

Review ESSD-2019-189, global exposure data

Data easy to find and easy to use. Very good metadata, clear licensing. The authors have done a good job of making their codes accessible as well as easy to understand and use.

The authors have not, and can not, validate LitPop to exposure. They have no actual global physical asset data to validate against, at least not at higher spatial resolution than country? They make an interesting case of relevance to GDP (or - if data available - to GRP) but not a definitive case. If they have done careful work to produce a trustworthy product - as I believe they have - perhaps they need substantial caution in extrapolating consistency and predictive skill to global scales. The tool sort of works for 14 rich countries for GDP. As exposure examples they show only 4 cities. Extrapolation to a global exposure data product remains very much a work in progress. The skillful combination of night light data and population data, as reproduced here, represents a useful but still small step? This statement (from the discussion section, line 305): “top-down approach implemented here does not account for differences in infrastructure types and vulnerability” seems to this reviewer to represent a more accurate and honest statement than their expansive title. Recommend publication after a better statement of actual accomplishment / progress.

Specific comments:

Line 46: “With global satellite images being publicly available and updated regularly, it has been proven to be an useful source”. Awkward. Authors intend singular ‘it’ to refer to nightlight data but in this sentence they confuse readers by the plural reference to satellite ‘images’. They could clarify by writing ‘global nightlight images’ ..., ‘they’ have proven ...? Need some change to smooth this out.

Line 55: Reader will find no Zhao et al. 2017 reference. Later (line 141) reader encounters “Naizhuo Zhao et al., 2017” with a matching citation in the reference list. Please fix one or the other and then use consistently? Again at line 161. Please check throughout the manuscript, you do not want to get this particular reference wrong.

Line 85: NASA produces the VIRS nightlight product used here but technically the data come from the Suomi NPP’s Visible Infrared Imaging Radiometer Suite where NPP indicates a joint NASA NOAA effort. Other ESSD papers that reference nightlight data (for emissions purposes) use the NOAA DMSP URL rather than the NASA VIRS link promoted here? E.g. https://ngdc.noaa.gov/eog/dmsp/download_radcal.html. Some remote sensing papers compare VIRS to DMSP, favor of VIRS, but gridded emissions products tend to use DMSP? Emissions products tend to want fires but this population product tends to avoid fires? Here (line 89) these authors use the term ‘stable lights’ but most readers will not understand that term as excluding fires? For remote sensing community, some clarification useful here?

Line 87: Better to use ISO units for times, e.g. 0130 and 1330?

Line 104: “selected for this application, because unlike other spatial population datasets, it does not incorporate” Change punctuation here to: ‘... selected for this application because, unlike other spatial population datasets, it does not incorporate ...’

Line 108: “both spatial and temporal resolution” You mean temporal overlap or time step coincidence, rather than resolution? Resolution would suggest, annual, monthly, etc., when in fact you have used only 2012 and 2016 for nightlight while GPW has 2010 and 2015? (On line 115 you refer to time steps rather than temporal resolution.)

Line 118, 119: “no direct damage to the value of the land itself in the case of disaster” Authors need to justify this default assumption. For coastal land masses subject to wind, water current and sea level/inundation damage, land values almost certainly change pre- to post-disaster, sometimes extensively. For example, termination or increased cost of flood zone insurance, as does and even more should happen post-storm, changes land values? Local governments and commercial real estate firms notorious for artificially maintaining land-values at pre-storm levels to thereby maintain tax bases and market values? Hurricane loss and damage community publishes many assessments on land values before and after storm landfall?

Line. 120: A substantial literature exists on weakness of national GDP reports as indicators of economic output. Perhaps not relevant here? If relevant, authors need to justify why they use GDP?

Line 134: “wide range of income groups and world regions”. But, OECD data already filter out a large number of countries/economies? Therefore one might gain a wide range of OECD data, but not actually a wide range of global data? The list of 14 countries presented here looks more like G-7 plus BRIC, e.g. not exactly a wide range of global economies or regions? In line 135 the authors admit “bias towards developed and emerging economies”. “wide range” is not correct.

Line 234: What is “ Pop^2 ”? Earlier we have seen and understood $Lit^m Pop^n$ with m and n as weighting factors. In Figure 3 and Table A3 the reader now encounters Lit with values 1 (default) through 5, Pop with values 1 and 2, and LitPop with m of 2 and 3. In plain terms, we see examples with Lit weighted normally to heavily, Pop weighted normally to some increased value, and the LitPop combination with Lit at weights of 3 and 4. One can tease out the meanings and processes but one does not know the weighting factors? Weight of $m = 2$ means double? 20%? 2 orders of magnitude? It will follow that $m = 3$ indicates thrice? 30%? three orders of magnitude? From equation (1) m and n look like exponents, so Lit^5 indicates Lit to the 5th, e.g. 5 orders of magnitude? Mathematically correct, one suspects, but meaning obscure. Why did authors choose to vary Lit more than Pop? Given the strong valid preference for LitPop (with $m = n = 1$) what does a reader learn by seeing all these permutations? In line 279 the authors use the word “multiplicative” but, for this reader, that term differs substantially from exponential? Later (line 290) the authors use the word “exponent”.

Again, one assumes they know what they did, but they have not conveyed their approach clearly to this reader.

Line 240: “is the most an adequate combination”

Line 243: “In the validation in Section 3.2, Mexico shows” Because the authors do not mention Mexico in Section 3.2, this sentence should instead read ‘Compared to’ or ‘In contrast to’?

Line 245: “the smaller districts” You mean smaller economically, not smaller geographically?

Line 253: “housing and infrastructure in suburban México that is used by a population that works in the city”. This rural or suburban pattern of residence coupled with employment/work in a central district must represent a very common or even predominant pattern in most large cities? E.g. Rio, Jakarta, New York, even Mumbai? Not clear to this reviewer why Mexico City would represent an outlier in this regard?

Lines 268, 269: “performs well across countries from different continents and income groups” I already questioned this supposed broad coverage (see comment for line 134, above) and authors in their text have admitted that this is not true. Given the OECD filters and limited availability of data, the authors should show much more caution with broad statements like this?

Line 268: “Global” consistency. Authors presented data from 14 highly-selected countries. This subsample hardly qualifies as global. We do not even know - at least from this paper - what percentage of global population, global nightlights, or global GDP their subset represents. Substantial, perhaps (at least in 2012 and 2016), but hardly definitive?

Line 274: “income group 1” Does this text refer to a World Bank or IPCC categorization? Reader has not encountered group numbers? In lines 136, 137 authors referred to lower-middle-income and low income groups. ‘group 1’ refers to these income levels? Reader must seek out table legend for Table A1 to learn with group 1 means.

Line 294: “the LitPop exposure model” by this point in this manuscript, this reader views this phrase with deep dis-satisfaction and suspicion. The authors showed possibly valid (but highly geographically limited) LitPop to GDP correlations but they have in no way advanced to a LitPop to exposure model. As they say themselves!

Lines 311 to 319, openness replicability etc. Excellent section! Could / should prove useful example for other ESSD papers.