Metadata Report

Project Name

Survey on the Dhorpatan fault (Western Nepal fault system) - October 2021

Summary

During investigations of the Western Nepal fault system (NSF award #1827870), we targeted a moraine and terrace complex near the north end of the Dhorpatan fault for slip rate studies. The site name, Phalgune, is derived from the name shown on local trekking maps for a nearby pass.

Personnel

- PI: Sean P Bemis, Virginia Tech
- Collected and processed by: Sean Bemis and Elizabeth Curtiss, Virginia Tech

Site Information

- Site description: The Dhorpatan fault crosses Phalgune Pass near the northern mapped extent. North of this pass, the fault transects a terminal moraine and several terraces inset inside the moraine. This site is situated between 3900 and 4000 m elevation. Dextral-normal slip on the Dhorpatan fault offsets the moraine and the inset terraces across a distinct, down-to-the-east, fault scarp.
- Site objective: Generate high-resolution topographic data to support mapping and measuring geomorphic offsets.
- Site location: 83.0275947°E 28.5721369°N
- Site conditions: Clear sky, light to moderate winds
- Date/time spent at each site: Survey occurred between 10:20 and 11:32 am local time on October 15th, 2021.
- Source photos: DJI_0001.jpg through DJI_0252.jpg

Survey Results

- Equipment used: DJI Mavic Pro

- GPS solutions: We collected some ground control points within each survey, but due to poor accuracy, very distant base data stations for differential corrections, and inconsistent coverage, we chose to use the embedded geotags in the photos as our georeferencing control.

- Errors:

As a simple assessment of potential error, we differenced the WNFS_Phalgune_dem with the EarthDEM 2m dataset. The mean vertical difference is 137.09 m (WNFS_Phalgune_dem higher) with a standard deviation of 1.66 m. The range of differences is from 132.29 to 142.44 m. In map view, there is a pattern of higher than the mean differences on the south flank of the moraine and lower than the mean differences on the north flank of the moraine, indicating a small (no more than a few meters) shift of the WNFS_Phalgune_dem dataset relative to the EarthDEM data at the site. Higher differences also occur along sharp topographic breaks, such as the moraine crest, the fault scarp, and the crest of terrace risers, but these higher difference values appear to be a product of the lower resolution EarthDEM data smoothing those landforms relative to the high resolution WNFS_Phalgune_dem data.

- Collection methods

The survey was conducted as 4 flights consisting of two overlapping single grids. The camera was inclined 20° from nadir. We used the Pix4Dcapture app to design and manage the survey.

Products

The products include: 1) source photos (.jpg), 2) unclassified point clouds (.laz), 3) raster DEMs (_dem.tif), and 4) orthoimagery (_ortho.tif).

We performed all data processing within Agisoft Metashape Pro v2.2. We al;so generated a Metashape processing report to capture processing settings and provide those reports within this metadata document.

In addition to the processing settings described in the metadata reports, we exported the datasets with the following settings:

1) Coordinate System: WG84 UTM Zone 44N
2) DEM raster resolution: cell size = 0.075 m
3) Orthoimagery resolution: = 0.04 m

All exported datasets were clipped to an outer boundary. This boundary was manually mapped around the perimeter of the survey area in Agisoft Metashape Pro to exclude portions of the working dataset that contained low-confidence data, low point density, and/or obvious artifacts

WNFS_Phalgune

Processing Report

30 September 2025

Survey Data

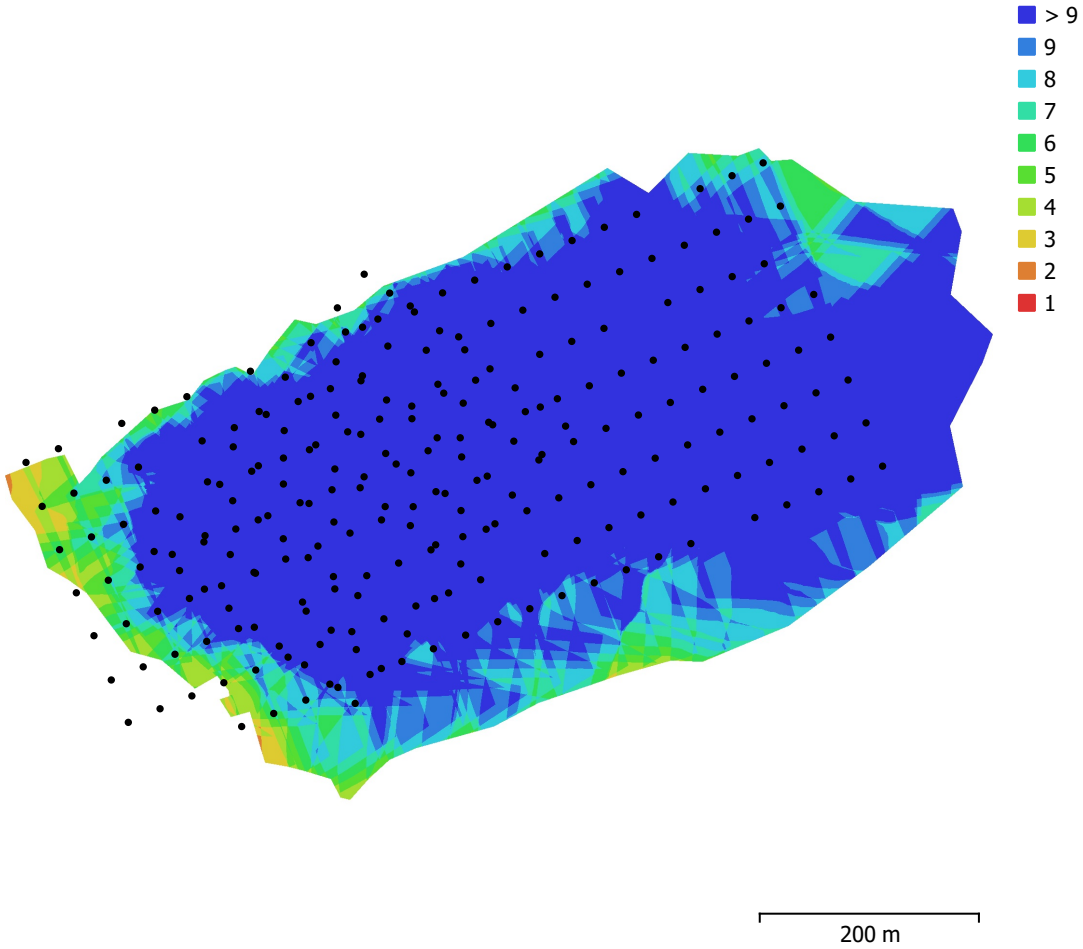

Fig. 1. Camera locations and image overlap.

Number of images:	252	Camera stations:	249
Flying altitude:	105 m	Tie points:	200,485
Ground resolution:	3.72 cm/pix	Projections:	828,082
Coverage area:	0.308 km²	Reprojection error:	1 pix

Camera Model	Resolution	Focal Length	Pixel Size	Precalibrated
FC220 (4.7mm)	4000 x 3000	4.7 mm	1.56 x 1.56 µm	No

Table 1. Cameras.

Camera Calibration

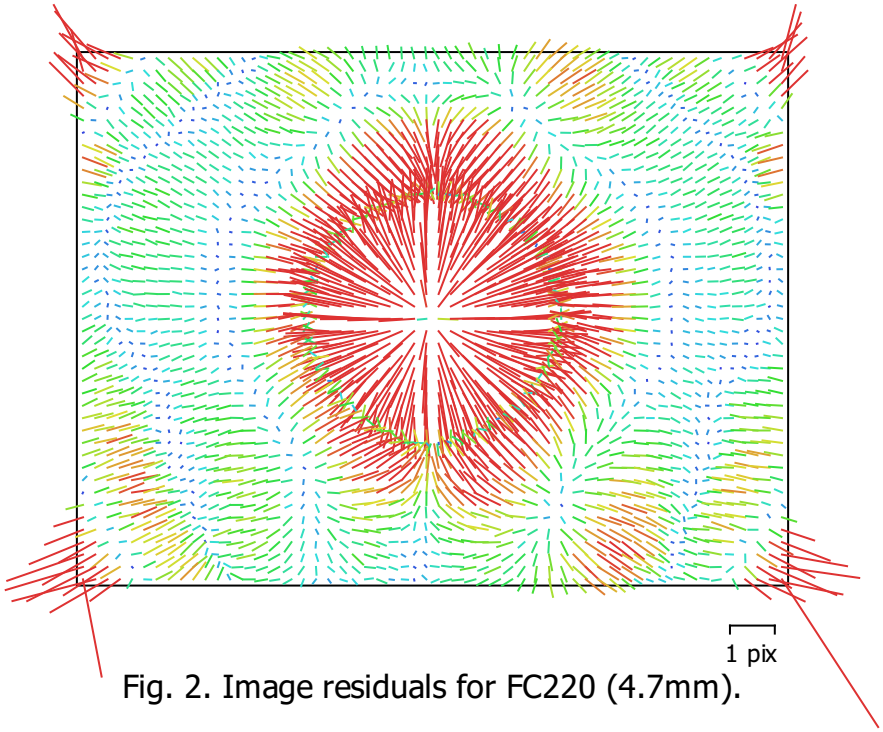

Fig. 2. Image residuals for FC220 (4.7mm).

FC220 (4.7mm)

252 images

Type	Resolution	Focal Length	Pixel Size
Frame	**4000 x 3000**	**4.7 mm**	**1.56 x 1.56 µm**

	Value	Error	F	Cx	Cy	K1	K2	K3	P1	P2
F	**3063.5**	0.15	1.00	0.10	-0.94	0.17	0.03	-0.00	0.07	-0.78
Cx	**2.42902**	0.037		1.00	-0.11	0.05	-0.02	0.02	0.82	-0.10
Cy	**-17.3796**	0.12			1.00	-0.29	0.06	-0.08	-0.07	0.90
K1	**0.0253096**	7.6e-05				1.00	-0.94	0.90	0.04	-0.31
K2	**-0.0711837**	0.00027					1.00	-0.99	-0.02	0.07
K3	**0.0738556**	0.0003						1.00	0.02	-0.09
P1	**-0.000622337**	4e-06							1.00	-0.07
P2	**0.000180361**	9.6e-06								1.00

Table 2. Calibration coefficients and correlation matrix.

Camera Locations

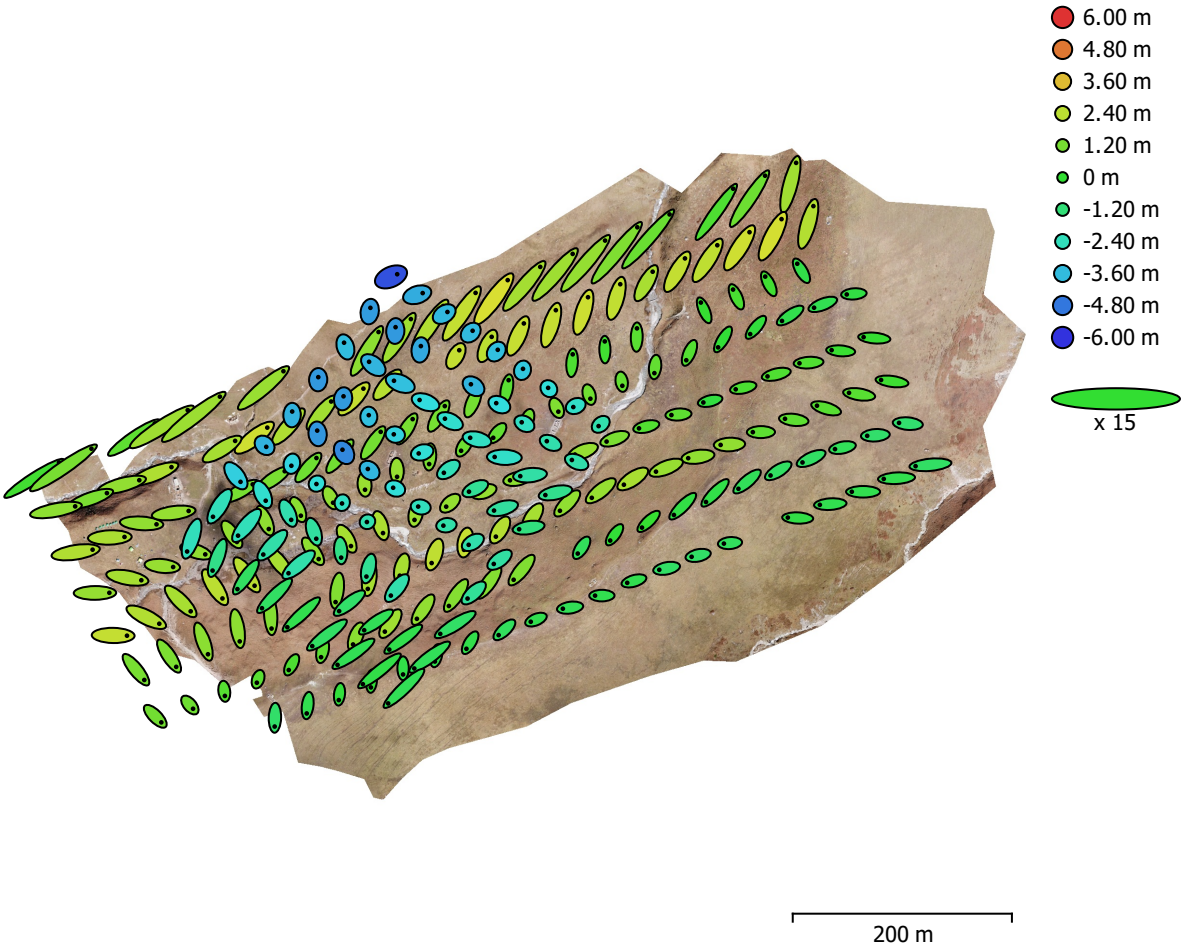

Fig. 3. Camera locations and error estimates.
Z error is represented by ellipse color. X,Y errors are represented by ellipse shape.
Estimated camera locations are marked with a black dot.

X error (m)	Y error (m)	Z error (m)	XY error (m)	Total error (m)
1.09448	1.06645	1.96939	1.52814	2.49273

Table 3. Average camera location error.
X - Longitude, Y - Latitude, Z - Altitude.

Digital Elevation Model

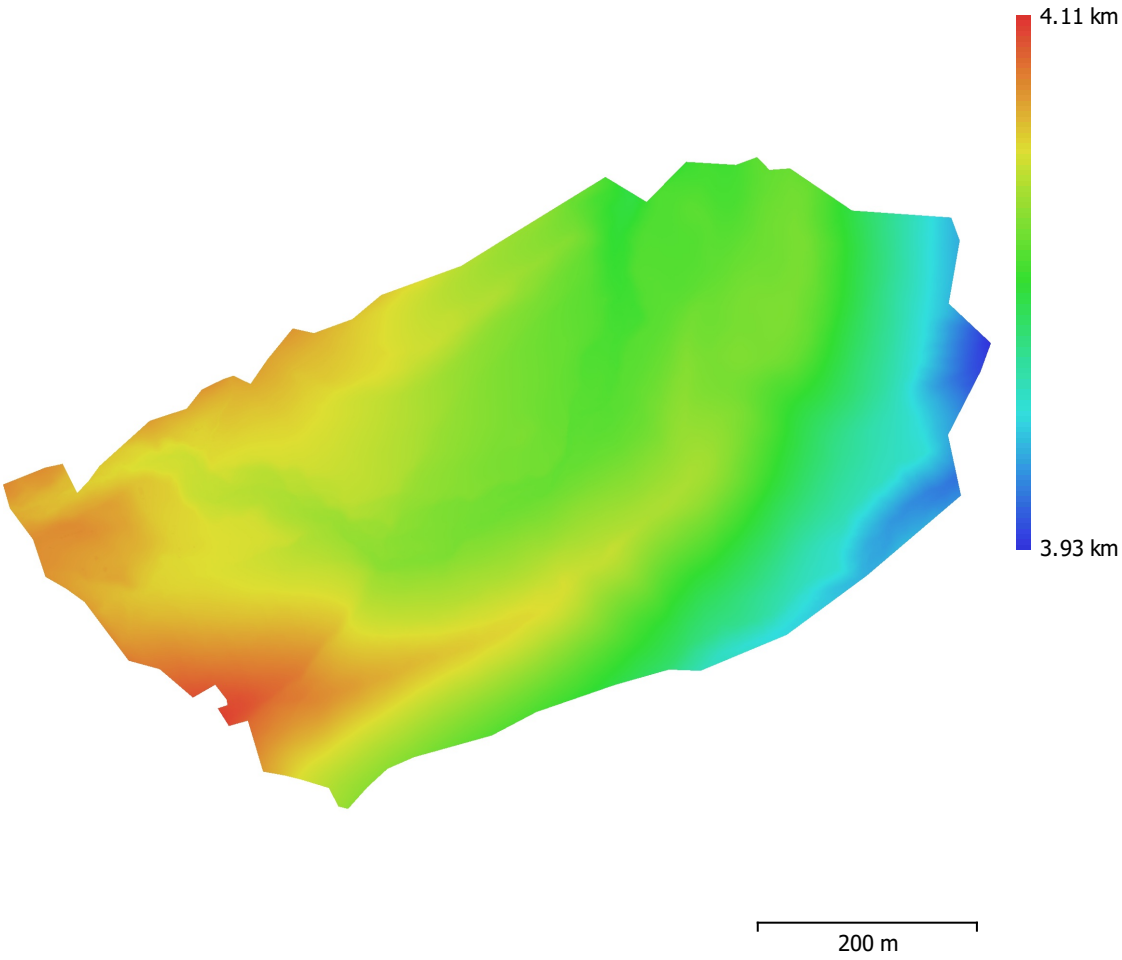

Fig. 4. Reconstructed digital elevation model.

Resolution:	7.45 cm/pix
Point density:	180 points/m²

Processing Parameters

General	
Images	252
Aligned images	249
Coordinate system	WGS 84 (EPSG::4326)
Rotation angles	Yaw, Pitch, Roll
Shapes	
Polygon	1
Coordinate system	WGS 84 (EPSG::4326)
Tie Points	
Points	200,485 of 232,704
Point colors	3 bands, uint8
RMS reprojection error	0.324647 (1.00034 pix)
Max reprojection error	1.10115 (12.5784 pix)
Mean key point size	3.15548 pix
Key points	No
Average tie point multiplicity	4.62465
Alignment parameters	
Accuracy	High
Generic preselection	Yes
Reference preselection	Source
Key point limit	40,000
Key point limit per Mpx	1,000
Tie point limit	4,000
Exclude stationary tie points	Yes
Guided image matching	No
Adaptive camera model fitting	No
Matching time	1 minutes 31 seconds
Matching memory usage	495.89 MB
Alignment time	40 seconds
Alignment memory usage	835.03 MB
Optimization parameters	
Parameters	f, cx, cy, k1-k3, p1, p2
Adaptive camera model fitting	No
Exclude corners	No
Optimization time	1 seconds
Date created	2025:09:02 17:04:22
Software version	2.2.2.21069
File size	21.71 MB
Depth Maps	
Count	249
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	5 minutes 37 seconds
Memory usage	3.07 GB
Date created	2025:09:02 21:45:16
Software version	2.2.2.21069
File size	1.11 GB
Point Cloud	

Points	63,648,714
Coordinate precision	1.86 cm
Point attributes	
Color	3 bands, uint8
Normal	
Confidence	1 - 32
Point classes	
Created (never classified)	63,648,714
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	5 minutes 37 seconds
Memory usage	3.07 GB
Point cloud generation parameters	
Source data	Depth maps
Processing time	13 minutes 10 seconds
Memory usage	5.87 GB
Date created	2025:09:02 21:58:34
Software version	2.2.2.21069
File size	936.92 MB
Model	
Faces	5,679,540
Vertices	3,902,758
Vertex colors	3 bands, uint8
Depth maps generation parameters	
Quality	High
Filtering mode	Aggressive
Max neighbors	16
Processing time	5 minutes 37 seconds
Memory usage	3.07 GB
Point cloud generation parameters	
Source data	Depth maps
Processing time	13 minutes 10 seconds
Memory usage	5.87 GB
Reconstruction parameters	
Surface type	Height field
Source data	Point cloud
Interpolation	Disabled
Strict volumetric masks	No
Processing time	2 minutes 46 seconds
Memory usage	1.65 GB
Date created	2025:09:03 09:48:43
Software version	2.2.2.21069
File size	126.24 MB
DEM	
Size	12,060 x 8,059
Resolution	7.45 cm/pix
Coordinate system	WGS 84 / UTM zone 44N (EPSG::32644)
Reconstruction parameters	
Source data	Point cloud
Interpolation	Enabled
Processing time	40 seconds
Memory usage	309.81 MB
Date created	2025:09:30 14:26:49
Software version	2.2.2.21069

File size	243.01 MB
Orthomosaic	
Size	22,457 x 15,007
Resolution	4.00 cm/pix
Coordinate system	WGS 84 / UTM zone 44N (EPSG::32644)
Colors	3 bands, uint8
Orthophotos	1.30 GB
Reconstruction parameters	
Blending mode	Mosaic
Surface	DEM
Enable hole filling	Yes
Enable ghosting filter	No
Processing time	3 minutes 36 seconds
Memory usage	1.41 GB
Date created	2025:09:30 14:33:41
Software version	2.2.2.21069
File size	1.61 GB
System	
Software name	Agisoft Metashape Professional
Software version	2.2.2 build 21069
OS	Windows 64 bit
RAM	127.63 GB
CPU	13th Gen Intel(R) Core(TM) i9-13900
GPU(s)	NVIDIA RTX 4000 Ada Generation