Del Valle, A., Elliott, R. J., Strobl, E., & Tong, M. (2018). The Short-Term Economic Impact of Tropical Cyclones: Satellite Evidence from Guangdong Province. *Economics of Disasters and Climate Change*, 2(3), 225-235.

This paper is the first to examine the short term local economic impact of tropical cyclones by estimating the effects on monthly nightlight intensity. More specifically, for Guangdong Province in Southern China, we proxy monthly economic activity with remote sensing derived monthly night time light intensity and combine this with local measures of wind speed derived from a tropical cyclone wind field model. Our regression analysis reveals that there is only a significant (negative) impact in the month of the typhoon strike and nothing thereafter. Understanding that typhoons are inherently a short-term phenomenon has possible implications for studies using more aggregate data.

Ishizawa, O. A., Miranda, J. J., & Strobl, E. (2017). The impact of hurricane strikes on short-term local economic activity: evidence from nightlight images in the Dominican Republic. *World Bank Group: Policy Research Working Paper 8275*. December 2017 Social, Urban, Rural and Resilience Global Practice Group

The Dominican Republic is highly exposed to adverse natural events putting the country at risk of losing hard-won economic, social, and environmental gains due to the impacts of disasters. This study uses monthly nightlight composites in conjunction with a wind field model to econometrically estimate the impact of tropical cyclones on local economic activity in the Dominican Republic since 1992. It is found that the negative impact of storms lasts up to 15 months after the strike, with the largest effect observed after nine months. Translating the reduction in nightlight intensity into monetary losses by relating it to quarterly gross domestic product suggests that on average the storms reduced gross domestic product by about US$1.1 billion (4.5 percent of gross domestic product in 2000 and 1.5 percent in 2016).

Elliott, R. J., Strobl, E., & Sun, P. (2015). The local impact of typhoons on economic activity in China: A view from outer space. *Journal of Urban Economics*, 88, 50-66.

We examine the impact of typhoons on local economic activity in coastal China. To capture potential damages from an individual typhoon we use historical typhoon track data in conjunction with a detailed wind-field model. We then combine our damage proxy with satellite derived nightlight intensity data to construct a panel data set that allows us to estimate the impact of typhoons at a spatially highly disaggregated level (approx. 1 km). Our results show that typhoons have a negative and significant, but short-term, impact on local activity – a typhoon that is estimated to destroy 50% of the property reduces local economic activity by 20% for that year. Over our period of analysis (1992–2010) total net economic losses are estimated to be in the region of $US 28.34 billion. To assess the damage risk from future typhoons we use simulated probability distributions of typhoon occurrence and intensity and combine these with our estimated effects. Results suggest that expected annual losses are likely to be around $US 0.54 billion.

Gillespie, T., Frankenberg, E., Chum, K. & Thomas, D. (2014) Night-time lights time series of tsunami damage, recovery, and economic metrics in Sumatra, Indonesia, *Remote Sensing Letters*, 5:3,286-294, DOI: 10.1080/2150704X.2014.900205

On 26 December 2004, a magnitude 9.2 earthquake off the west coast of the northern Sumatra, Indonesia, resulted in 160,000 Indonesians killed. We examine the Defense Meteorological Satellite Program-Operational Linescan System night-time light imagery brightness values for 307 communities in the Study of the Tsunami Aftermath and Recovery (STAR), a household survey in Sumatra from 2004 to 2008. We examined nightlight time series between the annual brightness and extent of damage, economic metrics collected from STAR households and aggregated to the community level. There were significant changes in brightness values from 2004 to 2008 with a significant drop in brightness values in 2005 due to the tsunami and pre-tsunami night-time light values returning in 2006 for all damage zones. There were significant relationships between the night-time imagery brightness and per capita expenditures, and spending on energy and on food. Results suggest that Defense Meteorological Satellite Program night-time light imagery can be used to capture the impacts and recovery from the tsunami and other natural disasters and estimate time series economic metrics at the community level in developing countries.

Kocornik-Mina, A., McDermott, T., Michaels, G. & Rauch, F. (2015) Flooded cities. *CEP Discussion Paper (1398).* London School of Economics and Political Science, CEP, London, UK.

Does economic activity relocate away from areas that are at high risk of recurring shocks? We examine this question in the context of floods, which are among the costliest and most common natural disasters. Over the past thirty years, floods worldwide killed more than 500,000 people and displaced over 650,000,000 people. This paper analyzes the effect of large scale floods, which displaced at least 100,000 people each, in over 1,800 cities in 40 countries, from 2003-2008. We conduct our analysis using spatially detailed inundation maps and night lights data spanning the globe's urban areas. We find that low elevation areas are about 3-4 times more likely to be hit by large floods than other areas, and yet they concentrate more economic activity per square kilometre. When cities are hit by large floods, the low elevation areas also sustain more damage, but like the rest of the flooded cities they recover rapidly, and economic activity does not move to safer areas. Only in more recently populated urban areas, flooded areas show a larger and more persistent decline in economic activity. Our findings have important policy implications for aid, development and urban planning in a world with rising urbanization and sea levels.

Mohan, P. & Strobl, E. (2017) The short-term economic impact of tropical Cyclone Pam: an analysis using VIIRS nightlight satellite imagery, *International Journal of Remote Sensing*, 38:21,5992-6006, DOI: 10.1080/01431161.2017.1323288

Cyclones are relatively instantaneous shocks where arguably most of the important consequences take place in the first few weeks or months. In this article, we construct destruction proxies of wind exposure and storm surge damages and use satellite measures of nightlight intensity to investigate the short-term impact of tropical cyclones using the case study of Cyclone Pam, which struck the South Pacific Islands in March 2015. Using the unaffected islands as a control group, our regression analysis reveals that initially the storm reduced economic activity in the affected islands by as much as 111%, but by the seventh month there were positive boosts to nightlight intensity. By the ninth month this resulted in cumulative net increases in activities related to night-time electricity usage. More generally, our results suggest that there is likely considerable temporal heterogeneity in the response of areas affected by tropical cyclones and demonstrates the potential of using nightlight imagery to assess the short-term economic impact of tropical storms, and possibly other extreme event phenomena, in a relatively timely manner.

Wang, J., Zhang, J., Gong, L., Li, Q., and Zhou, D. (2018) Indirect seismic economic loss assessment and recovery evaluation using nighttime light images – application for Wenchuan earthquake, *Nat. Hazards Earth Syst. Sci.*, 18, 3253-3266, <https://doi.org/10.5194/nhess-18-3253-2018>,

Indirect seismic economic loss not only impacts regional economic recovery policies but is also related to economic assistance at the national level. Due to cross-regional economic activities and the difficulty of obtaining data, it is difficult for the indirect economic loss survey to cover all economic activities. However, nighttime light in an area can reflect the economic activity of the region. This article focuses on the indirect economic losses caused by the 2008 Wenchuan earthquake and evaluation of the progress of restoration and reconstruction based on nighttime light images. First, the functional relationship between GDP and nighttime light parameters is established based on pre-earthquake data. Next, the indirect loss of the earthquake is evaluated by the nighttime light attenuation in the disaster area after the earthquake. Then, the capacity recovery, which is characterized by the brightness recovery process of the light area, is evaluated. Lastly, the process of light expansion in the disaster area is analyzed to evaluate the speed and efficiency of economic expansion.