

Title: Covid-19 lockdown effects on the seismic recordings of Central America

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Special Issue: Social seismology – the effect of COVID-19 lockdown measures on seismology

Review by Alan Kafka

General Comments:

This paper describes observations regarding effects of COVID-19 lockdowns (LDs) on seismic noise, number of detected and located earthquakes, and number of felt and reported earthquakes for Central America. I think this documentation is important and I recommend publication after significant revision. Below are some thoughts I have regarding revisions that the authors might consider to improve the paper.

I see two components to this paper:

1. Documentation of a pattern decrease in seismic noise during LDs in Central America. The authors show this effect clearly, and the documentation of this effect is useful for comparison with similar analyses published for other regions, as well as globally. I think this contribution is very good as basic science, and likely also be good for society, as it contributes to improving our understanding of how seismology could be used for tracking pandemics and other human activities. So, I think this component of the paper should be published without much change.

2. The results are somewhat more mixed regarding the extent to which it demonstrates an increase in (a) number of detected and located earthquakes, and in (b) number of felt and reported earthquakes. Although I see some evidence of such increases, that increase looks less dramatic to me than what I might have imagined, given the clear case for decrease in noise. That mix of results makes it hard to interpret and write about this component of the study. I nonetheless think it's important that the authors are documenting this and that these results should be published, but:

I think there could be improvement in how the authors can best interpret and write about these not-so-dramatic and mixed results regarding the question of whether we are actually seeing an increase in the number of detected and located earthquakes, and in the number of felt and reported earthquakes. Under Specific Comments below, I provide a suggestion for how that might be done.

Another reviewer suggested that the paper needs an in-depth statistical analysis. I agree that there needs to be some statistical analysis of the results, but I don't think that implementing that needs to be complicated. Below, Under Specific Comments, I suggest a way that the results could be statistically tested.

That other reviewer also suggested presenting b-value graphs as a comparison for assessing whether or not the number of detected earthquakes is increasing. I think that is a good idea, and I think the analysis could be improved by including that, such as: fitting a Gutenberg-Richter

relationship line to the data for each region analyzed, projecting that to lower magnitudes, and analyzing the extent to which the observed number of earthquakes matches that expected from the projected G-R relationship.

Specific Comments:

I had a difficult time trying to follow what was the overall pattern of the extent to which we are actually seeing an increase in the number of detected, located, felt, reported earthquakes for before LD vs during LD.

I think this could be helped by adding a table or figure something like the one shown below, that tries to capture the overall pattern of which observations in Figures 7 and 9 show increase versus decrease, versus remains the same, for before vs during LD, and for high versus low magnitude ranges. The authors might be able to find a better way to do this than the way I've done it here, and I might have made some misinterpretations of my specific entries in this table that the authors could correct. But, I do think that adding something along these lines would strengthen the interpretation.

Summary of Results RE Increase in Number of Earthquakes Detected and Felt/Reported			
Evidence of Increase: Lower magnitudes			
Evidence of Increase: Higher magnitudes			
	Costa Rica		Guatemala
Number Detected	* No increase * Small Decrease for M2.5-2.9		* No change for M<=3.4 * Increase for M>=3.5
Number Picked Phases	* On Average: ~10% increase		* Average higher for M<=3.0
Number Felt	* Mostly decrease * Increase in M2.0-2.9 bins		* No change below 4.0 * Increase for M>=4.0
Number Reported	* Mostly no change * Increase for M4.5-4.9		

This type of framework might provide a way of statistically testing the results by doing a series of hypothesis tests for cases where there is an observed increase: null hypothesis of “no increase” vs. alternative hypothesis of “increase.”

Rather than presenting the results as a positive finding, i.e., discovery of increase during LD, I think this contribution might be more valuable if the storyline was from a more skeptical perspective, i.e., about how the results are mixed and how, although there is some evidence of

increase, there is also a storyline about how that increase is not very dramatic and not easy to untangle from other effects, such as random coincidence.

Technical Corrections:

Figures 7b and 9b: I think that, in addition to showing the scatter plots, it would also be useful to show plots of differences between the number of picks for before vs during LD as a function of magnitude bins. This might be a good way to illustrate how often the number of picks is higher versus lower for before vs during LD.

Additional comments and suggested revisions are in the attached PDF annotated manuscript.