Assessing Vertical Accuracy of Digital Elevation Model Using Actual Flood Line as Reference

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SUMMARY

Digital Elevation Models (DEMs) are used in many branches of geoscience as fundamental datasets for applications and studies. Therefore vertical/horizontal accuracy and precision characteristics are paramount. As established, the vertical accuracy and precision of DEM depend on the terrain characteristics (slope), pixel size, and environmental factors. In the case of global DEM, it might also depend on a geographic component. Several methods have been developed to assess the accuracy and precision of DEMs. These methods use features with known elevation and datasets, including higher accuracy benchmarks, roads, runways, and DEMs. In this contribution, we propose a novel approach to assess the accuracy and precision of a DEM. The idea is to use the horizontal feature of the water surface. The water surface intersects with the terrain along a line that, by definition, at any point possesses the same elevation. To demonstrate the approach, we selected the actual flood lines of the devastating floods in the Australian New South Wales state in February 2022. The flood lines can be identified using in situ, aerial photography, or satellite imagery. In this project, we utilised the Sentinel-1 Synthetic Aperture Radar (SAR) imagery to discriminate smooth surface water from the rough land surface, which was performed with a well-documented automatic procedure. However, some manual editing was required to eliminate insignificantly small polylines. Two global DEMs were selected for testing, i.e., the well-known Shuttle Radar Topography Mission (SRTM) and Copernicus DEM (COP) developed from the TerraSAR-X/TanDEM-X twin satellites. Statistical assessment of the differences between the DEMs pixels and the constant elevation of flood lines provided an opportunity not only to assess the accuracy of DEMs but also offered an inside look at the accuracy of the identification of the flood inundation using the SAR satellite imagery. This method can be utilised almost everywhere because floods are a common hazard. Also, no reference data are required beyond freely available satellite imagery of the Copernicus Sentinel program or others.