

# Stereo2SWE: Regional snow depth and SWE from sub-meter optical satellite stereo DEMs

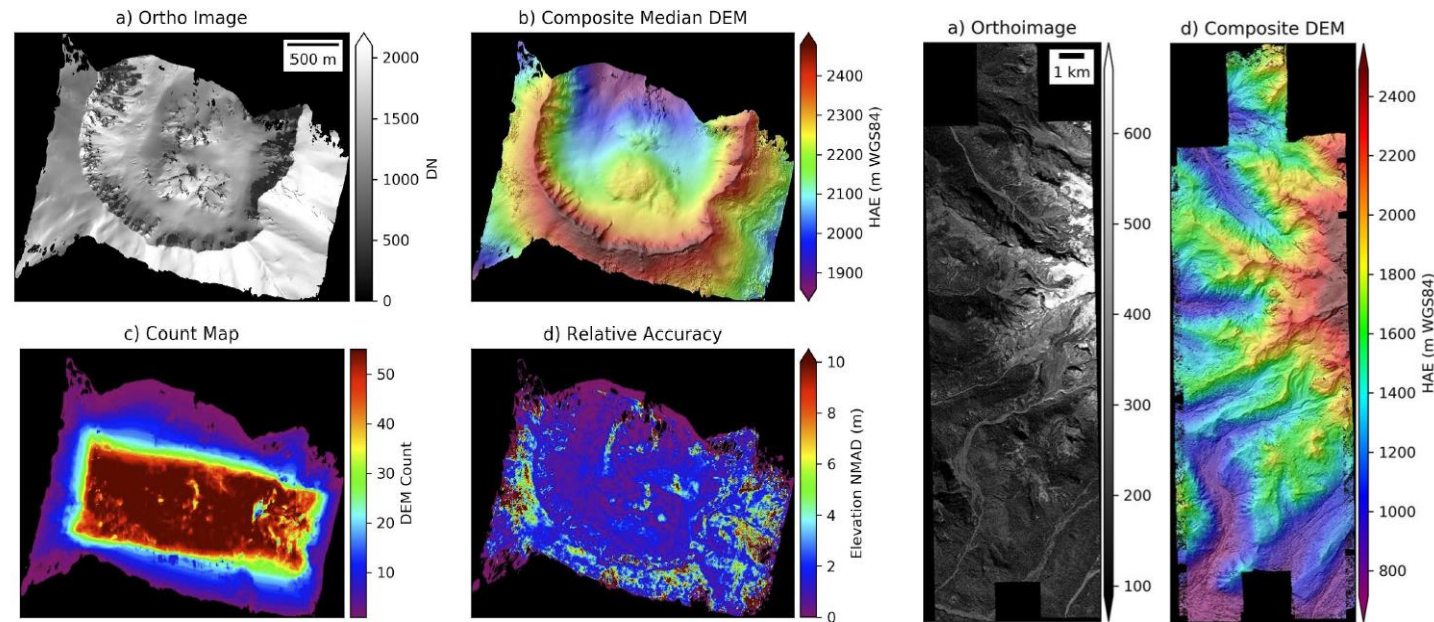
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**Purpose:** Monitoring of elevation change and snow cover throughout the Cryosphere

**Study Objective:** Evaluate potential for stereo reconstruction using commercially available video and triplet/multi-collect stereo products for a range of targets including snow-covered mountains, glaciers, forests, salt flats, etc. Evaluate the potential for accurate, meter-scale snow depth mapping and glacier velocity.

**Imagery:** SkySat (Planet) and WorldView-3 (DigitalGlobe)

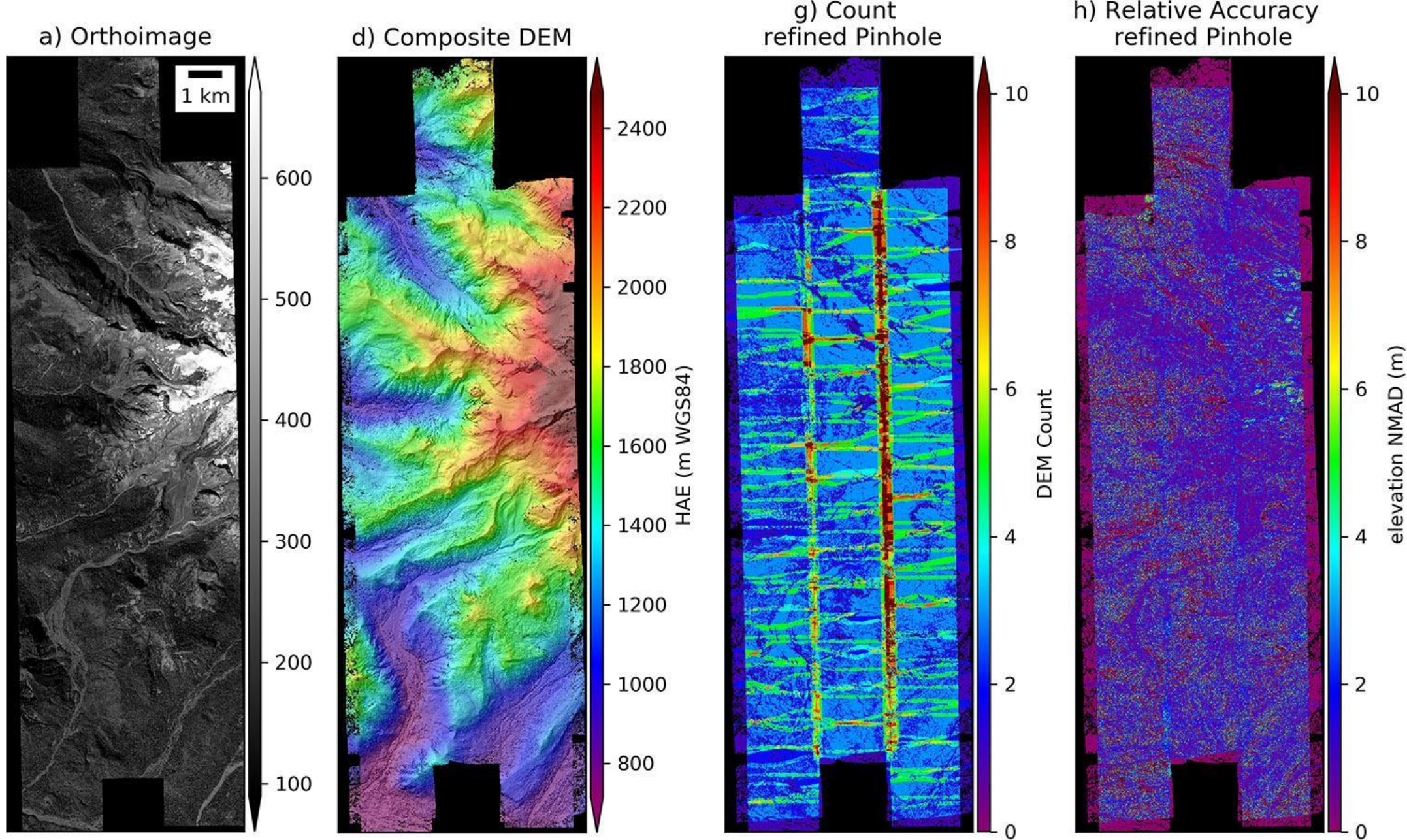
**Findings:** We successfully demonstrated the generation of more accurate DEM using SkySat imagery. Submeter imagery is essential for accurate stereo reconstruction, especially over surfaces that appear featureless at lower resolution (e.g., fresh snow). Stereo DEM accuracy and quality scales with resolution.



Products produced from SkySat video sample for Mt. St. Helen's crater, acquired April 20, 2019 (near peak snow depth). Shown in a) Orthorectified image mosaic, b) Composite ASP DEM from 55 stereo pairs, c) per-pixel DEM count, and d) per-pixel Normalized Mean Absolute Difference (NMAD), which provides a metric for relative accuracy of composite DEM. The composite DEM absolute vertical accuracy is typically <1 m when compared against a reference DEM (e.g., airborne LiDAR, WorldView stereo DEM).

Sample Skysat triplet stereo products acquired August 27, 2019 for the western flank of Mt. Rainier, WA. a) Composite orthoimage from all three collections, d) Composite 4-m DEM from 641 individual DEMs created using all two-scene stereo combinations.





Sample Skysat triplet stereo products acquired August 27, 2019 for the western flank of Mt. Rainier, WA. a) Composite orthoimage from all three collections, d) Composite 4-m DEM from 641 individual DEMs created using all two-scene stereo combinations, g) per-pixel DEM count, h) per-pixel Normalized Median Absolute Deviation (NMAD) for all DEMs after bundle adjustment, with self.