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Distortions of glacial landform sizes by manual mapping

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Mapped topographic features are important for understanding processes that sculpt the Earth's surface. Subjective manual techniques are commonly used for mapping, yet how effective they are in quantitative terms is poorly constrained. Here 12,121 outlines drawn by 25 interpreters searching for a total of 21,625 drumlins in 5 synthetic DEMs are interpreted in terms of how the manual mapping process distorts the height (H), width (W) and length (L) of the reported features. Bias in the size-frequency distributions is caused by the sub-set of the forms 'found', even assuming perfect extraction of sizes, and is governed by H driving detectability. Bias is then compounded in sizes that are extracted using the mapped outlines but, remarkably, the size-frequency distribution is not altered further when mappers' incorrect guesses (i.e. outline corresponds to no input synthetic drumlin) are then included; it seems possible that, once mappers have their 'eye in' based on the most clearly defined features, they are very effective at identifying similar morphologies. Of the metrics available to quantify the size of a population, maximum size and λ, the exponent of its tail, are the most robust to these distortions. The drumlins in the study area resemble UK drumlins, permitting extrapolation of the conclusions. These are the first results to give such granular insights into the impacts of the various stages in manually mapping glacial landforms, permitted by the development of the synthetic DEMs. Arguments will always exist about how realistic any synthetic is, but this work demonstrates another use of synthetic DEMs that may be applied more widely in geomorphology.