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A new approach to reduce the mapping error of landslide inventory maps

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Landslide inventory maps are key in documenting the type and extent of mass movements in local to regional areas, for both geomorphological studies and landslide hazard assessment. Geomorphologists usually prepare landslide inventories by aerial photo interpretation (API) of stereoscopic images aided by field surveys. Criteria adopted for visual image analyses are derived from the heuristic interpretation of photographic and morphological features of the image, such as shape, size, color tone, texture and pattern. The established (traditional) procedure for transferring photo-interpreted information to a GIS environment involves the manual drawing of information from the aerial photograph to the topographic base map. In this stage, mapping (i.e., positioning, shape, size) errors can occur due to (i) the change in scale, from the aerial photographs to the topographic map, (ii) object deformation in the stereoscopic model, due to the vertical exaggeration and the conical projection of the aerial photographs, (iii) differences in topography in the different cartographic media (aerial photographs and base maps). We recently developed a method to reduce mapping errors which exploits the ortho-rectification of the aerial photograph and the photo-interpreted thematic layers, thus avoiding manual transferring of information to the topographic map. The technique was evaluated in a test area of about 50 km^2 in the neighboring of Taormina (Sicily, Southern Italy), where the information concerning mass movement was transferred to two inventory maps using the traditional and ortho-rectification technique. More than 500 landslides pairs have been compared in this test region, ranging in landlside area between 10^2 and 10^7 m^2. The mapping error associated with the mapped features has been evaluated by calculating the mismatch index for each landslide pair as: E = (A U B)-(A $\cap$ B)/(A U B), where A is a landslide of the inventory obtained using the manual drawing approach and B is a landslide reported using the ortho-rectification technique, U denotes landslide polygon union, and $\cap$ denotes landslide polygon intersection. The ortho-rectification procedure accounts for a Root Mean Square Error at defined GCPs lower than 5m. Preliminary results show that (i) the positional mismatch decreases as landslide area increases, (ii) landslide areas are generally overestimated when using the traditional method (iii) although minor differences are observed in the landslide frequency-area statistics between methods, there is relatively good agreement in the fit of the power law tail of both distributions. We propose that previous inventories produced using the traditional method remains correct, but some estimation of positional and size uncertainty should be included in future work. We outline procedures for estimating this uncertainty.