The Cryosphere Discussions

The Cryosphere Discuss., community comment CC1
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Comment on tc-2021-197: vertical datum offsets for global DEMs

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Community comment on "Towards ice-thickness inversion: an evaluation of global digital elevation models (DEMs) in the glacierized Tibetan Plateau" by Wenfeng Chen et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2021-197-CC1, 2021

This is a brief comment based on a quick skim of the discussion paper. It looks like a nice contribution, but I believe there is a fundamental issue with the methodology involving global DEM preparation.

I noticed what looks like a systamatic vertical datum offset in some of the results (e.g., Figure 12), with offsets of ~30 m between ICESat-2 elevation (height above ellipsoid) and a subset of the global DEM elevations (height above respective geoid model - see documentation for specific geoid used by each DEM). It's important to account for this offset before doing any analysis. The apparent 30 m bias is due to the geoid offset, and is not representative of the quality of the DEM. This bias will propagate to RMSE numbers, which will impact the conclusions.

It should be relatively straightforward to correct each of the input DEMs to provide ellipsoidal heights using available offset grids (https://cdn.proj.org/), and repeat the analysis. I can't remember if the RGI-TOPO dataset (https://rgitools.readthedocs.io/en/latest/dems.html) has already accounted for vertical datum differences between different sources. One can also use the OpenTopography GlobalDEM API (https://portal.opentopography.org/apidocs/#/Public/getGlobalDem), which provides versions of some global DEMs with ellipsoidal heights rather than the orthometric heights.