The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2020-93-SC1, 2020

The Cryosphere
Discussions

Interactive comment on "Intercomparison of photogrammetric platforms for spatially continuous snow depth mapping" *by* Lucie Anne Eberhard et al.

César Deschamps-Berger

cesar.deschamps-berger@cesbio.cnes.fr

Received and published: 8 June 2020

Eberhard et al. present an inter-comparison of methods to measure distributed snow depth maps in alpine terrain. They combined snow-on and snow-off digital terrain models (DTM) calculated with various methods to produce snow depth maps. In particular, they evaluated the accuracy of a snow depth map derived from spaceborne photogrammetry (satellite Pléiades) using snow depth maps measured with ground based photogrammetry (1.12 km^2), UAS photogrammetry (3.59 km^2) and airplane photogrammetry (75.7 km^2). They found that the accuracy of the Pléiades snow depth map depends on the reference snow depth map and on the use of a 2 x STD filter of the snow depth

Printer-friendly version

Discussion paper

residuals (STD: Standard Deviation).

In section 6.1, the authors compared the accuracy of a Pléiades snow depth map with previous studies of Marti et al. (2016), Deschamps-Berger et al. (2020). Using the accuracy of their Pléiades maps and the one obtained from an Unmanned Aircraft System (UAS) survey over 3.59 km^2 (RMSE*=0.44 m, NMAD**=0.38 m), they concluded that they achieved higher accuracies than above cited works. We think that this comparison should be discussed in the light of two important methodological differences.

First, the reference snow depth map was calculated with different methods. This impacts the accuracy calculation as each method has its own uncertainty and are not available on the same areas. Deschamps-Berger et al. (2020) evaluated their snow depth maps against a reference snow depth derived from airplane laser scanning over 138 km^2 (RMSE=0.80, NMAD=0.69). In Eberhard et al. (2020), the reference dataset was obtained using UAS photogrammetry over 3.59 km^2 (RMSE*=0.44 m, NMAD**=0.38 m). At this spatial scale, UAS photogrammetry is expected to have a higher accuracy than airplane laser scanning. The accuracy assessment in Deschamps-Berger et al. (2020) actually compares well to the one calculated by Eberhard et al. (2020) with the reference snow depth map measured by airplane photogrammetry over 75.7 km^2 (RMSE = 0.92, NMAD = 0.65 m). Eberhard et al. (2020) puts more weight on the validation using UAS photogrammetry because of the lack of validation for the airplane survey for the whole study site. However this airborne method was well evaluated in previous studies (Nolan et al., 2015, Bühler et al., 2015).

Second, in Eberhard et al. (2020), only the snow-on DTM was calculated with Pléiades images. The snow-off DTM is always common to the evaluated and the reference snow depth map. It is calculated with the same method as the reference snow-on DTM (ground-based, UAS, airplane photogrammetry) which are expected to have higher accuracy than Pleiades-derived DTM. In Marti et al. (2016) and Deschamps-Berger et al. (2020), both the snow-on and snow-off DTM were calculated with Pléiades images. This is a major difference as the accuracy of a snow depth map results from the combination of the accuracy of the snow-on and the snow-off DTM.

César Deschamps-Berger, CESBIO, Toulouse, France

Simon Gascoin, CESBIO, Toulouse, France

Etienne Berthier, LEGOS, Toulouse, France

*RMSE: Root-Mean-Square Error **NMAD: Normalized Median Absolute Deviation

Bühler, Y., Marty, M., Egli, L., Veitinger, J., Jonas, T., Thee, P. and Ginzler, C.: Snow depth mapping in high-alpine catchments using digital photogrammetry, The Cryosphere 9(1), 229–243, doi:10.5194/tc-9-229-2015, 2015.

Deschamps-Berger, C., Gascoin, S., Berthier, E., Deems, J., Gutmann, E., Dehecq, A., Shean, D., and Dumont, M.: Snow depth mapping from stereo satellite imagery in mountainous terrain: evaluation using airborne lidar data, The Cryosphere Discuss., https://doi.org/10.5194/tc-2020-15, in review, 2020.

Marti, R., Gascoin, S., Berthier, E., De Pinel, M., Houet, T. and Laffly, D.: Mapping snow depth in open alpine terrain from stereo satellite imagery, The Cryosphere 10(4), 1361–1380, doi:10.5194/tc-10-1361-2016, 2016.

Nolan, M., Larsen, C. and Sturm, M.:Mapping snow depth from manned aircraft on landscape scales at centimeter resolution using structure-from-motion photogrammetry, The Cryosphere, 1445–1463, doi:10.5194/tc-9-1445-2015, 2015.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2020-93, 2020.