

Response to the Comments of Reviewer No. 2

We sincerely acknowledge the reviewer for her/his time spent reviewing this manuscript. We feel the manuscript has been improved after addressing the reviewer's comments. The following contains our response to each comment. Each response contains a reply and reports the changes in the manuscript. In this document, we refer to the manuscript that was revised by the reviewer as the *original* manuscript, and the manuscript that contains the modifications, based on the reviewer's comments, is referred as the *updated* manuscript.

Comment:

"This is not cutting-edge work. In fact, it does not present any scientific novelty, nor does it suggest any new methodology. Indeed, it is an application of SAR technology in the field of risk prevention. Therefore, at best, this work can fall within the scope of a "Technical Note" or a "Case Study" (Possibly "Brief communication")."

Reply:

The reviewer is right pointing out the manuscript does not present a new method, nor a scientific novelty. We motivation of this manuscript is to disseminate SAR data as a useful tool to monitor informal urban growth, which is critical social issue in Perú, and other developing countries. Therefore, with all due respect, we believe the manuscript does fall in the scope of Brief communication (https://www.natural-hazards-and-earth-system-sciences.net/about/manuscript_types.html).

Change in manuscript:

No changes

Comment:

"However, even as a "Technical Note" ("Brief communication"), in order to be useful to an interested reader, and possibly less knowledgeable about this technology, the manuscript should provide more insights and sufficiently detailed contents on the ground conditions of the areas imaged and common backscatter intensity values, including the variety of factors on which they depend (types, sizes, shapes and orientations of the scatterers in the target area, soil characteristics, vegetation cover, moisture content of the target area, as well as the incident angles of the radar beam)."

Reply:

Following the reviewer's comment, we have included further information of the radar images, such as polarization (VV) and incident angle at the study areas (about 38°). Besides, videos recorded from a UAV at the occupied areas in Lomo de Corvina were recently published in the internet:

- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217521408>

- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217520606>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217520563>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217520465>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217520257>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217518049>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217517546>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217516965>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217516619>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217515700>
- <https://www.dreamstime.com/lima-peru-april-th-aerial-media-over-pan-american-highway-one-most-important-america-crossing-south-to-north-video217513019>
- <https://www.dreamstime.com/lima-peru-zone-known-as-lomo-de-corvina-people-illegal-invasion-land-poor-people-illegal-land-dealer-lima-lima-peru-april-video217512728>

Based on the videos, we prepare a simplified scheme of an elevation profile in Lomo de Corvina and discussed the scattering mechanism in the topography of Lomo de Corvina. We already provided common backscattering intensity values and the backscattering mechanism in the occupied areas (Figure 2c of the original manuscript, and Figure 2d of the updated manuscript).

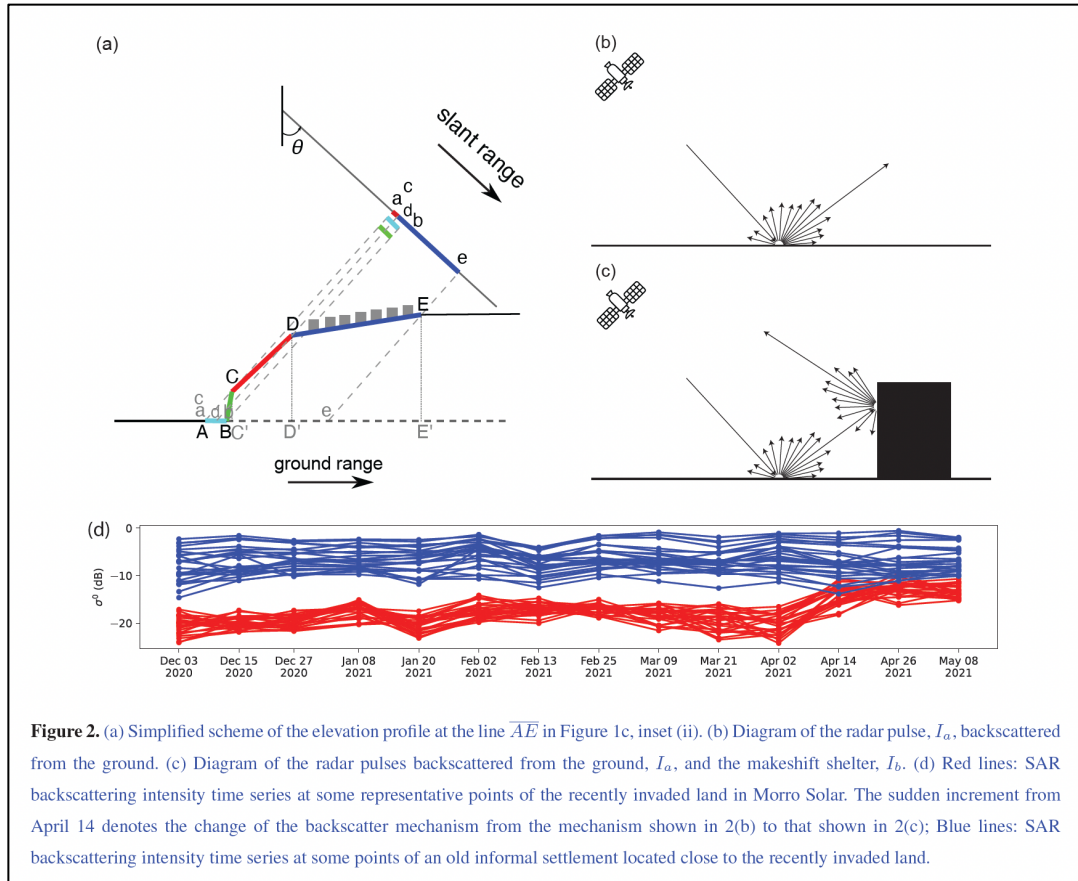
Regarding vegetation and soil moisture, the vegetation is almost absent in the case study areas, and we are afraid we do not have information about the soil moisture. However, we believe the referred information is out of the scope of the present study.

Change in manuscript:

From line 67 onwards:

cloud-covered in most of the days after the invasion. From the beginning of April 2021 until May 5, only one product from the Sentinel-2 constellation recorded on April 20 was cloud-free. On the other hand, synthetic aperture radar (SAR) images are designed to pass through the clouds; thus, we focus on SAR images from the Sentinel-1 constellation. A total of fourteen Sentinel-1 SAR images, recorded from December 3, 2020, to May 8, 2021, were used for the analysis. The images were taken by the VV polarization from the ascending path, and the incident angle at the two study areas are about 38° . Figure 1d shows a color composite of backscattered intensity recorded on different dates. The red band denotes an image recorded on December 03, 2020, and the green and blue band denote the image recorded on April 14, 2021. Note from inset (ii) in Figure 1c and 1d that the Lomo de Corvina area in the SAR image looks smaller than that from the optical image. Such geometric distortions are because of the oblique observation geometry of SAR images. Figure 2a depicts a scheme of the elevation profile corresponding to the line \overline{AE} depicted in the inset (ii) of Figure 1. The profile is simplified by four segments, \overline{AB} , \overline{BC} , \overline{CD} , and \overline{DE} . In order to illustrate the geometric distortions in the SAR images, it is assumed that the range direction is parallel to the vertical plane that contains the profile. The slant range denotes the direction from which the microwave energy travels from the satellite to the ground. The microwave images are presented in ground-range format. Note that because the points A and C share about the same distance to the satellite, both segments \overline{AB} and \overline{CB} occupy the same geographic position in the ground-range (\overline{ab} and \overline{cb}) of the SAR image. In the optical image, the profile scheme is located over the line \overline{AE} (Figure 1c); on the other hand, the profile is located along the segment \overline{ae} in the SAR image, which is significantly smaller. However, the segment that contains the informal settlement in the optical image, \overline{DE} , is only slightly larger than the length of \overline{de} . Note also there is a shift between \overline{DE} and \overline{de} .

Figure 2:



Comment:

“Figure 1 caption reads "Red band: image recorded on April 14, 2021; Green and blue band: image recorded on December 03, 2020"; later on the same figure, lines 65-66 read "The red band denotes an image recorded on December 10, 2020, and the green and blue band denote the image recorded on April 14, 2021"”

Reply:

We apologize for the typo. It has been corrected accordingly.

Change in manuscript:

Line 70:

<p>70 color composite of backscattered intensity recorded on different dates. The red band denotes an image recorded on December 03, 2020, and the green and blue band denote the image recorded on April 14, 2021. Note from inset (ii) in Figure 1c and 1d</p>
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Comment:

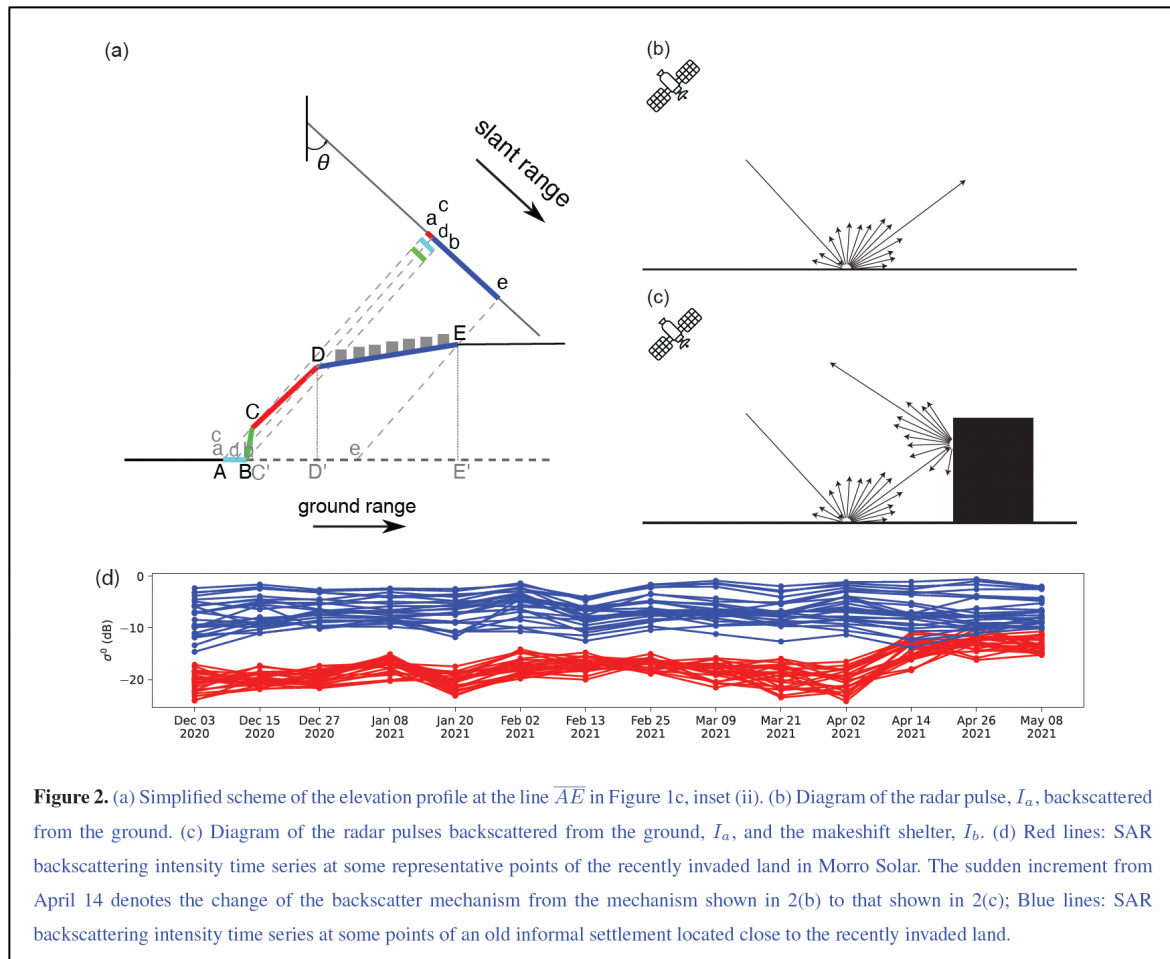
“Figure 2c) must include units on the vertical axis.”

Reply:

Following the reviewer’s comment, we have included units on the vertical axis.

Change in manuscript:

Page 5:



Comment:

“Given the great relevance of the colors and sharpness of figures, improvements are expected (at least) in Figures 1c), 1d) and 3.”

Reply:

The figures have been modified according to the reviewer’s comment.

Change in manuscript:

Figure 1:

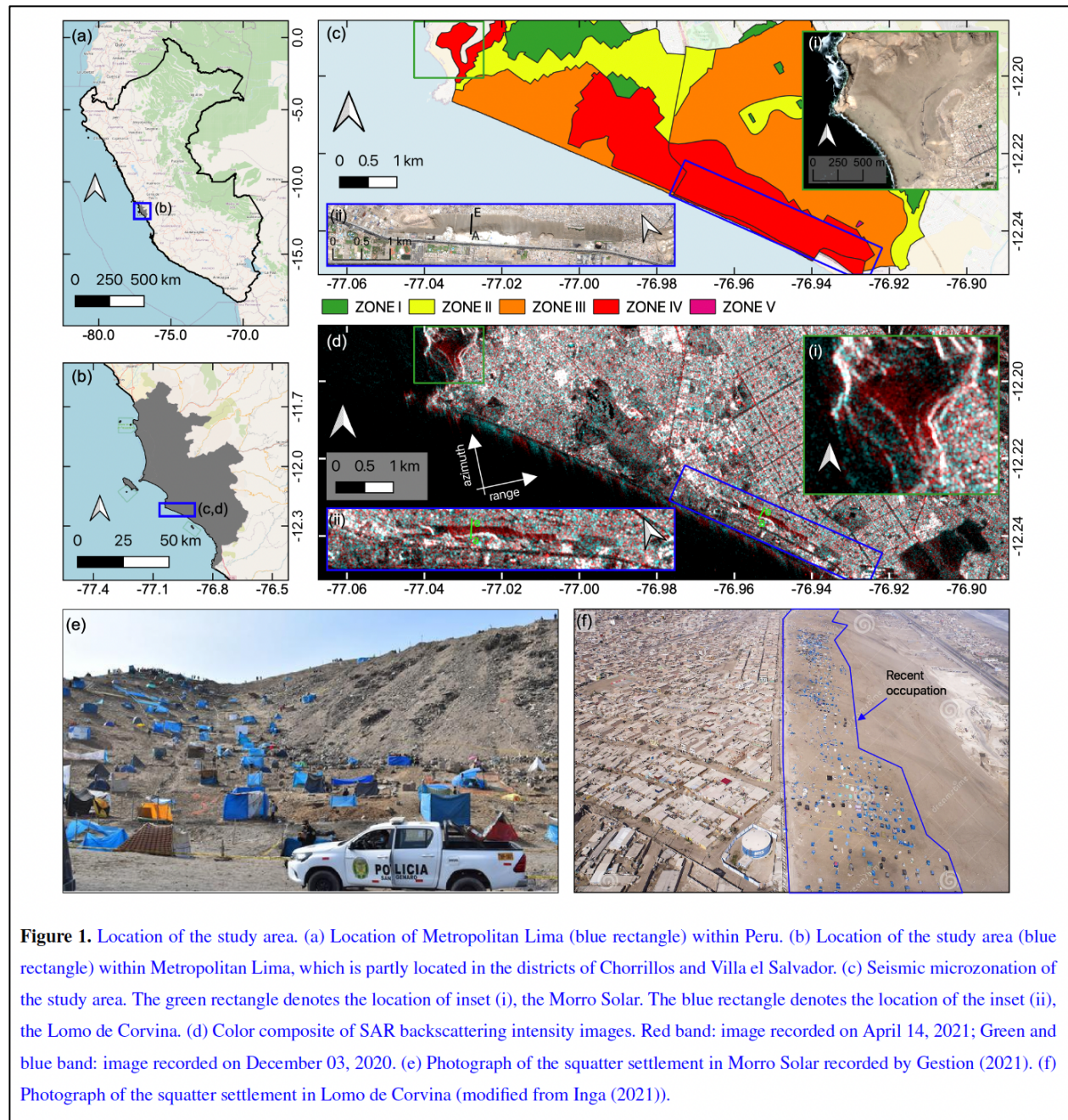


Figure 3:



Figure 3. Sentinel-1 SAR-based map of the recent informal settlement in Morro Solar (a), and Lomo de Corvina (b).