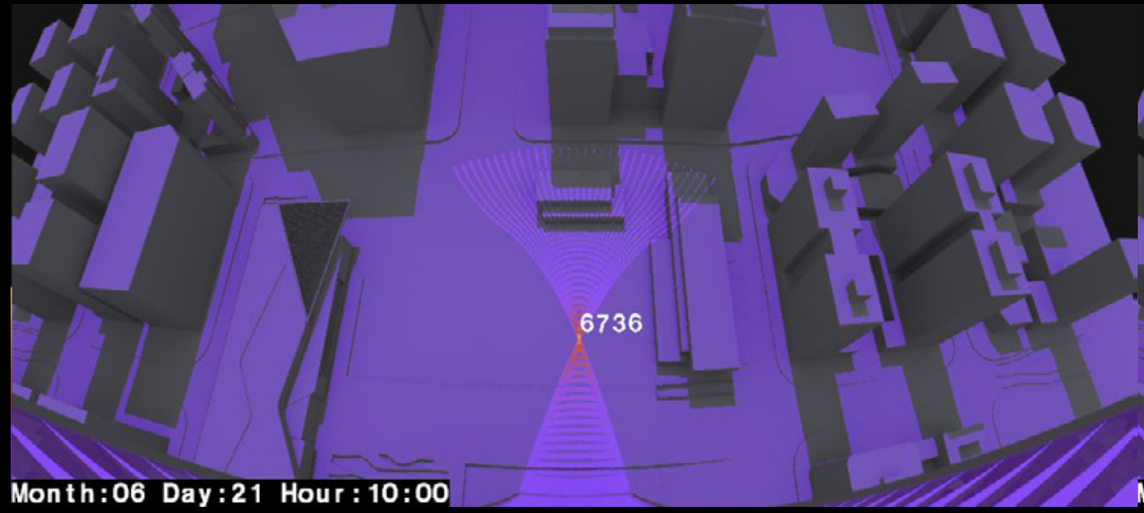
Settings Comparison



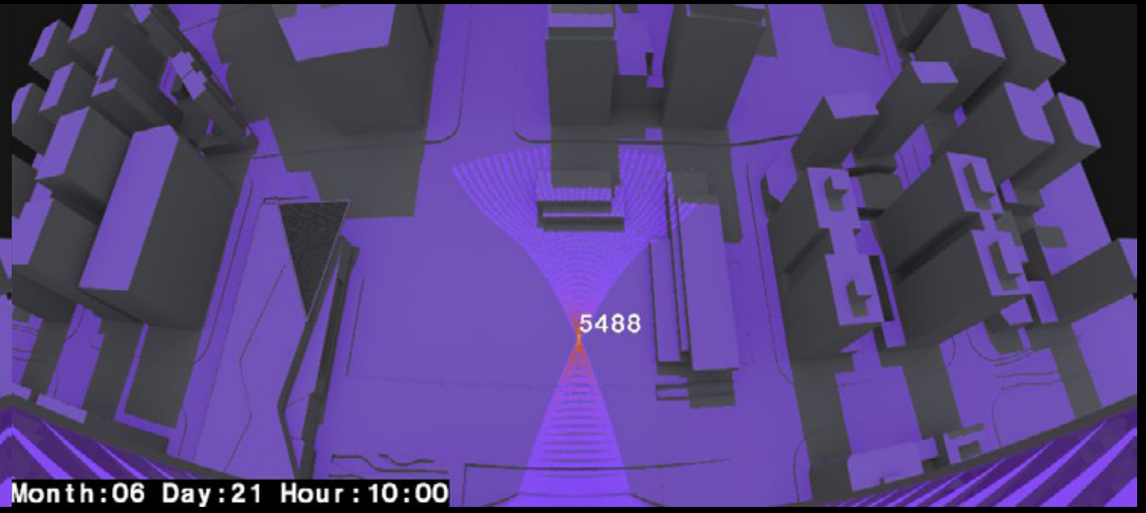
-dj 0 -ps 3 Average Render Time : 1 min 42 sec / frame



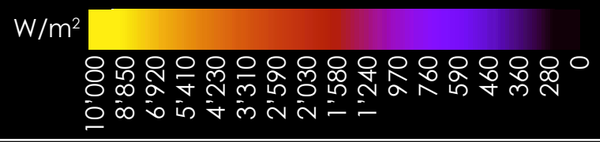
-dj 1 -ps 3 Average Render Time : 5 min 8 sec / frame



-dj 0 -ps 1 Average Render Time : 10 min 17 sec / frame



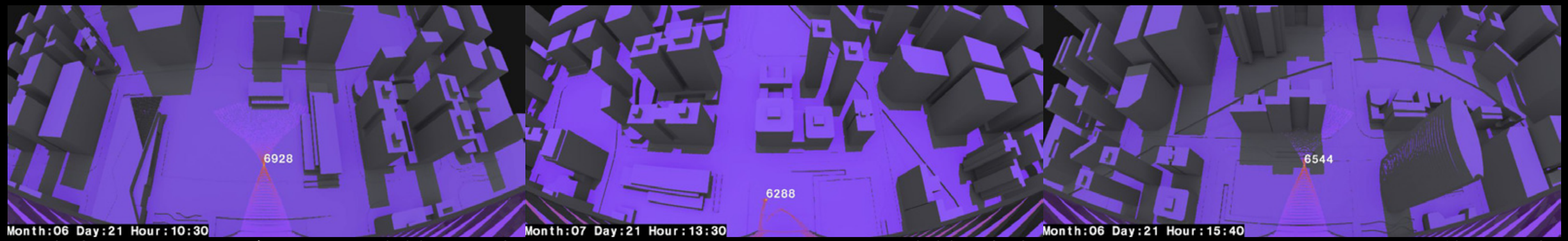
-dj 1 -ps 1 Average Render Time : 35 min 17 sec / frame



Initial Characterization

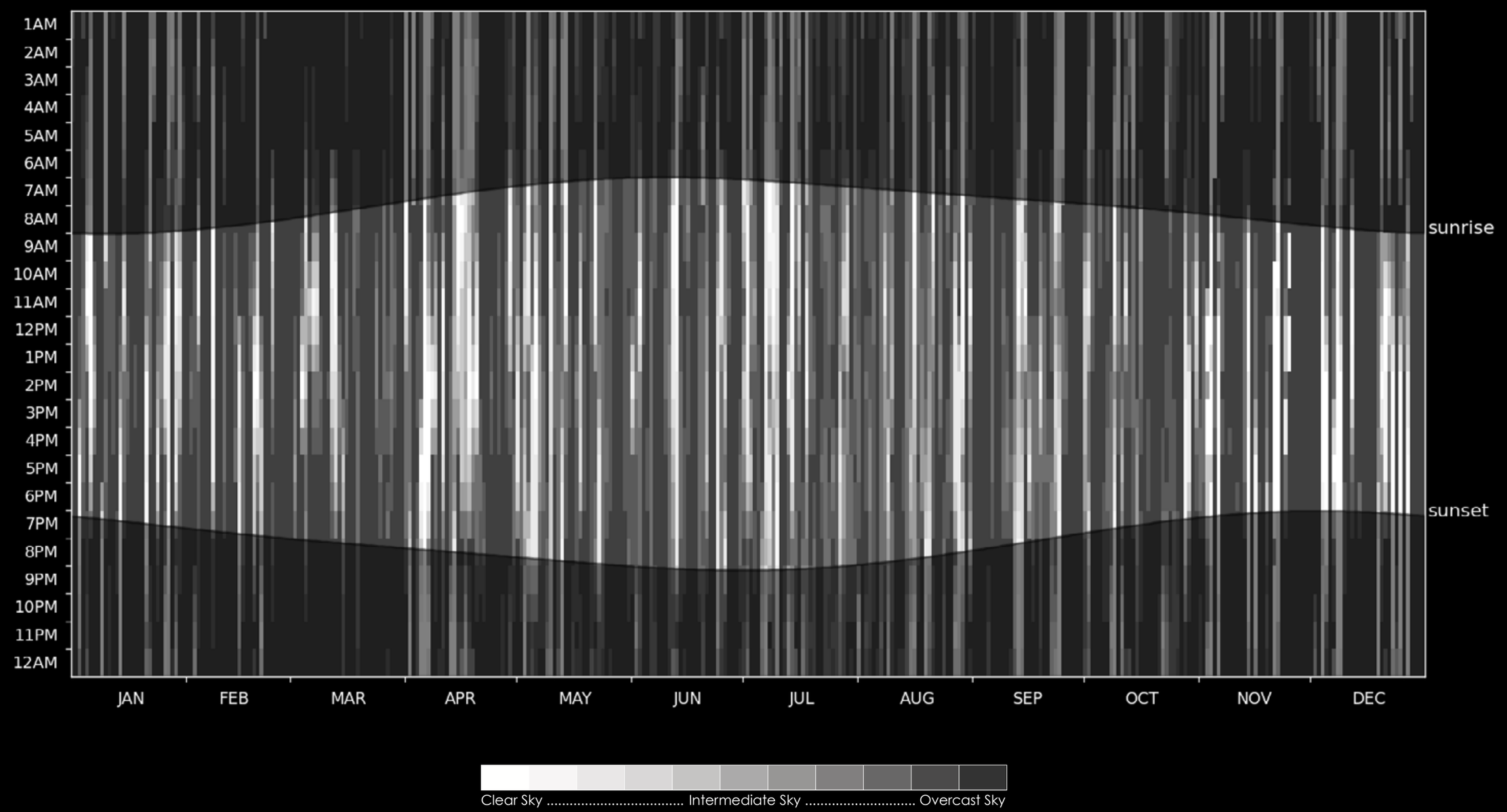
Looking East | Looking South | Looking West

Animation :: 1 Day Each Month (June-December)

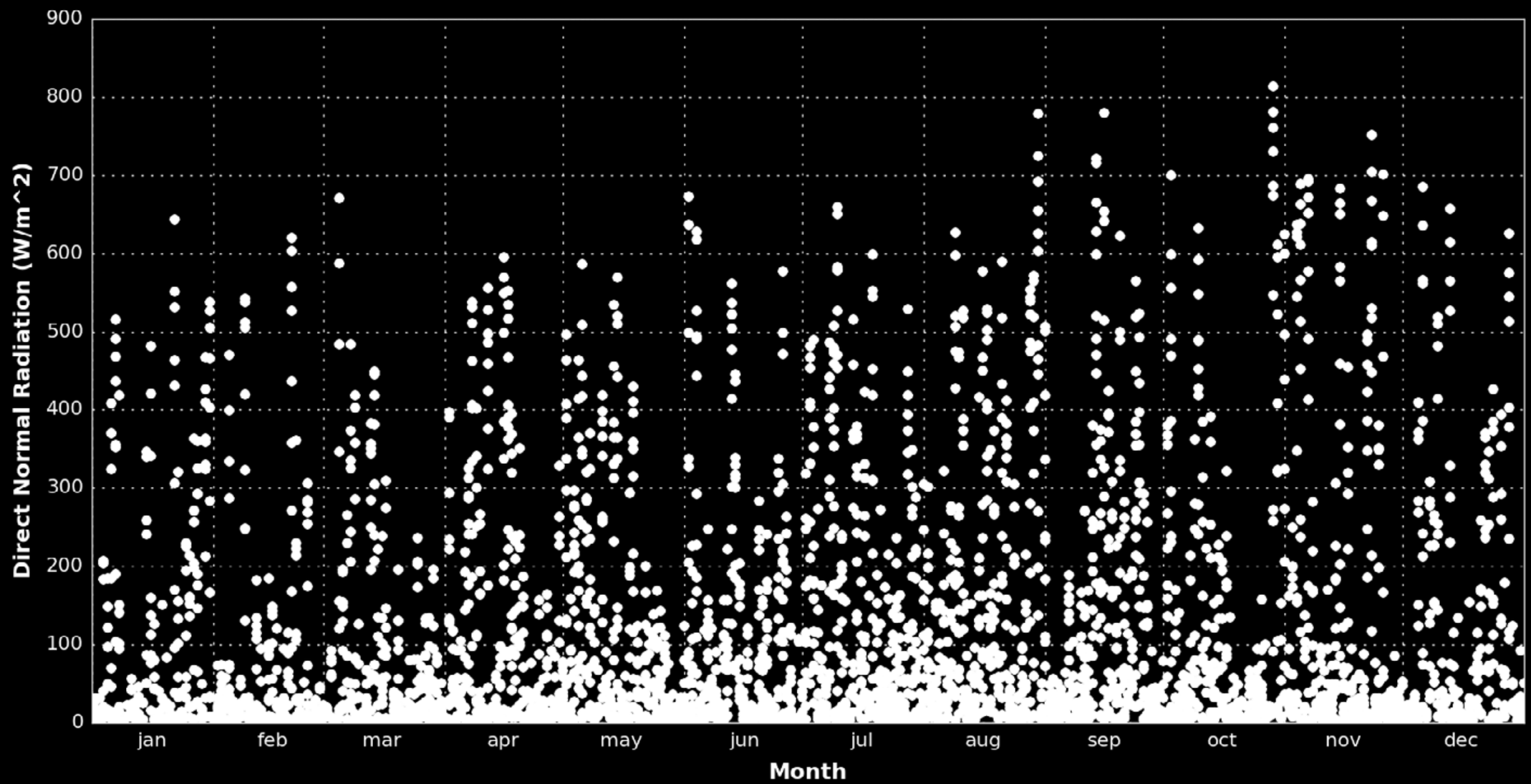


Peak Convergence Times: 10:30 June 21 | 13:30 July 21 | 15:40 June 21

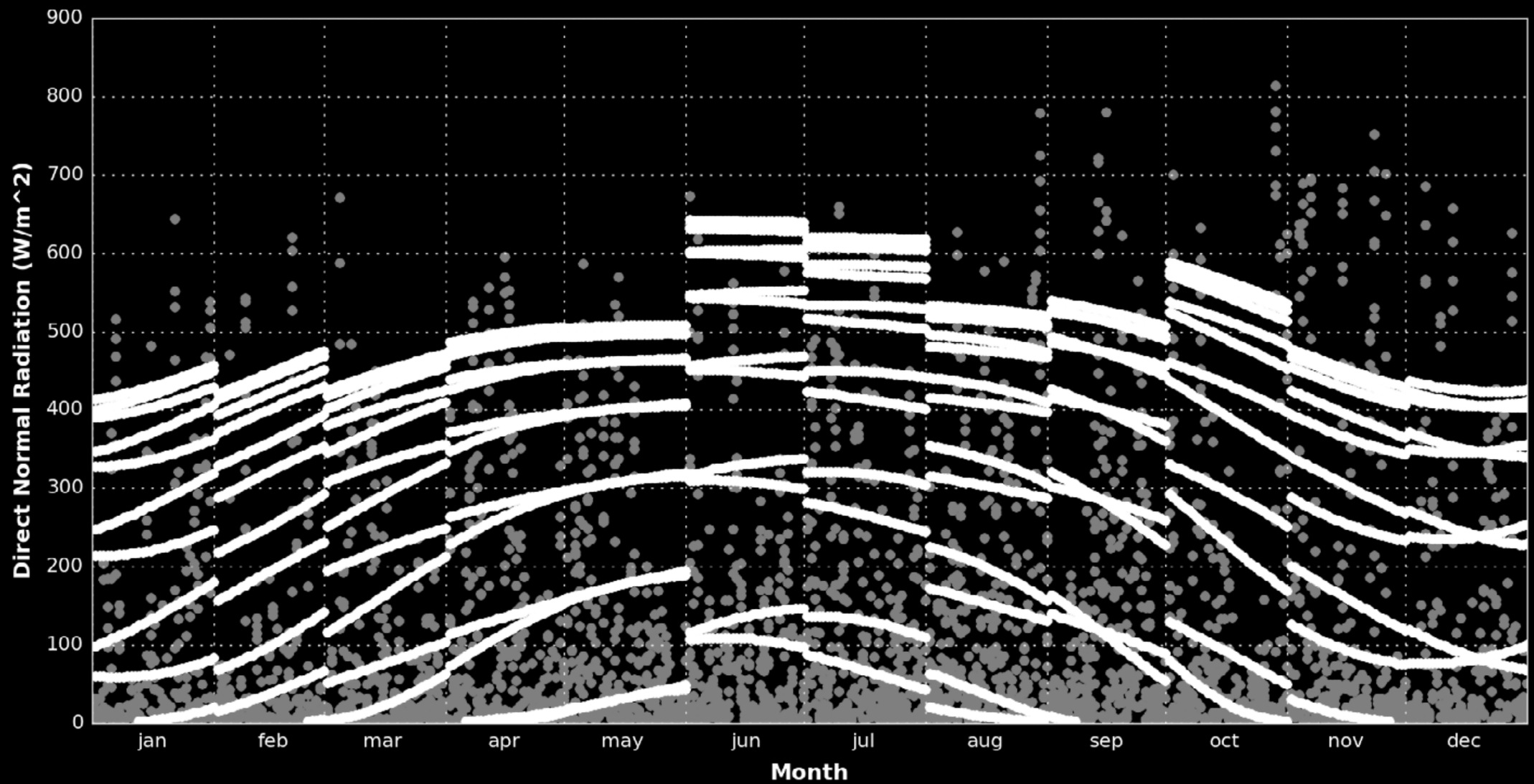
Building Site Skycover



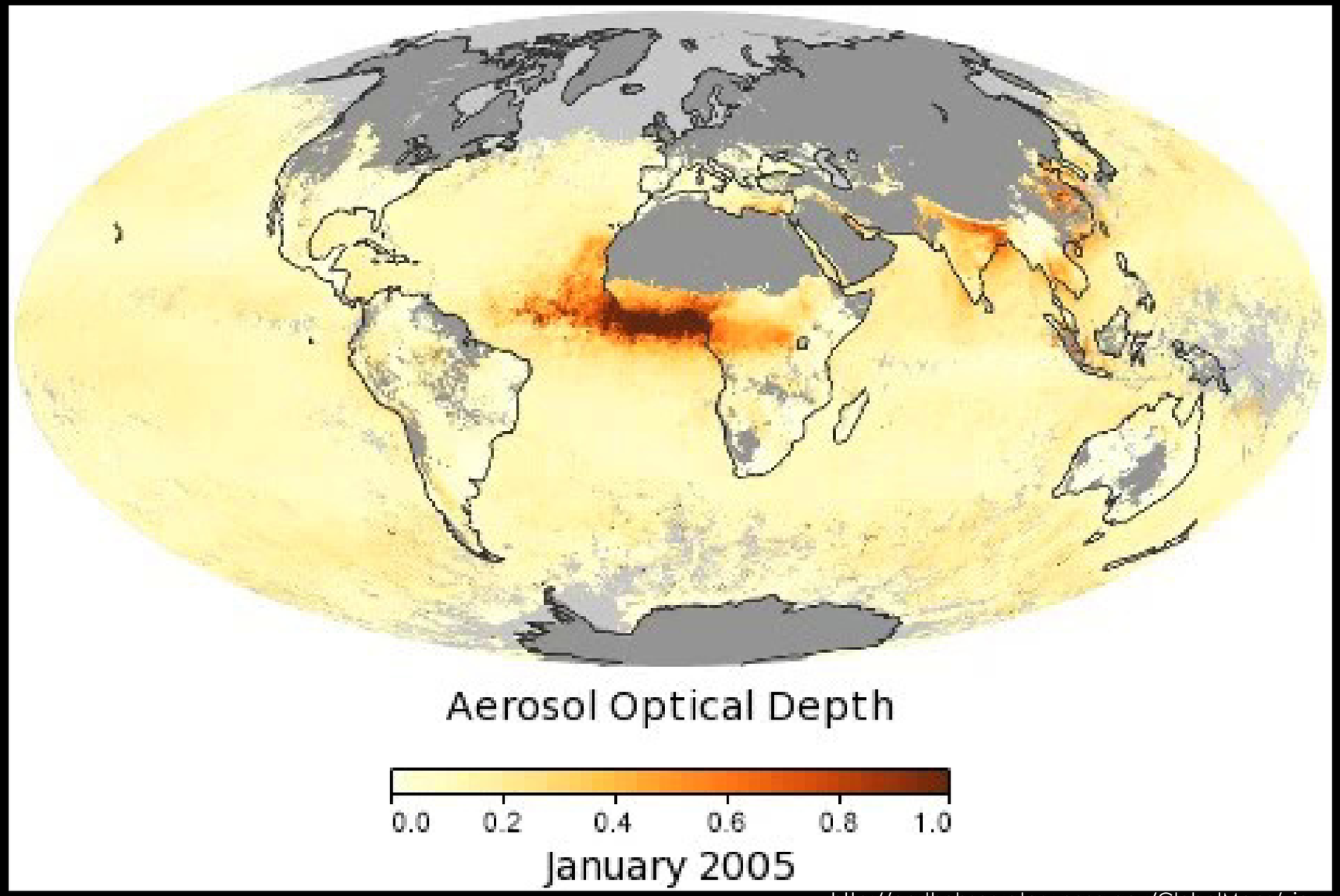
Direct Normal :: TMY Data



Direct Normal :: ASHRAE clear sky :: Southwest China

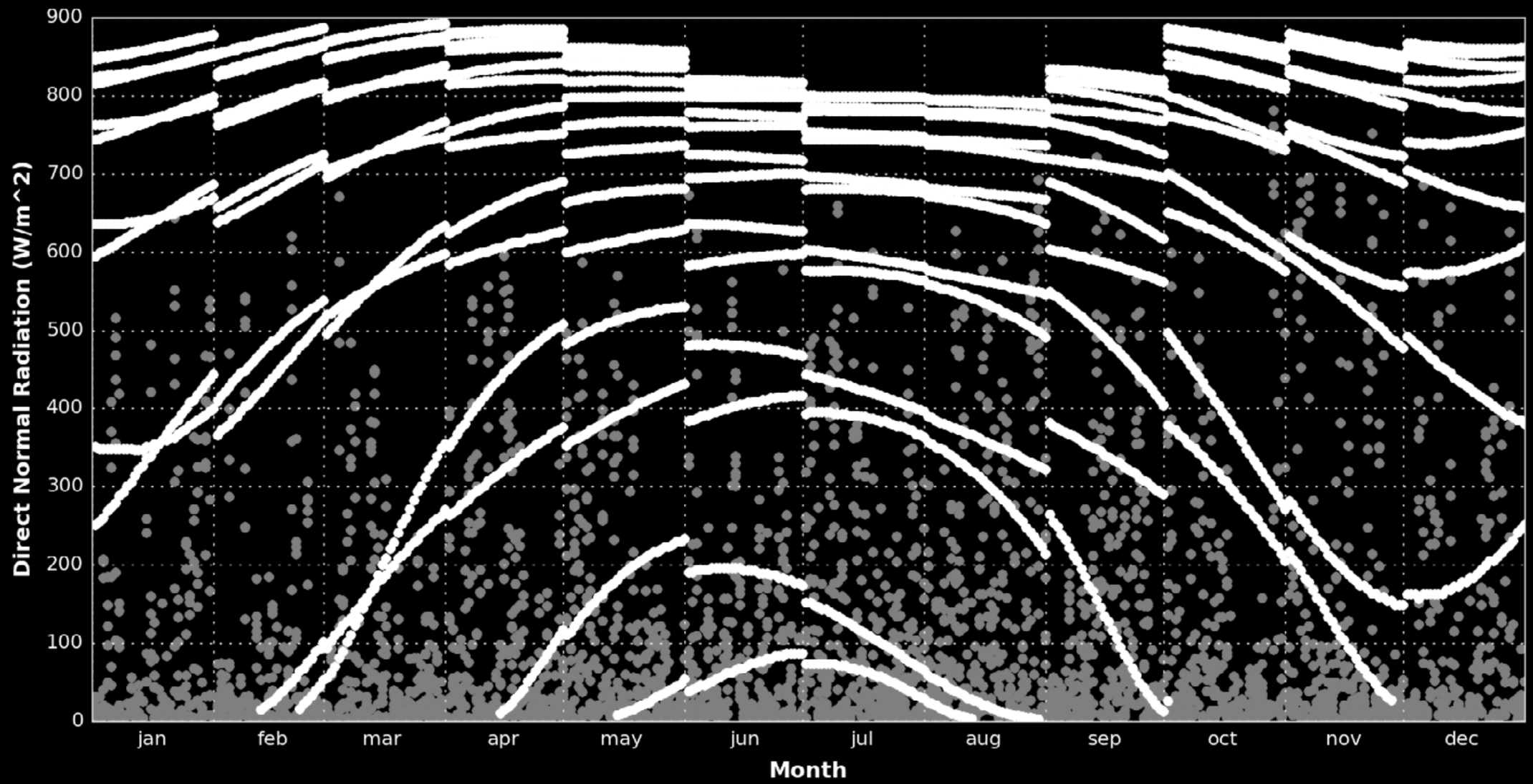


Aerosol Optical Depth

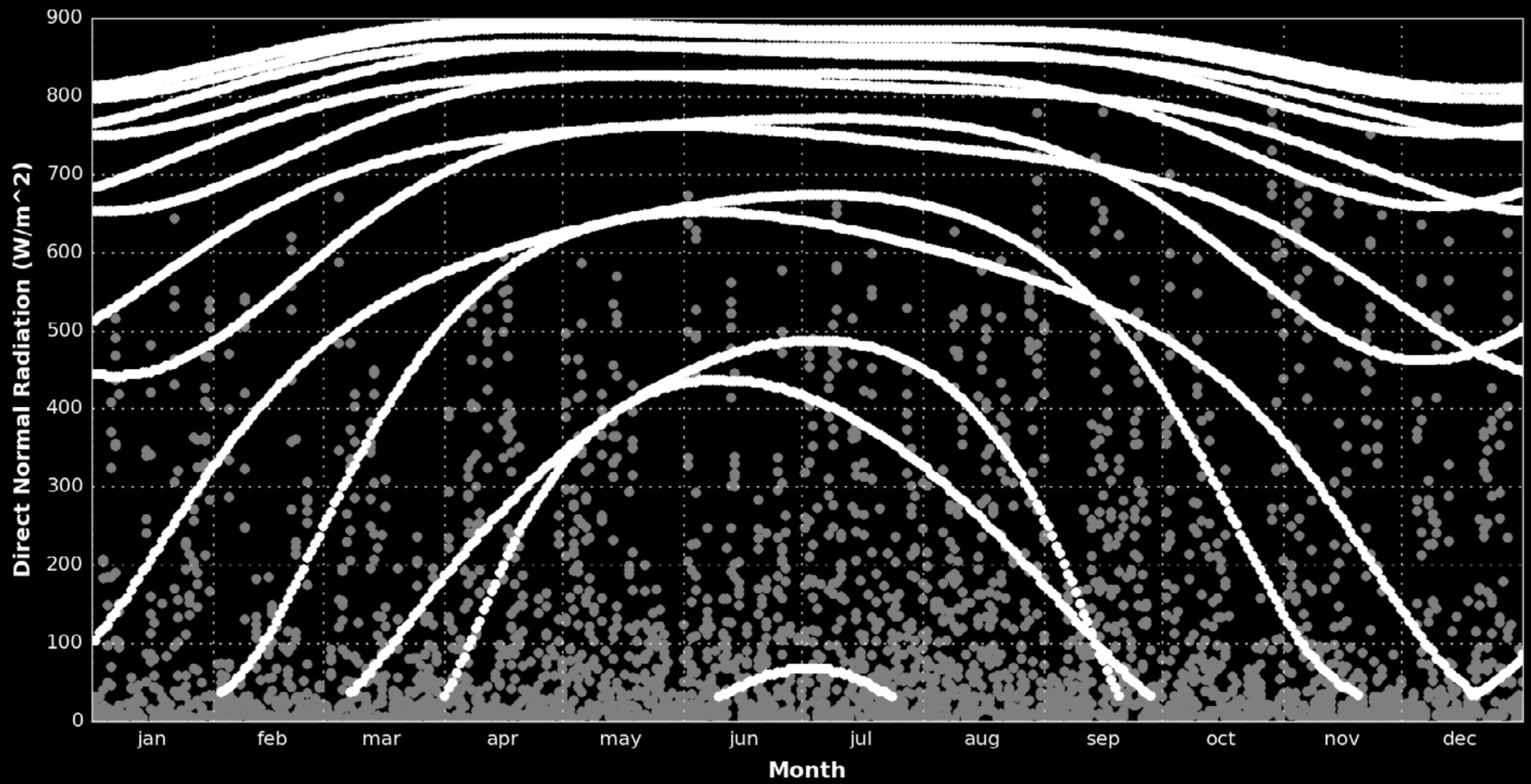


http://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MODAL2_M_AER_OD

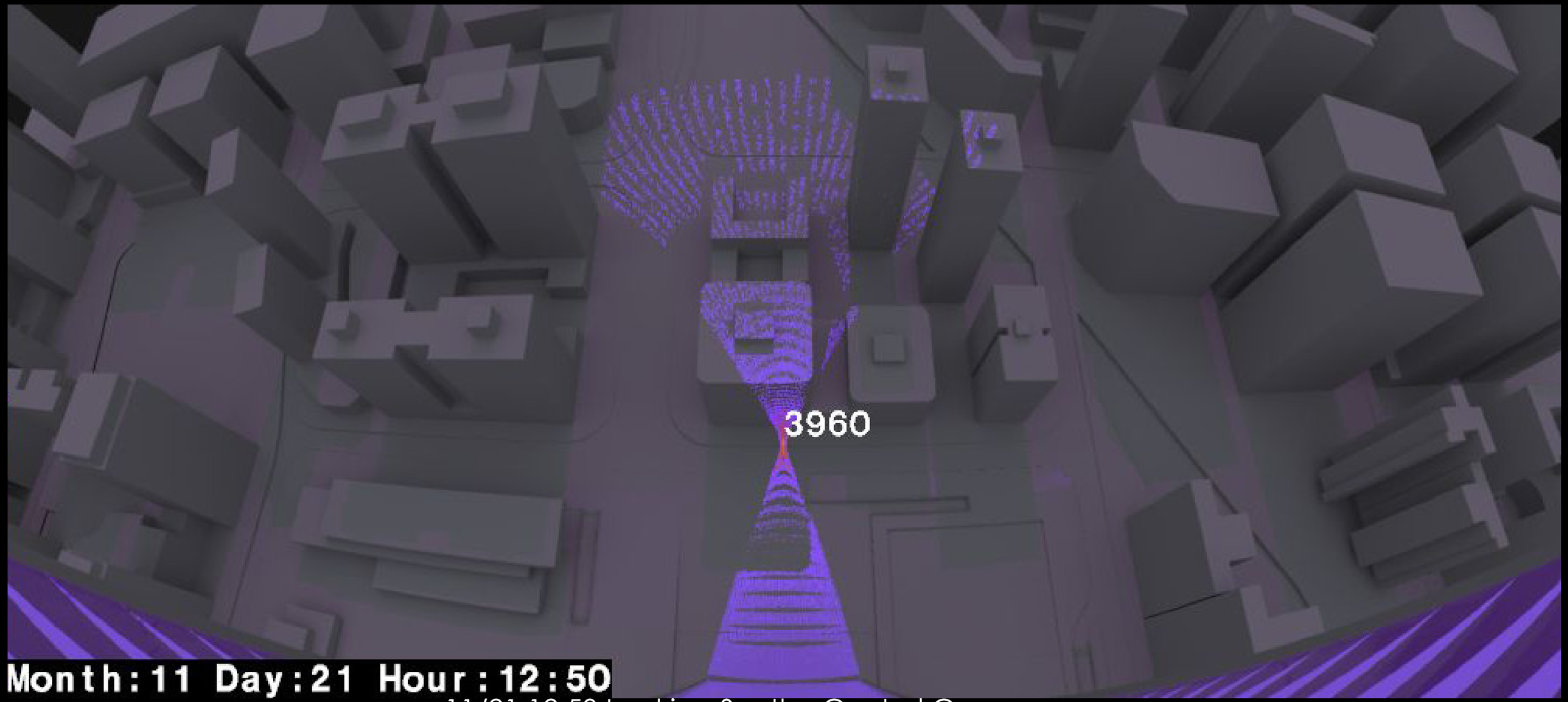
Direct Normal :: ASHRAE clear sky :: Houston



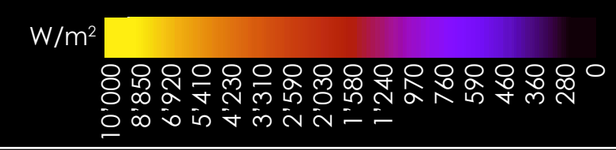
Direct Normal :: ASHRAE clear sky :: Modified Site Condition



Typical Convergence Events :: Unmodified Clear Skies

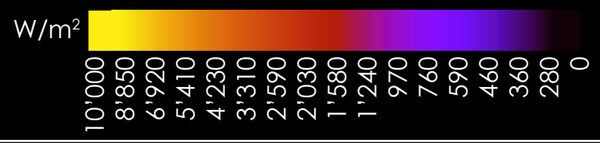


11/21 12:50 Looking South - Central Convergence



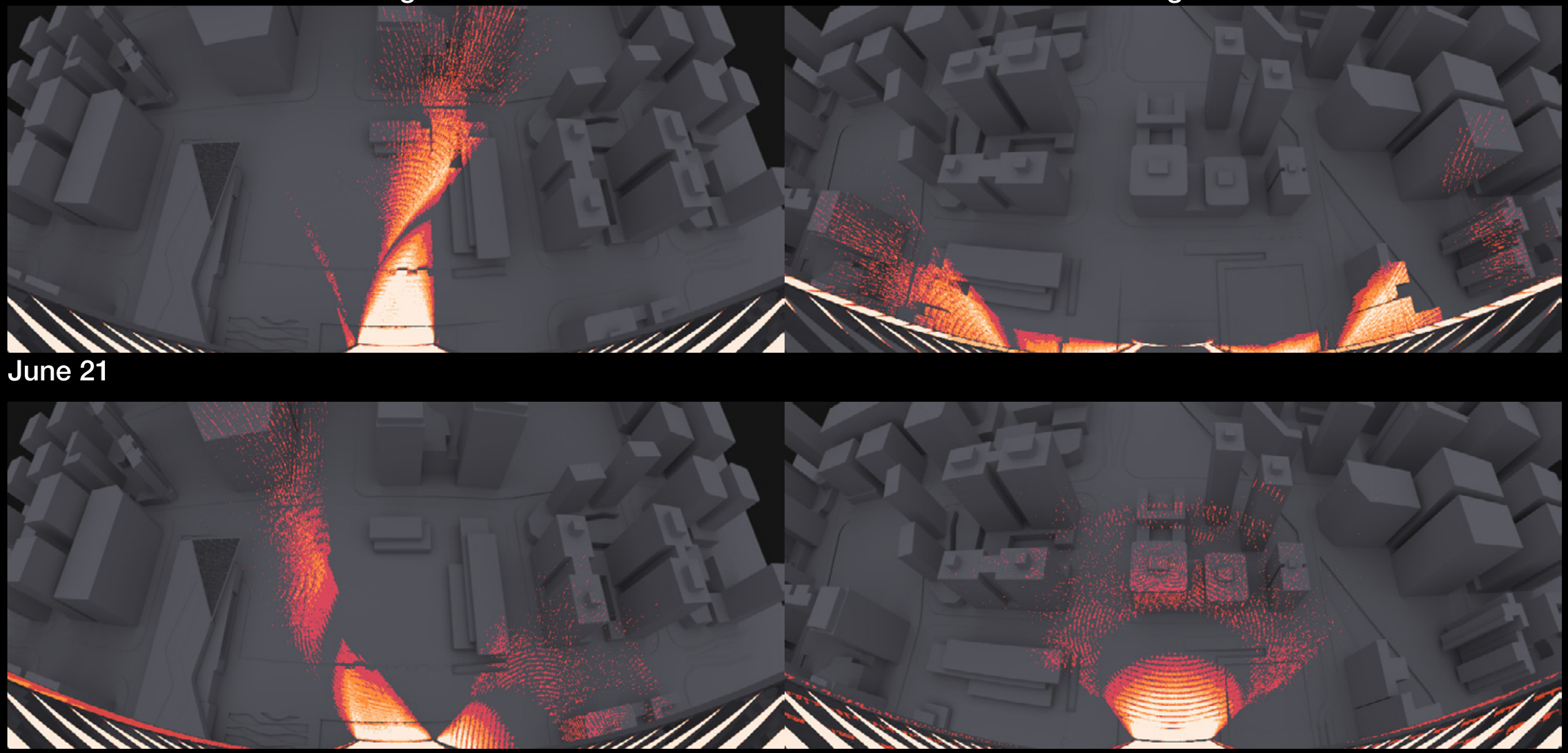
Typical Convergence Events :: Modified Skies

11/21 12:50 Looking South - Central Convergence



Duration of Direct Reflection

Looking East | **Looking South**



June 21

October 21

NOTE: These Images are composites of 10 minute interval frames which show the duration of reflected light on a typical day. Images do not account for intensity.

Hours/Day

2 | 1.5 | 1 | .5 | 0

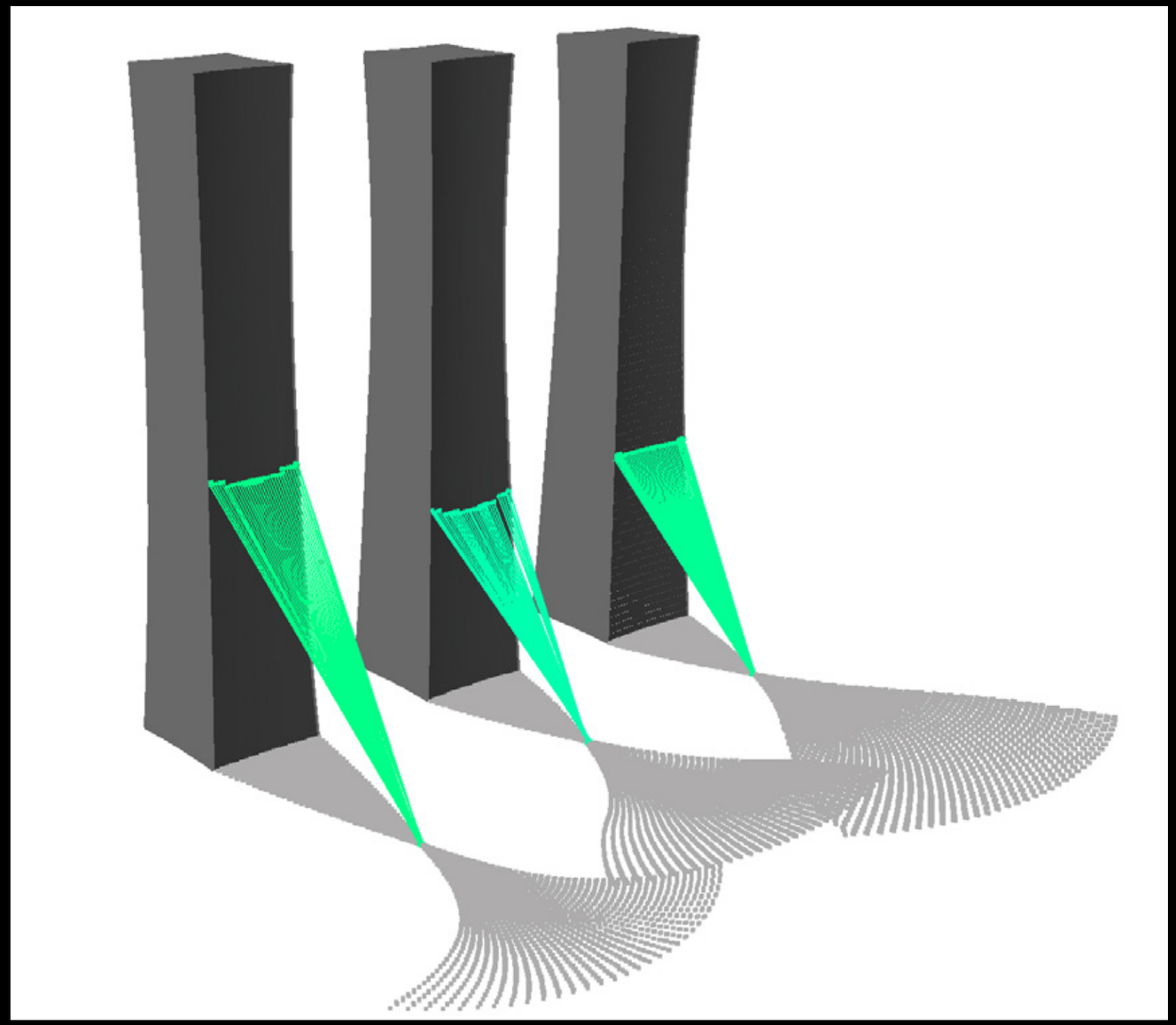
Possible Mitigation Strategies

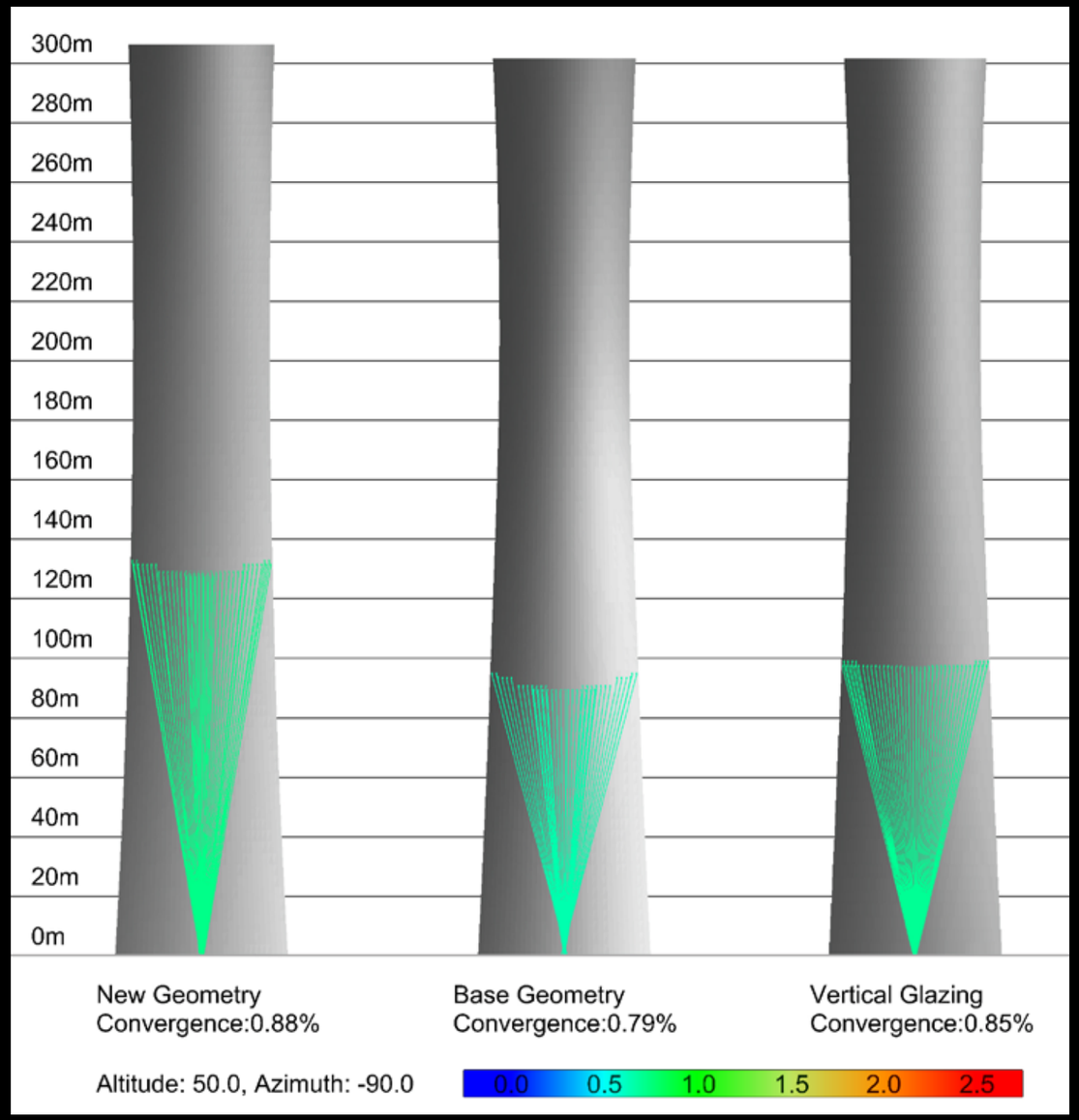
Change Building Form

Manipulate Facade - Change Glass Orientation

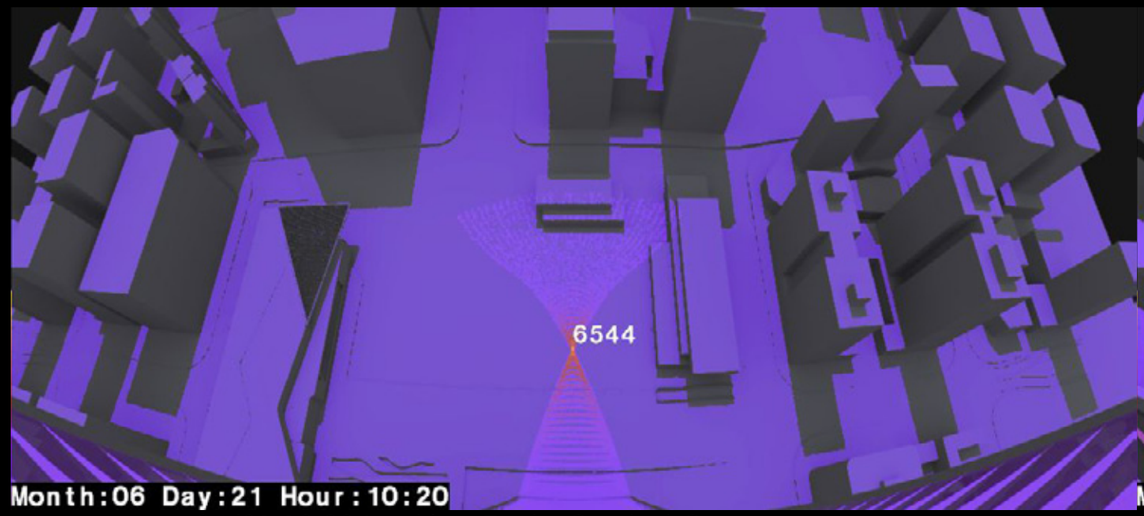
Change Glass Type - Lower Total Solar Reflectance

Adjust Exterior Shading

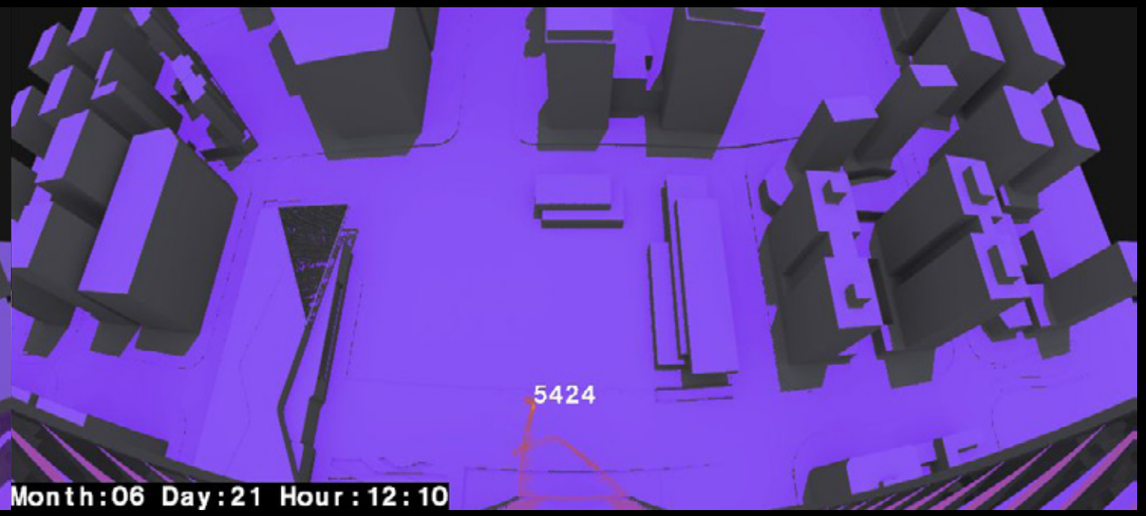



300m
280m
260m
240m
220m
200m
180m
160m
140m
120m
100m
80m
60m
40m
20m
0m
New Geometry
Convergence:0.88%
Base Geometry
Convergence:0.79%
Vertical Glazing
Convergence:0.85%
Altitude: 50.0, Azimuth: -90.0
0.0
0.5
1.0
1.5
2.0
2.5

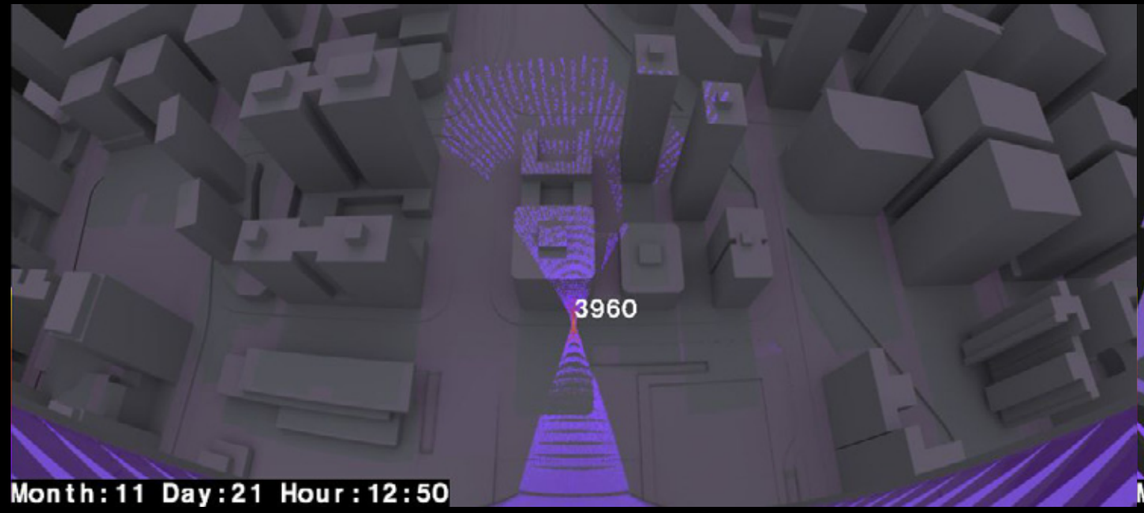
Base Building Form



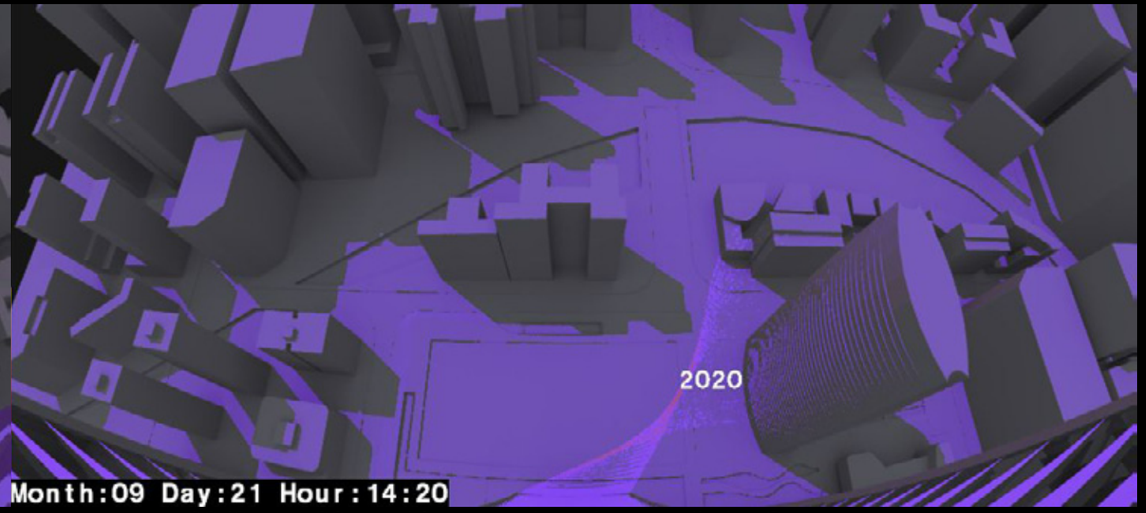
06/21 10:20 Looking East - Central Convergence



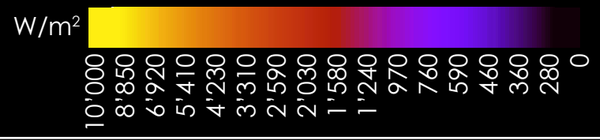
06/21 12:10 Looking East - Edge Convergence



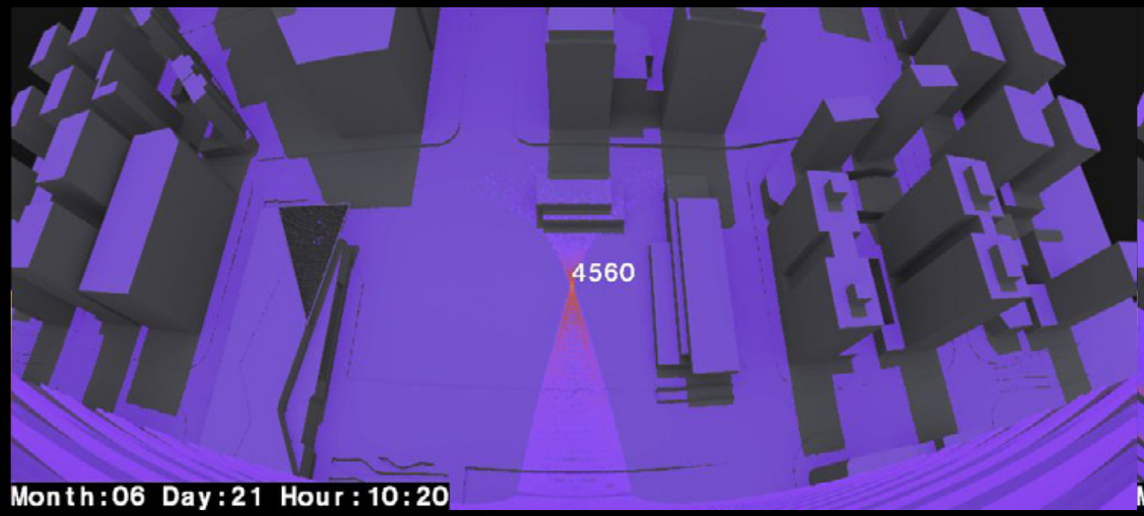
11/21 12:50 Looking South - Central Convergence



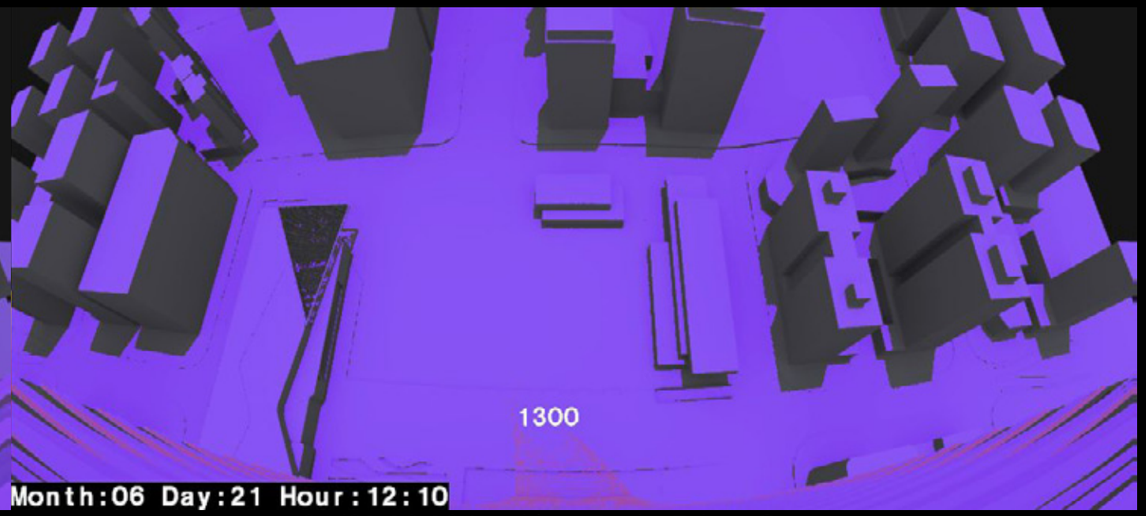
09/21 14:20 Looking West - Intermediate Convergence



Modified Building Form 1

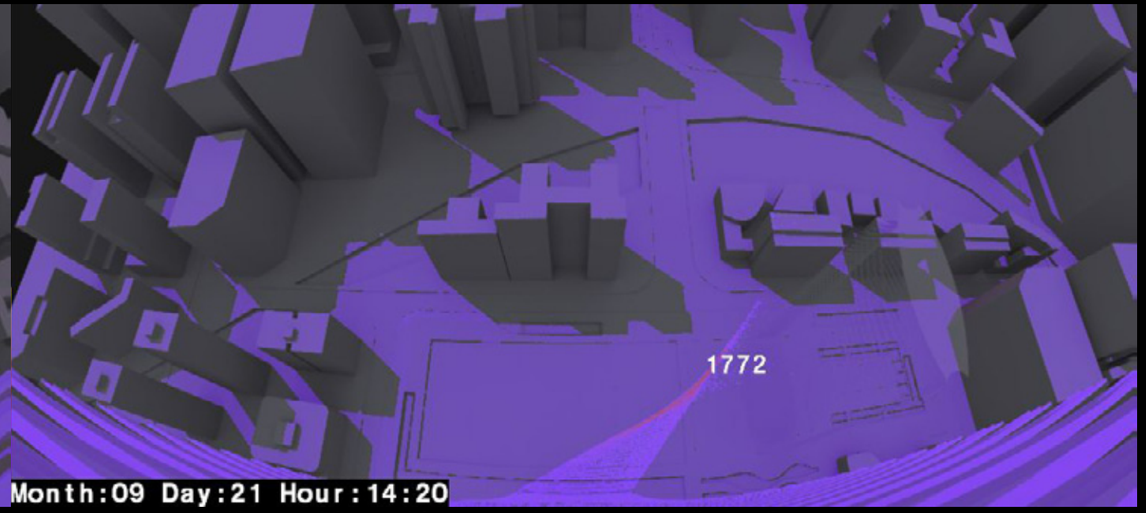


06/21 10:20 Looking East - Central Convergence

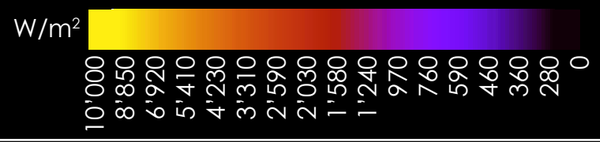


06/21 12:10 Looking East - Edge Convergence

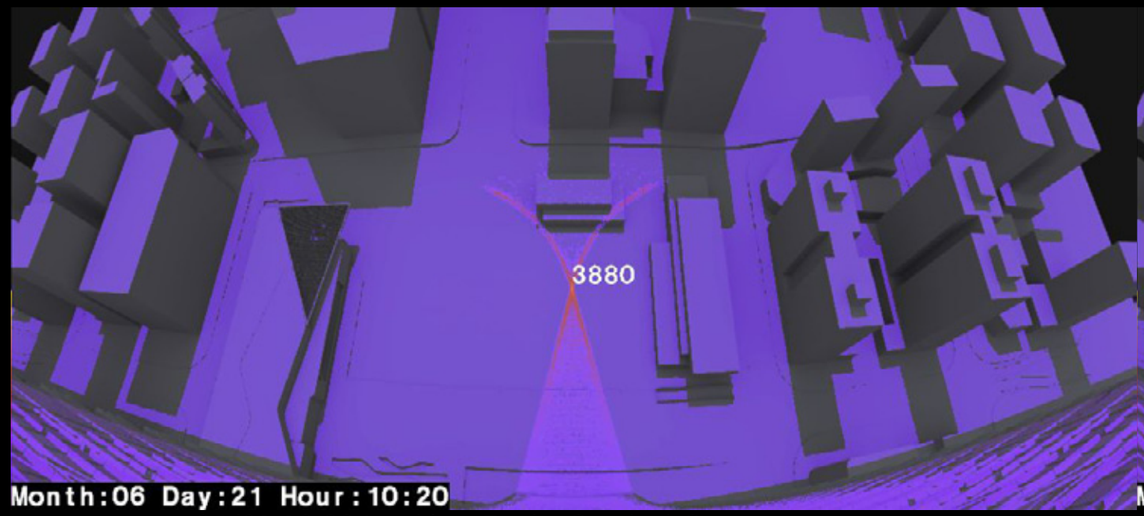
11/21 12:50 Looking South - Central Convergence



09/21 14:20 Looking West - Intermediate Convergence



Modified Building Form 2



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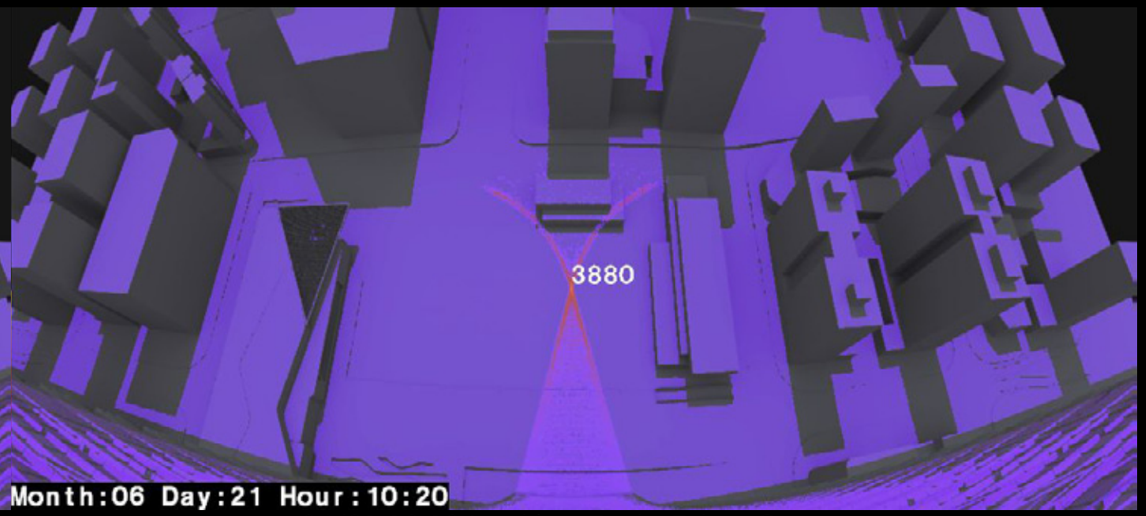

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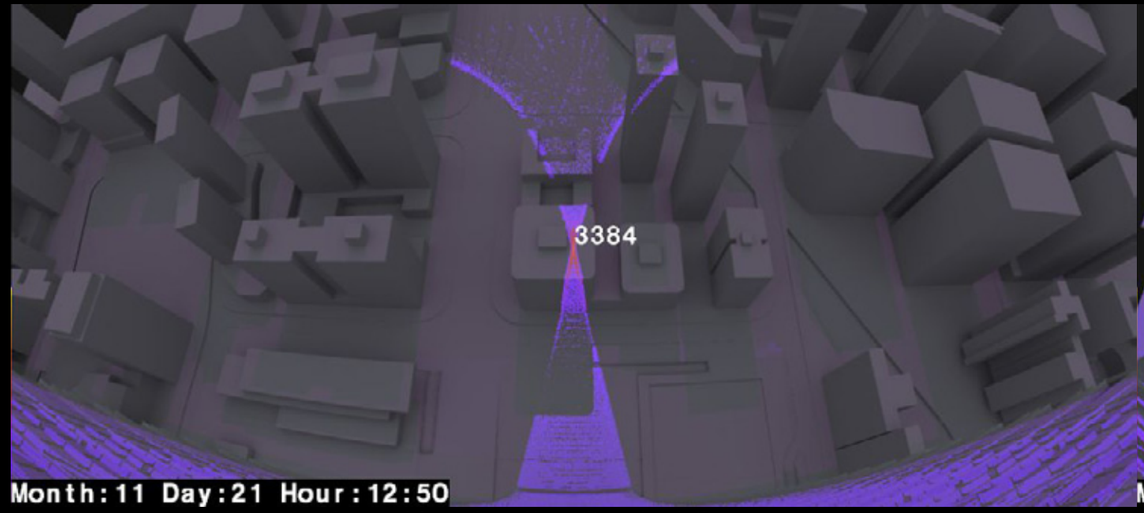

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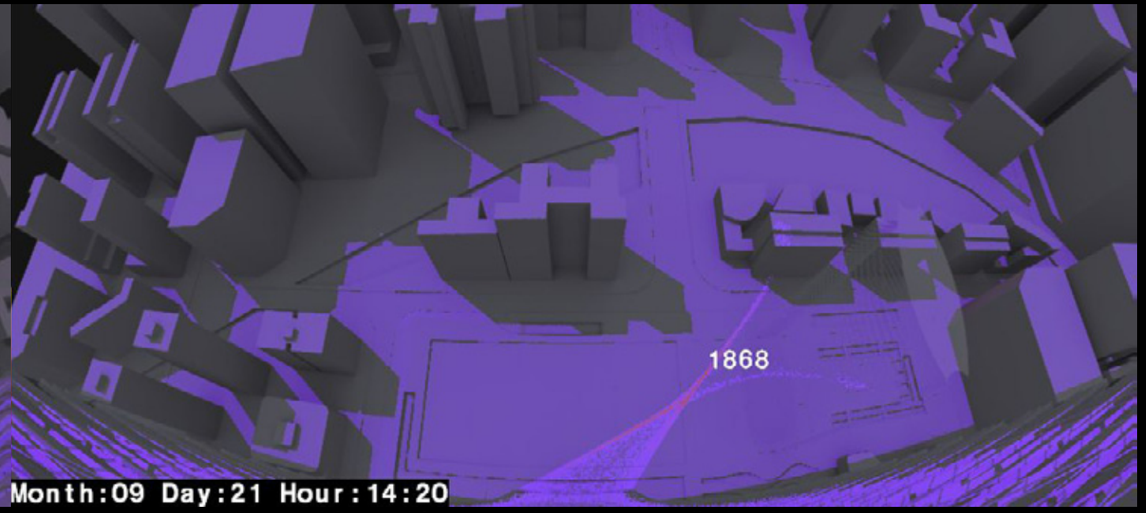
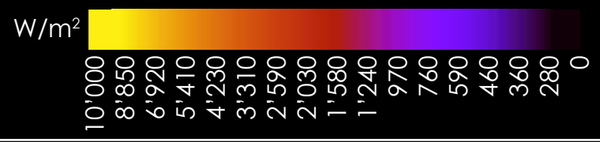
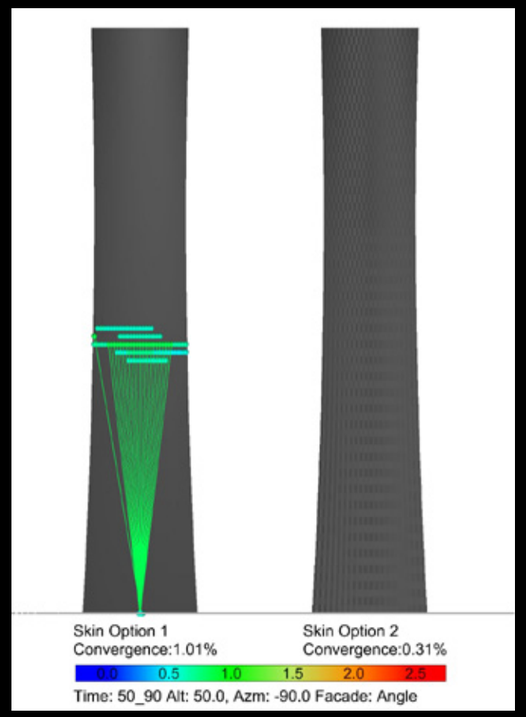


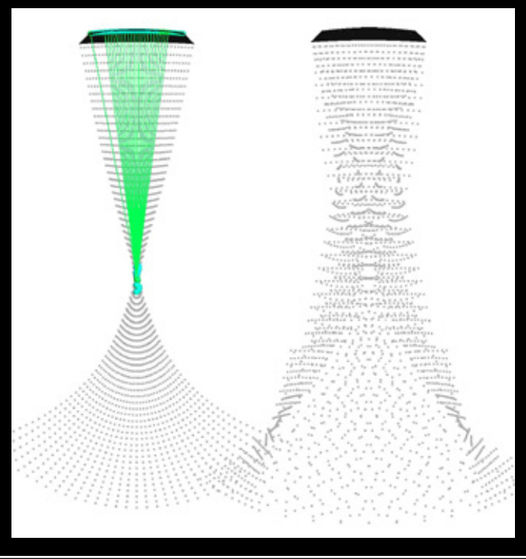
09/21 14:20 Looking West - Intermediate Convergence



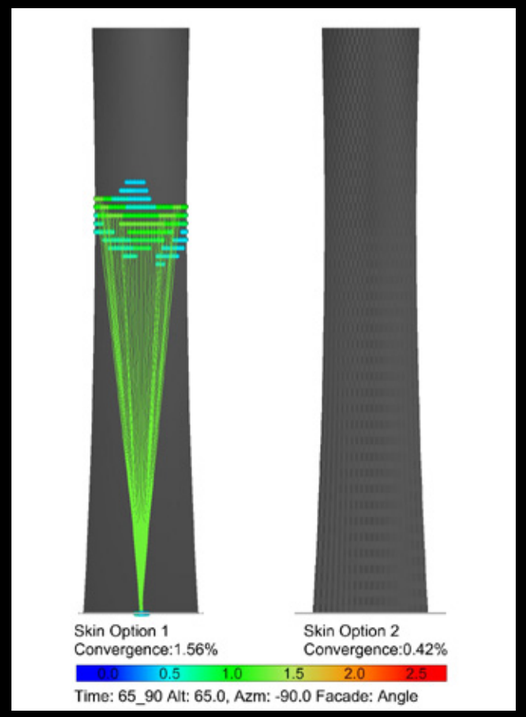
Facade Manipulation :: Base Option ‘A’ :: Varied Glass Normals ‘B’

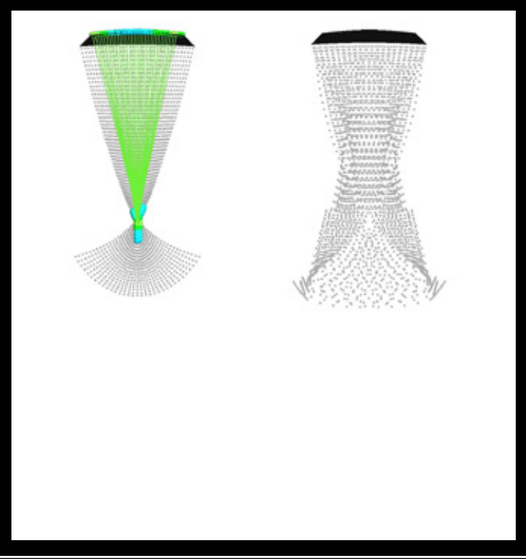
Alt: 60, Azm: 0 — A B



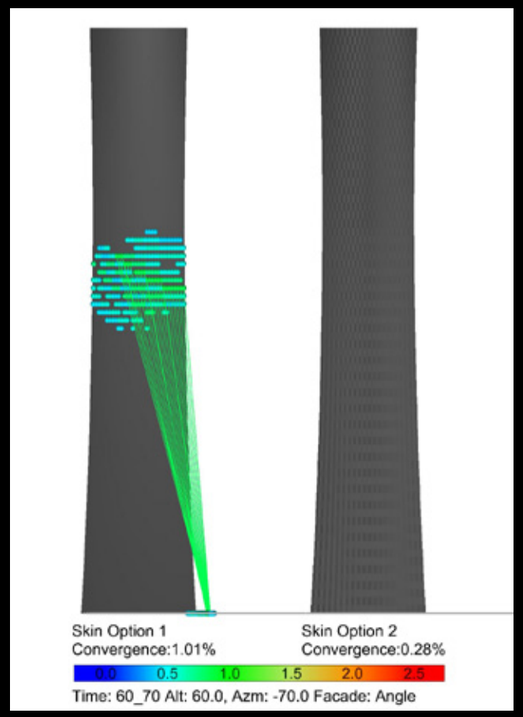


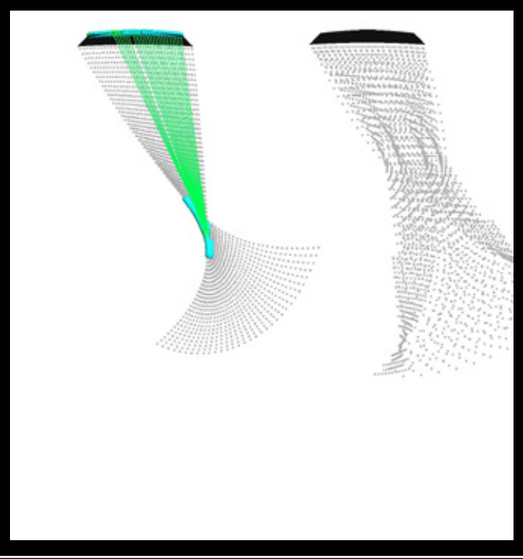
Alt: 65, Azm: 0 — A B



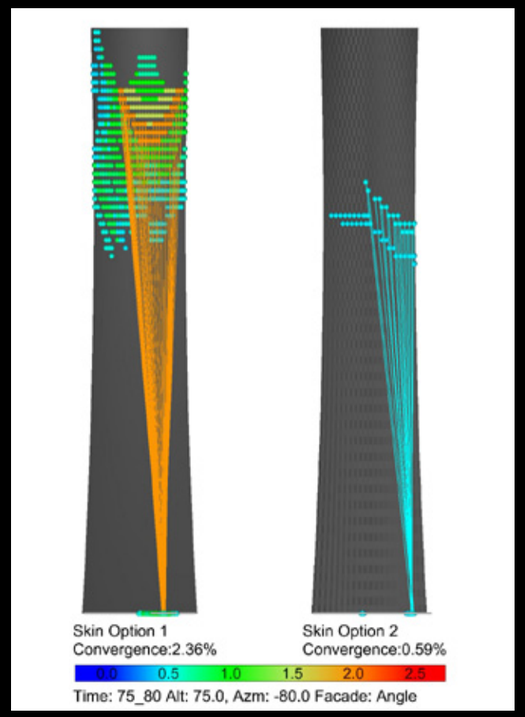


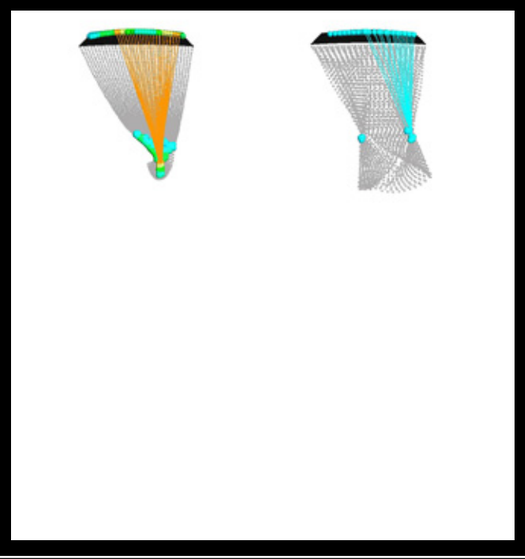
Alt: 60, Azm: 20 — A B



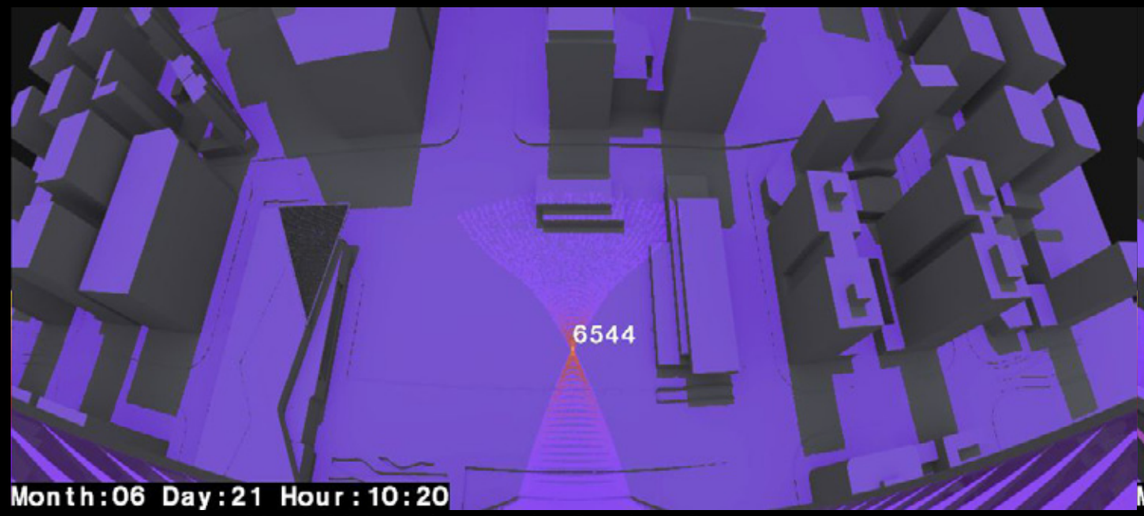


Alt: 75, Azm: 10 — A B

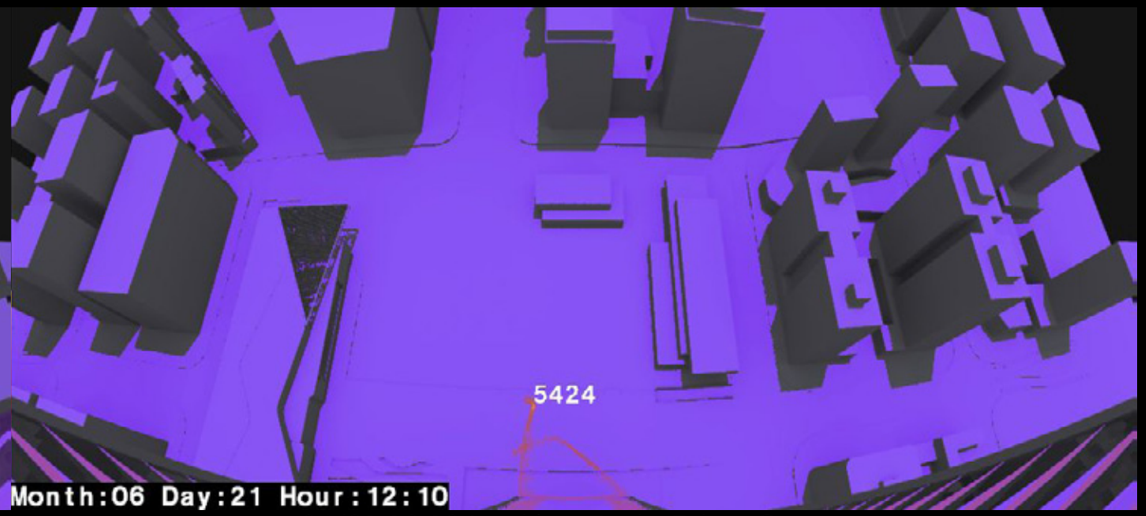




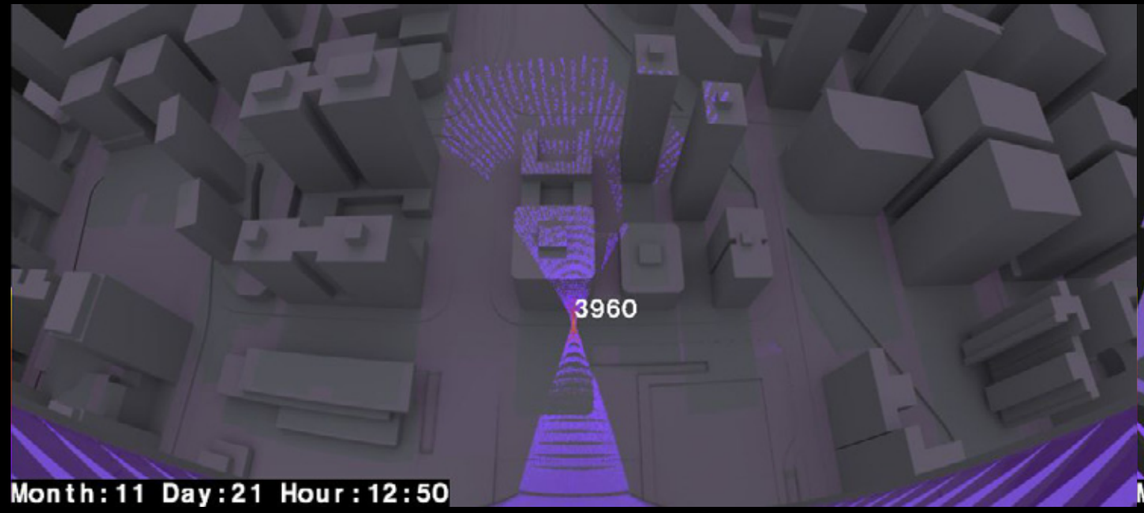
Glass Follows Building Form ('A')



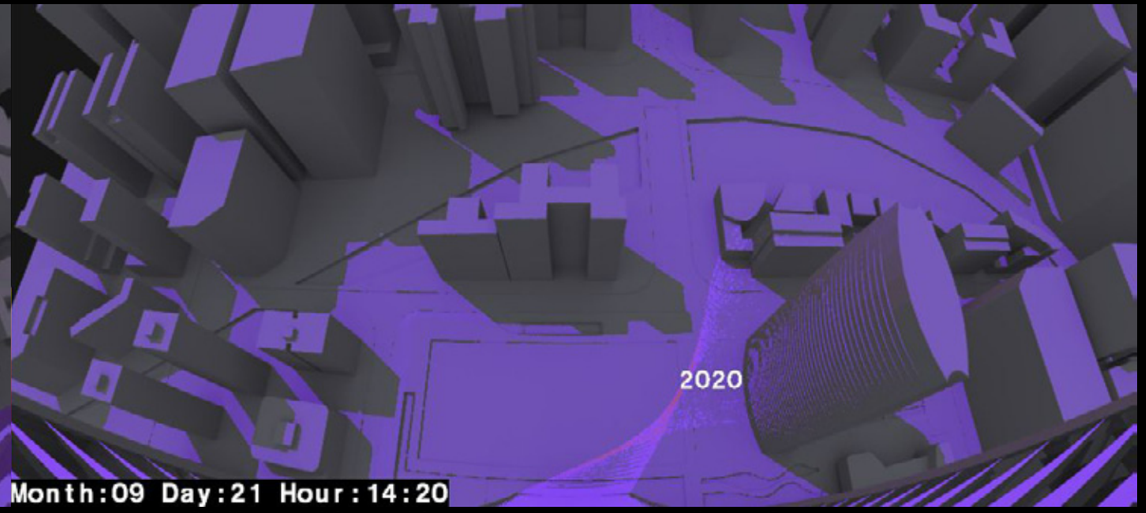
06/21 10:20 Looking East - Central Convergence



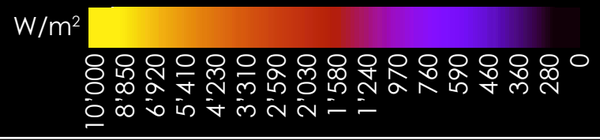
06/21 12:10 Looking East - Edge Convergence



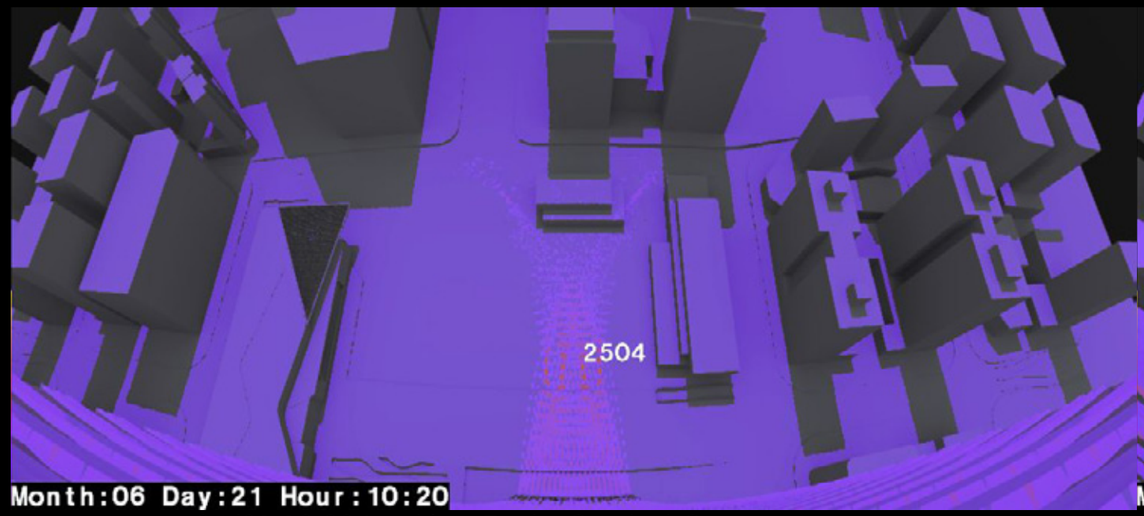
11/21 12:50 Looking South - Central Convergence



09/21 14:20 Looking West - Intermediate Convergence



Manipulated Glazing ('B')



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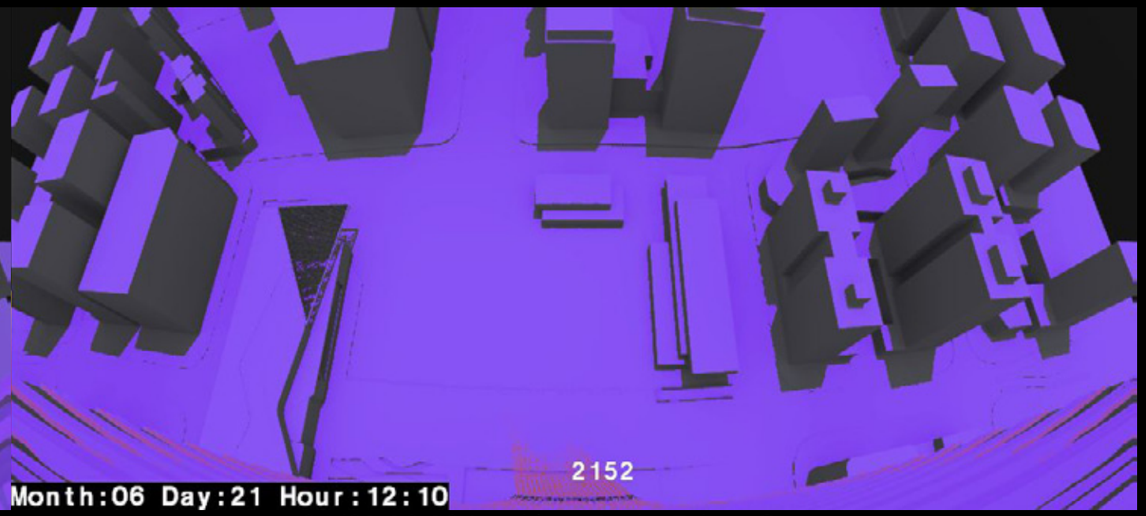

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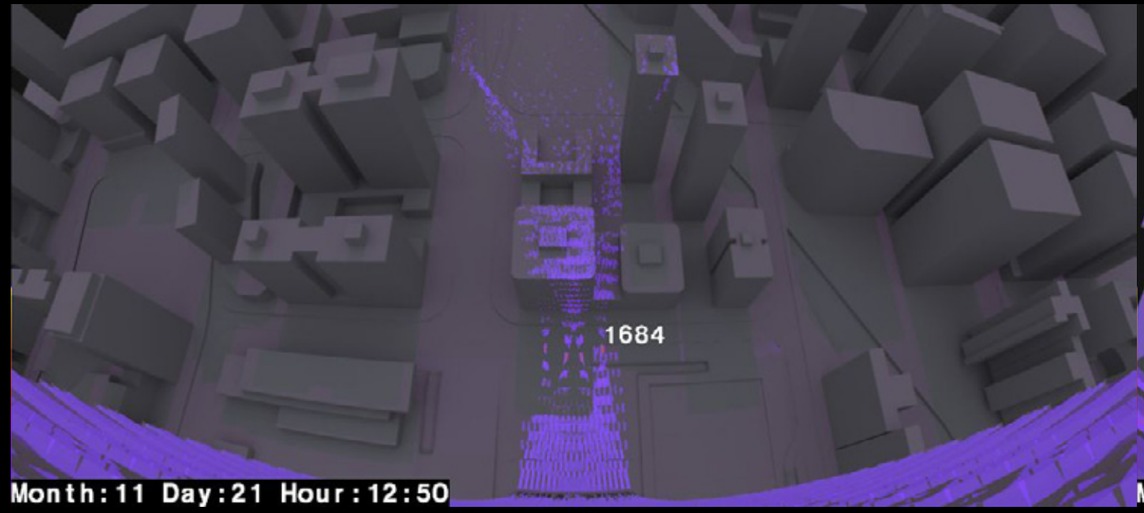
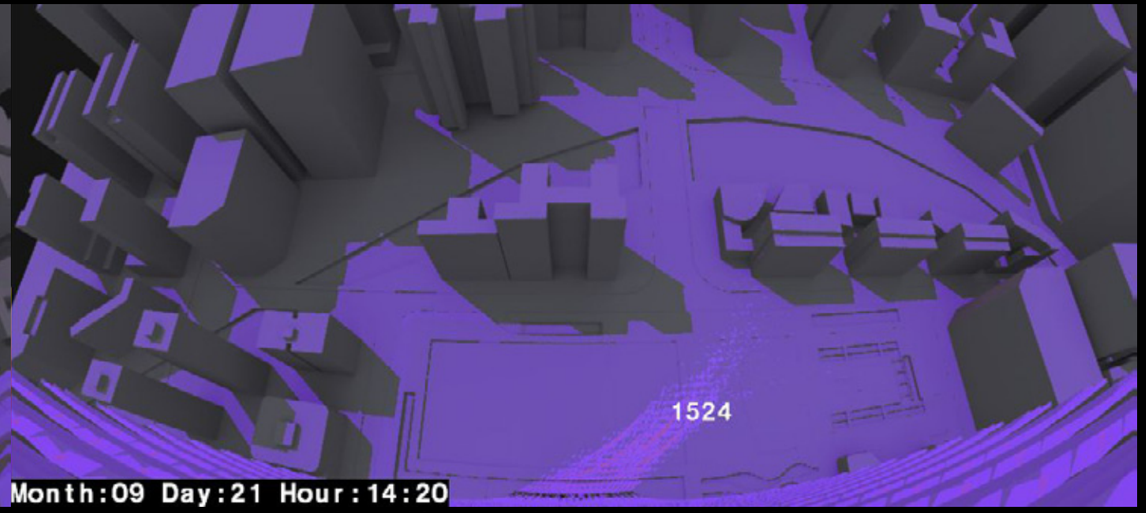
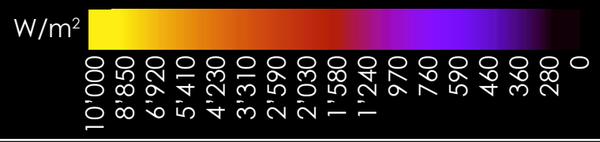


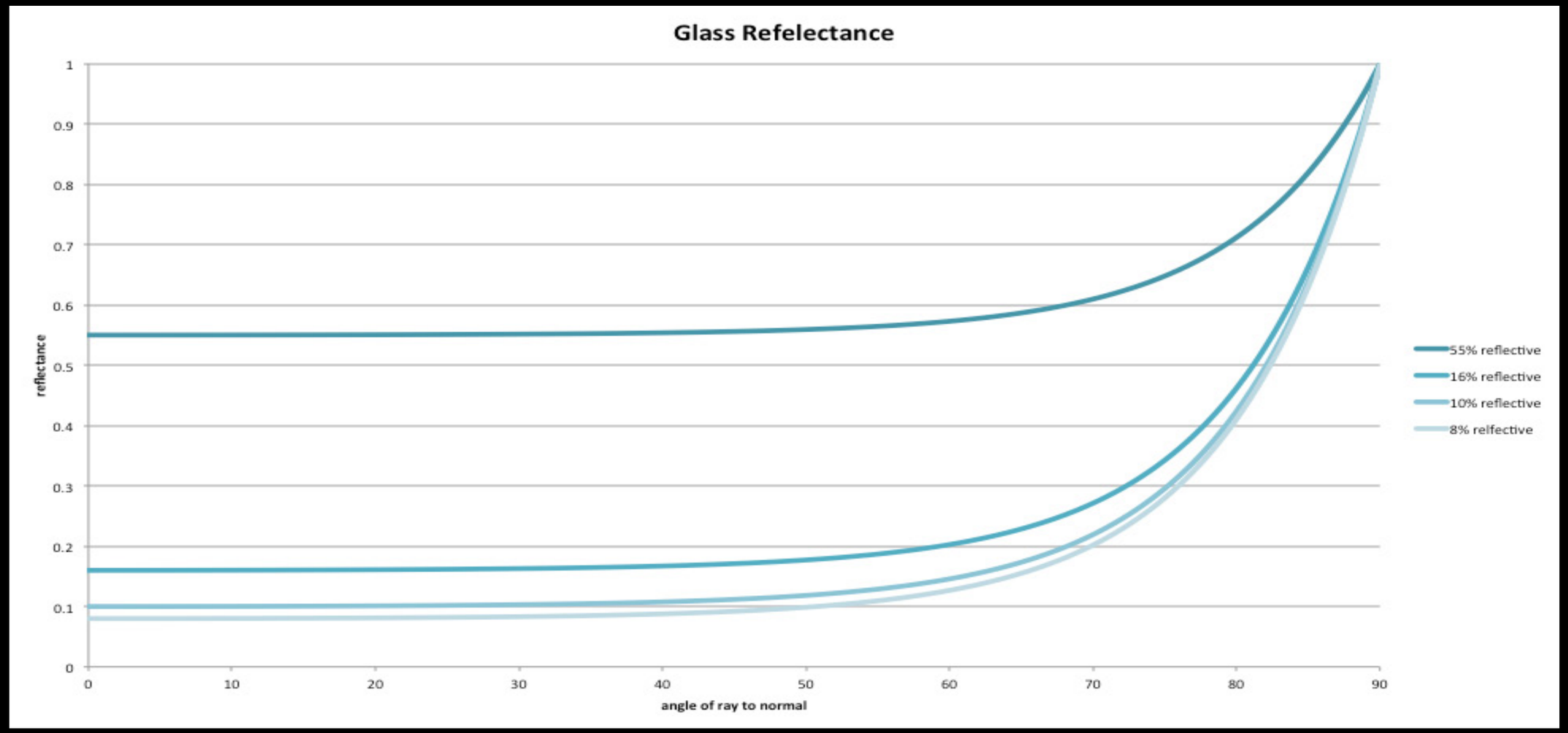
11/21 12:50 Looking South - Central Convergence



09/21 14:20 Looking West - Intermediate Convergence



Glass Reflectance :: Angle of Incidence

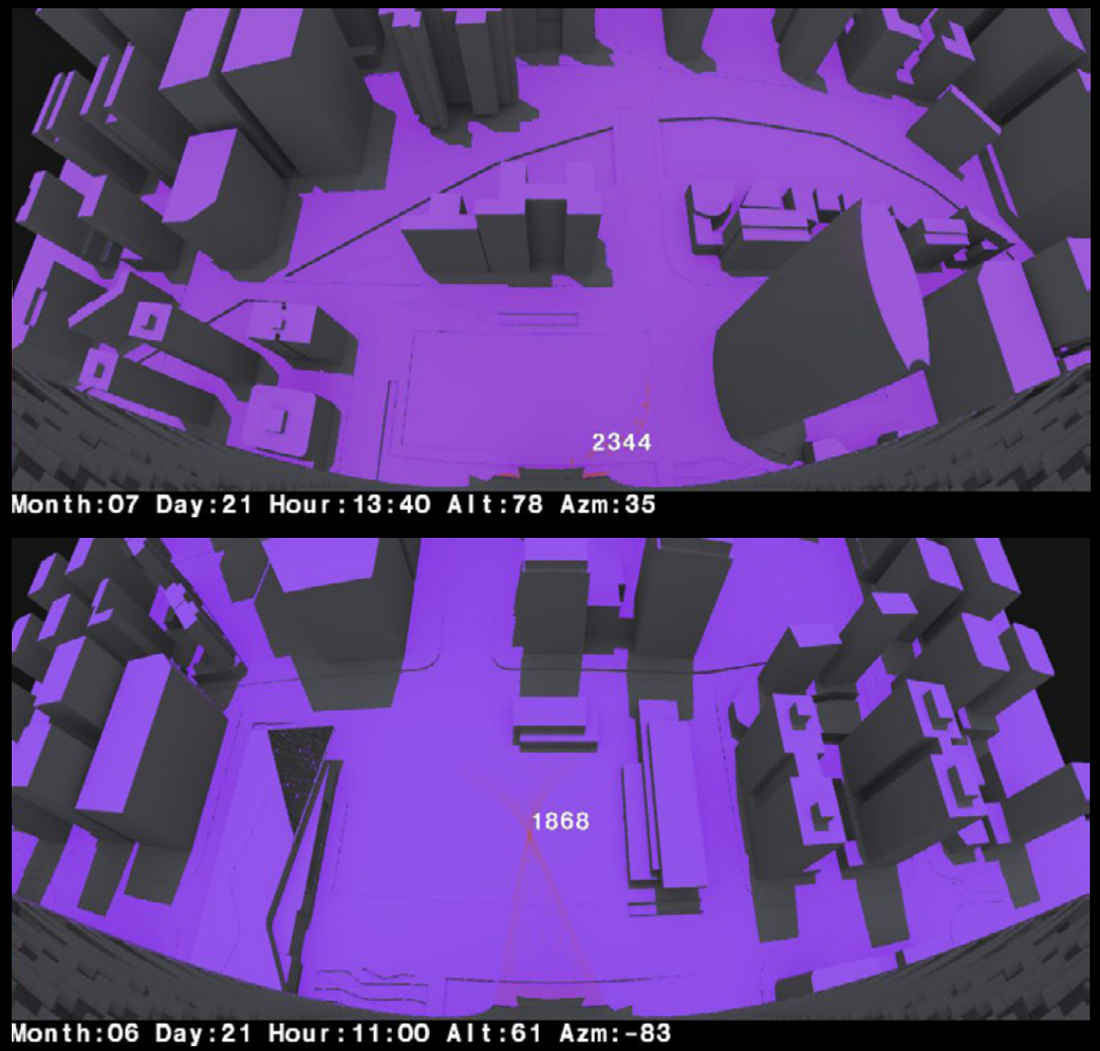


Original Glass:
VNE16-63: Starphire, **55% !!!** reflective of total Solar Energy

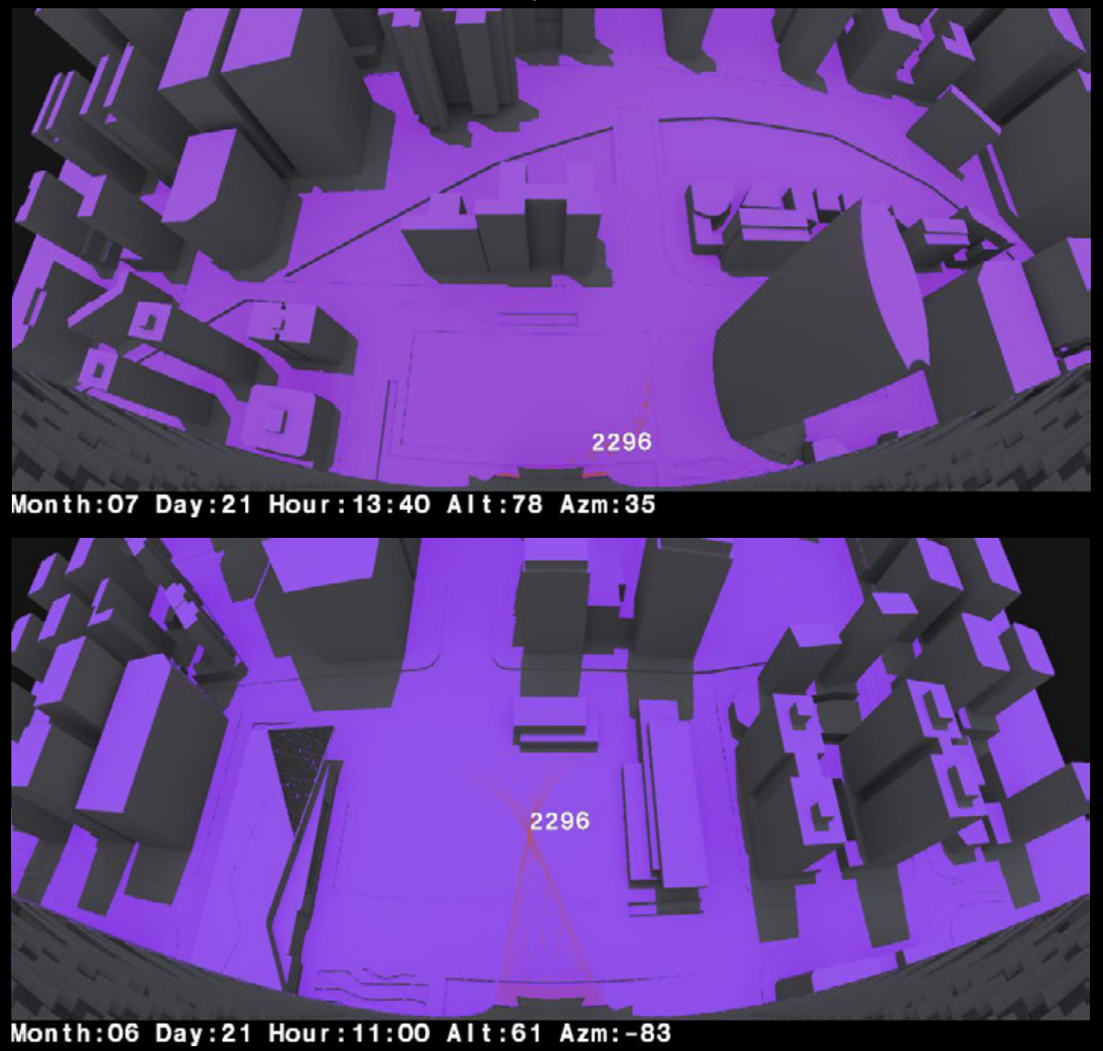
Glass Types:
VE11-2M: Blue, 8% reflective of total solar energy
VE2-2M: Green, 10% reflective of total solar energy
VE19-2M: Grey, 16% reflective of total solar energy

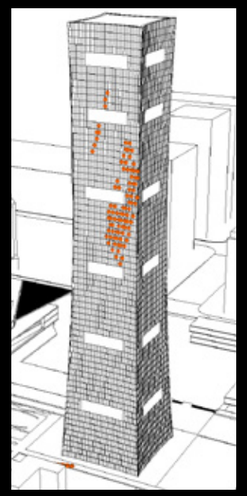
Glass Reflectance :: Angle of Incidence

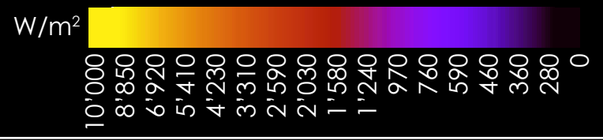
VE2-2M: Green, 10% reflective



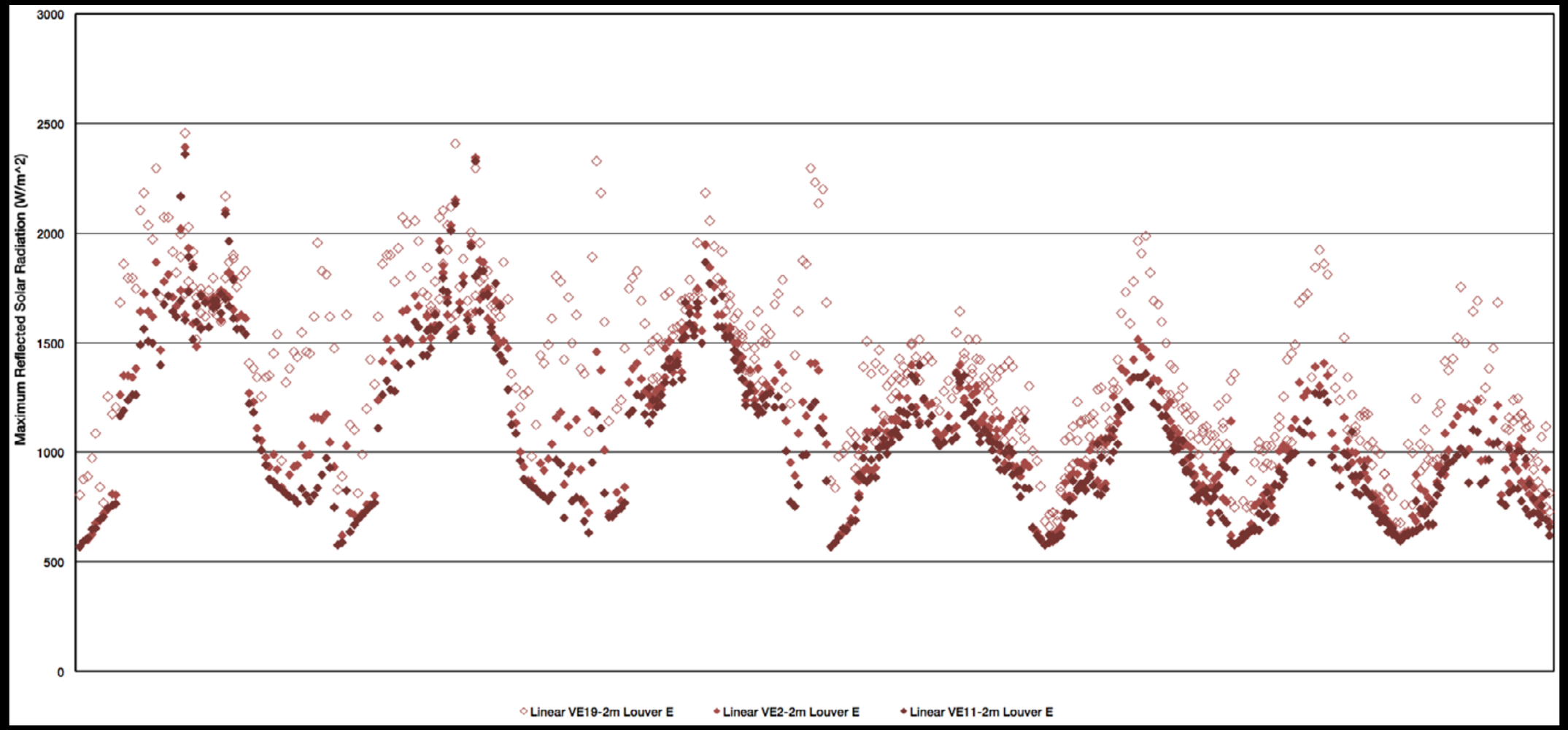
VE19-2M: Grey, 16% reflective







Glass Type



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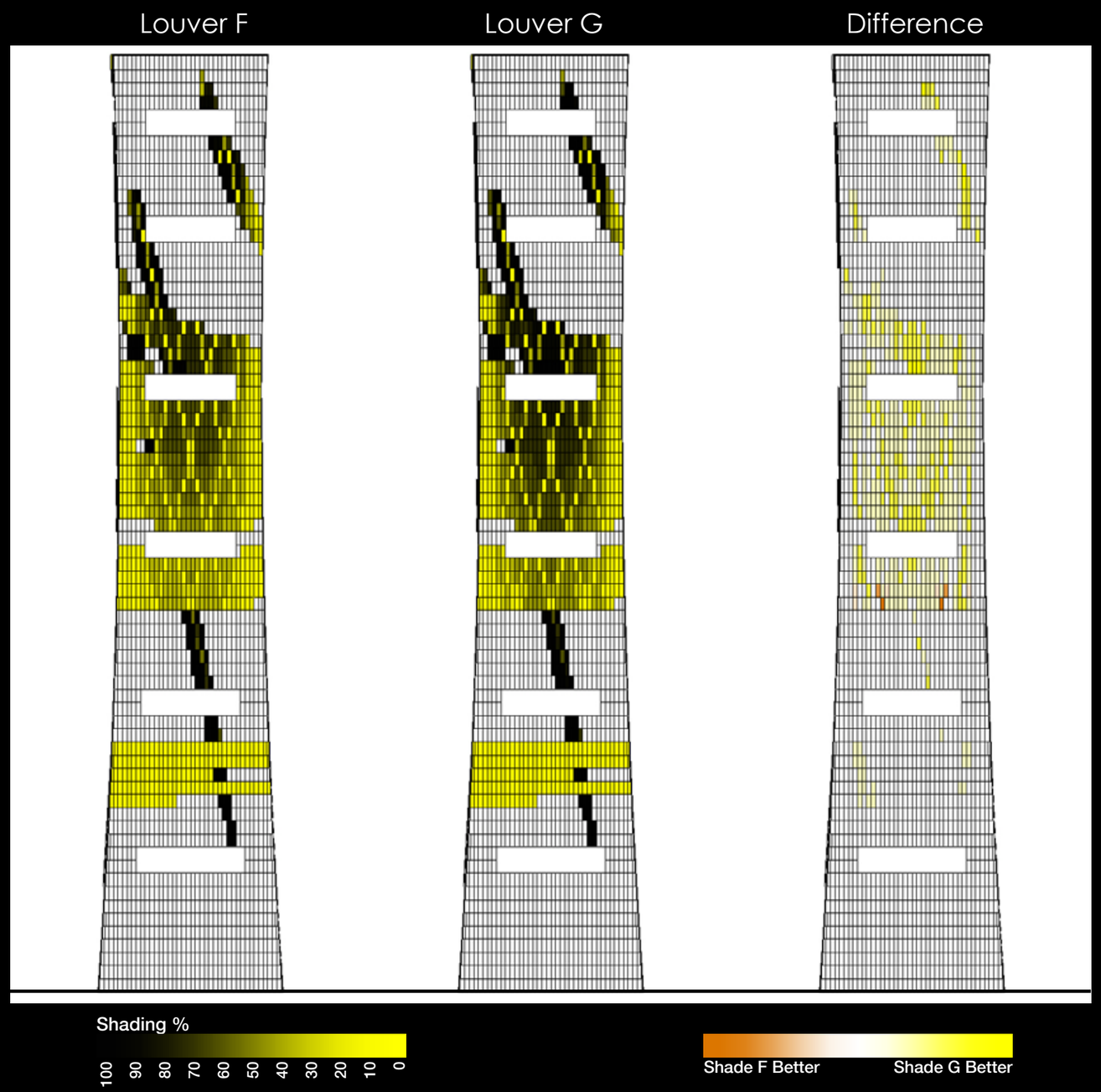
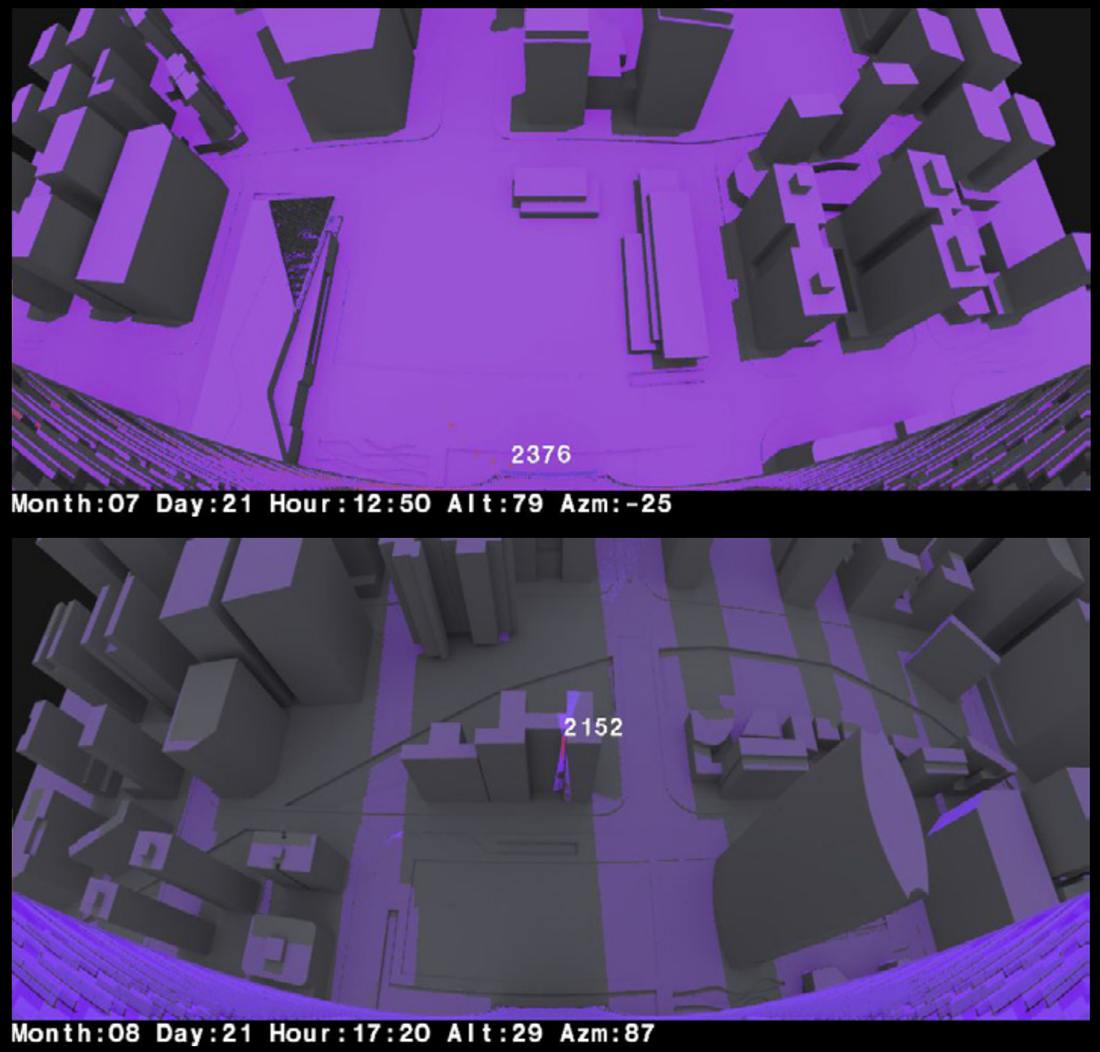
Shading Effectiveness

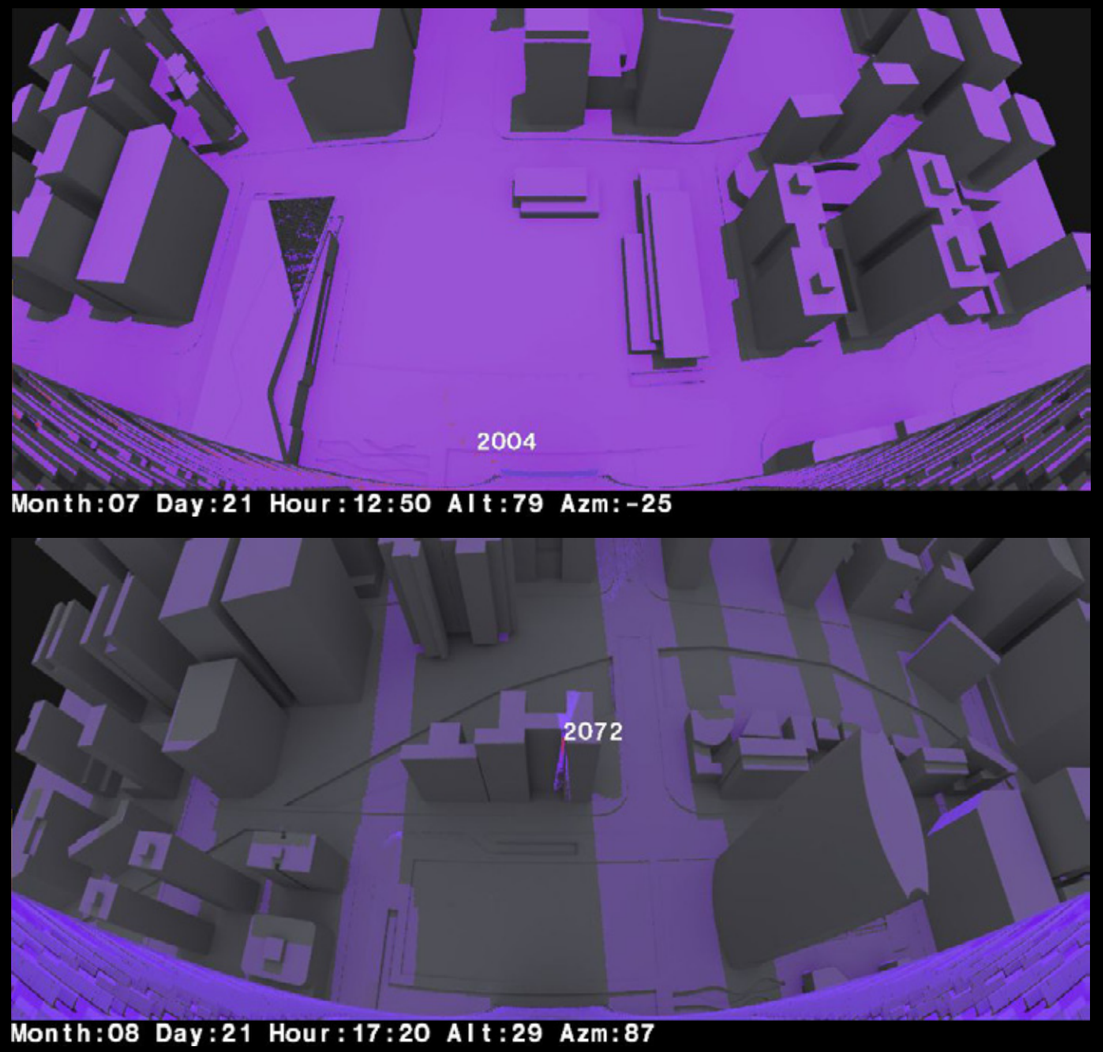


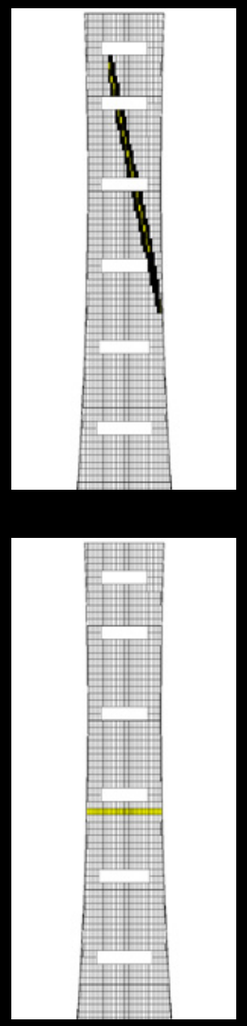
Shading Effectiveness

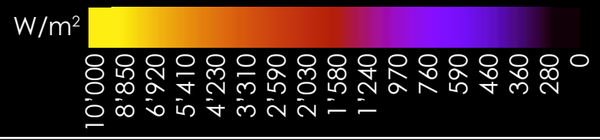
Louver F



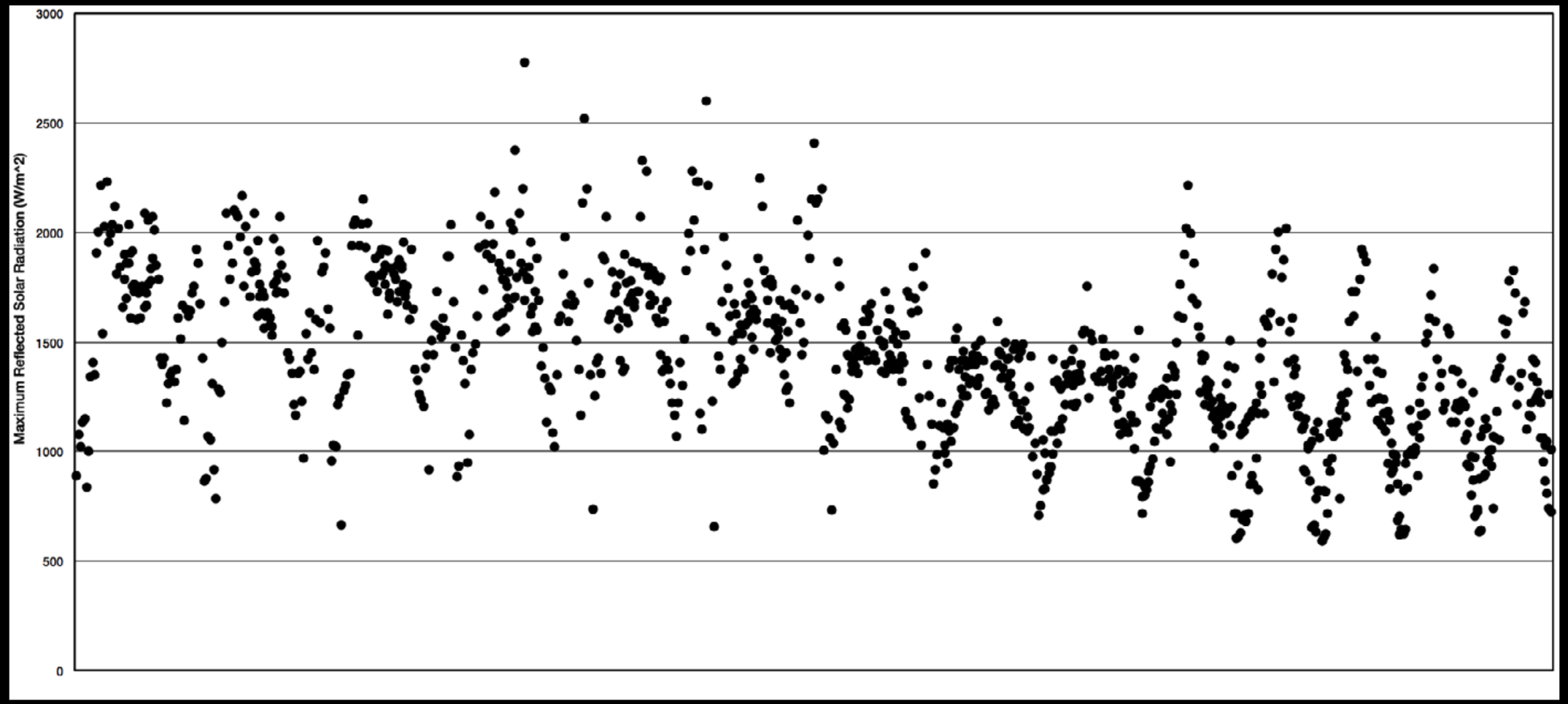
Louver G



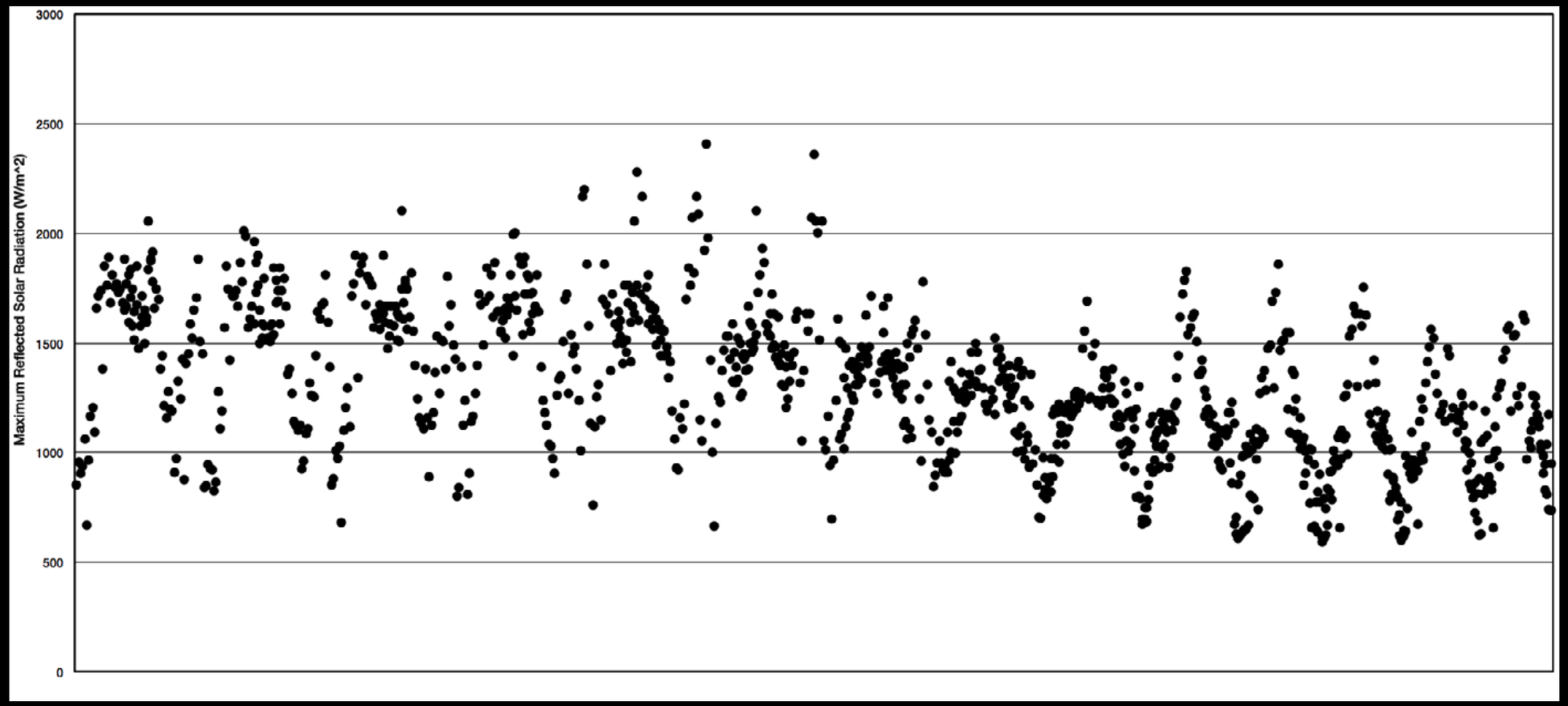
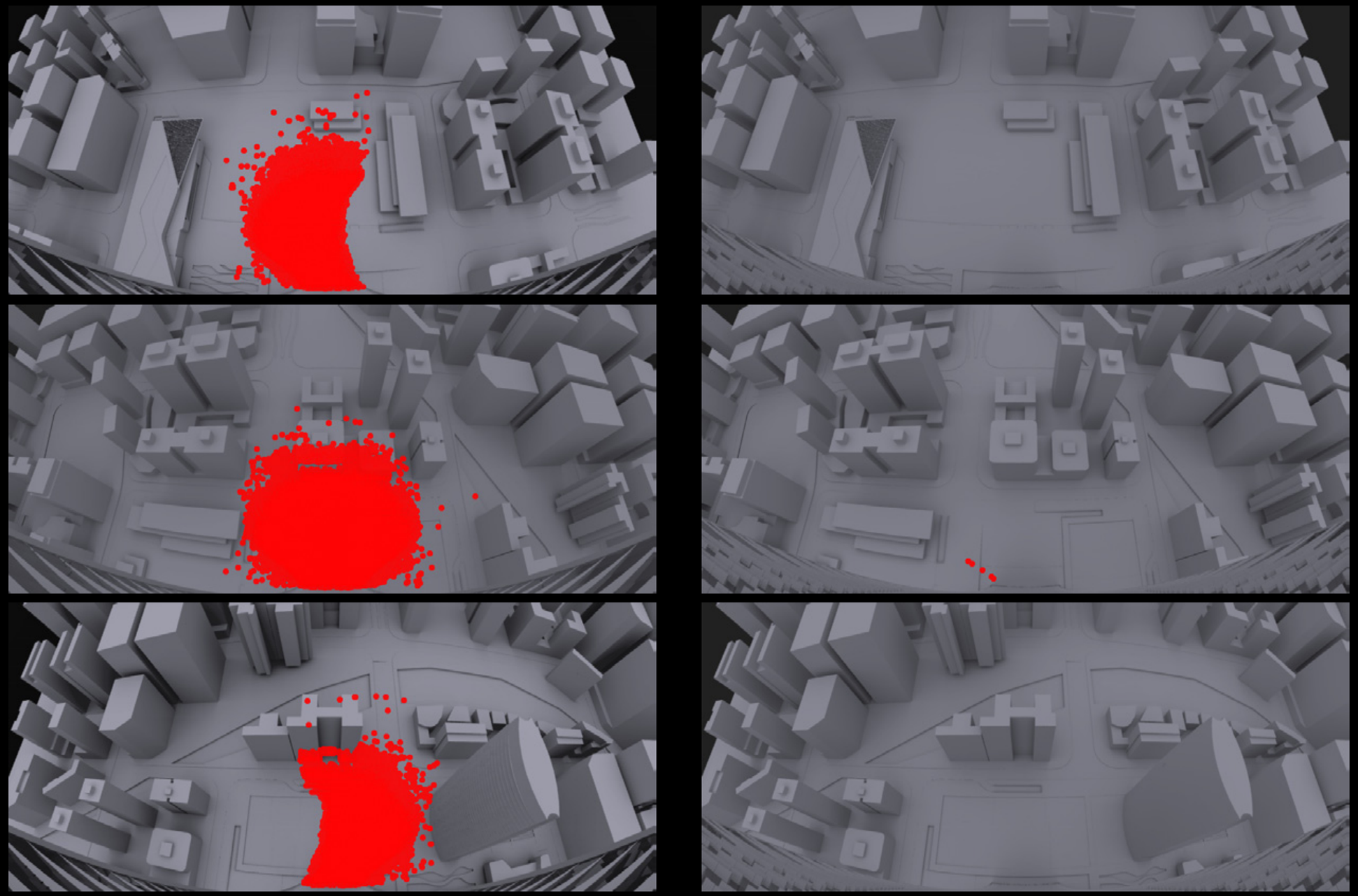




Shading Effectiveness :: Louver F



Shading Effectiveness :: Louver G



Final Results :: Locations Abve 2000 W/m^2