GARLOCK FAULT | 10 GCP

Accuracy Study

A Direct Comparison of Survey Data Produced from WorldView-3 Satellite Imagery with LiDAR

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PhotoSat
Better Data for Better Decisions

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Abstract

In this accuracy study, PhotoSat conducts a direct comparison of an elevation survey produced from satellite imagery against a LiDAR survey.

Located in California, the Garlock Fault test area (Fig 1) covers 146 km². This area is suitable for accuracy studies, since highly accurate LiDAR survey data already exists for this site.

For this study, PhotoSat independently produced a survey including a 50 cm elevation grid over the Garlock Fault test area. To produce the survey, PhotoSat obtained stereo satellite photos taken by MAXAR's WV-3, which have a resolution of 30 cm. From these photos, PhotoSat produced the 50 cm elevation grid using proprietary deep learning algorithms. The PhotoSat survey referenced 10 ground control points (GCPs) from the LiDAR survey.

To determine the vertical accuracy of the PhotoSat survey, it was directly compared to 7,234 elevation checkpoints with slopes less than 20% grade extracted from the previous LiDAR survey.

For results, read the full study.

Figure 1: Location of the Garlock Fault test area in California, USA

Source [Fig 1]:

TerraColor NextGen (2021) colour mosaic image produced from 15 m Landsat photos

Test Area

The Garlock Fault test area (Fig 2) is located approximately 200 km north of Los Angeles, CA.

Source [Fig 2]:

PhotoSat (2021) colour orthophoto with overlaid 50 cm contours

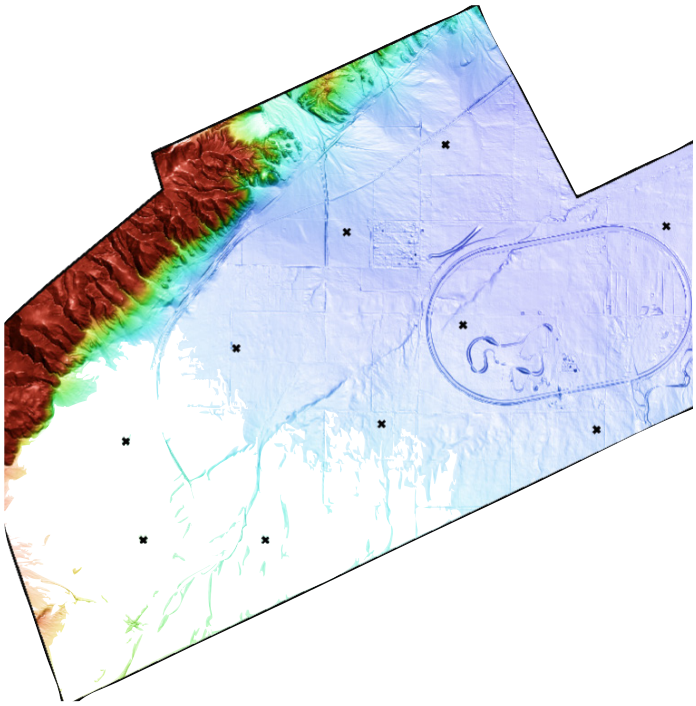
Figure 2: Portion of the Garlock Fault test area

Area of LiDAR Survey

The dimensions of the area covered by the LiDAR survey (Fig 3) are 12.2 km east-west by 12 km north-south.

The oval Honda California Test Track is clearly visible on the east side of the test area (Fig 3).

Warm colours indicate high elevations, and cool colours indicate low.



Source [Fig 3]:

PhotoSat (2021) colour elevation image with 10 GCPs overlaid in black

Figure 3: Portion of the OpenTopography.org LiDAR survey used in accuracy study

Survey Comparison

The Guidelines for Digital Elevation Data of the US National Digital Elevation Program (NDEP) recommends that elevation checkpoints should be chosen in areas with slopes less than 20% grade.

From the LiDAR survey (Fig 4), the 7,234 elevation checkpoints with slopes less than 20% grade have RMSE of 12 cm and LE90 of 19 cm.

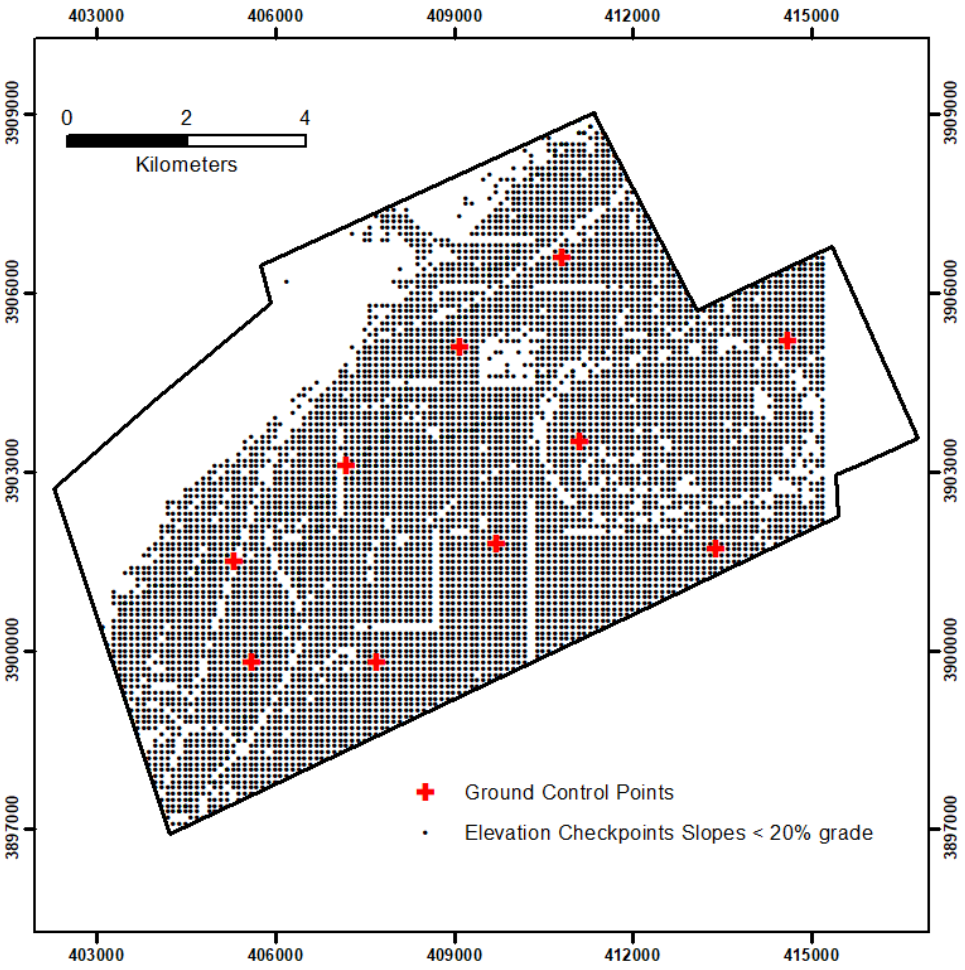


Figure 4: LiDAR survey elevation checkpoints with slopes less than 20%

Source [Fig 4]:

PhotoSat (2021) map of LiDAR survey with overlaid elevation checkpoints

Adjustments to PhotoSat Survey

To match the 10 GCPs (Fig 3 and Fig 4), the PhotoSat survey (WV-3 orthophoto and 50 cm elevation grid) needed a constant shift of:

- East: 1.6 m
- North: 0.8 m
- Elevation: -0.96 m

For most MAXAR WorldView stereo satellite photos, the global accuracy is better than 3 m (horizontally).

Accuracy Evaluation of PhotoSat Survey

After the adjustments were completed, the accuracy of the PhotoSat survey was evaluated by direct comparison to the LiDAR survey.

The results are shown in a histogram (Fig 5).

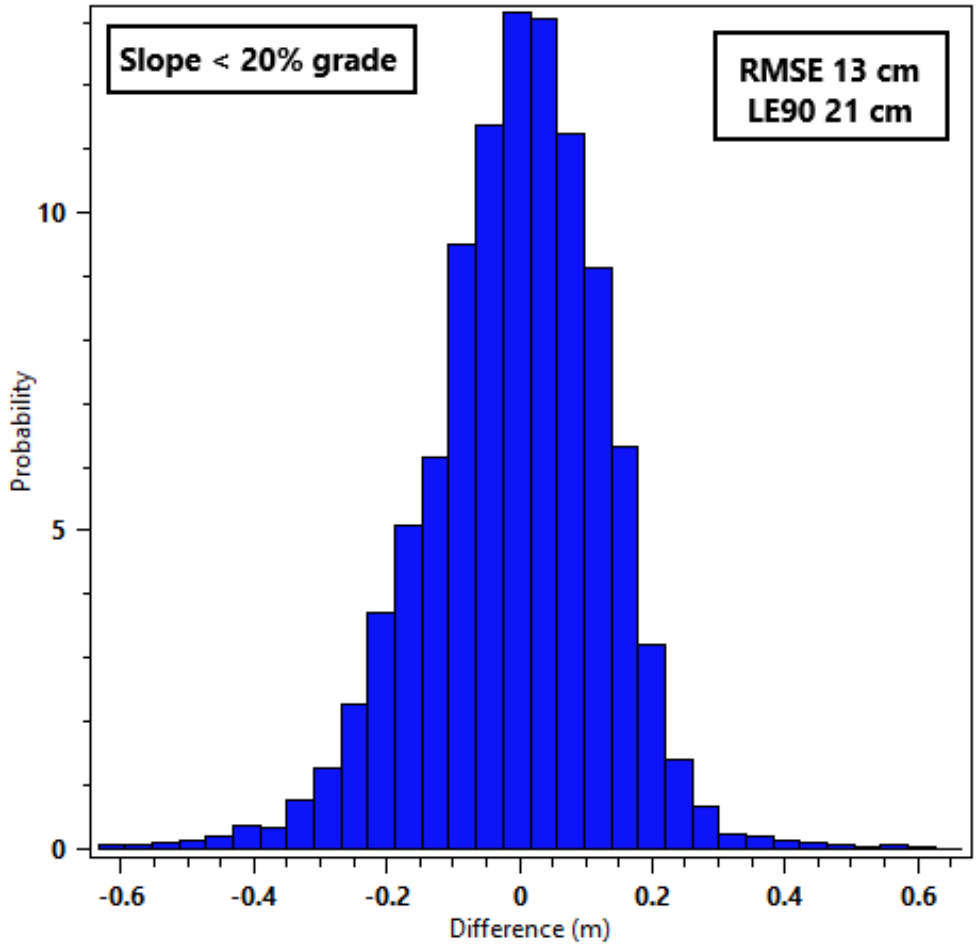


Figure 5: Elevation differences between the PhotoSat survey and the LiDAR survey

Source [Fig 5]:

PhotoSat (2021) histogram of elevation differences

Study Summary

Accuracy of PhotoSat survey:

13 cm RMSE; LE90 21 cm

Test area:

146 km² in Garlock Fault

Reference points:

10 GCPs extracted from LiDAR survey

Satelite imagery collected:

November 2014 by MAXAR WV-3

Photos processed:

February 2021

Comparison survey:

7,234 elevation checkpoints with slopes less than 20% from LiDAR survey (12 cm RMSE; LE90 19 cm)

To see more accuracy studies, visit our website.

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