FireCCILT11 artifacts may confound the link between biomass burning and infant mortality

Louis Giglio[a,1] 🆔 and David P. Roy[b,c] 🆔

We read with interest the study by Pullabhotla et al. (1) that sought to quantify the global impact of exposure to biomass burning on infant mortality from 2004 to 2018. They used the FireCCILT11 monthly burned area (BA) product that was derived using Advanced Very High Resolution Radiometer (AVHRR) satellite data at 0.05° and 0.25° resolution (2). The AVHRR sensors were not designed for BA mapping and of some concern is the impact of known FireCCILT11 product flaws (3, 4) and another product flaw found based on our examination of Pullabhotla et al.'s findings. Unless the effects of these flaws on their analysis are shown to be negligible, the veracity of their findings is questionable. This is unfortunate, as inappropriate use of FireCCILT11 has detracted from another potentially impactful study (5).

First, there is a significant lack of consistency between the FireCCILT11 0.05° product and the higher quality MODIS satellite-based FireCCI51 product used to train the statistical classifier and constrain BA proportions in the 0.05° product. The two products have major inconsistencies over regions of Africa (4) and elsewhere (Fig. 1). Overlapping these regions are extensive areas identified by ref. 1 as having some of the highest proportions of infant deaths attributable to biomass burning exposure. Pullabhotla et al. did not address the

extent to which their attribution may have been influenced by FireCCILT11 BA errors.

Second, the FireCCILT11 BA05 product has 0.25° blocky artifacts that make adjacent 0.05° monthly BA proportions nearly identical (Fig. 2). These artifacts likely impact Pullabhotla et al.'s analysis, given that spatial autocorrelation was a key parameter in their 0.05° BA simulation to assess measurement error impacts. The artifacts are not documented in the FireCCILT11 product user guide (6), and it is understandable

Author affiliations: [a]Department of Geographical Sciences, University of Maryland, College Park, MD 20742; [b]Center for Global Change and Earth Observations, Michigan State University, East Lansing, MI 48824; and [c]Department of Geography, Environment, and Spatial Sciences, Michigan State University, East Lansing, MI 48824

[1]To whom correspondence may be addressed. Email: lgiglio@umd.edu.
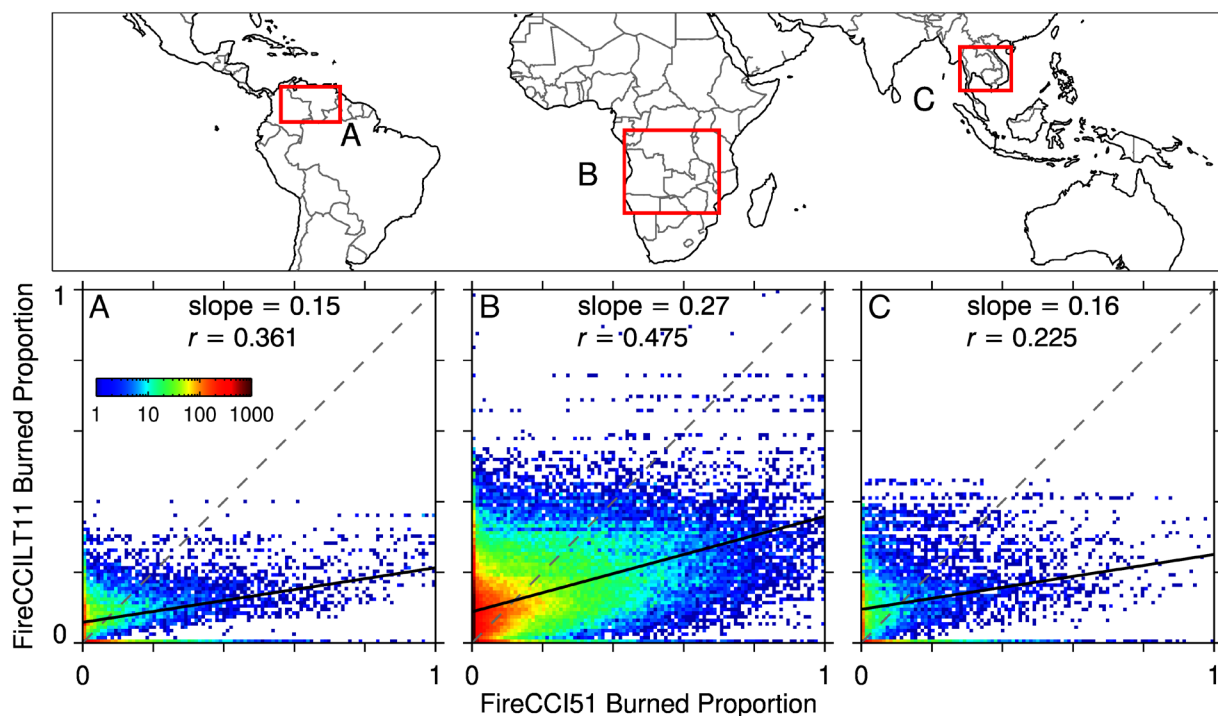
Fig. 1. Comparison of BA proportions defined by the FireCCILT11 0.05° product with contemporaneous 0.05° proportions derived from the independent higher quality 250-m FireCCI51 product for regions and months when burning peaked globally in February 2007 (*A*), August 2012 (*B*), and February 2007 (*C*). FireCCILT11 is poorly correlated (*r* < 0.5) and underestimates/overestimates high/low BA proportions relative to FireCCI51. The ordinary least squares regression and 1:1 reference lines are shown in solid black and dashed gray, respectively.
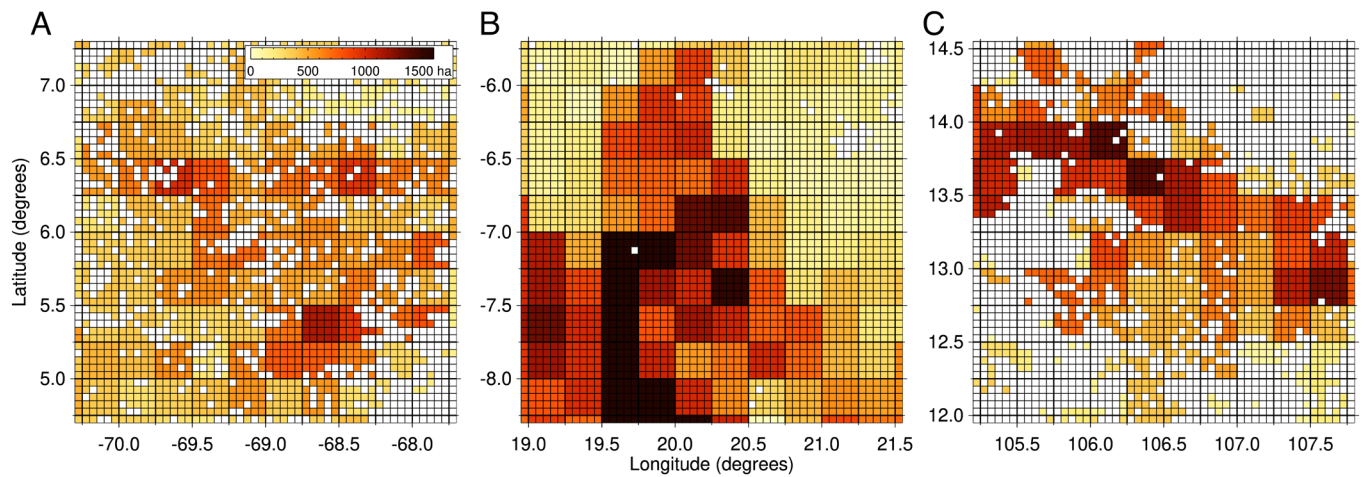
Fig. 2. Subsets of the FireCCILT11 monthly 0.05° BA product selected from within Fig. 1 regions *A*, *B*, and *C*, illustrating the blocky 0.25° artifacts (0.05° pixel and 5 × 5-pixel boundaries delineated by thin and thick black lines, respectively).

that Pullabhotla et al. would not recognize this 25-fold reduced spatial resolution as an error source.

Finally, we note that the FireCCILT11 validation study reported BA biases from −35 to 1125% for 2001 to 2018 (7). While the appropriateness of Pullabhotla et al. citing this study as providing "consistent and accurate estimates of BA over a long time period" is debatable, errors of this magnitude and variability reinforce the need for an explicit consideration of FireCCILT11 BA product errors in global and long-term analyses.

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2. G. Otón, J. Lizundia-Loiola, M. L. Pettinari, E. Chuvieco, Development of a consistent global long-term burned area product (1982–2018) based on AVHRR-LTDR data. *Int. J. Appl. Earth Obs. Geoinf.* **103**, 102473 (2021).
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5. L. Giglio, D. P. Roy, Satellite artifacts modulate FireCCILT11 global burned area. *Nat. Commun.*, in press.
6. G. Otón, "ESA climate change initiative–Fire_cci D4. 2.2 product user guide-AVHRR-long term data record (PUG-LTDR)" (Fire_cci, 2020). https://climate.esa.int/en/projects/fire/keydocuments/. Accessed 16 November 2023.
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