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Comment on nhess-2022-23

Anonymous Referee #3

Referee comment on "Uncovering the veil of night light changes in times of catastrophe" by Vincent G. Schippers and Wouter J. W. Botzen, Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-23-RC3, 2022

Comments on "Uncovering the veil of night light changes in times of catastrophe"

This paper aims at assessing "to what extent it is possible to capture the regional economic dynamics following damages from a big natural disaster by making use of the annual nighttime lights" (p. 2) especially in countries with poor quality of administrative data. The paper addresses this question by using hurricane Katrina as a test, which hit the US, a country with comparative high-quality public administrative data, in 2005. Using descriptive statistics on eight counties damaged most severely by Katrina, they find that changes of DMSP-OLS night light data are positively correlated with changes of population, employment, real GDP and household income in these counties after 2005. The authors conclude from these positive correlations that "night light changes reflect the general pattern of direct impacts of Katrina as well as the subsequent recovery" (p. 21).

Major comments

- The research question of the paper is interesting and relevant in my view. Night light data may help assess the damages of natural disasters in countries or regions where reliable official data is not available.
- The empirical approach adopted in the paper, the correlation analysis in Section 3.3, is not suited too well for providing a reliable answer to this question, however, for at least three reasons. The first is that, focusing on only 8 severely damaged counties, this correlation analysis may not be representative of all counties hit by Katrina, not to mention regions elsewhere hit by other hurricanes. The second reason is that this correlation analysis lacks a benchmark, i.e., does not control effectively for the regular relationship between night lights and economic indicators in "normal" times. The paper presents correlations for the 8 counties in the five pre-Katrina years but this analysis produces weird results (negative rather than positive correlations). Taken at face value,

these correlations suggest that night lights are poor predictors of economic activity in the 8 counties in "normal" times. Why should they predict economic activity more reliably in times of disaster? And third, the results may be biased by top-coding of the night light data.

- The authors may consider using a more sophisticated empirical approach that can be expected to yield a more reliable answer to the core question of their paper. I suggest using a panel regression that starts from the premise that the relationship between night lights and economic indicators is stable over time and across space in "normal" times, and test if this relationship is different in times of disaster (remark: If the stability assumption is violated even in normal times, the whole exercise is pointless anyway). One way to do this test, in accordance with Henderson et al. (2012), would be estimating the model

$$\ln(L(i,t) = a(0) + a(1)*\ln(Y(i,t) + b(2005)*\ln(Y(i,t)*D(i)*2005 + b(2006)*\ln(Y(i,t)*D(i)*2006 + \dots + b(2012)*\ln(Y(i,t)*D(i)*2012 + \text{county fixed effects} + \text{year fixed effects} + \text{residual}(i,t),$$

for all 3,000something US mainland counties (indexed by i) and years t = 2000, …, 2012. L(i,t) denotes average night light intensity, A(i) area in sqkm, Y the economic indicator of interest (e.g., GDP, population, employment), D(i) a measure of the damage induced by Katrina in county i and the respective year after Katrina, and 2005…2012 year dummies. D may be a dummy variable that is set to 1 for the counties hit by Katrina (maybe above a some threshold damage), or may be defined as ln(1 + % of damaged housing). The parameter a(1) reflects the elasticity of night lights w.r.t. the Y in "normal" times, identified from all annual observations in the counties unaffected by Katrina and the pre-Katrina annual observations in the counties hit by Katrina. The parameters b(2005) … b(2012) of the year-specific interactions between the economic variable of interest and disaster will reflect annual deviations from these normal elasticities in times of disaster, identified from the post-Katrina annual observations in all counties hit by Katrina. The null hypothesis is that these parameters are zero, in which case night lights can - conditional on the stability of a(1) - be considered a reliable predictor of the respective Y in times of disaster because the elasticity is unaffected by the disaster. Setting D=ln(1 + % of damaged housing) even allows for testing if this elasticity is invariant to the intensity of the damages induced by Katrina. Robustness checks should address the biases due to top coding, as in Henderson et al. (2012).

- I find the lengthy verbal descriptions of the association between changes of night light intensities and economic indicators in Sections 3.1 and 3.2 rather uninformative and confusing. I suggest skipping them. In addition to this, Section 4 may be dropped after moving the few points not made elsewhere in the paper to other sections.

Minor comments

- I suggest concentrating discussion of the three methodological issues of the night light

data (intertemporal differences, top coding, overglow) in a single subsection. The discussion of overglow on p. 9 (FN 10) is misplaced in my view.

- I strongly suggest using average night light intensities (by square kilometer) rather than sums of night light intensities across pixels throughout the paper. The sums do not control for differences in the geographic sizes of the counties. This is particularly relevant for Figure 3.
- I also suggest using a single measure of changes of night intensities over time, percentage changes, consistently throughout the paper. Currently, the paper discusses absolute changes in some Figures (3, 7) and percentage changes (or indexes) in others.
- I suggest either harmonizing the spatial scales of the maps in Figure 2, or putting the upper left map into a separate figure.