Spatial prediction of earthquake-induced landslide probability

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1 Landslide area-frequency distribution extrapolation plots

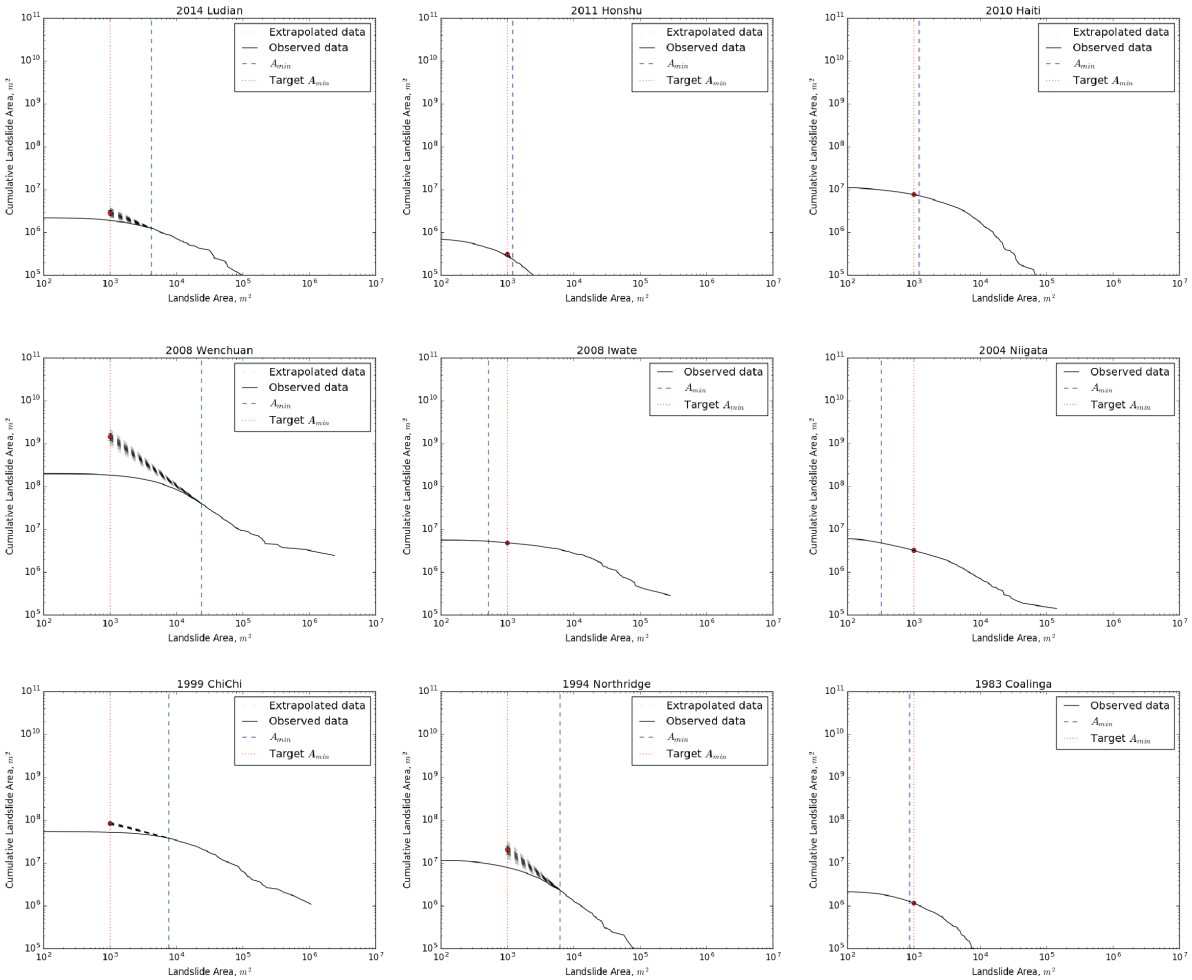
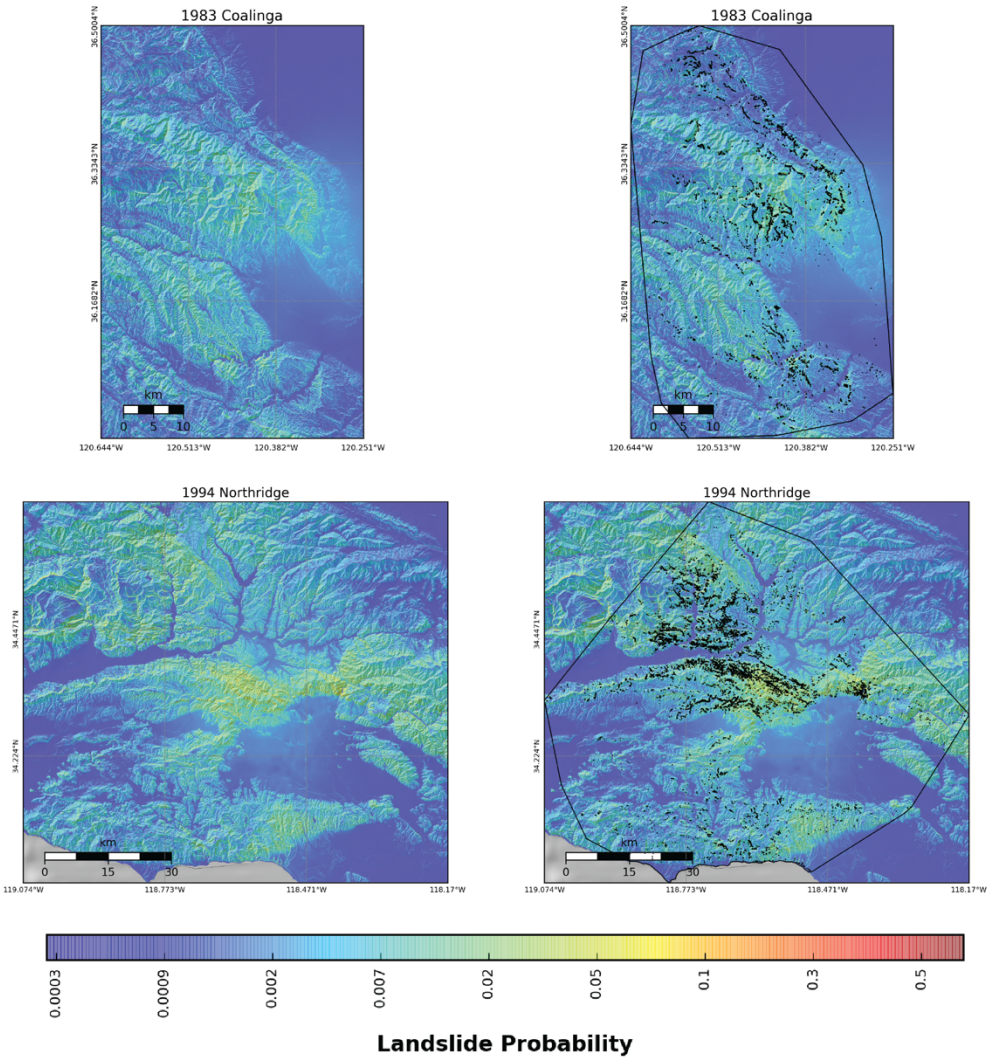
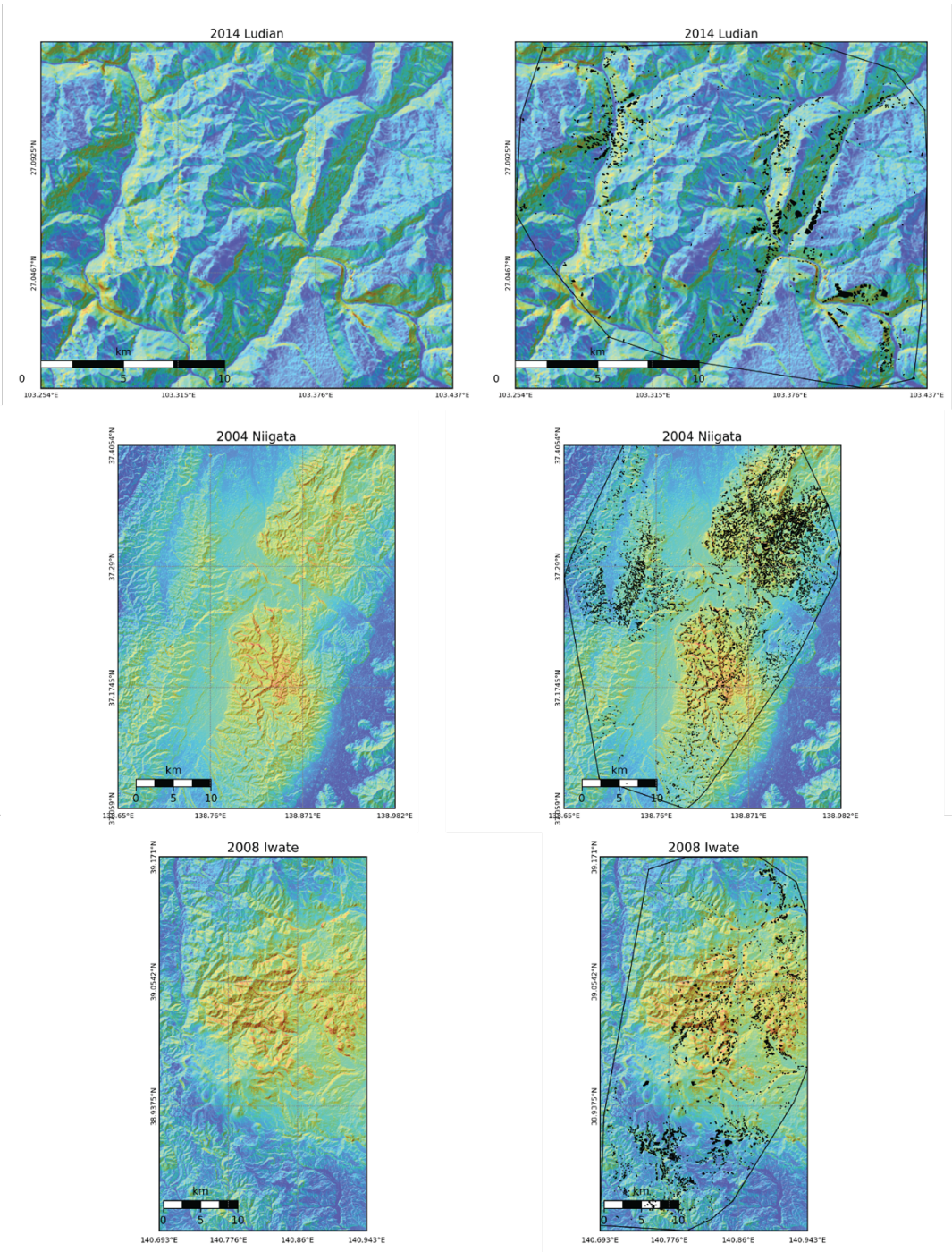


Figure S 1: Landslide area-cumulated area plots, showing the extrapolation of the landslide area frequency distribution, to estimate the severity of small landslide censoring in each dataset.

2 Maps of predicted hillslope failure probability, overlain with the locations of real landslides.




2014 Ludian
2014 Ludian
2004 Niigata
2004 Niigata
2008 Iwate
2008 Iwate
km
0
5
10
0.0003
0.0009
0.002
0.007
0.02
0.05
0.1
0.3
0.5
Landslide Probability

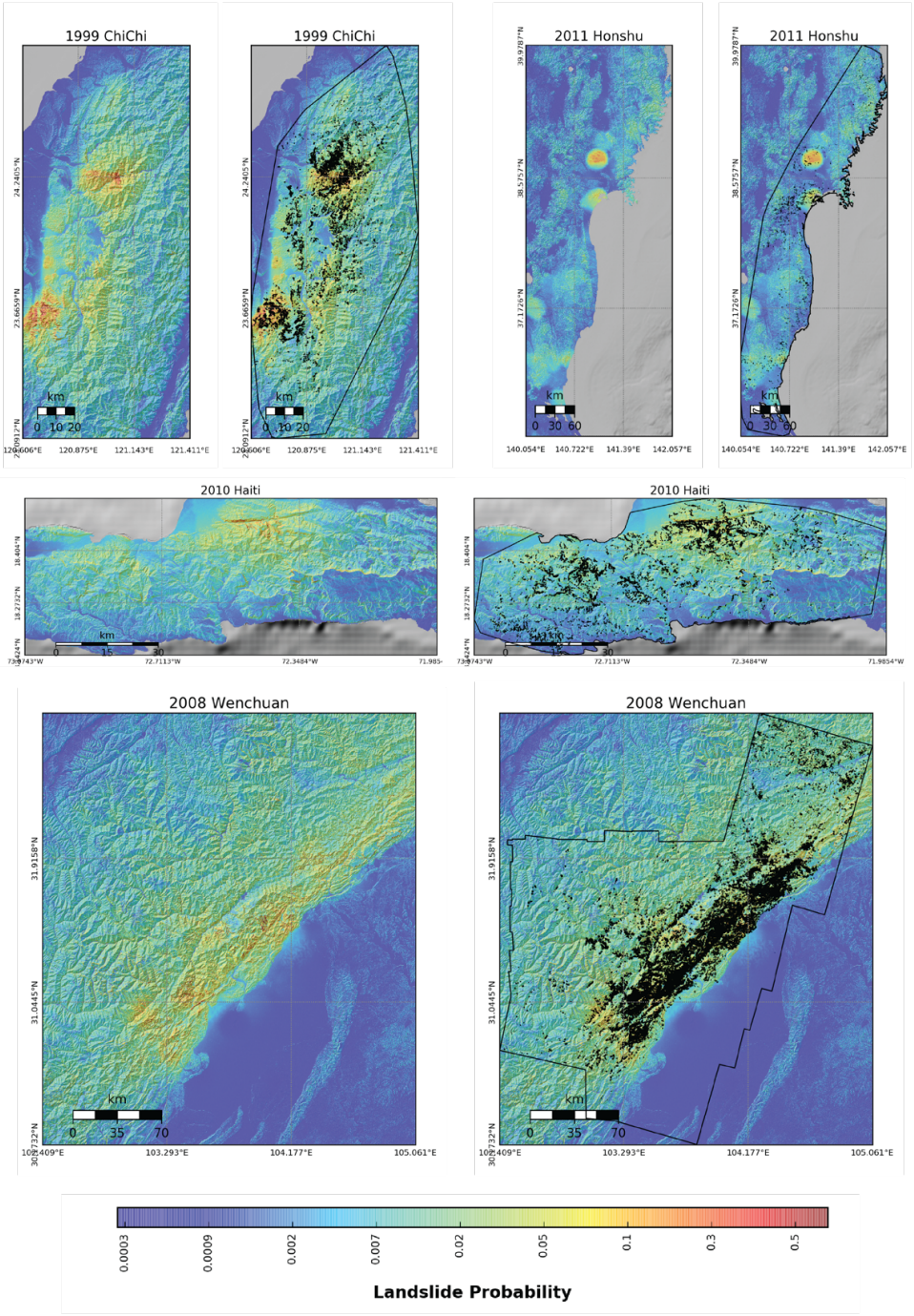


Figure S 2: Left: Maps of predicted landslide probability derived from best fit global model (Error! Reference source not found. **Combined model 2). Right: Maps shown overlain with landslides in black.**

3 Comparison of landslide depths and uncertainty in elevation data

In order to assess the implications of using pre- and post-landslide elevation data in our analysis, we test the extent to which the landslides have produced surface changes detectable in the elevation model. The SRTM elevation data has an absolute vertical height accuracy <-16m and a relative vertical height accuracy of <=10m (http://www2.jpl.nasa.gov/srtm/statistics.html).

In the absence of field-measured landslide depths, we estimate mean landslide depths using a published scaling relationship between landslide area and volume (Larsen et al., 2010):

Equation S 1

$$V = \alpha A^{\gamma}$$

Equation S 2

$$D = \frac{V}{A}$$

Where V is landslide volume, A is landslide area and D is mean landslide depth. α and γ are empirical parameters. Using the global best fit relationship for all landslides (bedrock and soil) α = 0.146 and γ = 1.332 ± 0.005 (Larsen et al., 2010). We calculated landslide depths conservatively, based on full landslide areas rather than landslide source areas. Based on this, we estimate that for more than 99.99% of mapped landslides in each earthquake, landslide depths are less than the 10 m elevation accuracy (Figure S 3). Surface changes produced by the landslides are therefore unlikely to be detectable in the elevation model.

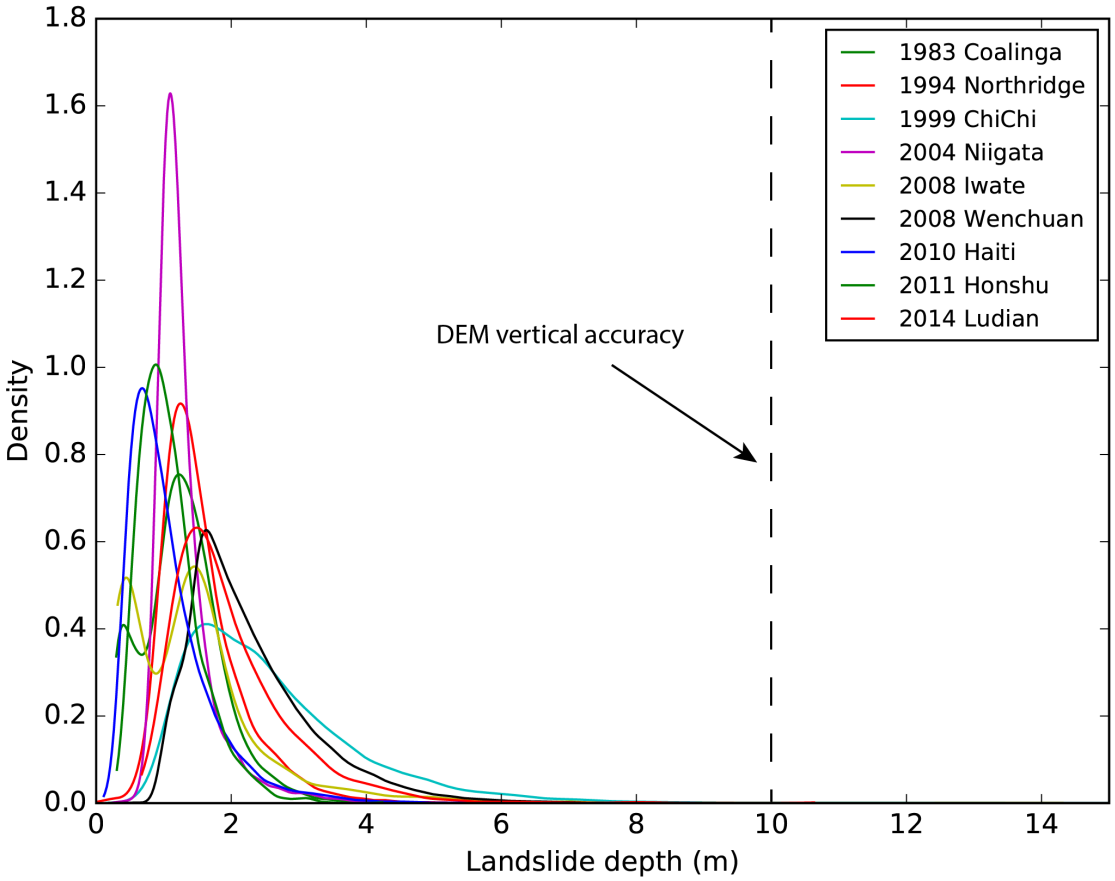


Figure S 3: Distribution of landslide depths for individual earthquakes, estimated using global best fit relationship between landslide area and volume (Larsen et al., 2010). Relative vertical accuracy of elevation data is indicated by the dashed line.

References

LARSEN, I. J., MONTGOMERY, D. R. & KORUP, O. 2010. Landslide erosion controlled by hillslope material. *Nature Geosci,* 3**,** 247-251.