Something Old, Something New: Hybrid Light Pollution Model Born from Combined Methods

Sophie McGrady

What would our world look like if we turned out all the lights? And when I say all the lights, I mean ALL of them. Porch lights, street lights, lights in sporting complexes, the list goes on. If we turned off all those lights and waited for the sun to set, would we be left in absolute darkness? The answer, perhaps surprisingly, is no. Our world would simply be lit by a different source: the Milky Way. When the band of stars making up the Milky Way is not dimmed by artificial lights, it can shed enough light to cast shadows where objects stand. The presence of these artificial lights at night and the reason why the Milky Way is not visible from every part of the world is something called light pollution.

But how much light pollution is there really? And why is this something people should be measuring? These are exactly the kinds of questions researchers Henryka and Pawel Netzel sought to answer. Drawing on previous methods of collecting light pollution data, the Netzels were able to invent a new, more efficient way of gathering accurate light pollution readings around the world.

Henryka Netzel is a researcher at the Nicolaus Copernicus Astronomical Center in Warsaw, Poland, and Pawel Netzel works at the Space Informatics Lab at the University of Cincinnati. The two researchers drew upon a critical part of scientific study to begin their research: models. Scientific models can be described as physical or conceptual representations of observations of real world events. Multiple light pollution models already exist, but the Netzels have identified ways that these models are flawed.

For example, while older models "were not demanding in terms of computational power" [1], they often struggled to deliver results with sufficient resolution. On the other hand, while newer models can deliver more realistic data, they require very high levels of computation. Considering these obstacles, the Netzels created a hybrid model that combined the best of both worlds: taking a very simple model and using high-resolution data to create a new model.

[1] "High Resolution Map of Light Pollution" 300

The importance of creating new and improved light pollution models stems from the fact that light pollution affects the majority of the world. According to Fabio Falchi, the creator of the new World Atlas of artificial night sky brightness, "more than 80% of the world and more than 99% of the U.S. and European populations live under light-polluted skies."[2] Though this is a problem that most of the planet faces, the subject is relatively new in terms of research being done. This puts a greater level of importance on the Netzel model. If the model is able to collect more accurate data, we can better understand the role light pollution plays in our lives.

In order to determine if the Netzel model is indeed more accurate than previous models, the researchers compared their data to Falchi's World Atlas. They were able to conclude that both of the models were equally accurate in approximating levels of light pollution, but the Netzel model was able to record data in a much more time-sensitive manner, making it a more efficient model.

This model can first be used to educate the public about this phenomena. However, such data can continue to serve the global community beyond that. According to Aaron E. Schirmer et. al, "a general lack of public concern has resulted in limited research to inform antiphotopollution policies."[3] Considering this, even after the public becomes more familiar with the topic of light pollution, best practices for combating this kind of pollutant remain undefined. Through continued research following the example of the Netzel model, the ways in which we respond to light pollution can become more informed and effective.

Through their research, the Netzels found that, even when looking to create something new, starting with something old can make all the difference. By combining aspects of new and old light pollution models, the Netzels were able to deliver the most efficient light pollution model yet. This data can help outline the problem that our world faces today as well as inform the best ways to combat light pollution. As time passes and this model becomes what researchers may define as old, a new generation of scientists may find themselves in a similar position as the Netzels: taking something old to create something new.

---

[2] "The new world atlas of artificial night sky brightness"

[3] "Mapping behaviorally relevant light pollution levels to improve urban habitat planning"

References

Falchi, Fabio, Cinzano, Pierantonio, Duriscoe, Dan, Kyba, Christopher C. M., Elvidge, Christopher D., Baugh, Kimberl, Portnov, Boris A., Rybnikova, Nataliya A. and Riccardo Furgoni. 2016. The new world atlas of artificial night sky brightness. Science Advances. [accessed June 28, 2020]. https://advances.sciencemag.org/content/2/6/e1600377.

Netzel, Henryka and Pawel Netzel. 2018. High Resolution Map of Light Pollution. Journal of Quantitative Spectroscopy and Radiative Transfer. [accessed June 25, 2020]. file:///C:/Users/16508/Downloads/High%20resolution%20map%20of%20light%20pollution.pdf.

Schirmer, Aaron E., Gallemore, Caleb, Liu, Ting, Magle, Seth, DiNello, Elisabeth, Ahmed, Humerah and Thomas Gilday. 2019. Mapping behaviorally relevant light pollution levels to improve urban habitat planning. Scientific Reports. [accessed June 28, 2020]. https://www.nature.com/articles/s41598-019-48118-z.