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PRESS RELEASE

Evidence light pollution can be measured directly from space

This new method allows us to estimate changes in air quality during the COVID-19 quarantine

Madrid, May 8, 2020. Due to the increasing amount of artificial light at night globally scientist are driven to determine the extent of light pollution at night. Until now, it was believed that this could only be measured with devices on the ground, but a new study shows that it is also detectable from space.

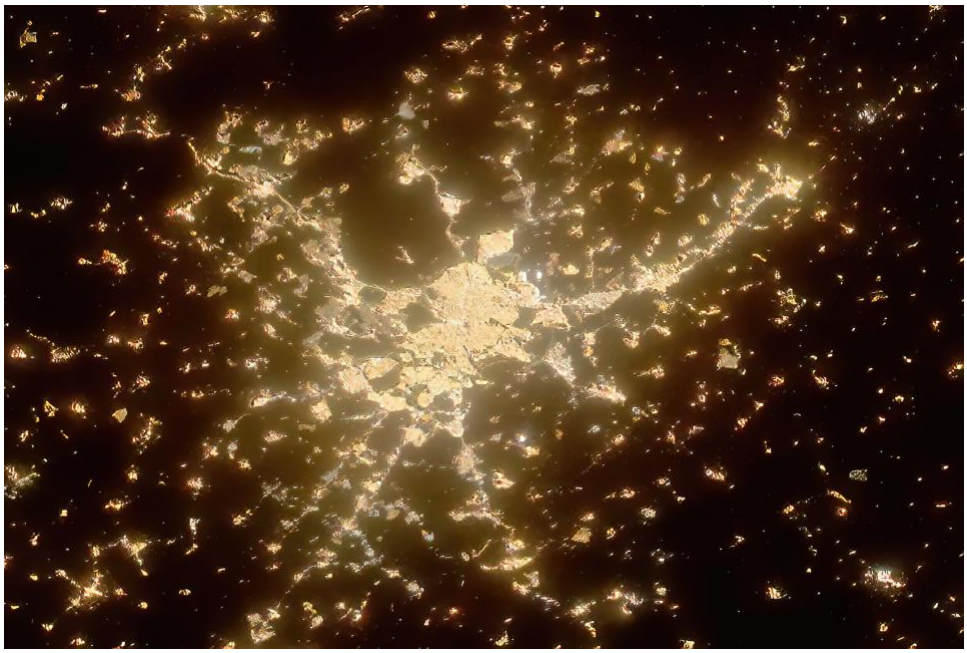
Scientist have uncovered a range of concerning impacts of artificial light at night on the environment and its effects plays a major role in the current global insect apocalypse, as well as the endangerment of many animal species such as migrating bird and turtles. In addition it has been linked to various human health issues.

Traditionally, light pollution and the sky glow is measured on the ground with devices such as photometers that offer only local measurements. This has been limiting for many scientists because in order to map out the true impact of light pollution it is essential to obtain data covering large areas. Being able to use satellite data to study artificial light at night is a major break through since it will let scientist have access to data covering large areas of earth in a far less time consuming method.

For more than twenty years satellites have been detecting diffused light in unlitted areas outside cities. Until now these detections were attributed to an instrumental effect. This research has proven that this diffused light has its counterpart measured from the ground and fits perfectly with the most advanced light pollution models.

This is explained because artificial night light passes through the atmosphere, interacting with air particles deflecting in all directions, generating a luminous halo in the sky, that now we know, can be seen from the ground as sky brightness and from the space as halo of diffuse light.

It is precisely this halo that scientists from the Complutense University of Madrid in collaboration with the University of Exeter have managed to detect after combining 24 months (spread over 6 years) of data in a single image from the SNPP/VIIRS-DNB satellite. Also used HDR images taken by ESA/NASA astronauts, made as requested by these researchers, have been fundamental to this study.



One of the HDR images used by the researchers in which the halo produced by the artificial night light in Madrid is observed. Credit: Alejandro Sánchez de Miguel /ESA / NASA

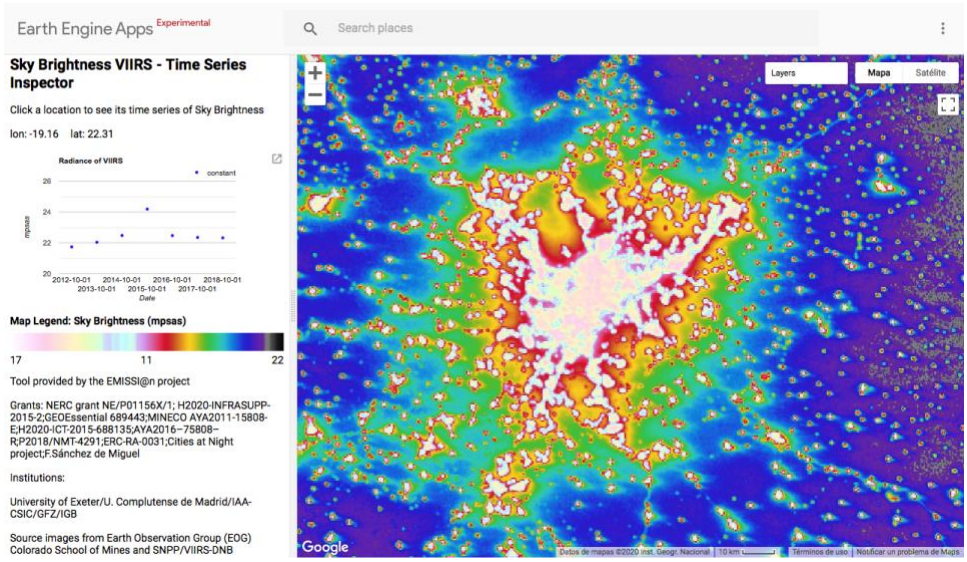
The doctor in astrophysics Alejandro Sánchez de Miguel, is the first author in the recently published article in Scientific Reports (Nature group) in which the details of this study are collected. According to this researcher, the key was in the mountains. "*The values obtained from satellite in places like Rascafría, which is protected by the port of La Morcuera from light pollution generated by Madrid, are too low compared to those predicted by models that do not take into account the shape of the terrain. This made us think that these direct measures could improve current models. In addition to simplifying data acquisition. "* Sánchez de Miguel explains.

"We observed this effect on 3 different satellites, that could not be an instrumental error as has been speculated for the past 20 years." Jesús Gallego, professor in astrophysics at the Complutense University of Madrid, tells us.

The shielding of the halo is not only observed in the capital of our country. The light emitted by the central area of the city of Los Angeles screened by the elevation of the San Gabriel Mountains, which produces darker values than expected in the Los Angeles National forest zone.

"The values of this halo could be affected by the measures of confinement and social distancing taken to slow the advance of the coronavirus. El sky brightness depends on the amount of suspension aerosol and disperse the artificial light as we know, air pollution has dropped sharply due to the decrease in human activity. " the researcher points out.

Thanks to these results, scientists have developed a new application, still in beta, from which the value of sky brightness and its evolution can be consulted anywhere on the planet outside of urbanized areas. It is a map with direct measurements and not data produced by a theoretical model like those that existed until now.



Capture of the new application. To carry out this study, 6,753 kilometers of measurements were used throughout the community of Madrid. Credit: Alejandro Sánchez de Miguel et al. / NASA / ESA.

To detect diffuse light in the atmosphere, it was necessary to use images made with long exposure from space. However, it is not easy to make these types of shots on board the International Space Station, which is moving at a dizzying speed of almost 28,000 km / h.

An instrument of the European Space Agency (ESA) has allowed researchers to work with this type of images. Nightpod consists of a camera installed on a motorized tripod that compensates the displacement of the Space Station by following the movement of specific points on Earth automatically. In this way, the city to be photographed remains within the frame and the end result is a focused image even in long exposure shots.


Astronaut André Kuipers aboard the International Space Station along with the NightPod instrument that made this study possible. Credit: ESA / NASA

The results of this project are good news for all researchers studying the effects of artificial night light, since they will not only be able to use the halo data to better delineate cities, but they will also save thousands of travel. kilometers to take measures as they have been doing until now.

Link to article

Alejandro Sánchez de Miguel, Christopher CM Kyba, Jaime Zamorano, Jesús Gallego, and Kevin J. Gaston. “The nature of the diffuse light near cities detected in nighttime satellite imagery” Scientific Reports-19-29787, 2020.
www.nature.com/articles/s41598-020-64673-2
https://doi.org/10.1038 / s41598 -020-64673-2

Link to the application

https://pmisson.users.earthengine.app/view/trends

Links to high resolution images.

One of the HDR images used by the researchers in which the halo produced by the artificial night light in Madrid is observed. Credit: Alejandro Sánchez de Miguel /ESA / NASA
https://drive.google.com/file/d/18Zd-1WOX2_RnTwjnumW70FvnHjTlHeeJ/view?usp=sharing

Astronaut André Kuipers aboard the International Space Station with the NightPod instrument that has made this study possible. Credit: ESA / NASA
https://www.esa.int/ESA_Multimedia/Images/2013/11/Andre_Kuipers_Nightpod

To carry out this study, 6,753 kilometers of measurements have been used throughout the community of Madrid. Credit: Alejandro Sánchez de Miguel et al. / NASA / ESA.
https://drive.google.com/file/d/1LZVIx9vYqk2WfwYr-k1RSINclSIesfr8/view?usp=sharing

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