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## Reply on RC2

Katy Burrows et al.

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Author comment on "Integrating empirical models and satellite radar can improve landslide detection for emergency response" by Katy Burrows et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-148-AC2>, 2021

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We thank the reviewer for their helpful comments, which we have responded to below.

**This work explores the combined approach derived from empirical susceptibility maps and landslide indicators derived from SAR data. The result shows improvement in model performance adding the PALSAR-2 InSAR coherence features. The study performed is certainly of interest and well-presented and I recommend its publication after some points have been addressed.**

### Specific comments

My main suggestion is to provide more information on the influence of wavelength (L-band) on the accuracy of the results. The difference between sentinel-1 and PALSAR-2 is not only the wavelength but also the resolution, polarization, and incidence angle. In particular, incidence angle or local incidence angle are important for landslide detection. I think that authors should consider these as well.

Polarisation: ALOS-2 acquires quad-pol data while Sentinel-1 acquires dual-pol only (single-pol for events early in the lifetime of the satellite e.g. the 2015 Nepal earthquake). However, here we use only single-pol data from both satellites. This is now specified at line 230. We chose to do this as single-pol SAR data are more likely to be available immediately after an earthquake. Examining the influence of fully polarimetric SAR on empirical models is beyond the scope of this study but would be interesting for future work.

ALOS-2 data is acquired at a larger range of incidence angles (8°-70° degrees) compared to Sentinel-1 (29.1°-46.0°). However, all data used in this study were acquired within a relatively limited range of angles (31.4°-43.8°) so that the incidence angle should be fairly similar for Sentinel-1 and PALSAR-2. These incidence angles are now provided at line 237

For information on the spatial and temporal resolutions of the two datasets, we direct readers to the paper from which these data were taken, where their processing is described in detail (Burrows et al. 2020). New text: "Further details on the spatial and temporal resolution of these SAR data, on their processing and on parameter choices made in the generation of the CECL, Bx-S, PECI,  $\Delta C_{\text{sum}}$  and  $\Delta C_{\text{max}}$  surfaces can be found in Burrows et al. (2020)." at lines 243-244

**Furthermore, I have a question in assessing model performance. Authors use ROC analysis based on the Burrows et al. (2020). However, ROC analysis requires the creation of binary landslide images. The binarization of landslide areal density (LAD) only degrades the image. I think R2 is fair for assessing the LAD prediction. Authors should describe the effectiveness of ROC analysis.**

We use ROC analysis as it is a metric commonly used in landslide detection / prediction studies and is easy to understand. Although this requires us to convert the landslide density to a binary surface, we do not suggest using the binary surface as the final product, as you are right this would lead to a loss of information. ROC AUC as we use it here provides an indication of the skill with which areas of particularly intense landsliding can be identified.

By presenting both ROC AUC values and R2 values, we feel a more complete picture of model performance is obtained than by using either one of these metrics alone. Indeed, Reviewer 1 indicates in their review that they prefer the use of ROC as a metric over the use of R2, so we believe the presentation of both metrics represents a good balance.

### **Technical corrections**

698 - 699 I think that Masato is given name. Please correct it.

We apologise for this oversight, this has been corrected in the references and in the main document.