



The International Year of Astronomy and



Connie Walker

The National Optical Astronomy Observatory



GLOBE @ Night Partners



NOAO – National Optical
Astronomy Observatory
(Tucson)

GLOBE Project (Boulder)

**International Dark-Sky
Association** (Tucson)

CADIAS – Centro de Apoyo a
la Didáctica de la Astronomía
(Chile)

ESRI – Environmental Systems
Research Institute, Inc
(Boulder)

**Get Out and Observe
the Night Sky!**
February 25 - March 8,
2008

Engage students worldwide in
observing the nighttime sky

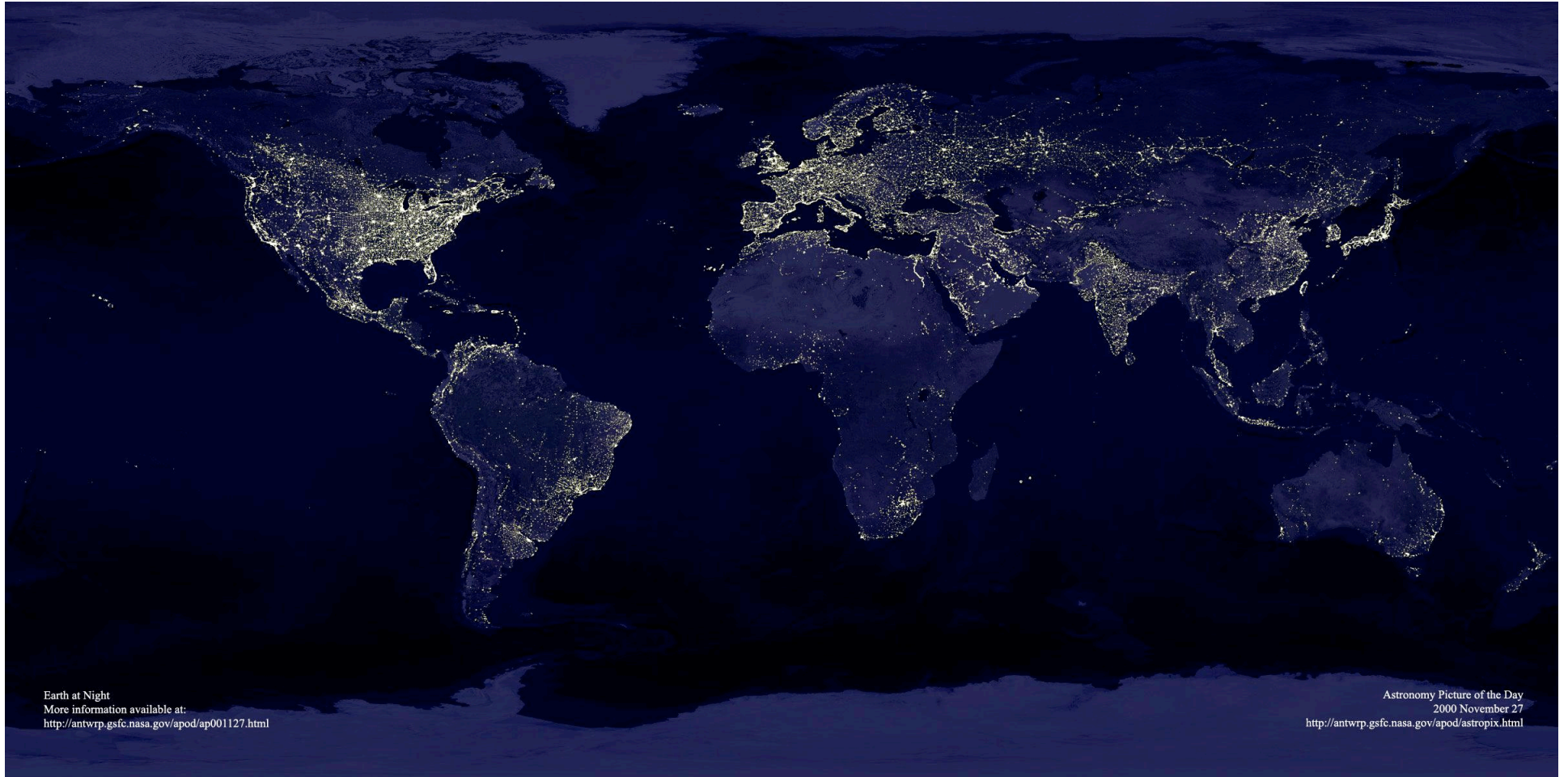
Encourage citizen and family
science with a hands-on learning
activity outside of the classroom

Gather light pollution data from an
international perspective

www.globe.gov/globeatnight
Participation is open to anyone who lives or works in one of the 110 GLOBE countries.



Light pollution is a global issue with local solutions...



Earth at Night
More information available at:
<http://antwrp.gsfc.nasa.gov/apod/ap001127.html>

Astronomy Picture of the Day
2000 November 27
<http://antwrp.gsfc.nasa.gov/apod/astropix.html>



Here's what we will discuss....

- Types of light pollution (briefly)
- A little on lighting
- A little on shielding
- Light pollution education kits
- GLOBE at Night
 - classic version
 - digital version
- The International Year of Astronomy 2009





Glare



Too much background light; can you see the stop sign in the foreground? Can you read the sign below it?





Light Trespass



Would you be able to sleep if your bedroom window faced this neighbor's light?





Sky Glow



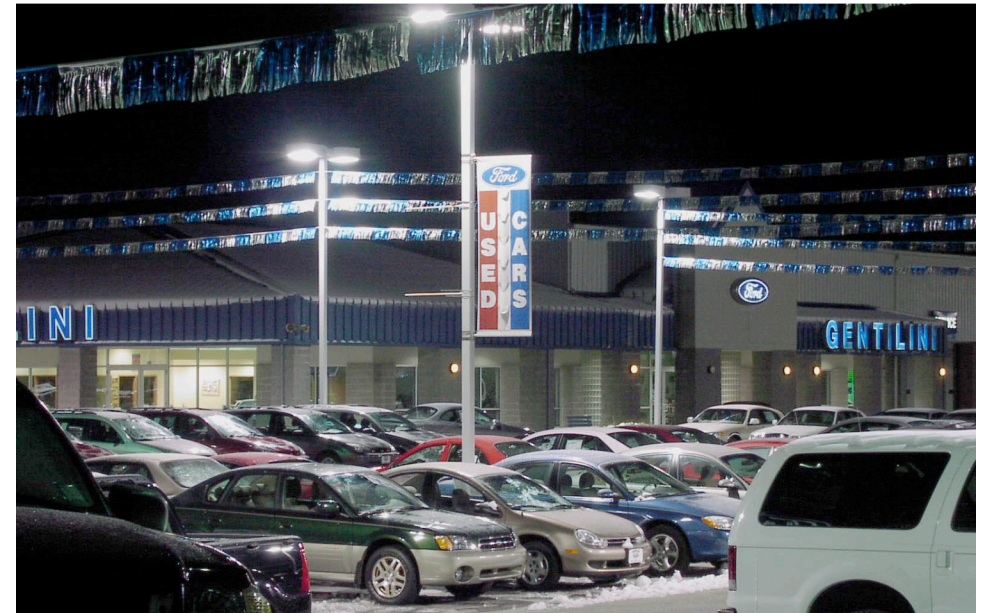
Lots of light scattering off particles in the air, giving the appearance of a glowing sky...See any stars?





Typical car lot?

Much better!





Now you see the person...sort of...



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Now you don't. (She moved about four feet.)

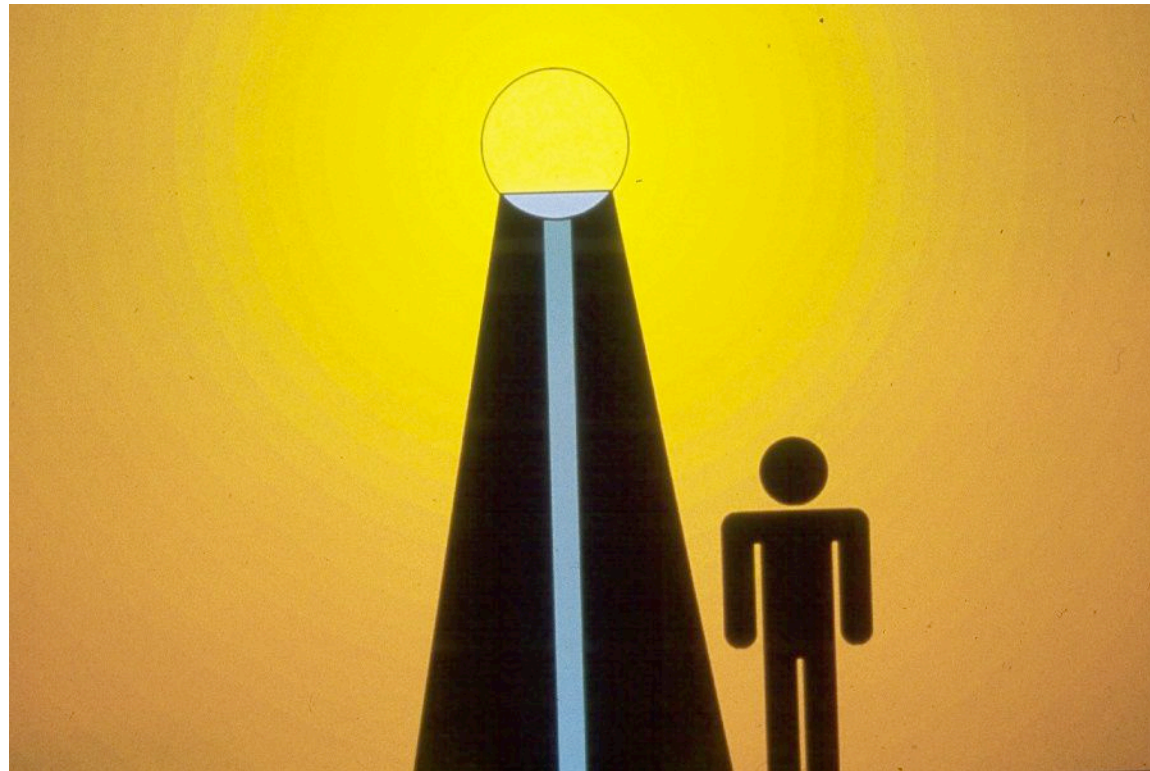


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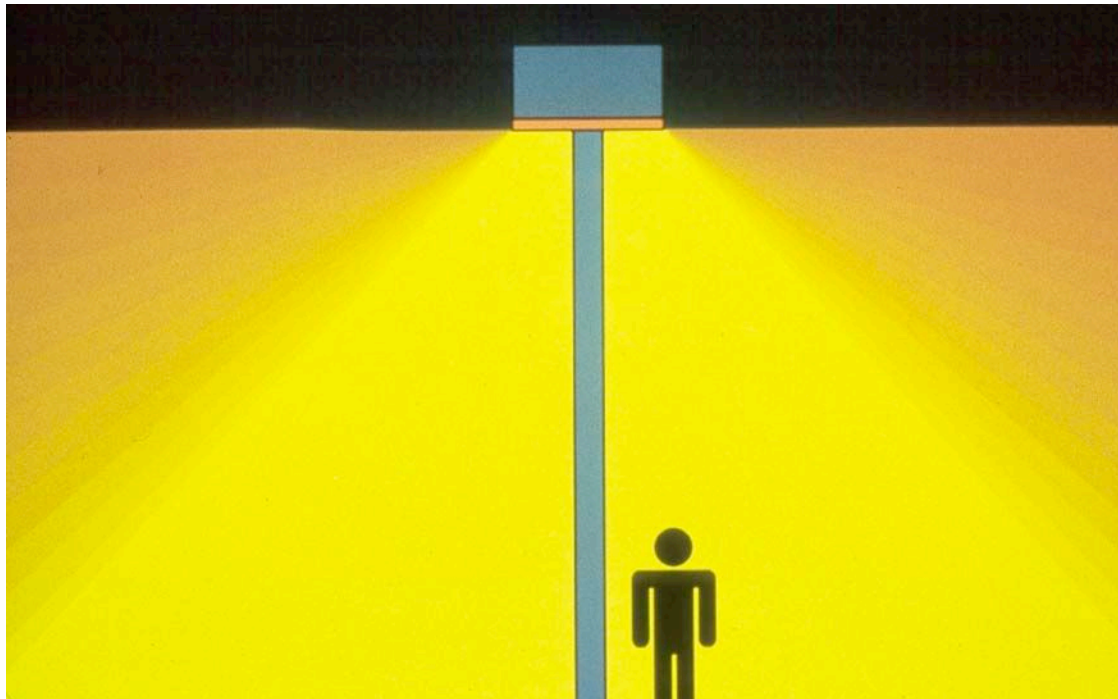


Unshielded Fixture





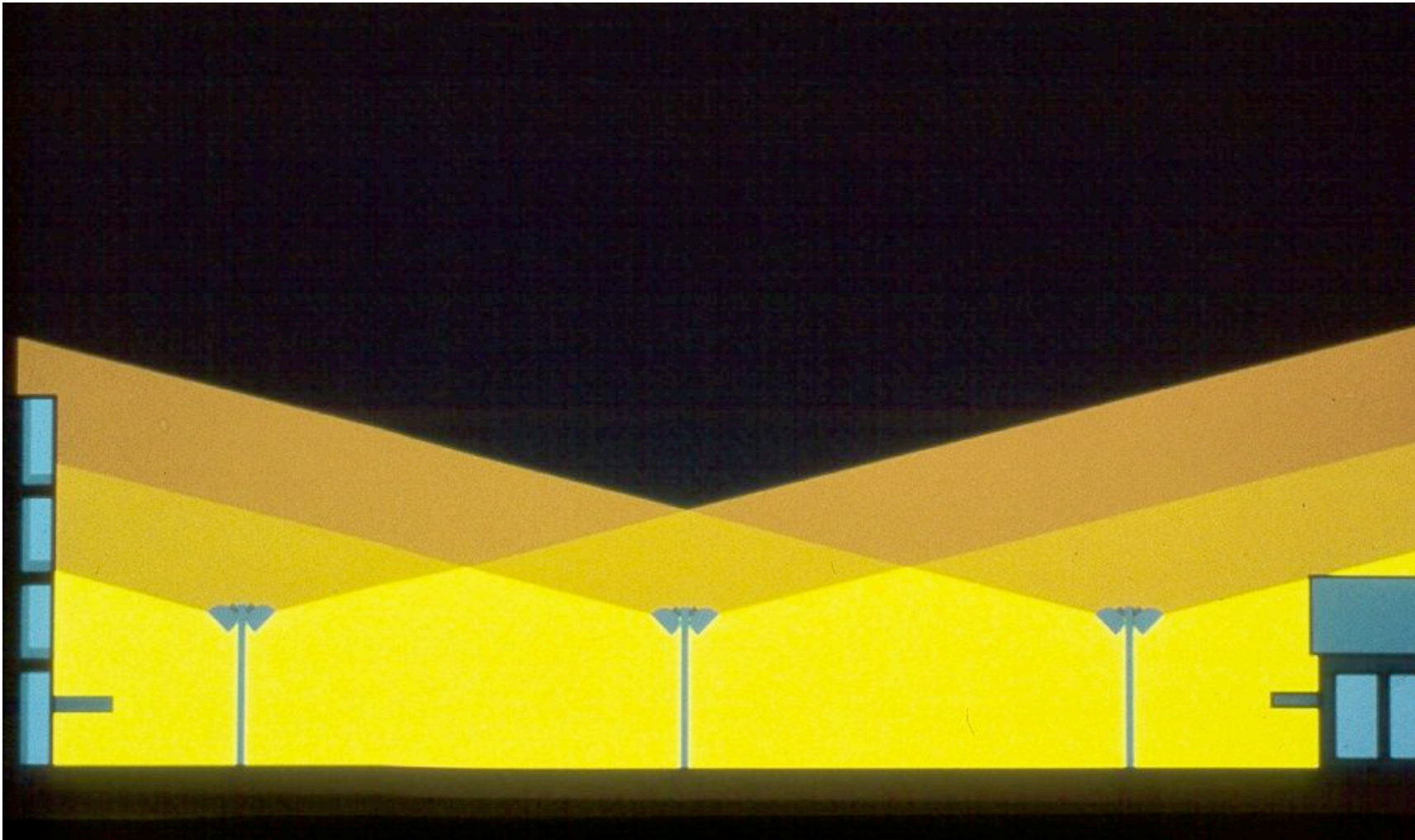
Shielded Fixture



- Minimizes glare.
- Minimizes light directed upward.
- Minimizes light trespass.
- Controls the light output.

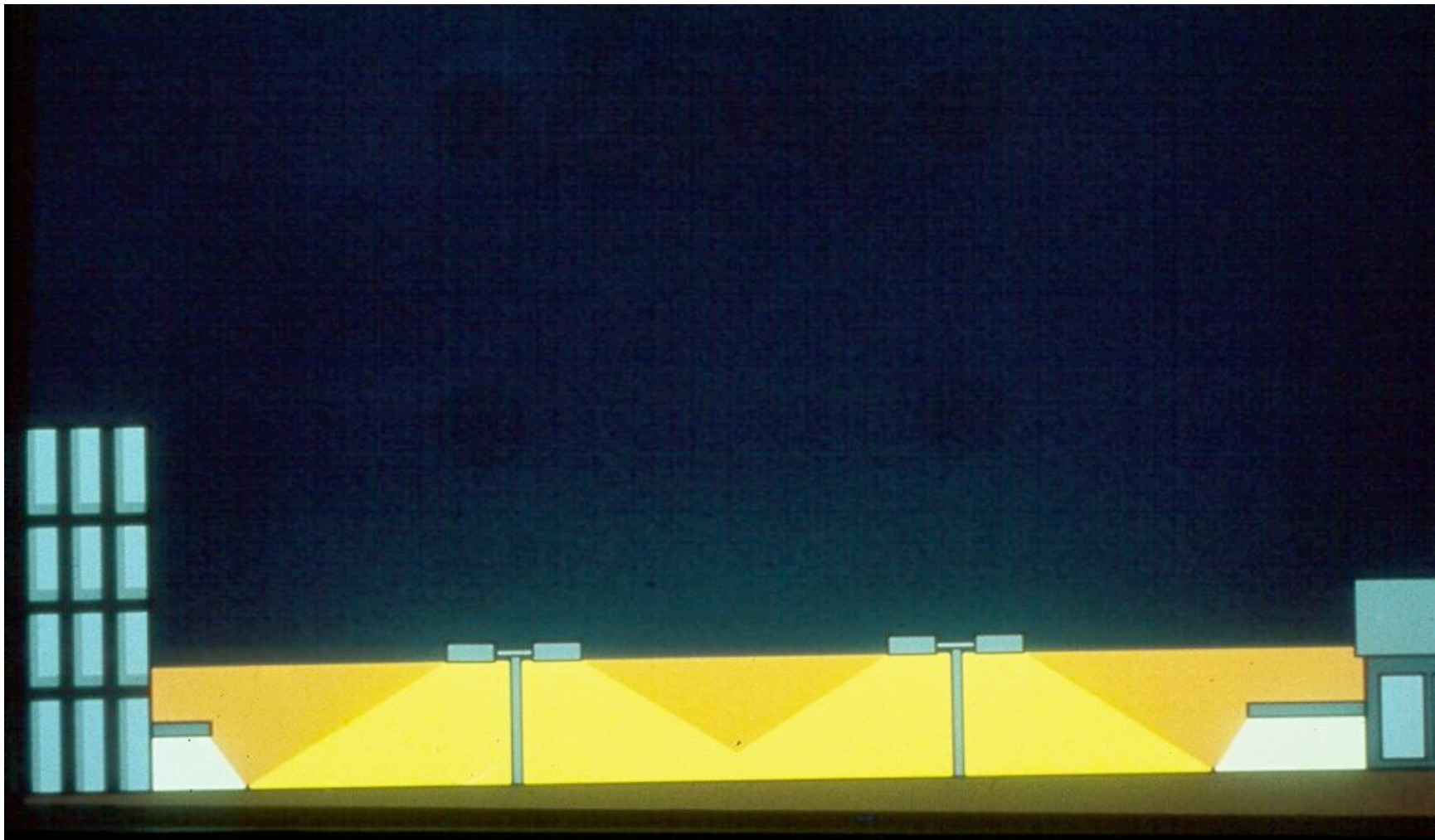


Not bad, but a good deal is wasted,
and the glare is too high for comfort.





An optimal design! Note the added light near the entrances where there is more need.



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Quality lighting.....

| Improves... | Minimizes... |
|--|------------------------------------|
| safety and security | glare, light trespass, sky glow |
| habits & habitats of animals & plants | energy used |
| human health | |
| nighttime ambiance | |

And now to demonstrate.....



GLOBE at Night

Light Pollution Education Kit

- 2 “Mini-lights” with batteries (Take out plastic disc in with batteries.)
- 1 paper cube with holes on 2 sides (i.e., mini-planetarium)
- 1 white PVC cap + 2 toy figures
- 1 book called “There Once Was a Sky Full of Stars”
- 1 flashlight with a red balloon (to preserve one’s dark adaptation)
- 2 D batteries for the flashlight
- 1 DVD called “Saving the Night”
- 1 “Our Globe at Night” poster



A Demonstration on Shielding

Using the items in your Light Pollution Education Kit:

- Make sure you are in a very dark room with a low ceiling and a white surface.
- Unscrew the reflectors from both “Mini-lights” and turn 1 on (“candle mode”).
- Place the bulb top of the “Mini-light” barely into the big hole at the bottom of the white paper cube.
- With the room lights off, project the “stars” from the white paper cube onto the ceiling.





A Demonstration on Shielding, continued...



- Using the 2nd mag light as a “street light”, place it on a table and turn it on.
- What do you notice about the number of stars?
- Now place the PVC cap (or another shield) above the 2nd mag light to represent a shielded streetlight.
- What difference do you notice with and without the shield?





The GLOBE at Night Program



- To teach about the impact of artificial lighting on local environments, and the ongoing loss of a dark night sky as a natural resource for much of the world's population.
- Citizen-scientists record the brightness of the night sky by matching its appearance toward the constellation Orion.
- Measurements are submitted on-line and resulting maps of all worldwide observations are created.
- March 2006: 18,000 citizen-scientists made 4600 Orion observations from 96 countries the inaugural year!
- March 2007: An increase of 85% in participation to 8500 observations. About 1000 SQM measurements.
- March 2008: 6900 Orion observations made from 61 countries. About 700 SQM observations from 12 countries.





The Globe at Night Website



<http://www.globe.gov/GaN/>

GLOBE at Night

For Students For Teachers For Parents

Home Learn Observe! Report Map

Can You See the Stars?

GLOBE at Night 2008
25 February - 8 March

Come join us for the 2008 GLOBE at Night Campaign from 25 February - 8 March. 2008 marks a monumental shift in human history when more than half the people on Earth are expected to be living in cities. Because of the ambient light of urban landscapes, many city dwellers have never seen a sky full of stars.

During the 2007 event there were **8,491 observations** reported from 60 GLOBE countries, almost doubling the observations from 2006. Thank you for your nighttime sky observations on light pollution from around the world! The final data sets and Analysis Summary are now available on the [Map](#) section.

FIVE EASY STAR-HUNTING STEPS:

- 1) FIND YOUR **LATITUDE AND LONGITUDE**.
- 2) FIND **ORION** BY GOING OUTSIDE AN HOUR AFTER SUNSET (ABOUT 7-10PM LOCAL TIME)
- 3) MATCH YOUR NIGHTTIME SKY TO ONE OF OUR **MAGNITUDE CHARTS**.
- 4) **REPORT** YOUR OBSERVATION.
- 5) **COMPARE** YOUR OBSERVATION TO THOUSANDS AROUND THE WORLD.

Download **Family Activity Packet***:
English, Spanish, Polish.

Participation in GLOBE at Night is open to anyone who lives or works in one of the 110 GLOBE countries. If you are not located in a GLOBE Country, please contact the **GLOBE Regional Desk Officer** for your region to learn more about how a country can join.

Share GLOBE at Night with your friends!



Download **Postcard*** - 2MB
(English or Spanish)

Download **Flyer***
(English or Spanish)

*Adobe Acrobat Reader needed

Subscribe to our mailing list to receive updates and results of this campaign!



Overview of How to Observe



Step #1. Find your latitude and longitude

Step #2. Find the constellation Orion; note sky conditions

Step #3. Match night sky to a magnitude chart

Step #4. Report your observations on-line

Step #5. Compare your observation(s) to thousands around the world





To Get Started... Step #1

http://www.globe.gov/globeatnight/observe_latlong.html

Step #1. On the reports page, click “Latitude & Longitude” and zoom in on your location to find the lat/long in decimal format.

NOAO’s latitude 32.234112

NOAO’s longitude -110.937838

Or you may find the latitude and longitude by:

- Using GPS units
- Downloading “Google Earth” at <http://www.earth.google.com>
- Using <http://www.itouchmap.com/?r=v&st=l2>





Step #2

Step #2. Find the constellation Orion; Note sky conditions

http://www.globe.gov/globeatnight/observe_finder.html

- Determine the darkest area where the most stars are visible.
- Wait 10 minutes for your eyes to adapt to the dark.
- Estimate the amount of cloud cover.
 - Clear
 - Clouds cover one quarter or less of the sky
 - Clouds cover about half of the sky
 - Clouds cover more than half of the sky
- Note any comments on your observing location or the sky conditions, such as street lights.

Select the latitude closest to your location: 40 deg S | 20 deg S | Equator | 20 deg N | 40 deg N | 60 deg N



Cloudy Sky



Magnitude 1 Chart



Magnitude 2 Chart



Magnitude 3 Chart



Magnitude 4 Chart



Magnitude 5 Chart



Magnitude 6 Chart

Step #3. Match Night Sky to a Magnitude Chart.

- Fill out the observation sheet. Downloadable from Teacher Packet at http://www.globe.gov/GaN/GaN2008ActivityPacket_Teacher.pdf.



Teacher Activity Packet: Observation Sheet

<http://www.globe.gov/globeatnight/report.html>

Only fields marked by * are required.

Step #4. Report observations on-line

Observe anytime between March 16 - 28, 2009.

Do it again from a different location!

*Date: March ____, 2007

*Observation Time: __: __ PM local time (HH:MM)

*Country: _____

*Latitude (In deg/min/sec ____ deg ____ min ____ sec or decimal degrees): _____ decimal degrees

(North / South)

*Longitude (In deg/min/sec ____ deg ____ min ____ sec or decimal degrees): _____ decimal degrees

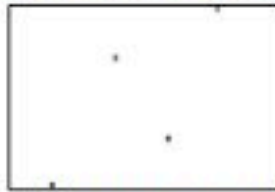
(East / West)

Comments on location: (e.g. There is one street light within 50 m that is shielded from my view.)

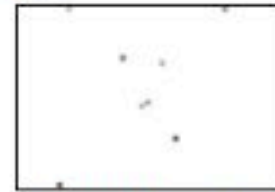
Match your nighttime sky to one of our magnitude charts :



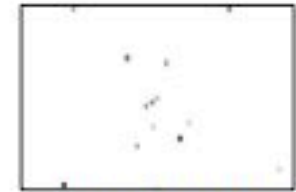
Cloudy Sky



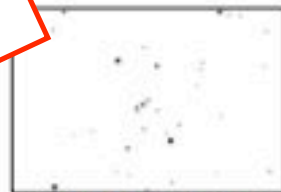
Magnitude 1 Chart



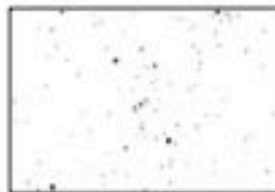
Magnitude 2 Chart



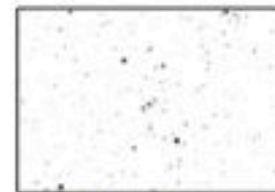
Magnitude 3 Chart



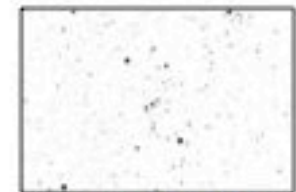
Magnitude 4 Chart



Magnitude 5 Chart



Magnitude 6 Chart



Magnitude 7 Chart

*Estimate the cloud cover in the sky:

Clear

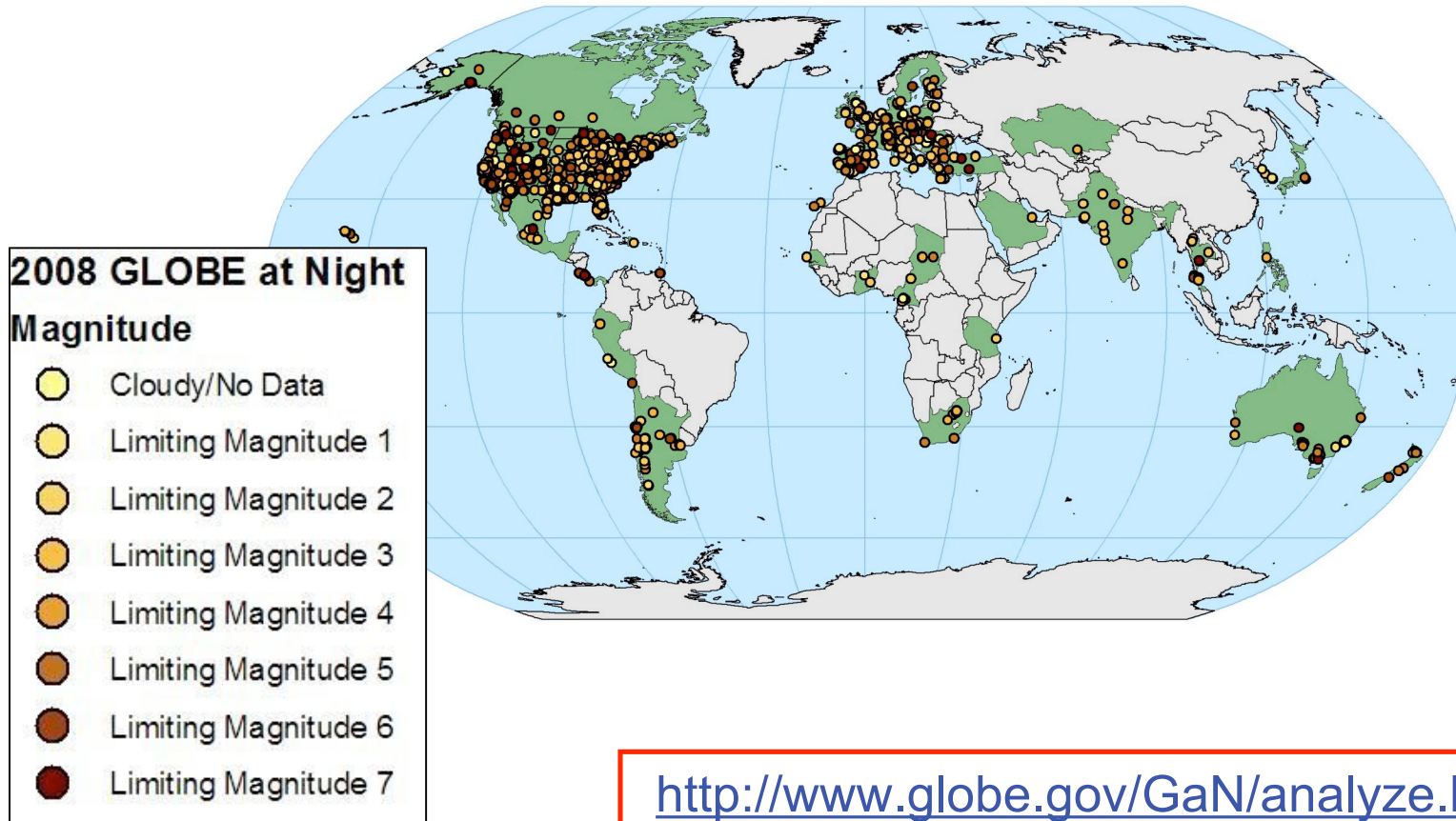
Clouds cover 1/4 of sky

Clouds cover 1/2 of sky

Clouds cover > 1/2 of sky



Step #5. Compare Your Observation(s) to Thousands Around the World



<http://www.globe.gov/GaN/analyze.html>

The darker dots represent darker skies & the brighter dots represent brighter skies.



Ancillary Materials for the Public

<http://www.globe.gov/GaN/learn.html>

- Magnitude of Stars
- Finding Orion (Interactive Tool)
- Orion Mythology
- Light Pollution
- Apparent Magnitude Changes with Light Pollution and Affects of Latitude Change with Orientation of Orion (LP Interactive Tool)





Zoom in with “Map Viewer”



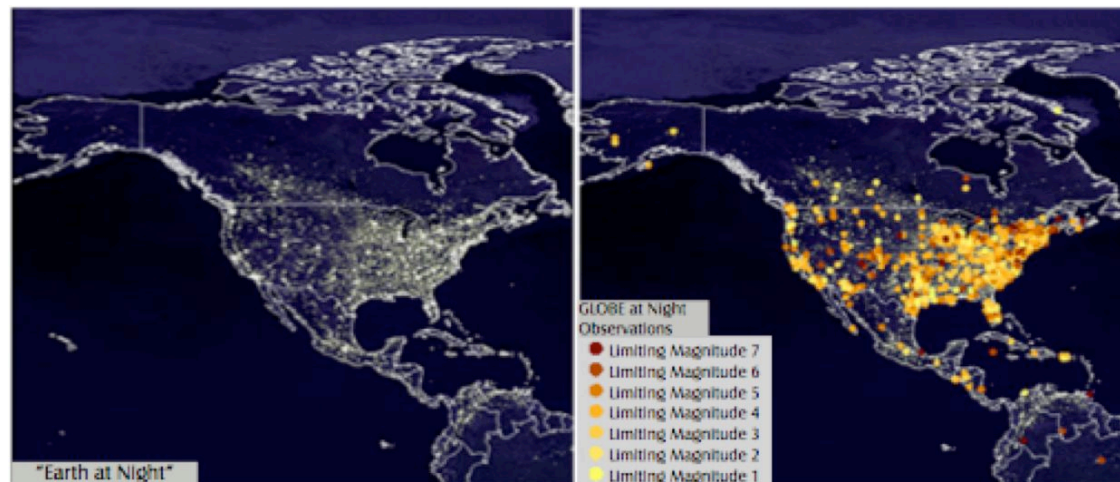
It is important to have many observations at about 1 km to 1 mile apart. Then we can map out light pollution within cities... and show how safe, quality lighting can make a difference in protecting night skies!



Capstone Activities

- Compare with other years of Orion and SQM data
- Compare with population density data
- Compare with Earth at night satellite data
- Suggestions in bringing results to your local government.

So you ask... what is SQM data?...



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Two Flavors of GLOBE at Night

- The “classic” GLOBE at Night observations that anyone can have fun doing with their unaided eyes.
- A new effort to obtain precise measurements of the night sky using digital sky-brightness meters, especially to identify and preserve urban dark-sky oases.





GLOBE at Night A Research Twist

- How can we expand the citizen-scientist experience?
- How can we make it more scientific?
- How can we make it more precise?
- How can we measure changes over time?
- Can we map a whole city in detail and identify oases?



We decided to take advantage of a portable sky-brightness meter to take the campaign to another level.



The Sky Quality Meter

Press start button here:

Light enters here:

Read-out numbers here:

Sky-quality meters (SQMs) are built by Unihedron in Ottawa, Canada.

Readings are repeatable to +/- 0.1 magnitude/square arcsec (Dr. Patrick Seitzer at U. Michigan).





The SQM is Easy to Use!

- **Point the SQM's sensor straight up** (toward zenith).
- The SQM should be **held at or above head level** so that shadows or reflections from your body do not interfere with the reading.
- **Avoid** using in areas that are shaded by **trees or buildings**.
- After you **press the button** to take a reading, the SQM will beep while it is accumulating photons. The **beeping will stop once the reading is ready to be viewed**.





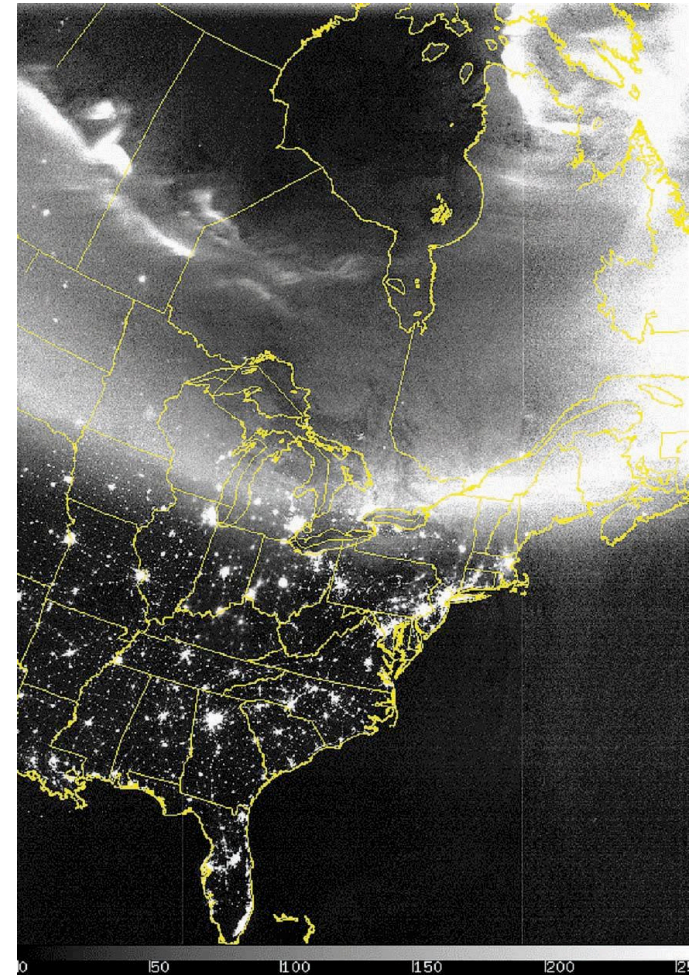
Magnitudes and Sky Quality Meter Readings





What to Watch Out For When Using the SQM

- The temperature in °C then °F is displayed when you press and hold the button a second time.
- Also the model and serial number is displayed.
- The meter readings are somewhat temperature dependent.
 - Leave meter outside a few minutes before taking measurements depending on the temperature differential.
- ALSO: Avoid streetlights and buildings.
 - Be at least as far from them as they are high.





Data Input for SQM

- Date and Local Time
- Latitude and Longitude
- Cloudy Sky/**No Data**
- Meter Reading (from sky brightness meter)
- SQM Serial #

OPTIONAL INPUT:

- Comments on location
- Estimate of cloud cover
- Comments on sky
- Additional comments



Report Form

Date Observation Date: * 02/25/2008 Local Observation Time (HH:MM): * 9 : 0 PM Time

Lat/Long Enter Latitude-Longitude Latitude: * 32.119722 Longitude: * -110.93000

Comments on location: A street light is 300 yards from the location at which the SQM measurement was taken. No other light sources are in the vicinity of the measurement.

Your nighttime sky:*



Select "Cloudy Sky/No Data" for SQM entries

Cloudy Sky/No Data Magnitude 1 Chart Magnitude 2 Chart Magnitude 3 Chart



Magnitude 4 Chart Magnitude 5 Chart Magnitude 6 Chart Magnitude 7 Chart

SQM entry
SQM serial
number

Optional reading from the Unihedron Sky Quality Meter: 17.62

Optional serial number from the Unihedron Sky Quality Meter: 2518

Estimate the cloud cover in the sky:*

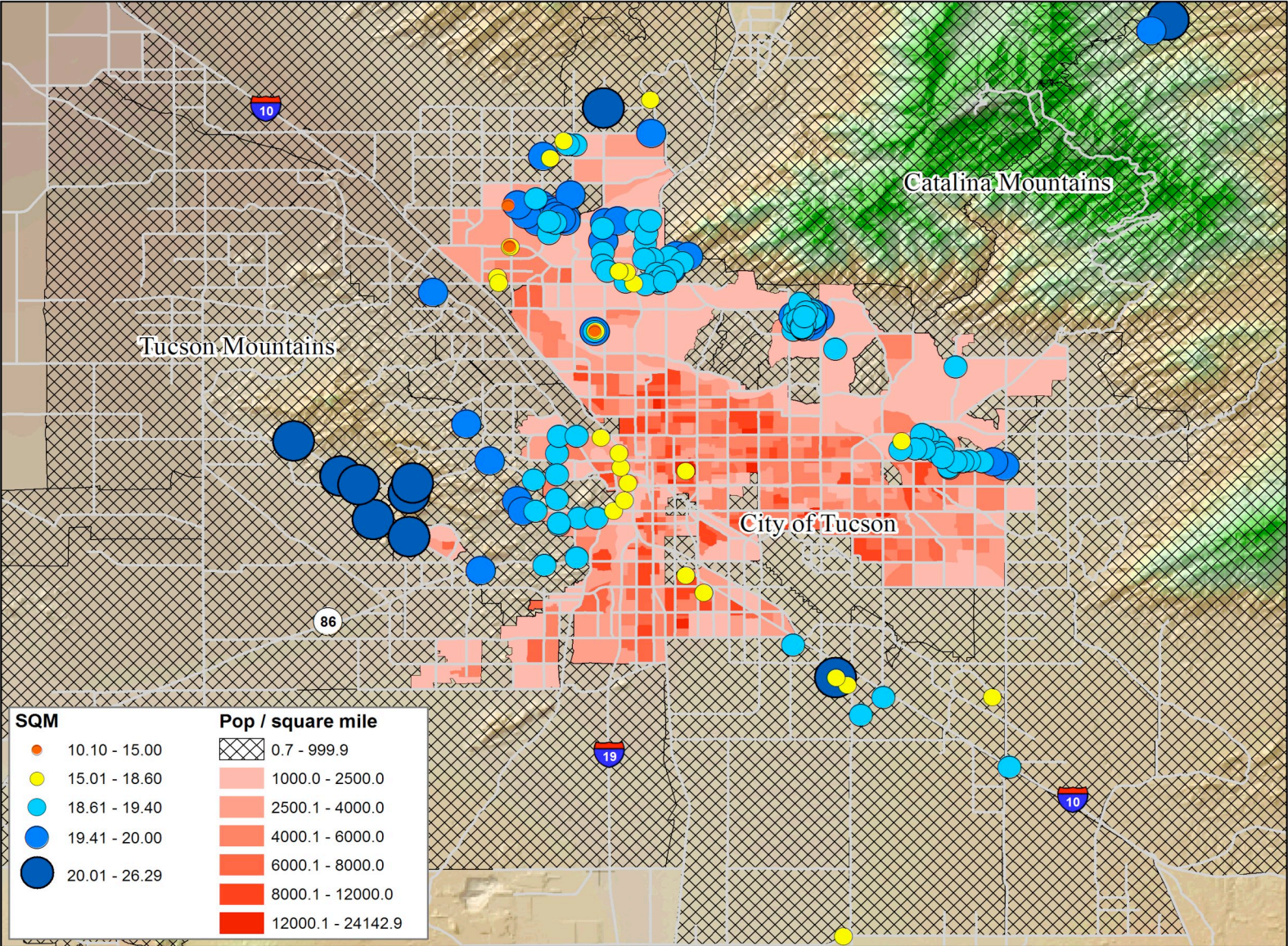
Clear Clouds cover 1/4 of sky Clouds over 1/2 of sky Clouds cover more than 1/2 of sky

Comments on sky: Sky was clear especially overhead where the SQM measurement was taken. "Cloudy Sky/No Data" option was chosen because no Orion data is being submitted; only SQM data.

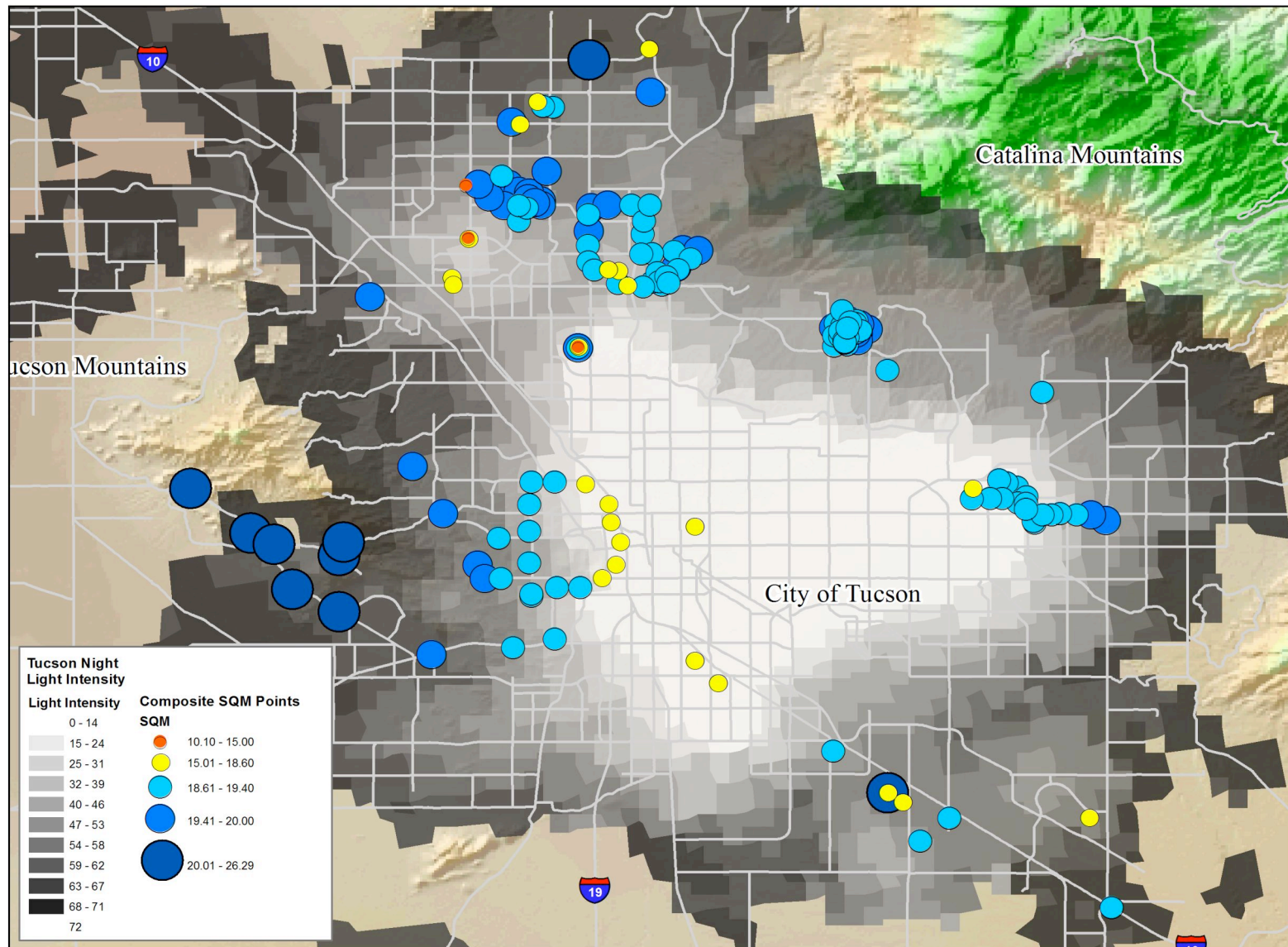
Additional comments: The SQM-L meter was used for measuring night sky brightness.

Reload or Refresh your browser before submitting more data.

SQM Measurements vs Population Density Tucson, Arizona



SQM Measurements vs Nighttime Lights Tucson, Arizona





GLOBE at Night Wants You!

Sign up today!

March 16 - 28, 2009

- Participate in
 - unaided eye observations and
 - sky brightness meter measurements
- With a kit and SQM:
 - become a local coordinator for the public who would take measurements & report them on-line.
- By 2009, quantitative approaches will be extended to other countries to make a worldwide major impact during the International Year of Astronomy!



<http://www.globe.gov/globeatnight/>



The Future: IYA 2009

- The GLOBE at Night campaign will expand to more countries under the auspices of the

International Year of Astronomy 2009

- US IYA GOAL: “To offer an engaging astronomy experience to every person in the country, and to cultivate partnerships to sustain public interest.”





Contact Information

Connie Walker

cwalker@noao.edu

520-318-8535

National Optical

Astronomy Observatory

950 N. Cherry Ave.

Tucson, AZ 85719

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March 16-28, 2009

Engage students worldwide in observing the nighttime sky

Encourage citizen and family science with a hands-on learning activity outside of the classroom

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NASA ES&I WINDOWS TO THE UNIVERSE COI UCAR EDUCATION AND OUTREACH NOAO

The poster features a night view of Earth from space, showing city lights. It includes a call to action to observe the night sky from March 16-28, 2009. The text describes the goal of engaging students and encouraging citizen science. At the bottom, there are logos for NASA, ES&I, Windows to the Universe, COI, UCAR Education and Outreach, and NOAO.