

חישה מרחוק של זיהום אור

נעם לוין

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המחלקה לגאוגרפיה, האוניברסיטה העברית בירושלים



LoNNe

ESI 204

Loss of the Night Network

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About us

Research

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Conclusions_astrotourism
symposium "There was a high
turnout at the conference, due to
the large number of presentations,
business fair and... [Read More](#)

EVENTS

[LoNNe intercomparison campaign at
Observatorio UCM](#)

on July 17, 2014

[2nd Artificial Light at Night Conference](#)

on September 2, 2014

<http://www.cost-lonne.eu/>

30 March 1973, Volume 179, Number 4080

SCIENCE

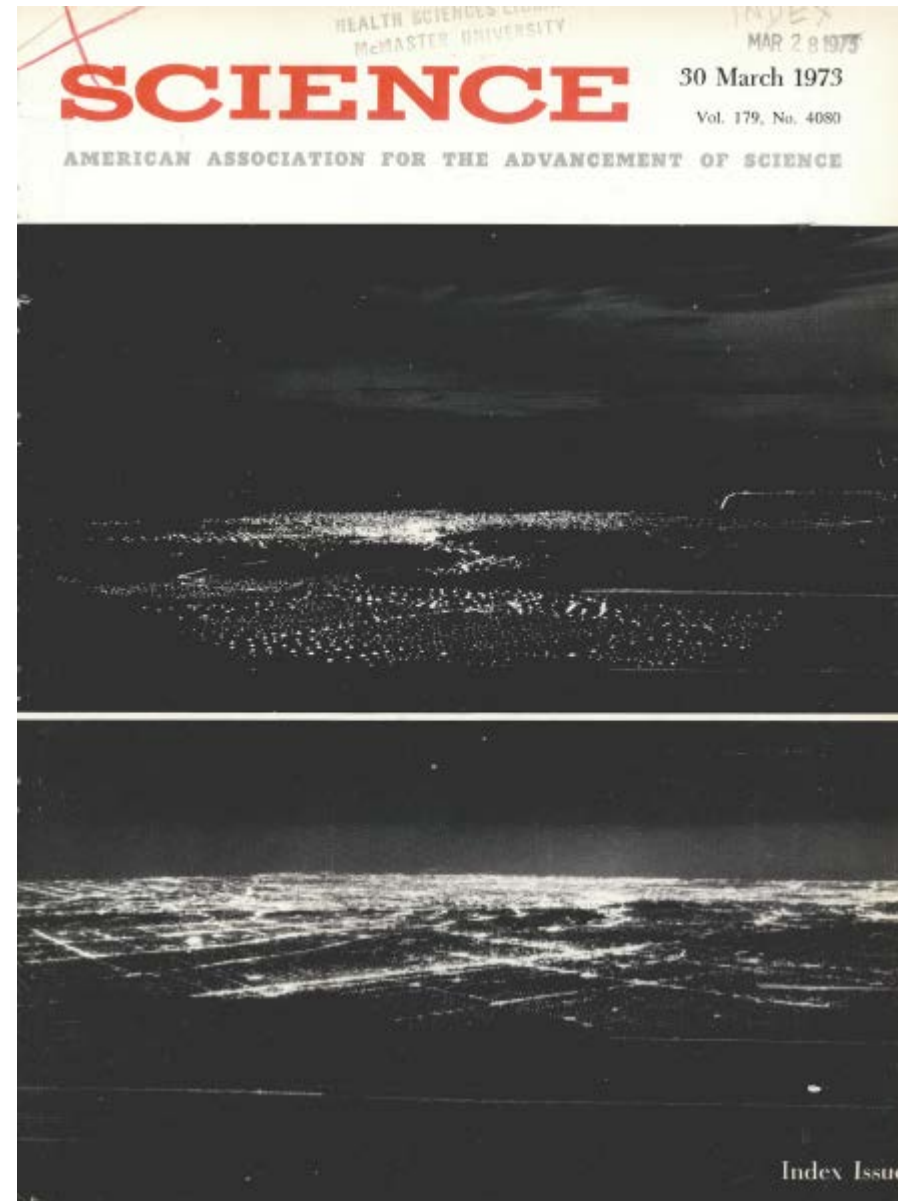
Light Pollution

Outdoor lighting is a growing threat to astronomy.

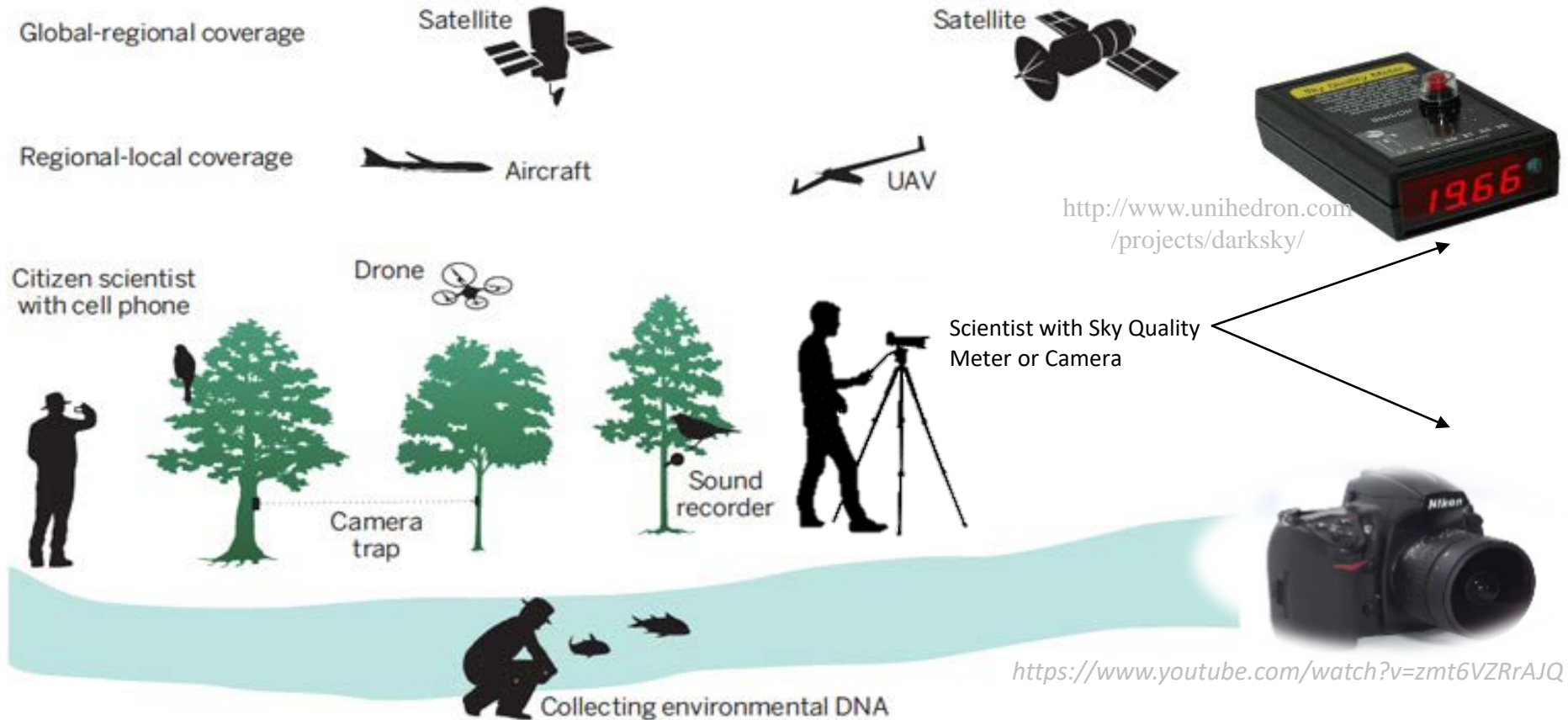
Kurt W. Riegel

Los Angeles 1911

Los Angeles 1965

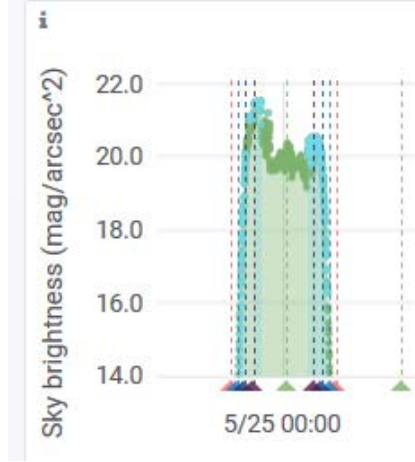


Como podemos medir contaminacion luminica?



<https://wildtech.mongabay.com/2014/10/with-drones-satellites-and-camera-traps-proliferating-conservation-needs-better-networking/>

<https://tess.stars4all.eu/>



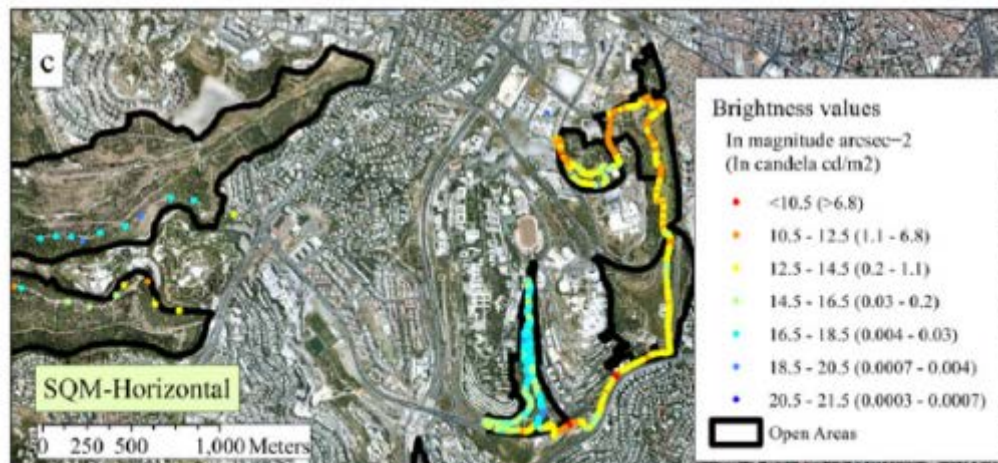
מדידות אור קרקעיות לצורכי כיול ואימות



Fig. 2. Setting of the three SQM devices for ground measurements of light pollution, pointing in three viewing directions on a specially designed pole which was mounted on a bicycle.

Katz, Y., & Levin, N. (2016). Quantifying urban light pollution—A comparison between field measurements and EROS-B imagery. *Remote Sensing of Environment*, 177, 65-77.

Katz, Y., & Levin, N. (2016). Quantifying urban light pollution—A comparison between field measurements and EROS-B imagery. *Remote Sensing of Environment*, 177, 65-77.



SQM brightness values (magSQM arcsec⁻²) in three directions as measured on February 6th, 2014 (a): SQM upward, (b): SQM downward, (c): SQM horizontally

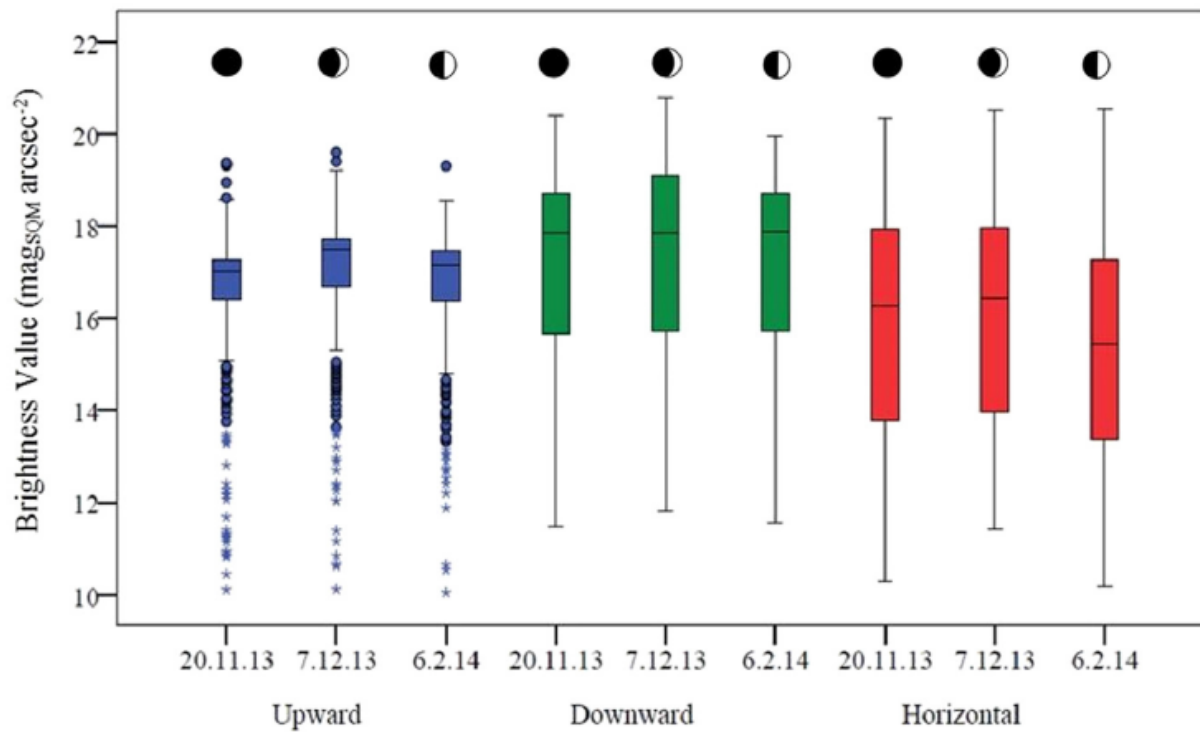
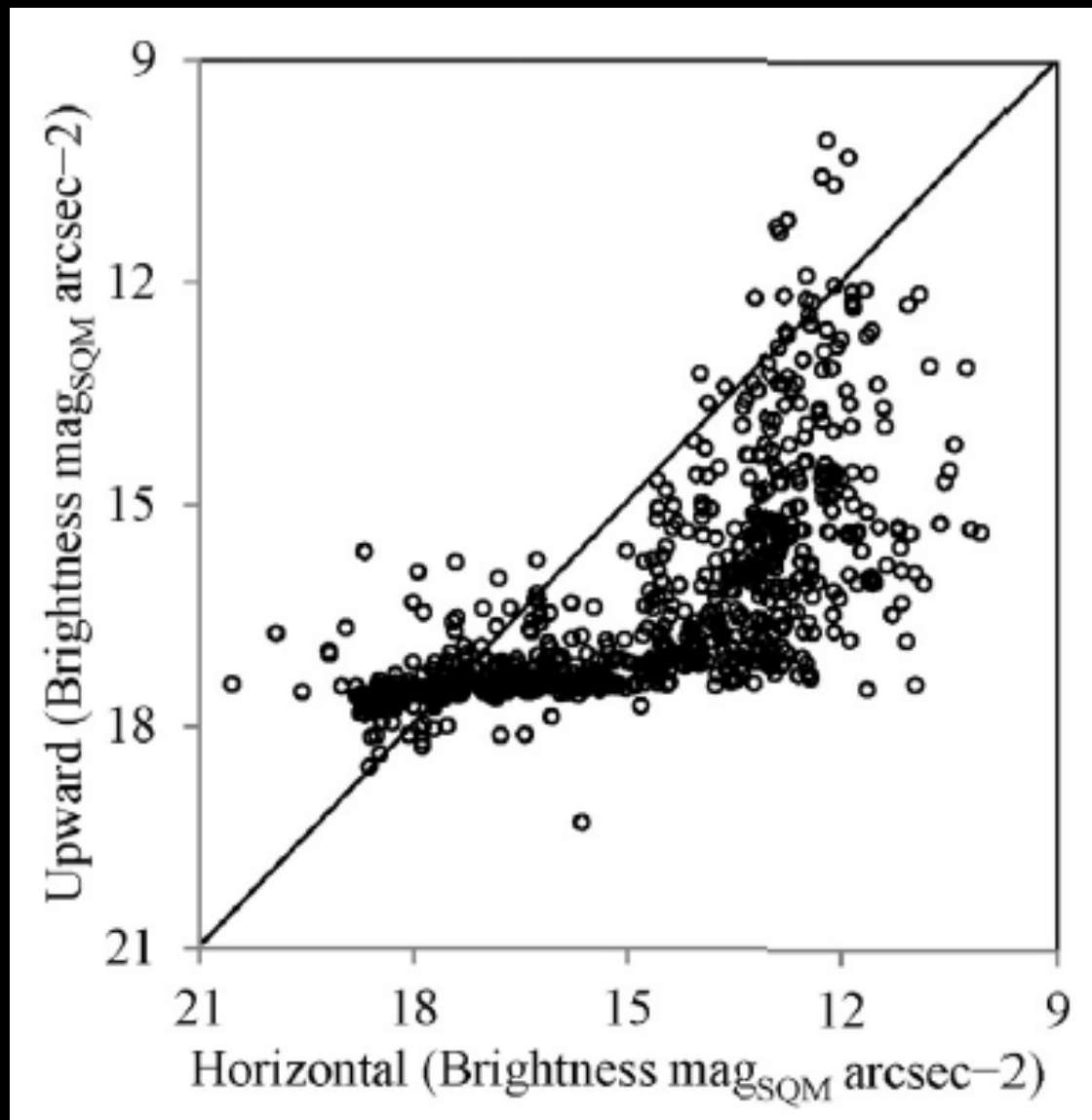


Fig. 4. Box plots of SQM brightness values as measured in the three directions at the same reading locations in three dates: November 20th, 2013, December 7th, 2013 and February 6th, 2014. The boxes represent the interquartile region, the thick line within the box represents the median value and the vertical line represents the maximum/minimum value or a distance of 1.5 times the box length from the edge of the box. The blue circles represent outlier's values above a distance of 1.5 times the box length from the edge of the box, whereas the blue stars are for outliers located more than 3 times the box length from the edge of the box. The circles above the box plots represent the moon phase in each measurement date (moon phases for the entire measurements are shown in Table 1). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)



Katz, Y., & Levin, N. (2016). Quantifying urban light pollution—A comparison between field measurements and EROS-B imagery. *Remote Sensing of Environment*, 177, 65-77.

Upwards Direction

Downwards Direction

Horizontal Direction

g • Mean (100m, Q-90%) — Predict (100m, Q-90%)

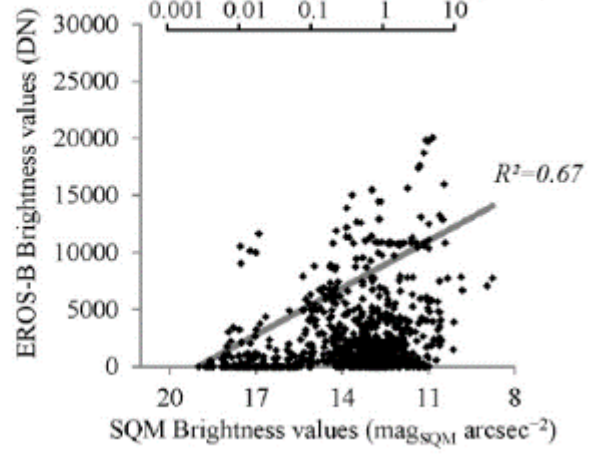
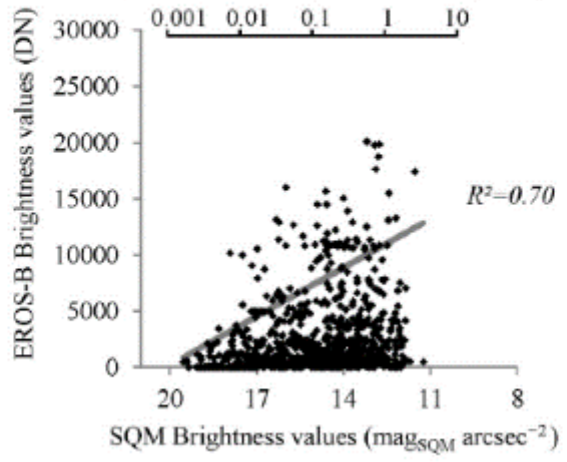
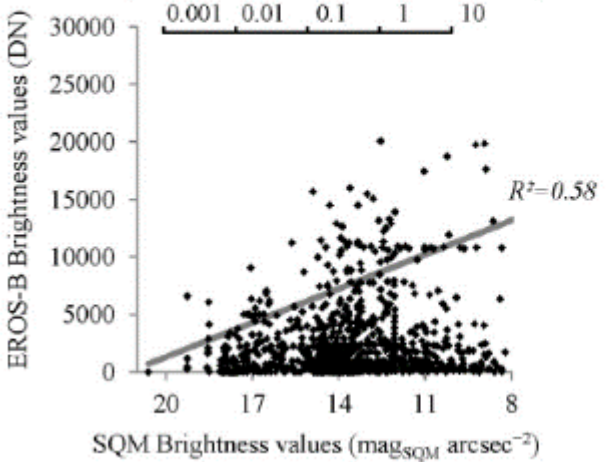
h • Mean (100m, Q-90%) — Predict (100m, Q-90%)

i • Mean (100m, Q-90%) — Predict (100m, Q-90%)

SQM values converted to Candela (cd/m^2)

SQM values converted to Candela (cd/m^2)

SQM values converted to Candela (cd/m^2)





Noam Levin, Norfolk Island, Australia

Norfolk Island, Emily Bay

SQC Sky Quality Camera

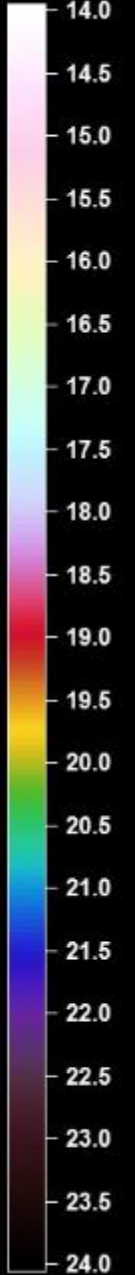
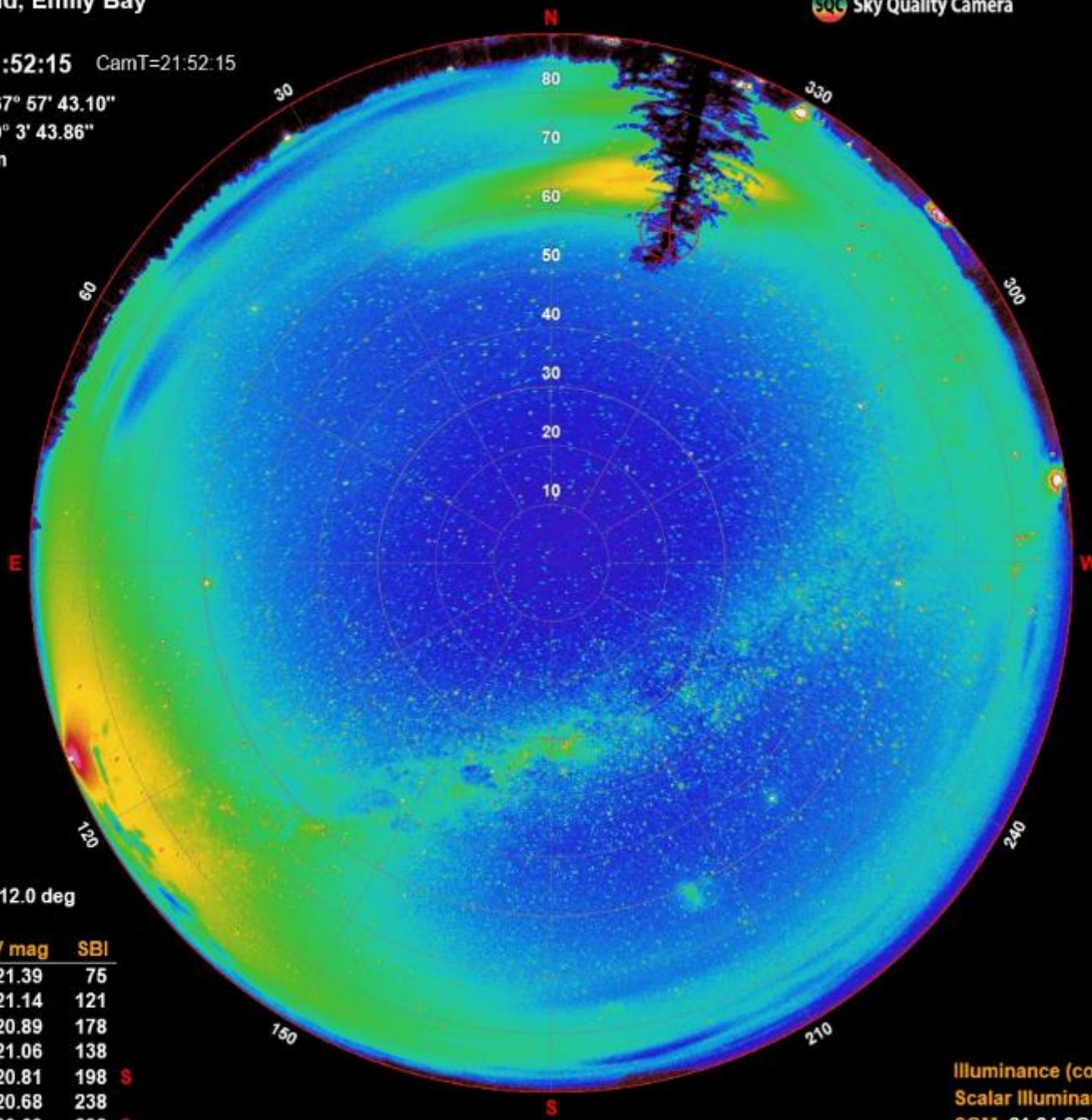
6.4.2018 21:52:15 CamT=21:52:15

Longitude: E 167° 57' 43.10"

Latitude: S 29° 3' 43.86"

Elevation: 29 m

Sky Brightness
(V mag/arcsec²)



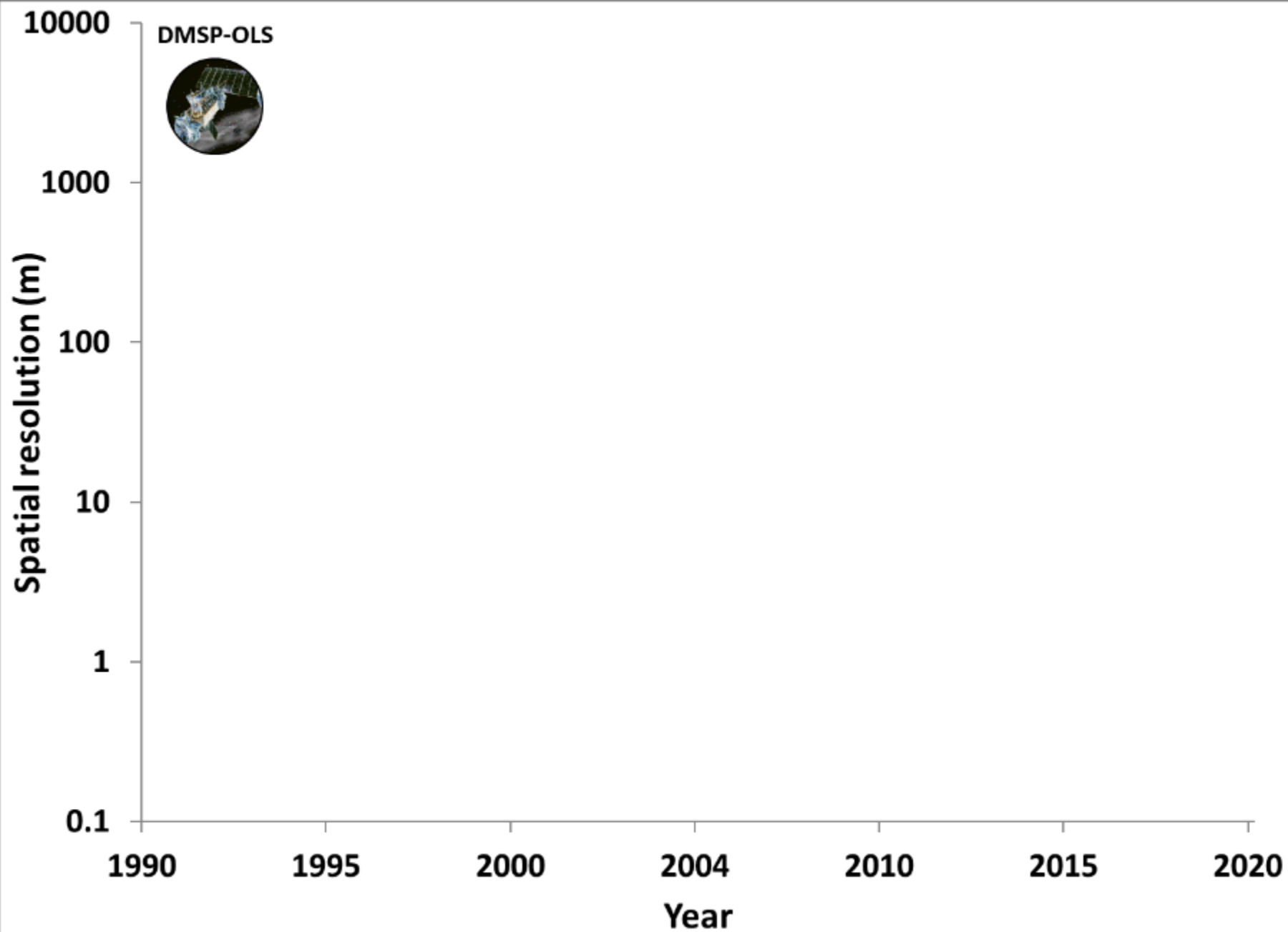
B. Stars ON
Milky Way ON

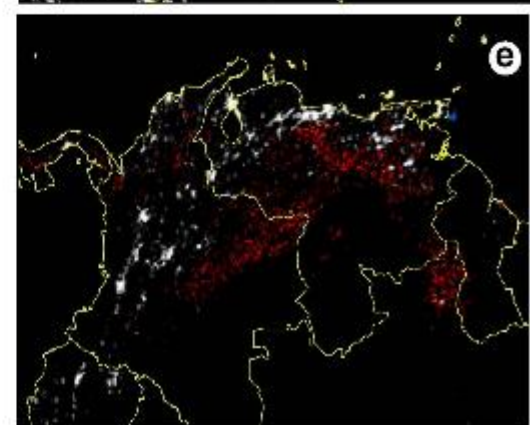
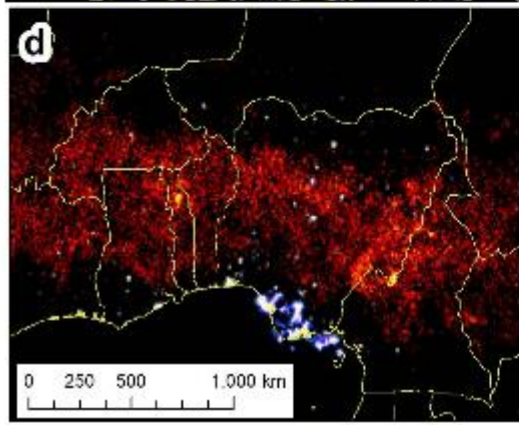
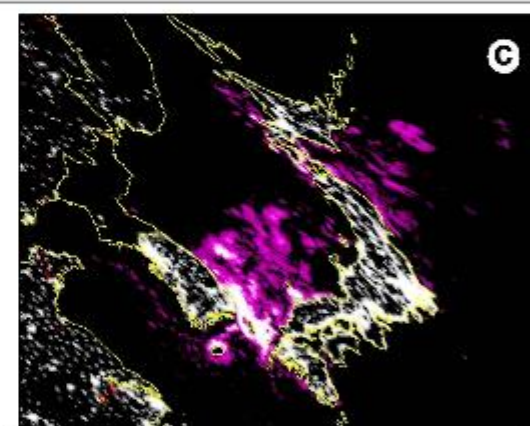
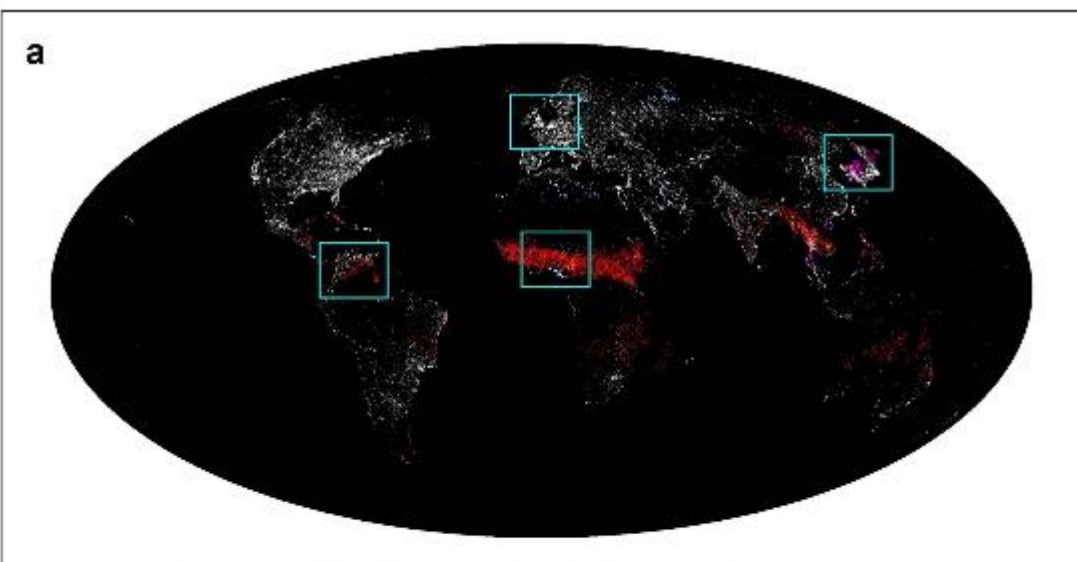
Moon Altitude: 12.0 deg

Zenith Angle	V mag	SBI
0° - 30°	21.39	75
0° - 60°	21.14	121
0° - 90°	20.89	178
30° - 60°	21.06	138
59° - 61°	20.81	198 S
60° - 80°	20.68	238
80° - 90°	20.69	233 S

⊕ 22.31
AZ: 340.2°
ZA: 60.0°

Illuminance (cos): 1.317 mlx
Scalar Illuminance: 2.994 mlx
SQM: 21.24 SQM mag

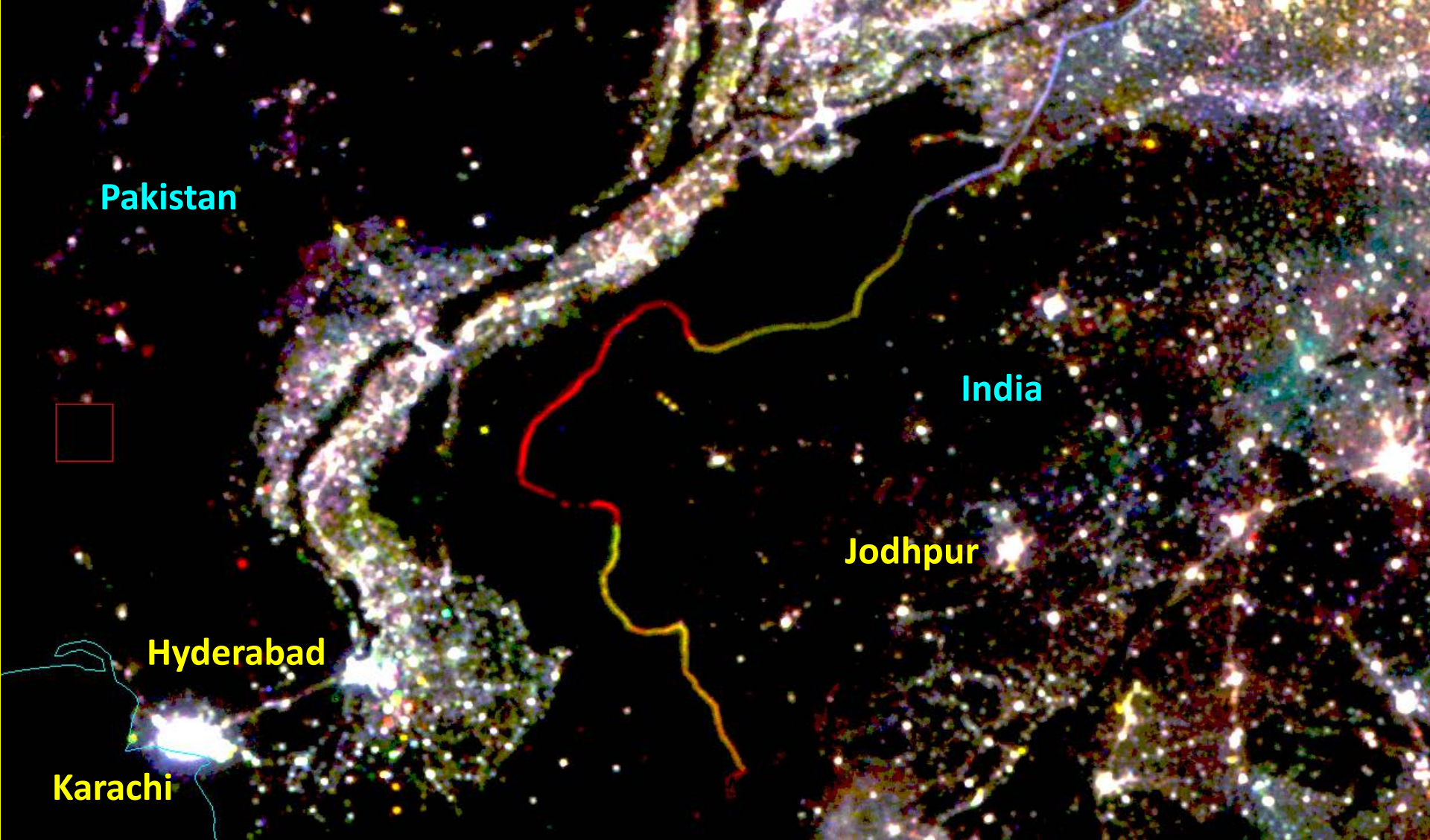




DMSP colorized night lights

The white represents lights generated from electricity, the red shading shows fires, the pink shading indicates light from squid fishing boats, and the blue spots are gas flares from oil rigs. Each is one year's worth of data. The differentiation of fires, boats, electric lights and gas flares was all done by temporal analysis (do the lights stay constant and do they move). The instrument itself is not able to distinguish between them. Zoomed in areas are shown for northern Europe (b), Japan and Korea (c), western Africa (d), and northern South America (e). Source of dataset:

<https://sos.noaa.gov/datasets/nighttime-lights-colorized/>



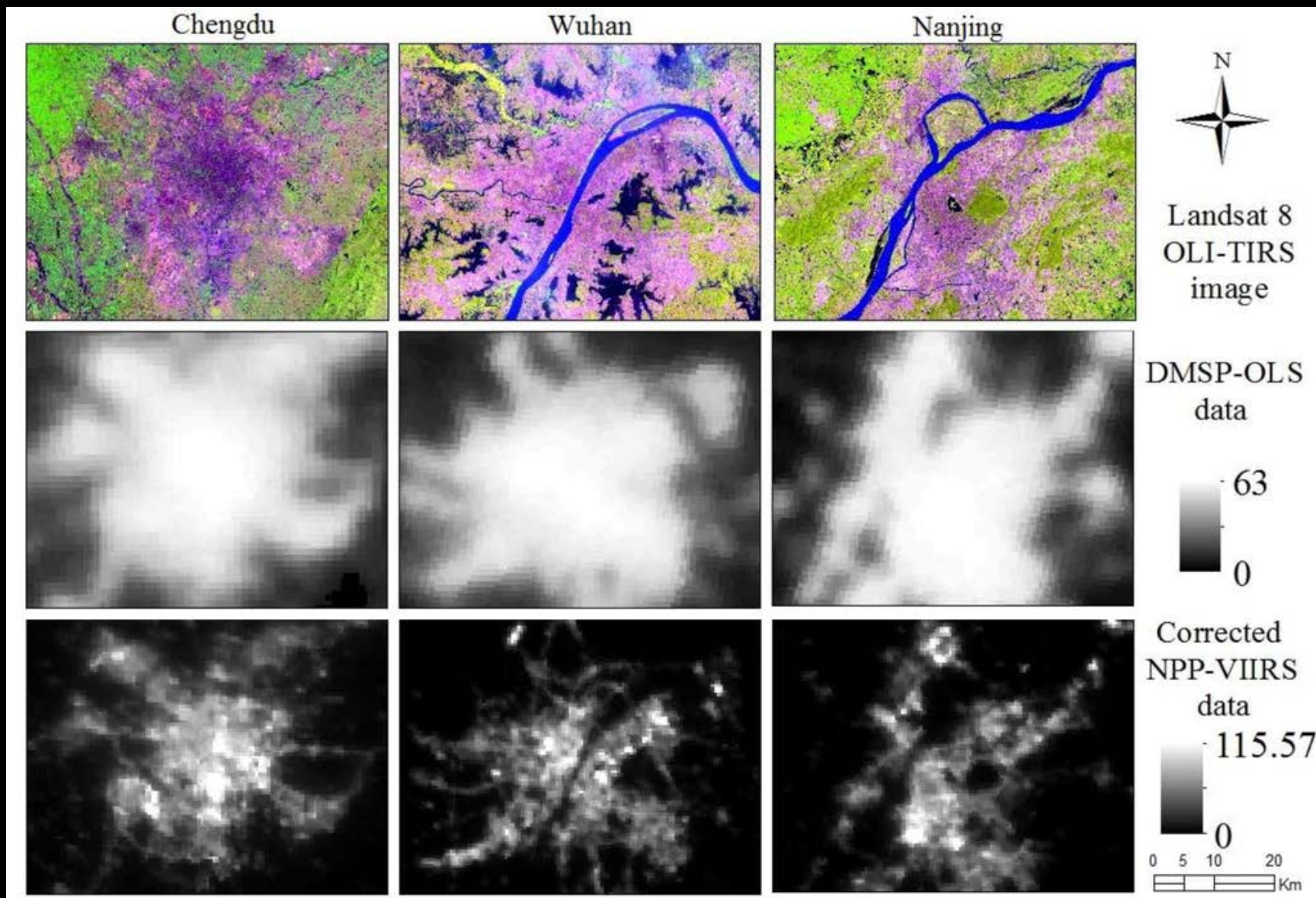
Pakistan – India border

R=2002, G=1997, B=1992



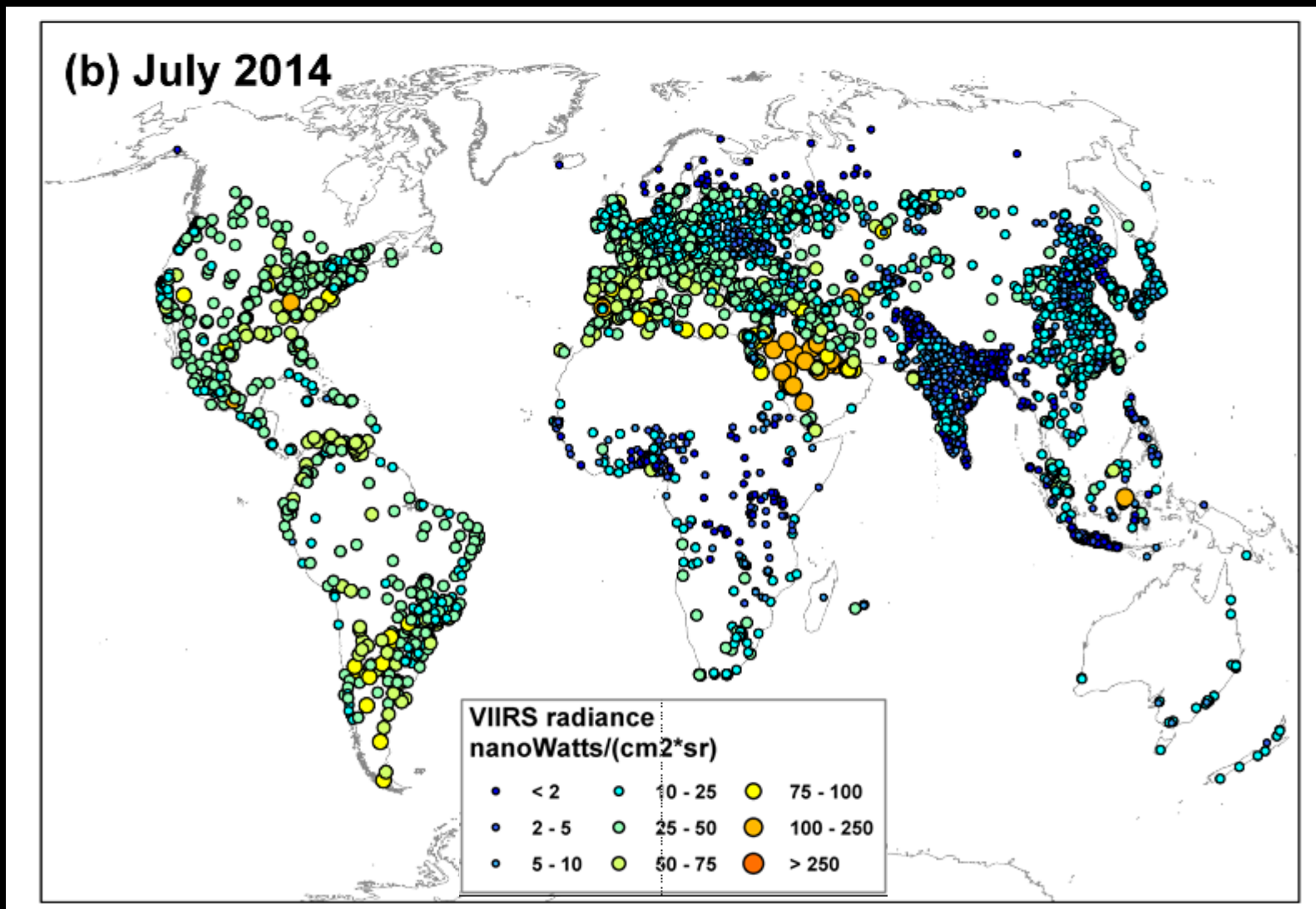
A Delta II rocket launch with the NPP spacecraft payload, October 28, 2011 at Vandenberg Air Force Base, California (NASA/Bill Ingalls)

<https://www.mapbox.com/blog/nighttime-lights-nasa-noaa/>

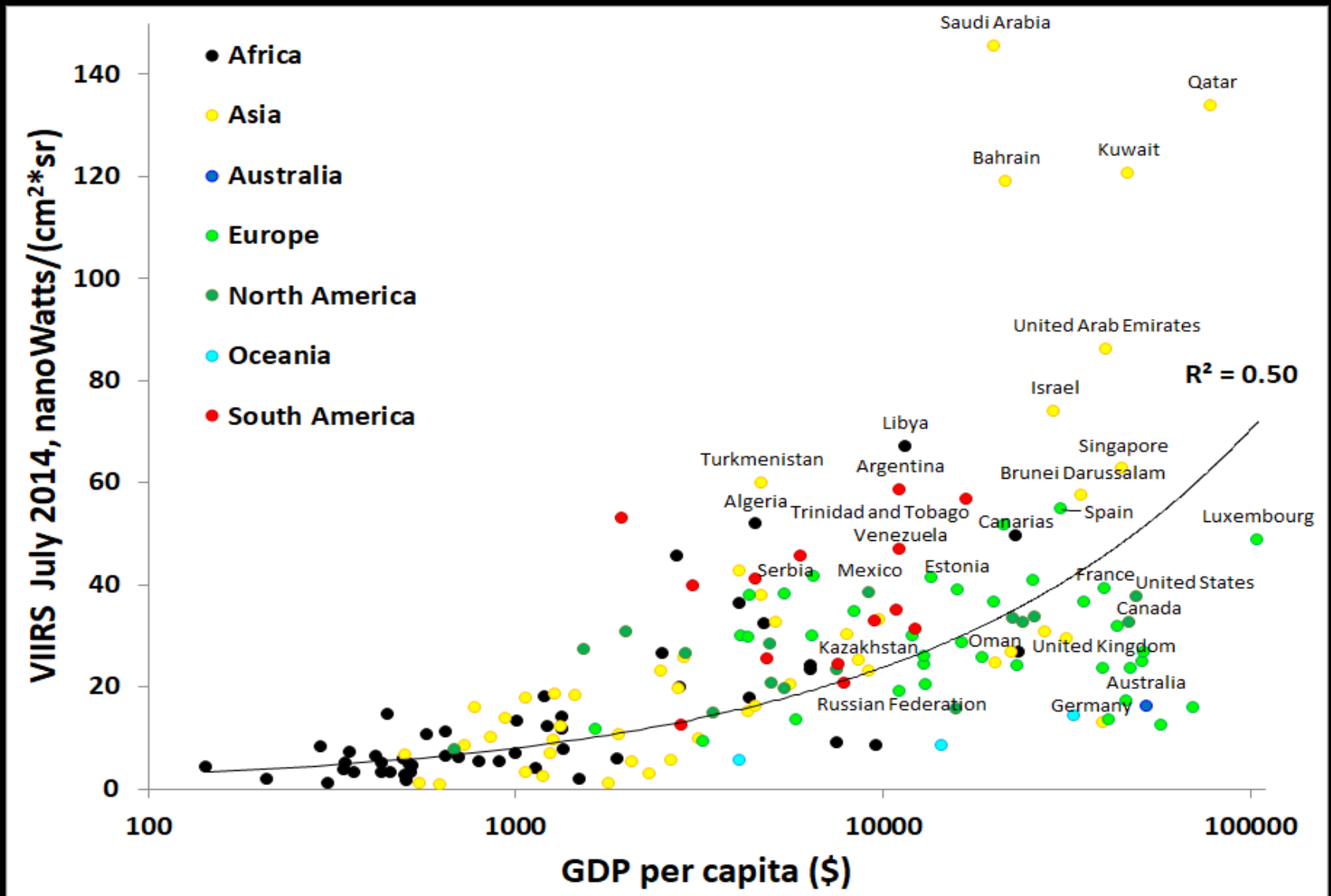


Source: Shi, K., Yu, B., Huang, Y., Hu, Y., Yin, B., Chen, Z., ... & Wu, J. (2014). Evaluating the ability of NPP-VIIRS nighttime light data to estimate the gross domestic product and the electric power consumption of China at multiple scales: a comparison with DMSP-OLS data. *Remote Sensing*, 6(2), 1705-1724.

El brillo de 4,153 ciudades del mundo

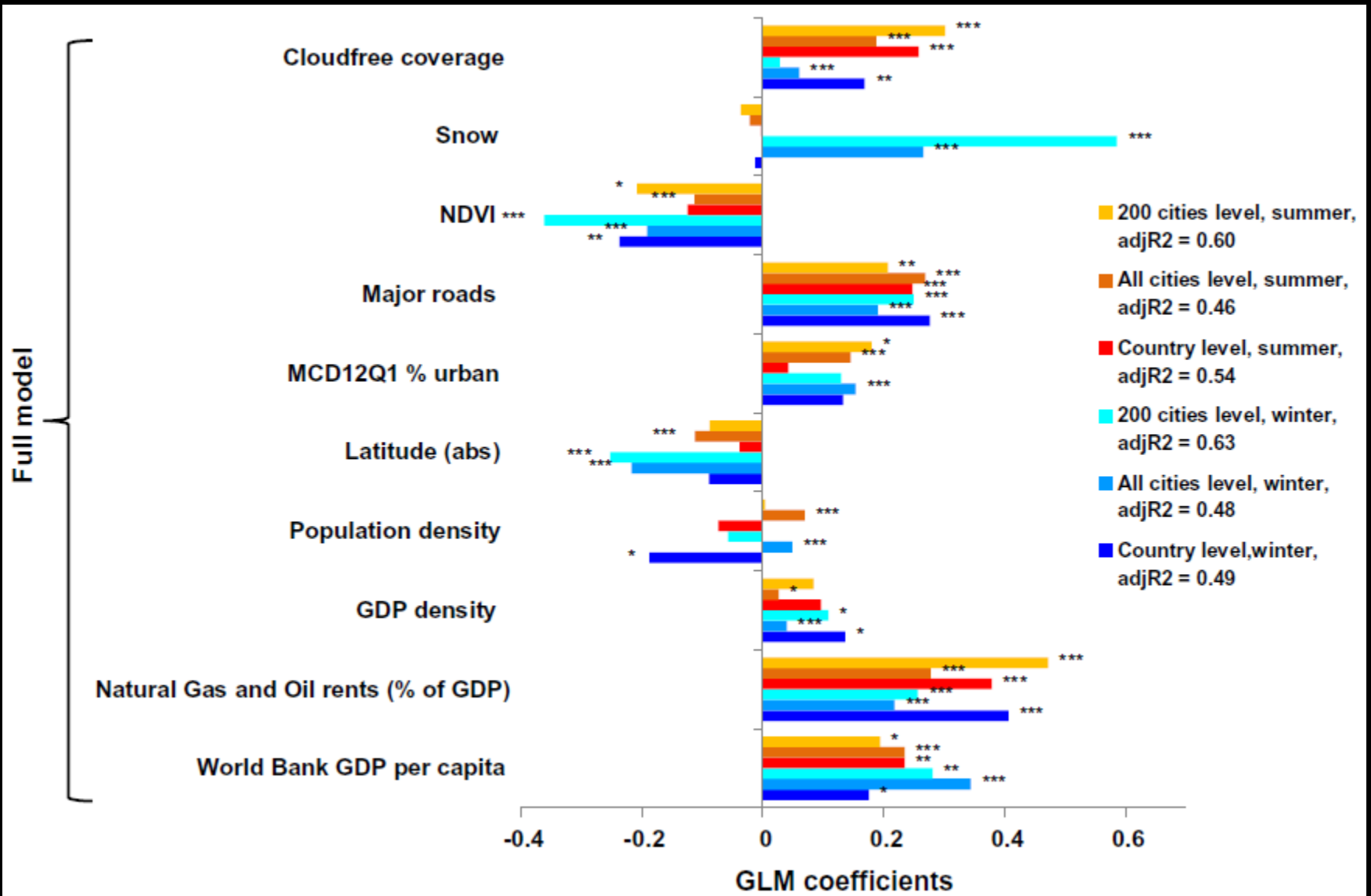


Levin, N., & Zhang, Q. (2017). A global analysis of factors controlling VIIRS nighttime light levels from densely populated areas. *Remote Sensing of Environment*, 190, 366-382.



Producto Interno Bruto per capita

Levin, N., & Zhang, Q. (2017). A global analysis of factors controlling VIIRS nighttime light levels from densely populated areas. *Remote Sensing of Environment*, 190, 366-382.



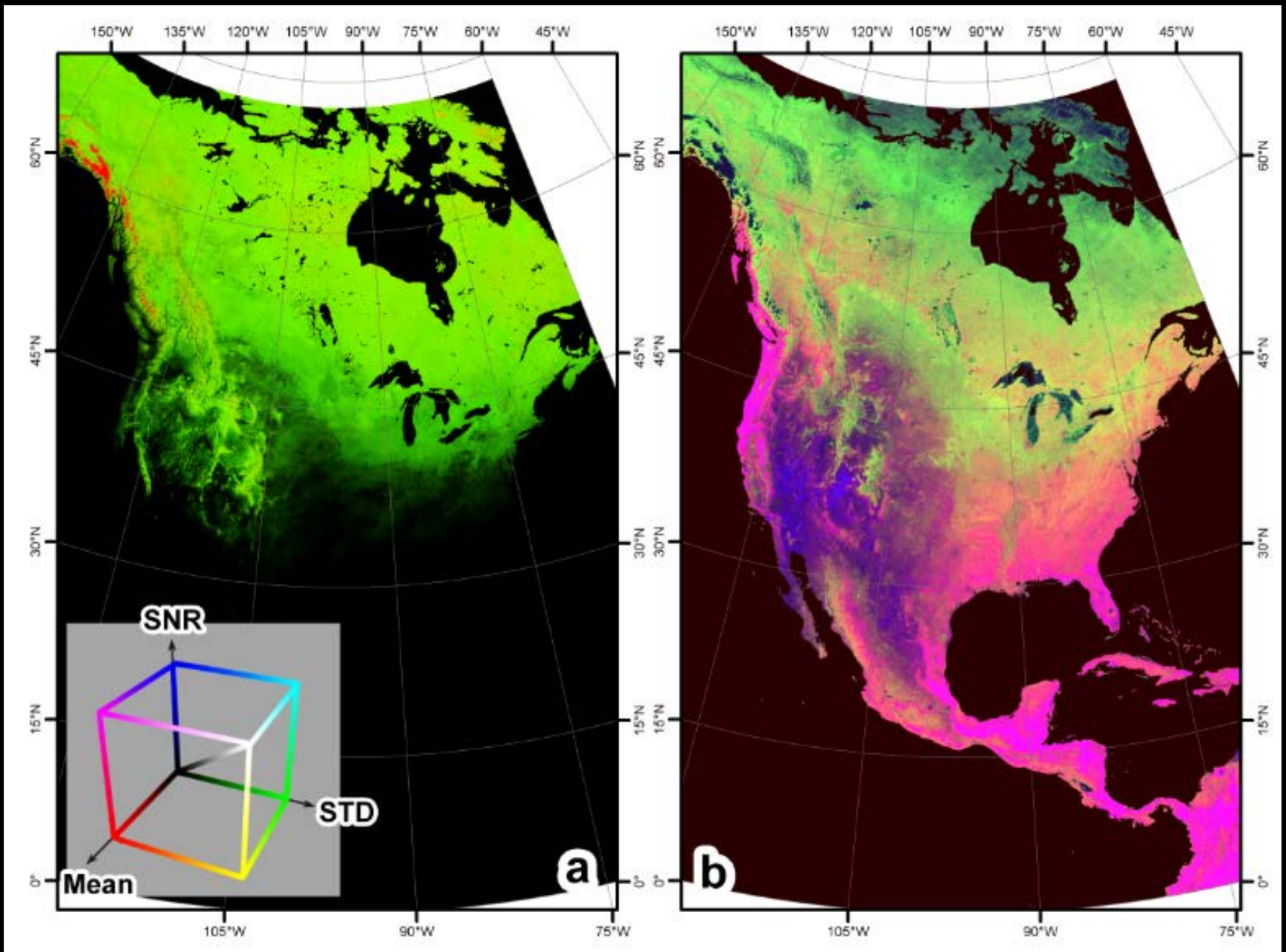
Levin, N., & Zhang, Q. (2017). A global analysis of factors controlling VIIRS nighttime light levels from densely populated areas. *Remote Sensing of Environment*, 190, 366-382.

Explicit analysis of seasonal changes in night-time brightness

**Study area: North & Central America
(268 administrative regions, 89 urban areas in the USA)**

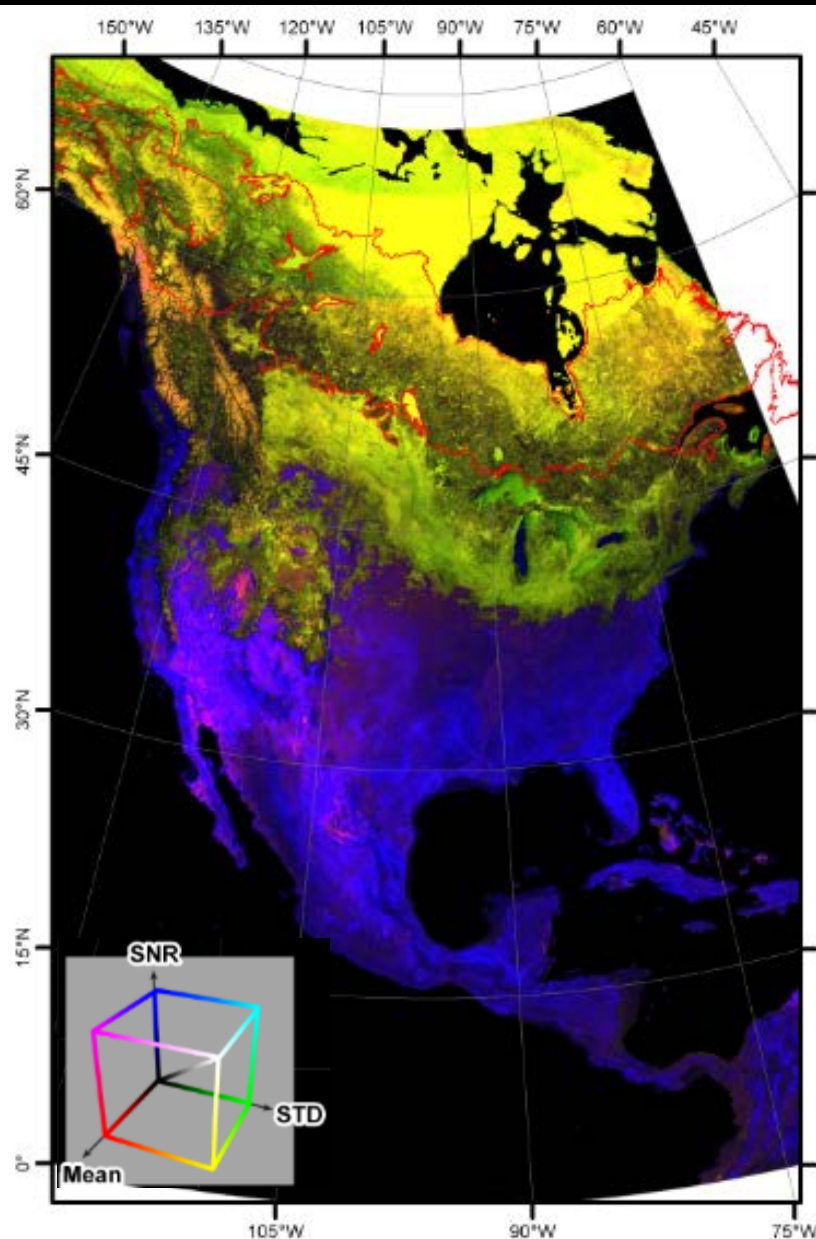
**Night-time datasets: Monthly VIIRS composites
2014-2015**


Predictors: Monthly snow cover, NDVI, albedo



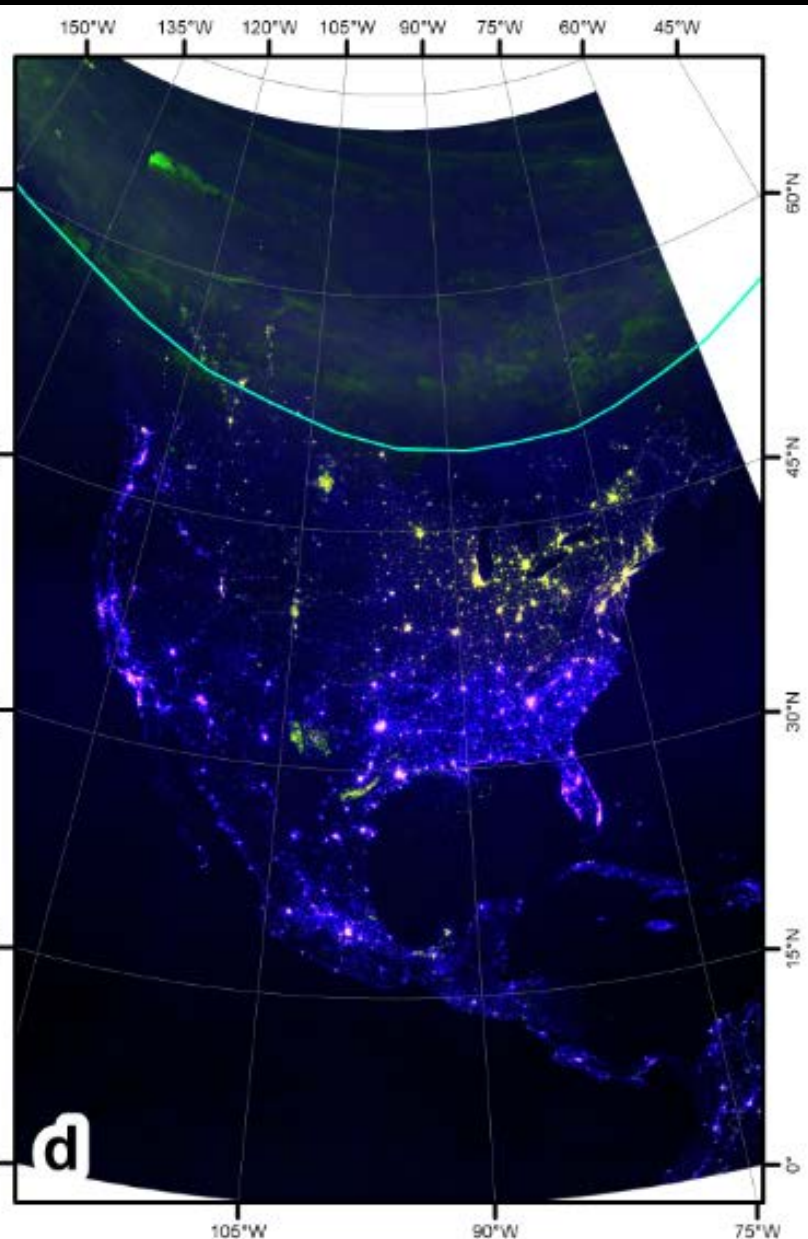
Snow

NDVI



 Boreal forests / Taiga

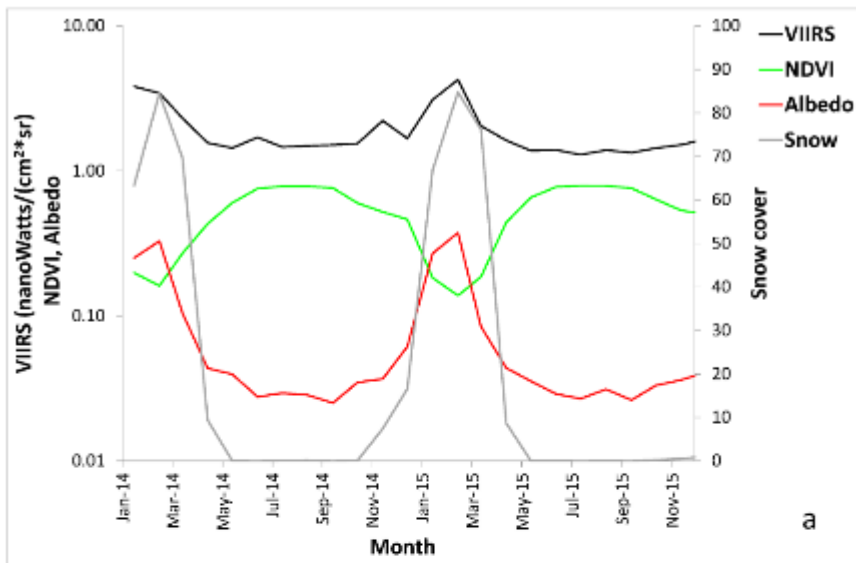
Albedo



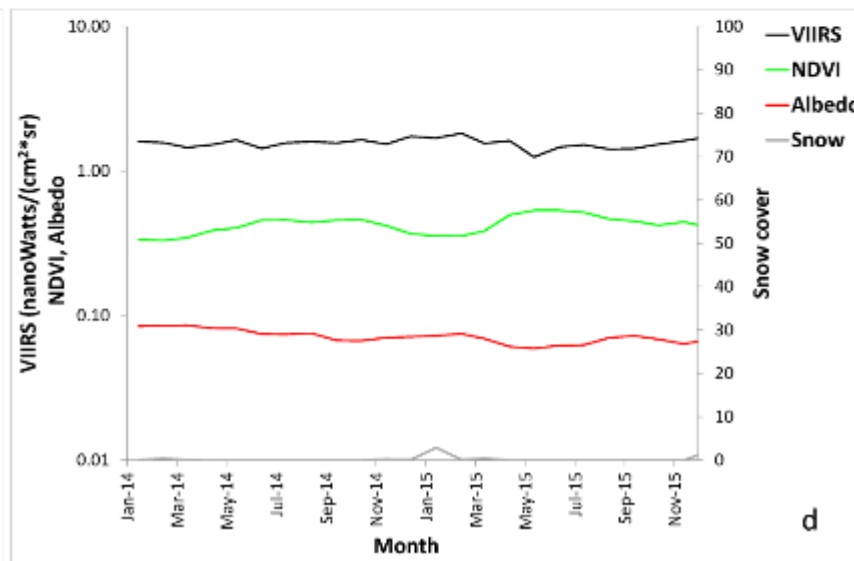
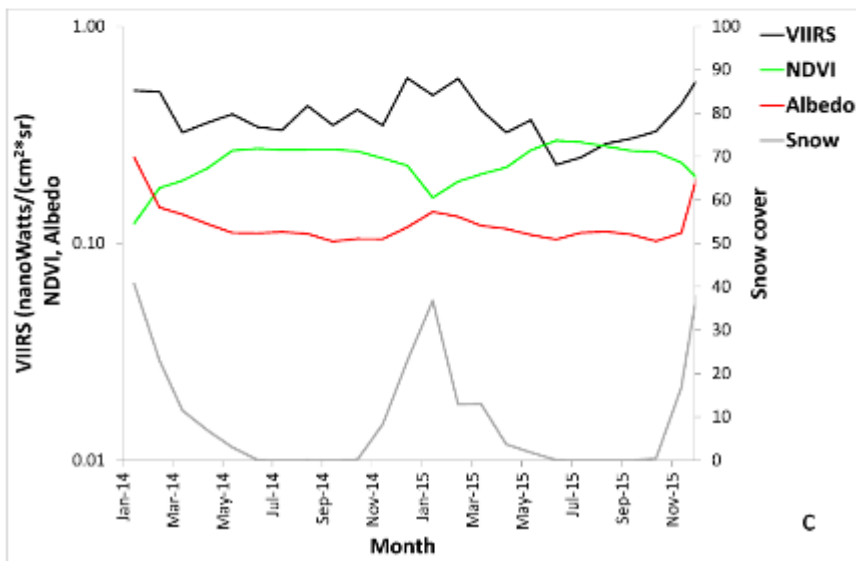
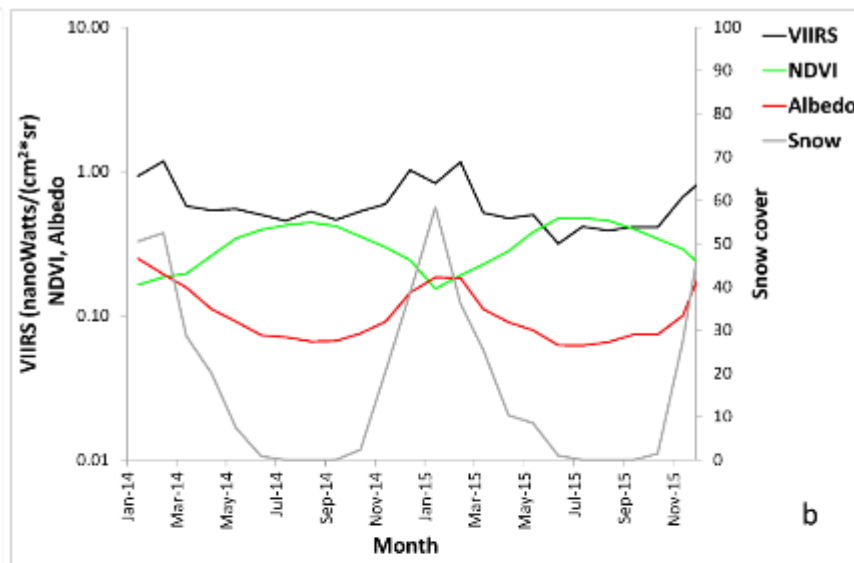
 Southern edge of aurora, Kp=3

Night-time brightness

New York



Colorado



Utah

Texas

שינויים עונתיים

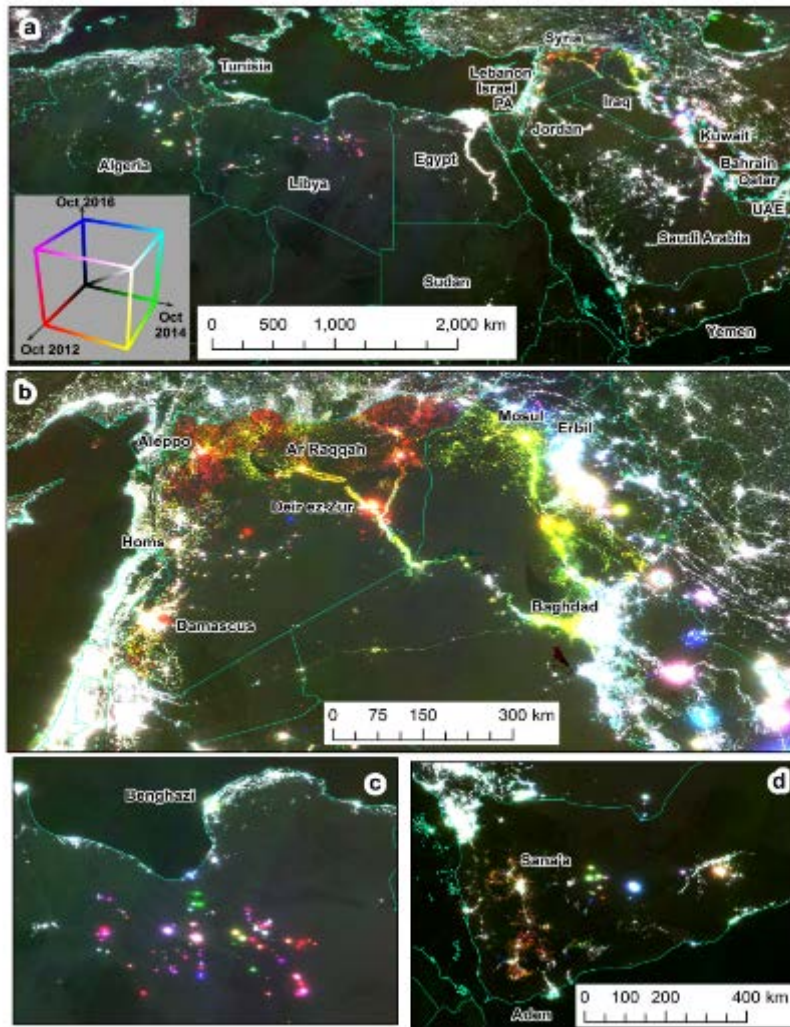


שינויים עונתיים בעוצמת התאורה: רעש

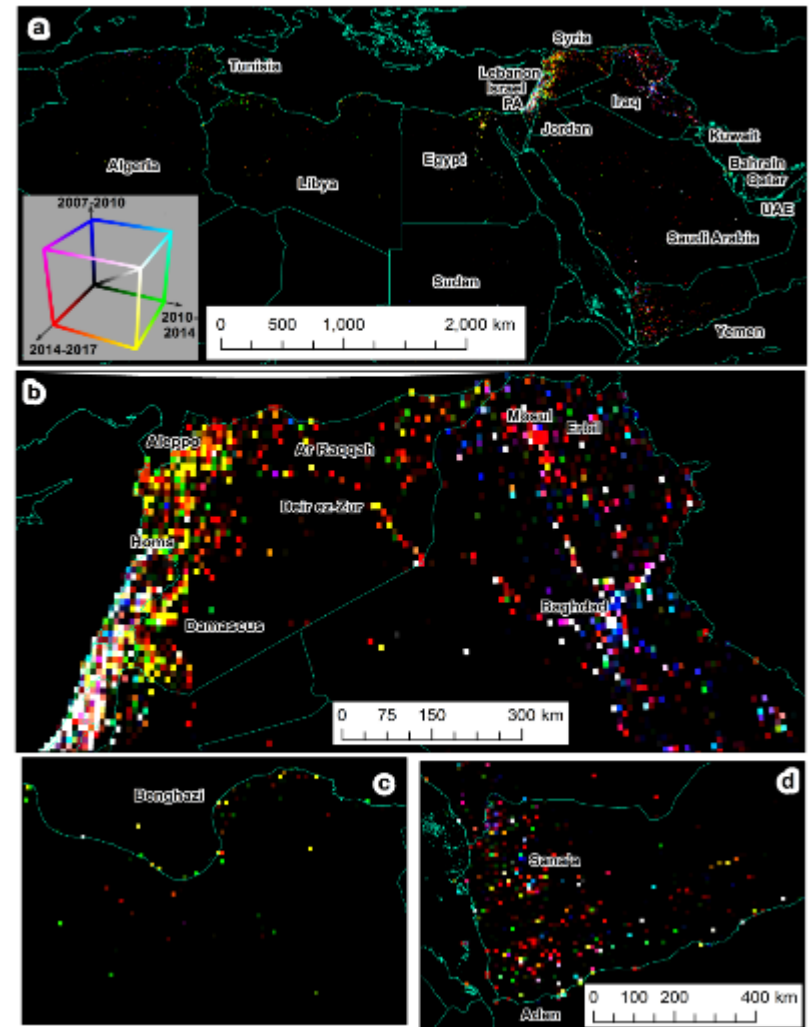
שינויים עונתיים בעוצמת התאורה: אות



ניטור ההשלכות של אזורי סכסוך



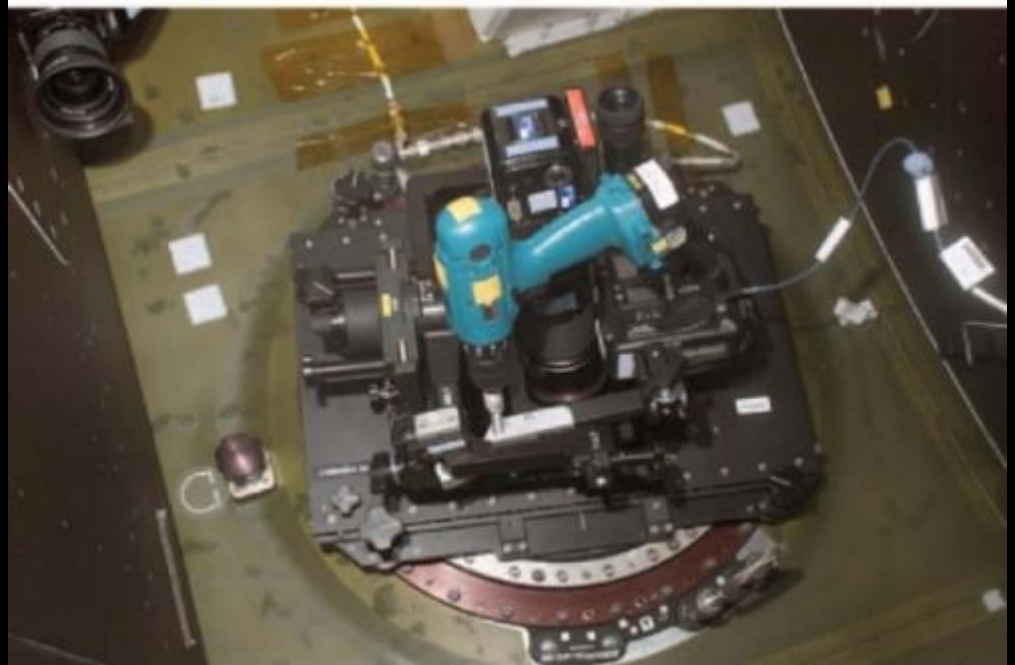
VIIRS night lights



GDELT fight events

Levin, N., Ali, S., & Crandall, D. (2018). Utilizing remote sensing and big data to quantify conflict intensity: The Arab Spring as a case study. *Applied Geography*, 94, 1-17.

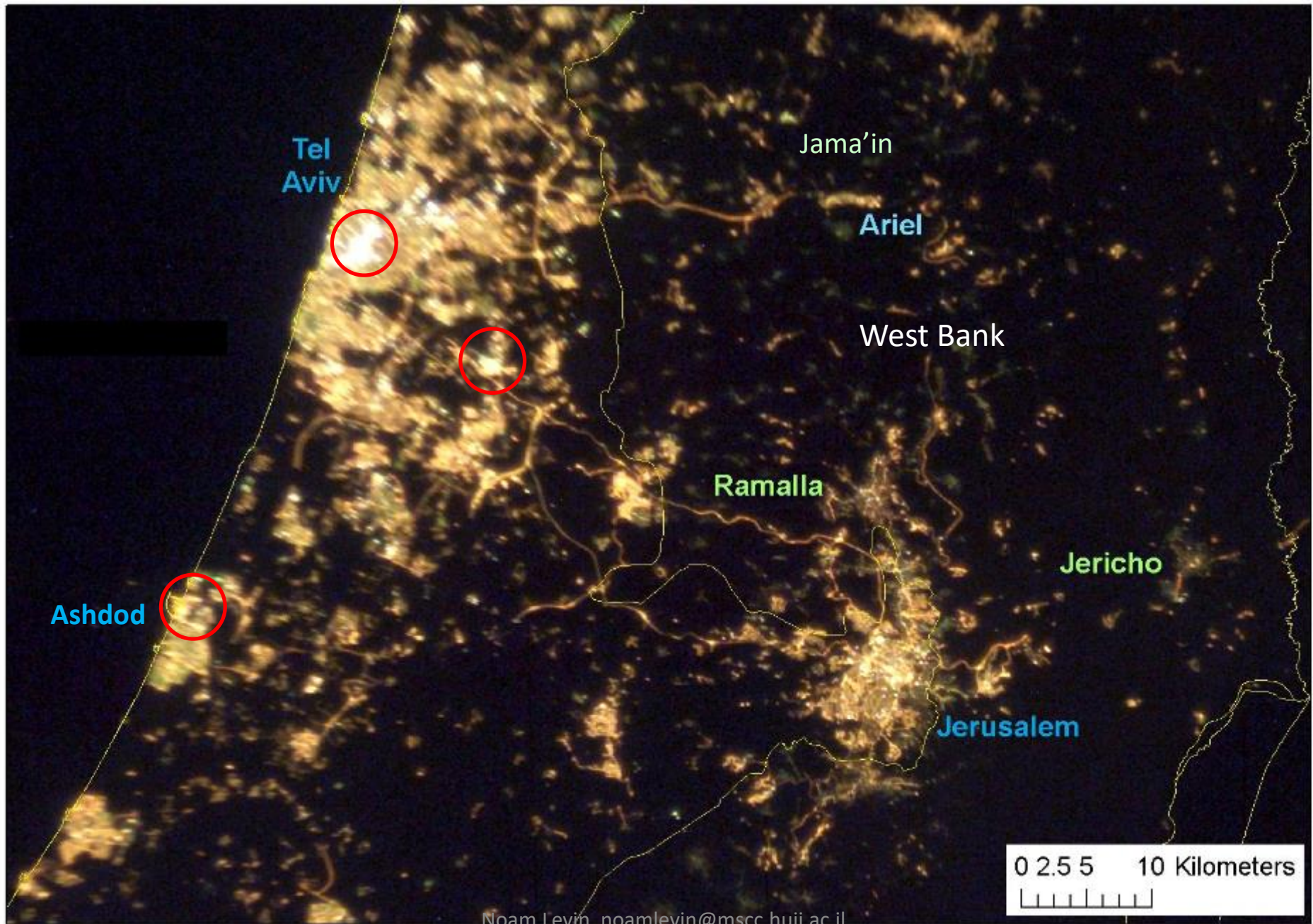
The optical window on the International Space Station (ISS) and the improvised image motion compensation attachment used to acquire moderate resolution colour photography of cities at night.

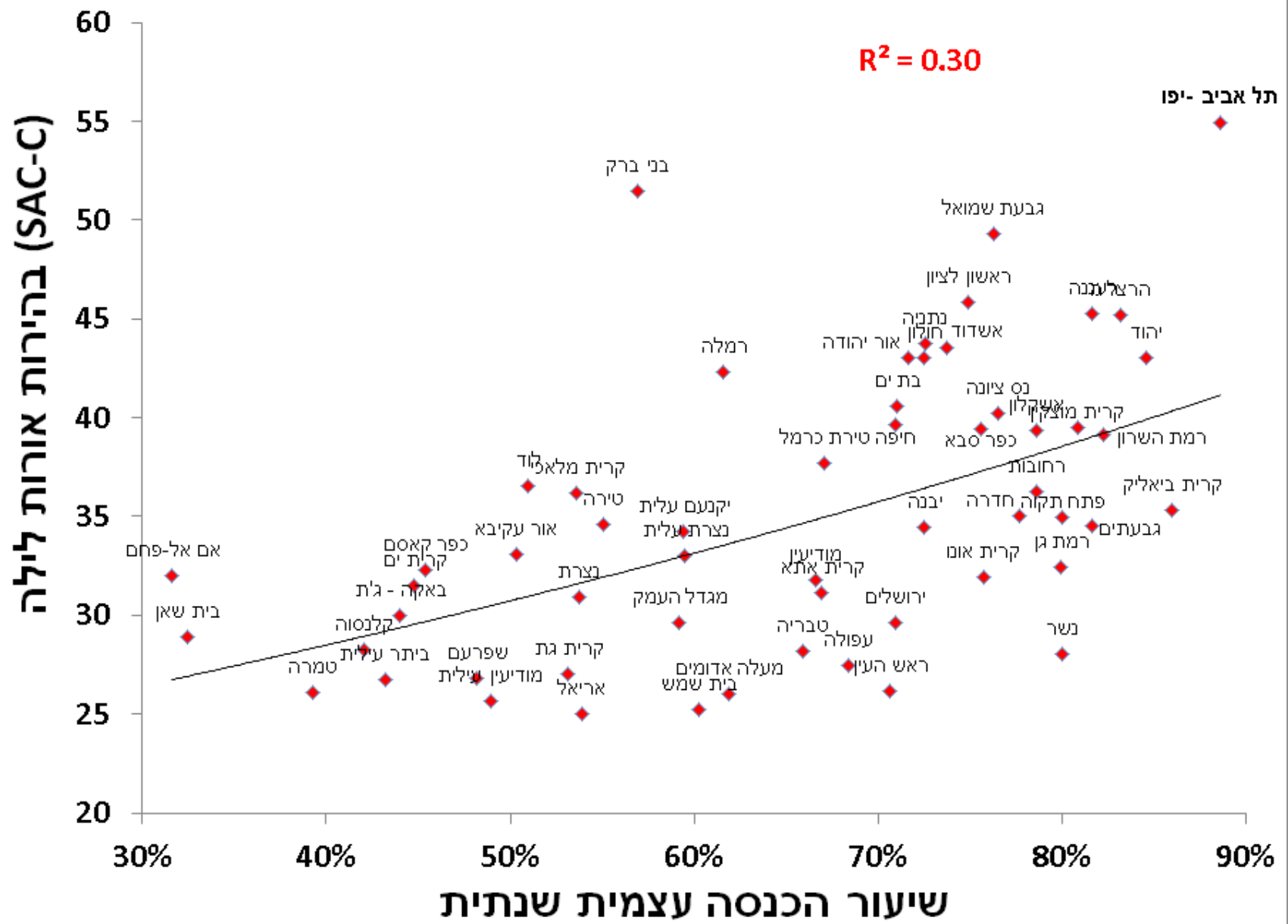


Source: Elvidge, C. D., Cinzano, P., Pettit, D. R., Arvesen, J., Sutton, P., Small, C., ... & Ebener, S. (2007). The Nightsat mission concept. *International Journal of Remote Sensing*, 28(12), 2645-2670.

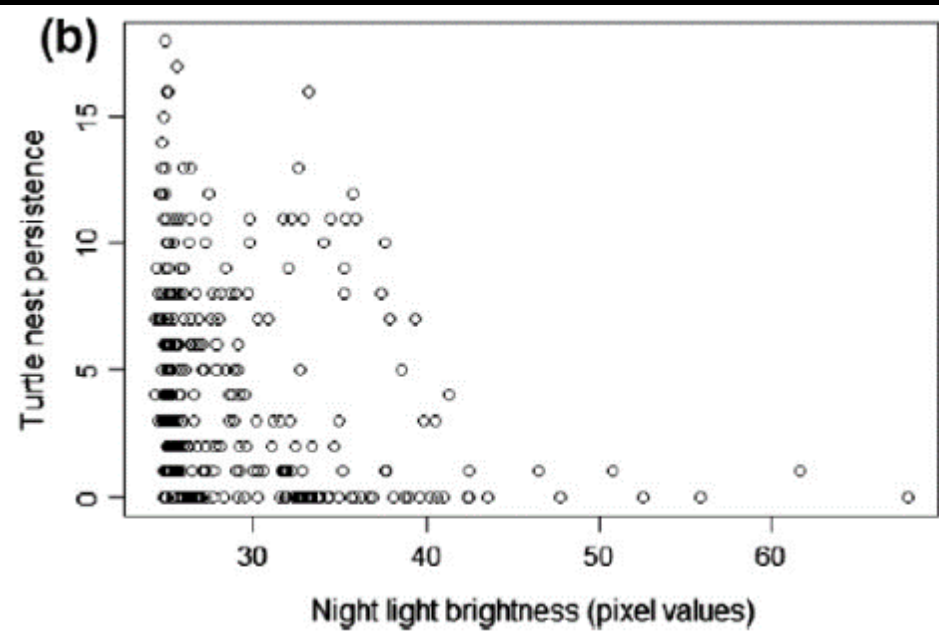
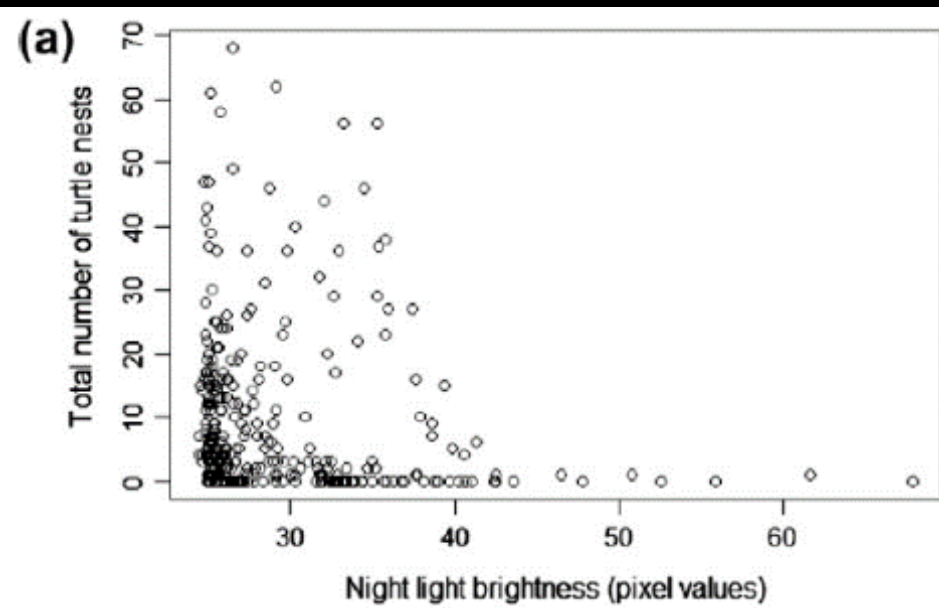
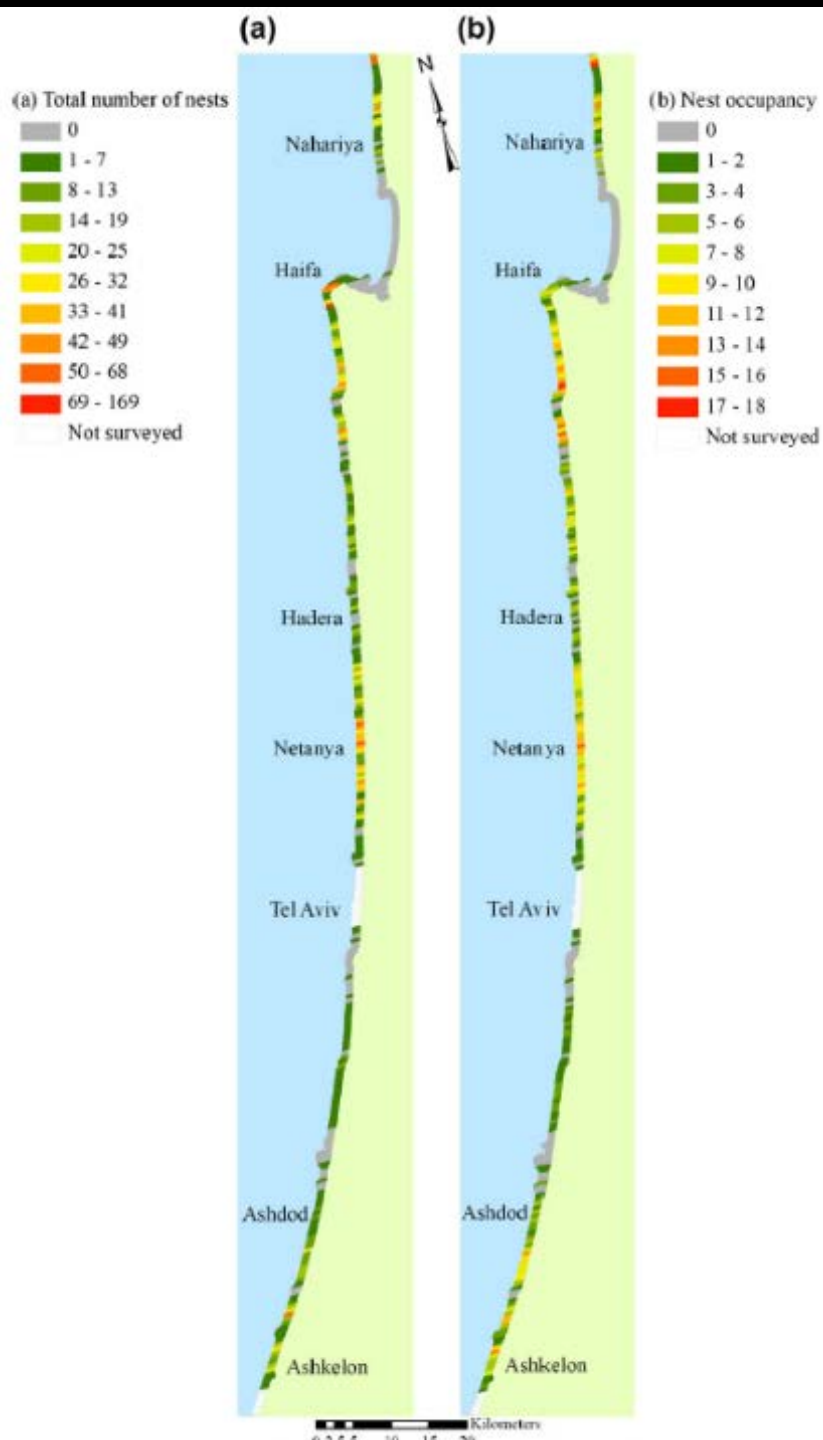


ISS038-E-38300 Korea





A positive correlation was found between locally self generated income and night lights, for 57 cities analyzed



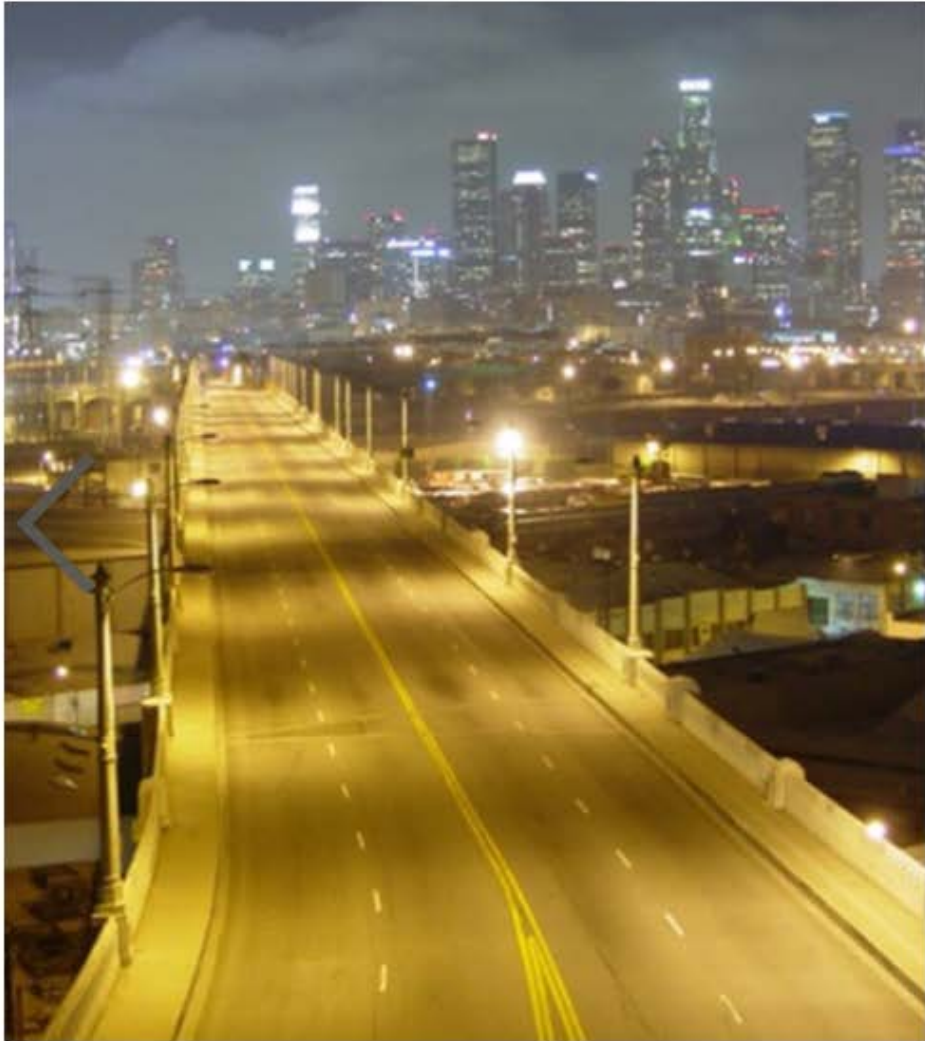
Source: Mazor, T., Levin, N., Possingham, H. P., Levy, Y., Rocchini, D., Richardson, A. J., & Kark, S. (2013). Can satellite-based night lights be used for conservation? The case of nesting sea turtles in the Mediterranean. *Biological conservation*, 159, 63-72.

Doctors issue warning about LED streetlights

THE CONVERSATION

By Richard G. "Bugs" Stevens, The Conversation

🕒 Updated 1800 GMT (0200 HKT) June 21, 2016



LA BUREAU OF STREET LIGHTING

Photos: Los Angeles LED streetlights

אתגרים בחישה מרחוק של אורות לילה:

- פיתוח חיישנים מולטיספקטראליים
- הבנת ההשפעה של הגאומטריה של הצילום על המדידות
- כיול ואימות של מדידות מהחלל
- הבנת השונות השעתית, יממתית ועונתית בעוצמת התאורה
- בחינת ההשלכות של מהפכת ה LED



Fig. 12. Conceptual diagram of urban light pollution sources, and dominant directions.

תודה על ההקשבה 😊



מכתש רמון
15/12/2018