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Comparison of event-based landslide inventories: a case study from Gorkha earthquake 2015, Nepal.

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Despite landslide maps being compiled every year in the world at different scales, limited efforts are made to critically compare landslide maps prepared using various techniques or by different investigators. Event-based landslide inventories indicate the location, distribution, and detected boundaries of landslides caused by a single event such as earthquake and rainstorm. Event-based landslide inventories are essential for landslide susceptibility mapping, hazard modelling and further management of risk mitigation. Moreover, such these inventories have deployed for recording the magnitude of the triggered reason of the landslide. In this research, we compare the statistical characteristics of existing landslides inventories. Landslide inventories were analysed based on the methodology, quality and completeness levels. They are analysed to determine the quality based on the direct comparison, from cartographic matching and mismatch between the maps. Also, statistical properties of landslide areas were defined, and the correlation between the frequency area statistics distribution of landslides was carried out. In Nepal, there have been several attempts to map landslides after the Gorkha earthquake 2015. Especially, after the main event of 25 April, 2015 researchers around the world mapped the landslides induced by Gorkha earthquake. In this research, we use four inventories obtained from different sources which are prepared through visual interpretation of remote sensing imageries.

Figure 1 illustrates the landslides in the study area which mapped by four different studies. It shows that the number of mapped landslides for the same area differs per interpreter which depends upon the personal perspective in mapping and method of mapping adopted. Interpreter A mapped 65 landslides for the common area using **Planet scope** satellite imagery. Interpreter C and Interpreter D also mapped landslides using **Google Earth ™ images** and mapped 25 and 43 landslides respectively, and. The other result shows the 102 landslides were mapped by interpreter B which is the result of using high-resolution **Digital Globe's WorldView-3 imagery**. The main reason for differences among the mapped landslide inventories is the personal mapping preference of the researchers and the detail of delineating landslides.

The minimum landslide area mapped by different researchers ranges from 35.50m² to 121.19m² for the study area. Also, the most massive landslide mapped ranges from 118805 m² to 764038 m². There is a zigzag pattern of the plotted landslide probability density to the inverse gamma fit. Differences in the probability density distribution and inverse gamma fit can be the result of gaps related to mapped landslides for given inventories which means that some landslides are missing or not mapped by respective interpreters due to personal mapping preferences. The rollover points for landslides mapped by interpreter A and interpreter D are almost similar around 290, but for landslides mapped by interpreter C, the rollover point is 223 which is nearly 70 points less than other two inventories. For inventory generated by interpreter B, the rollover point is 85.13 which is small in comparison to other inventories as the distribution of small landslides is given in inventory. Interpreter B Mapped smaller landslides in detail but for larger and medium size landslides distribution is scattered. For an inventory of interpreter C, there is a large gap between the rollover point and the smallest mapped landslide in the inventory that is 95.49 m². Between the smallest mapped landslide in the inventory and the rollover point, there are many small landslides in the region, but they are not mapped because of amalgamation, which is smaller landslides forms parts of bigger landslides polygons.

We compared four inventories qualitatively and quantitatively using different techniques. We also discussed the reasoning for the differences between the inventory maps using statistical methods degree of matching and mismatch between the inventories. Results of our work give an overview of the impact of methodology selection and outline the limitations and advantages of different remote sensing and mapping techniques.

Keywords: landslide map, inventory, natural disaster, map comparison

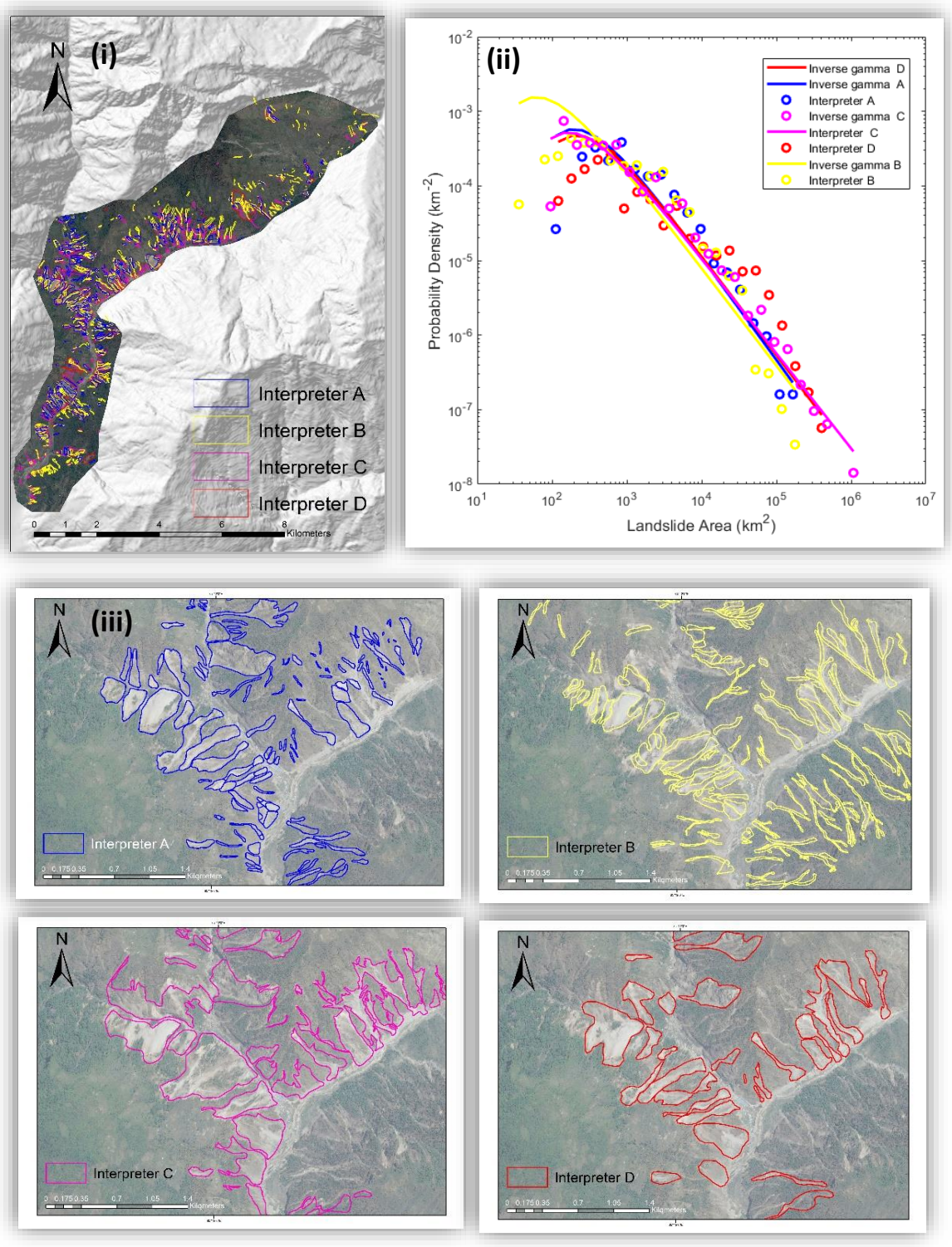

Figure 1. (i) spatial distribution of landslide inventories in the study area (ii) Probability density distribution of landslide inventories (iii) Mapping variation of landslide inventories by four interpreters.