# Metadata Report

## Project Name Drone lidar surveys of the Eastern Denali Fault, Yukon, September 2021 & August 2022


## Summary

Drone lidar over seven sections of the Eastern Denali Fault (EDF) were acquired over the course of two fieldtrips. The first in September 2021 and the second in August 2022. The data were collected to map and better constrain the geometry and kinematics of the EDF. A Riegl MiniVux1-UAV laser scanner and an Applanix APX-20 UAV IMU mounted to a DJI Matrice 600 Pro drone were used to collect the dataset, more information about the platform can be found in (Salomon et al. 2024). A classified point cloud and raster digital terrain models (DTMs) at different scales (30cm and 1m resolution) were produced.



## Personnel

- PI(s): Theron Finley[1]
- Field staff: Guy Salomon[1], Roger Stephen[2]
- Additional team members: Edwin Nissen[1]

[1] School of Earth and Ocean Sciences, University of Victoria, Victoria, British Columbia, Canada
[2] Department of Geography, University of Victoria, Victoria, British Columbia, Canada


## Site Information

- Site description:

All the sites were along between Kluane Lake and the frontal ranges of the St. Elias mountains, they all had boreal forest cover (White Spruce, aspen and poplar balsam).

  - Burwash Creek (BURW) – 1km long by 300 m. This site is located on the southeast side of Burwash creek.
  - Copper Joe Creek (COPJ) – A strip 2.2 km long by 500 m, centered over Copper Joe Creek was collected. The northwest side was collected in 2021 and the southeast in 2022.

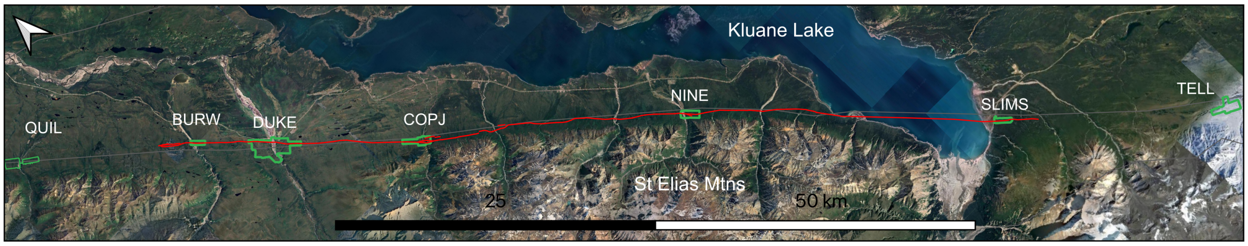
- Duke River (DUKE) – the largest survey by far, this is the result of 7 sub-areas that were collected independently over the two field seasons. This site is 4 km long and 1 km wide.
- Nines Creek (NINE) – 1.5 km long by 600 m, this site follows the EDF on the southeastern side of Nines Creek.
- Quill Creek (QUIL) – this site is a strip along the EDF, 2.5 km long by 600 m, centered over Quill Creek.
- Slims River / Topham Creek (SLIMS) – This site is 1.4 km long by 400 m, located just off the Alaska Highway, where Topham Creek crosses the EDF.
- Telluride Creek (TELL) – This site is roughly 2.2 km long by 600 m on the southern side of Telluride Creek.

● Site objective:

General site objectives were to capture lidar coverage to produce high resolution DTMs along the EDF to improve fault maps and better understand the kinematics of the EDF in this area.

- Burwash Creek (BURW) – the fault appears to cross an abandoned terrace within Burwash creek. Some push-up mounds are visible in the satellite imagery.
- Copper Joe Creek (COPJ) – Distinct scarp in satellite imagery, potentially offset push-up mounds.
- Duke River (DUKE) – Expected some fault complexity at this site as the EDF makes a bend of 7° where it crosses the Duke River. Along the mapped fault, there are good examples of push-up mounds visible in the satellite imagery.
- Nines Creek (NINE) – fault scarp south of Nines Creek.
- Quill Creek (QUIL) – Distinct fault scarp with en echelon mounds, significant vertical separation.
- Slims River / Topham Creek (SLIMS) – Distinct fault scarp in an area without lidar coverage. Topham creek is potentially offset where it crosses the EDF.
- Telluride Creek (TELL) – Potential fault scarp, somewhat away from where the geological maps place the EDF in this area.

- Site location (GPS cords and/or map)




Overview map of the site locations along the EDF (red line), grey line is the EDF from a regional map. Green outlines show the bounds for the different sites.

  - Burwash Creek (BURW) - 61.415,-139.230
  - Copper Joe Creek (COPJ) - 61.300,-138.994
  - Duke River (DUKE) - 61.374,-139.147
  - Nines Creek (NINE) - 61.178,-138.708
  - Quill Creek (QUIL) - 61.493,-139.422
  - Slims River / Topham Creek (SLIMS) - 61.015,-138.405
  - Telluride Creek (TELL) - 60.907,-138.162

- Site conditions: Leaf-on. generally good. Telluride was windy.
- Date/time spent at each site:
  - Burwash Creek (BURW) – 1 day (approx. 6 hours)
  - Copper Joe Creek (COPJ) – 2 days (approx. 5 hours each)
  - Duke River (DUKE) – 5 days (approx. 6 hours each)
  - Nines Creek (NINE) – 1 day (approx. 5 hours)
  - Quill Creek (QUIL) – 2 days (approx. 5 hours each)
  - Slims River / Topham Creek (SLIMS) – 2 days (approx.  5 hours each)
  - Telluride Creek (TELL) – 2 days (total of approx. 8 hours)

OpenTopography

## Survey Results

- Equipment used: Drone lidar system includes a Riegl MiniVux1-UAV laser scanner, Applanix APX-20 UAV GNSS-inertial measurement unit. Ground control was collected using two Trimble R12 units in a base and rover configuration.
- GPS solutions: local base data was collected by our Trimble R12 base station, which ran for the duration of surveying. The base rinex file was processed using NRCANs Precise Point Positioning tool.
- Errors: Flat surfaces in the point cloud have a scatter of approx. 20 cm.
- Alignments: Alignments of the point clouds was done using the RiPrecision Tool within the RiWorld processing workflow. These alignments make use of collected GCPs as well as attempt to resolve planar differences between individual flight line point clouds.
- Collection methods: Flight plans were created with Map Pilot Pro in 2021 and UgCS in 2022 (better performance in areas without SRTM coverage and out of cell signal). The drone was flown at 80 m AGL and at speeds of 6 m/s in 2021 and 4 m/s in 2022. Harlequin-cross style targets were used as ground control for each site. Flight lines were generally parallel to the fault, except in the Duke River area, where most of the lines to the west of the fault were orthogonal to the fault. Calibration lines were orthogonal to the flight lines.

## Products

- Date of dataset collection: September 2021 – August 2022
- Coordinate system of datasets: WGS84 / UTM 8N
- Spatial resolution
  - lidar: 97.54 pts/m$^2$, 45.47 ground pts/m$^2$ (point spacing of 0.21 m)
  - DTMs: 0.3 m and 1 m
- Accuracy and errors: laser scanner (Riegl MiniVux1-UAV)
    - Accuracy: 15 mm
    - Precision: 10 mm
    - Angle measurement resolution: 0.001°
  - GNSS-IMU RMS Error (Applanix APX-20 UAV)

- Position: 0.02-0.05 m
- Velocity: 0.010 m/s
- Roll & Pitch: 0.015°
- True Heading: 0.035°

- Data formats
  - lidar: laz
  - DTMs: tif
- Data processing methods: Drone trajectories were processed in POSPac UAV, the smoothed best estimate trajectory was exported with orthometric heights. The lidar was processed using Riegls' RiProcess package. A field of view filter was used to only export data collected within 45 degrees of nadir (90°). The drone trajectories were imported into RiProcess, where turns were removed using the RXP cutter tool. Control objects (points) were added, and the flight lines were aligned using RiPrecision. Once the flight lines were suitably aligned, the data could be exported. The exported point cloud was classified and rasterized using LAStools. More details for the processing methods can be found in (Salomon et al. 2024)

## Misc Notes

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