

## Hurricane Laura from Space

By Christopher Elvidge, Feng-Chi Hsu, and Morgan D. Bazilian

We consider satellite power outage detection following Hurricane Laura. One of the consequences of many natural disaster are power outages, which result in losses in electric lighting that can be detected with low light imaging data.

Figure 1 provides shows the nighttime light image overlaid with cloud cover in blue from colored longwave infrared signal during the night of August 28th, 2020. City lights that had gone dark will be rendered red. Lights obscured by cloud cover are shown as magenta. Unaffected areas are shown as yellow. It is clear that Lake Charles lost most of its power supply except for the two refineries.

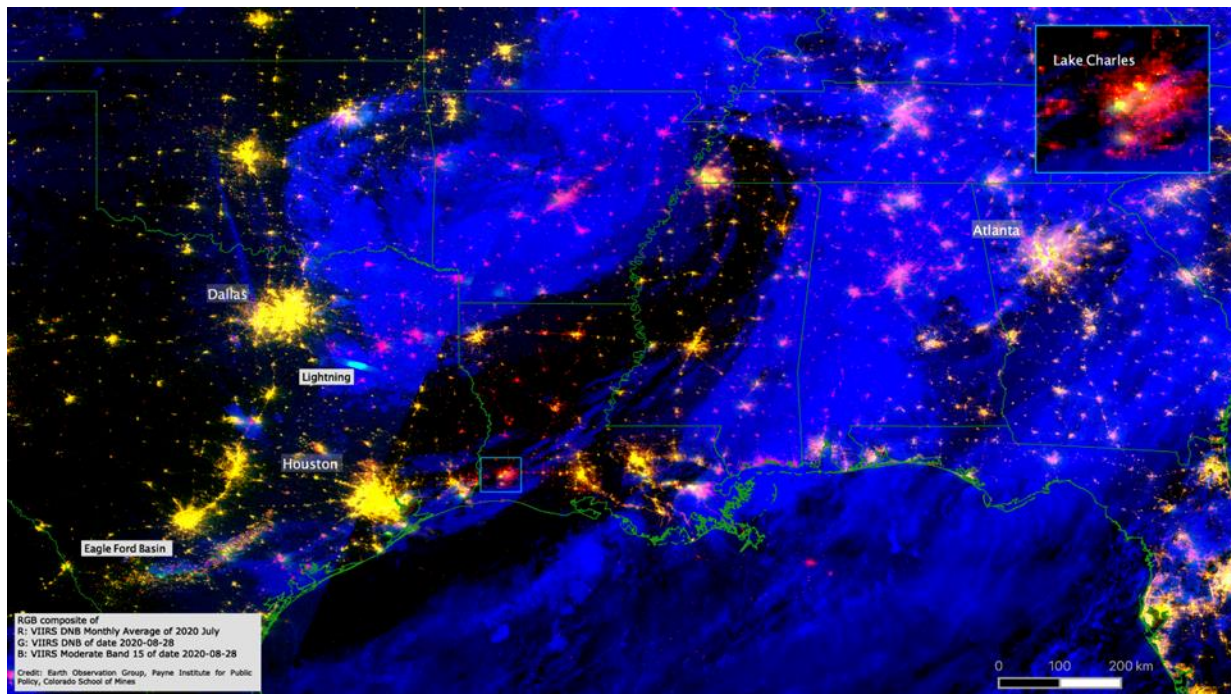


Figure 1

The US Department of Energy Hurricane Laura [Situation Report #4](#) cites As of 2:30 PM EDT (on August 27<sup>th</sup>) , there are a total of 831,767 outages across the states of Louisiana, Texas, Arkansas, and Mississippi as a result of Laura.

By providing up-to-date spatial inventories of human activities and their consequences, remote sensing is increasingly used for public policy applications. During daytime remote sensing is ideal for the observation of the earth surface from space using solar illumination, such as the photosynthetic state of vegetation and human built infrastructure. At night, key radiant emissions resulting from human activities are best observed; this includes electric lighting observable in the visible and infrared emissions from fires, flares, and industrial sites.

It has been known for many years that power outages can be observed by satellite sensors capable of observing electric lighting at night. Elvidge et al. [1] developed the first formalized approach for the detection of power outages using before and after images to identify power outages for specific events. This method was subsequently followed by a number of investigators. In general, the technique involves the comparison of a subject image containing outages with a reference image deemed to be free of outages. Techniques based on individual images break down in cases where cloud obscuration prevents the clear observation of the lights in either the subject or reference image. We propose to build on these previous studies to develop indices of power stability that can be routinely updated worldwide.

[1]Elvidge, C. D., Baugh, K. E., Hobson, V. R., Kihn, E. A., & Kroehl, H. W. (1998). Detection of fires and power outages using DMSP-OLS data. *Remote Sensing Change Detection: Environmental Monitoring Methods and Applications*, 123-135.

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## **ABOUT THE AUTHORS**

### **Christopher Elvidge**

#### **Senior Research Associate, Director of Earth Observation Group**

Christopher D. Elvidge has decades of experience with satellite low light imaging data, starting in 1994. He pioneered nighttime satellite observation on visible lights, heat sources including gas flares and wild fires, as well as bright lit fishing vessels. He led the development of these nighttime remote sensed products with images from DMSP, JPSS, and Landsat satellites. These data are very popular and used globally in both public and private sectors. As of February 2018, he has more than 11,000 scholarly publication citations.

### **Feng-Chi Hsu**

#### **Research Associate, Earth Observation Group**

Fen-Chi Hsu was born and raised in Taiwan. He was a trained engineer in Environmental Engineering, later found his passion in remote sensing. He received his PhD degree in the University of Tokyo in 2012, and started working in Earth Observation Group with Dr. Elvidge in the same year. Since then he has learned the secrets of nighttime light production and helped develop critical algorithms for new products as well as tools for robust processing. Besides being a researcher in remote sensing, he is also building up his skill set as a full stack system administrator as well as a web application designer.

### **Morgan D. Bazilian**

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Morgan Bazilian is the Director of the Payne Institute and a Professor of public policy at the Colorado School of Mines. Previously, he was lead energy specialist at the World Bank. He has over two decades of experience in the energy sector and is regarded as a leading expert in international affairs, policy and investment. He is a Member of the Council on Foreign Relations.

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