Topographic and Bathymetric LiDAR in the Coastal Zones

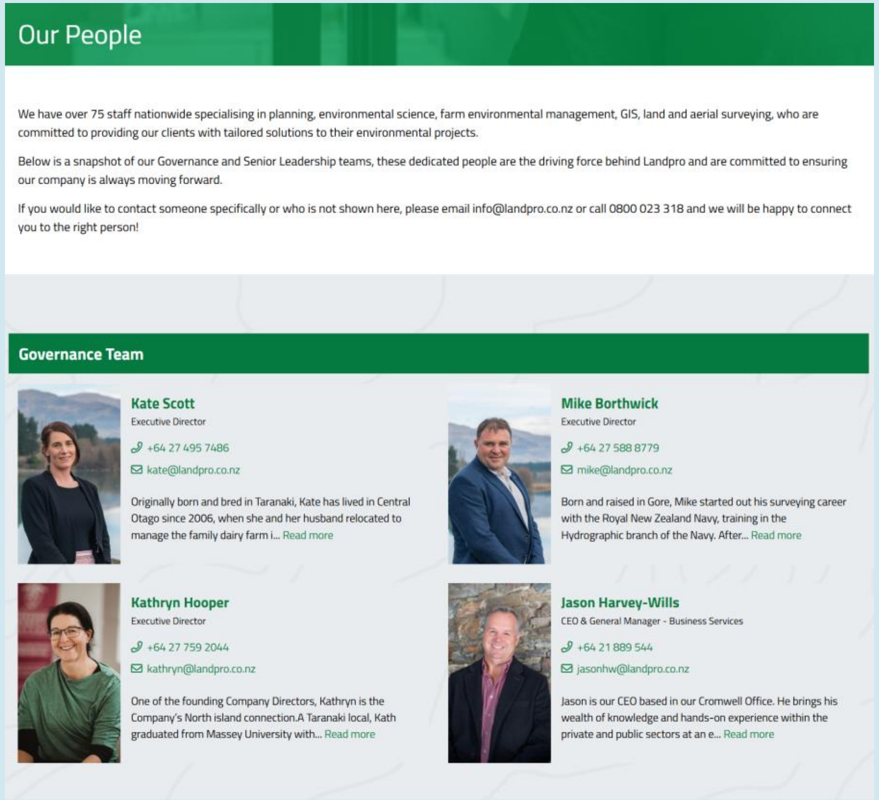
Better
environments
Better returns

LANDPRO.

Speaker and Company Background

Andy Burrell

Aerial Systems and Sales Manager


Our People

We have over 75 staff nationwide specialising in planning, environmental science, farm environmental management, GIS, land and aerial surveying, who are committed to providing our clients with tailored solutions to their environmental projects.

Below is a snapshot of our Governance and Senior Leadership teams, these dedicated people are the driving force behind Landpro and are committed to ensuring our company is always moving forward.

If you would like to contact someone specifically or who is not shown here, please email info@landpro.co.nz or call 0800 023 318 and we will be happy to connect you to the right person!

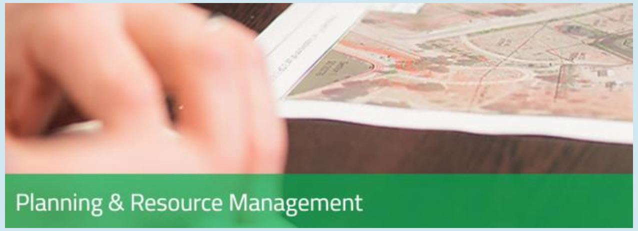
Governance Team

Kate Scott
Executive Director
+64 27 495 7486
kate@landpro.co.nz
Originally born and bred in Taranaki, Kate has lived in Central Otago since 2006, when she and her husband relocated to manage the family dairy farm i... Read more

Mike Borthwick
Executive Director
+64 27 588 8779
mike@landpro.co.nz
Born and raised in Gore, Mike started out his surveying career with the Royal New Zealand Navy, training in the Hydrographic branch of the Navy. After... Read more

Kathryn Hooper
Executive Director
+64 27 759 2044
kathryn@landpro.co.nz
One of the founding Company Directors, Kathryn is the Company's North island connection.A Taranaki local, Kath graduated from Massey University with... Read more

Jason Harvey-Wills
CEO & General Manager - Business Services
+64 21 889 544
jasonhw@landpro.co.nz
Jason is our CEO based in our Cromwell Office. He brings his wealth of knowledge and hands-on experience within the private and public sectors at an e... Read more



Leica Geosystems

RIEGL

LANDPRO

Introduction

- Purpose and applications of topographic and bathymetric LiDAR.
- **What is LiDAR?**
- Definition and basic principles of LiDAR technology.
- Difference between topographic and bathymetric LiDAR.

LANDPRO.

- **Components of a LiDAR System**
- Laser scanner, GPS, IMU (Inertial Measurement Unit).
- **How LiDAR Works**
- Emission and reception of laser pulses.
- Determination of distance and elevation.

Advantages of LiDAR in Coastal Zones

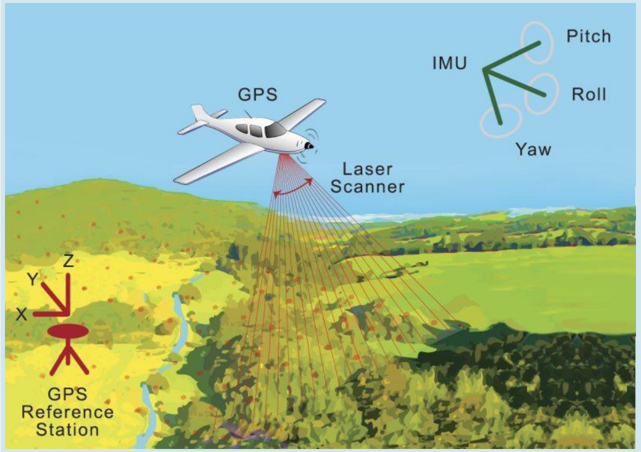
- **High Accuracy and Resolution**
- Precision in mapping complex terrains.
- **Efficiency**
- Faster data collection compared to traditional methods.
- **Adaptability**
- Effective in both terrestrial and aquatic environment

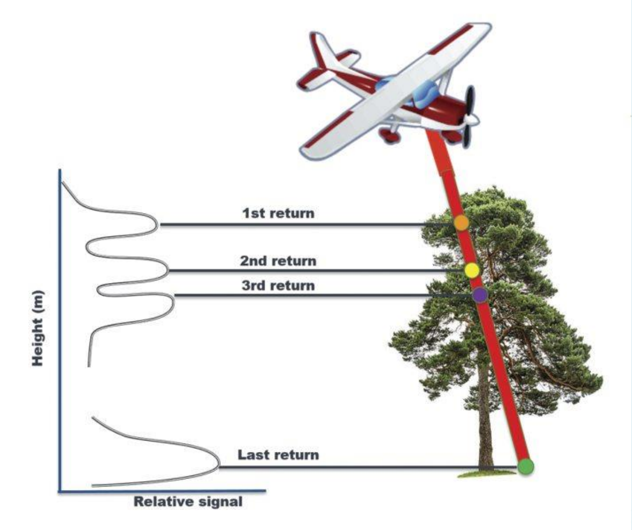
Limitations and Challenges

Turbidity and water clarity for bathymetric LiDAR.

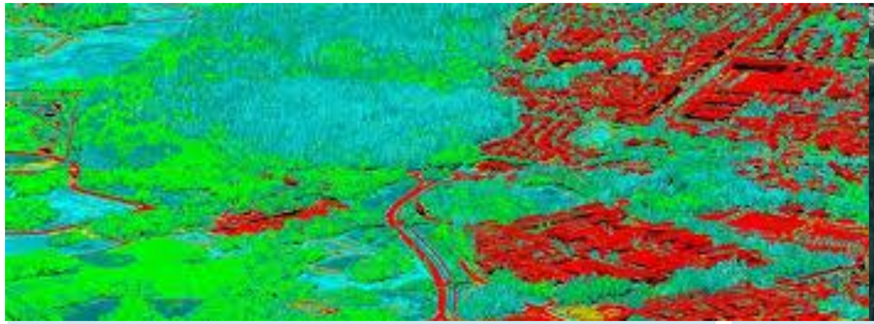
- Weather and environmental conditions.
- **Cost and Accessibility**
- High initial investment for equipment and software.
- **Integration of Datasets**
- Combining topographic and bathymetric data seamlessly

Topographic LiDAR





LANDPRO



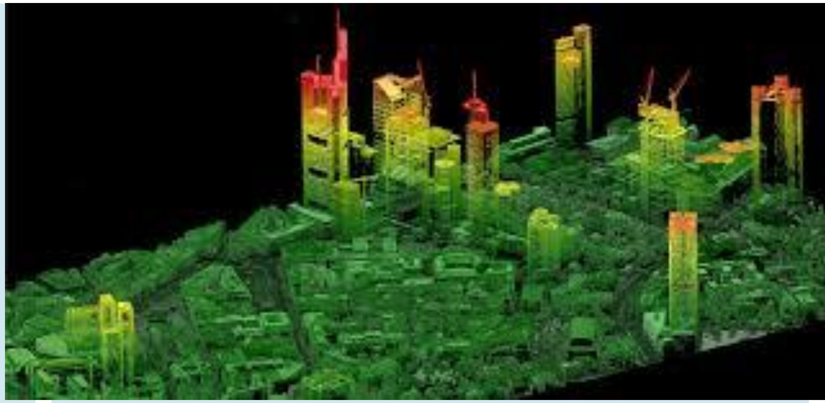
Laser Wavelength

Three different wavelength regions are used in LiDAR systems: NIR excitation at 1064 nm using either DPSS or Yb-doped fiber lasers, VIS excitation at 532 nm produced by frequency-doubling a 1064 nm laser, and SWIR excitation at 1550 nm using Er-doped fiber lasers. Each wavelength has a unique set of advantages and disadvantages that depend on the target reflectance and absorbance, background radiation, atmospheric transmission, and eye-safety issues.

Laser Power and Beam Divergence

Spectral Width

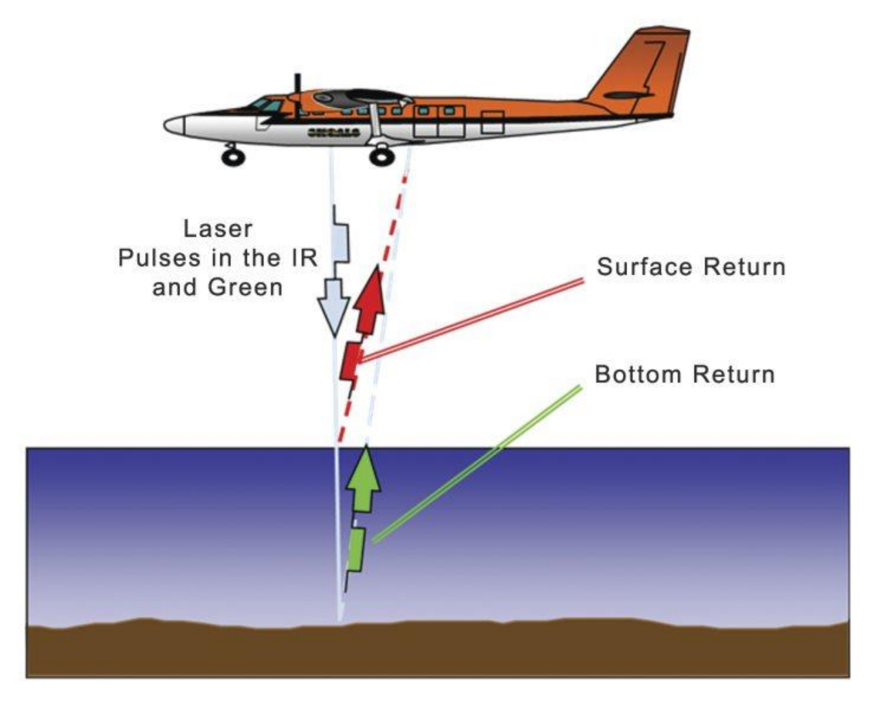
Efficiency, Footprint, and Weight

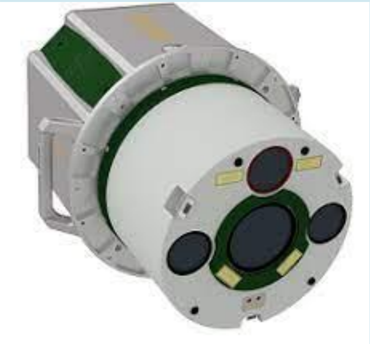


For airborne topographic mapping, 1064 nm is the most commonly-used wavelength. A major advantage of this wavelength is the abundance of commercially-available laser sources and light detectors. Another advantage is that the detectors can be Si-based, and therefore offer higher gain and lower cost than alternative GaAs-based photodetectors. Furthermore, this wavelength generates high reflectance from the most commonly-mapped targets, e.g., vegetation and snow. A major disadvantage is this wavelength's potential to be hazardous for the eyes. This limits the radiance that can be used for the laser beam requiring either laser power reduction or beam expansion to reduce the hazard. Another disadvantage is the large background noise experienced in this part of the spectrum, particularly from the spectral irradiance of the sun.

Bathymetric LiDAR

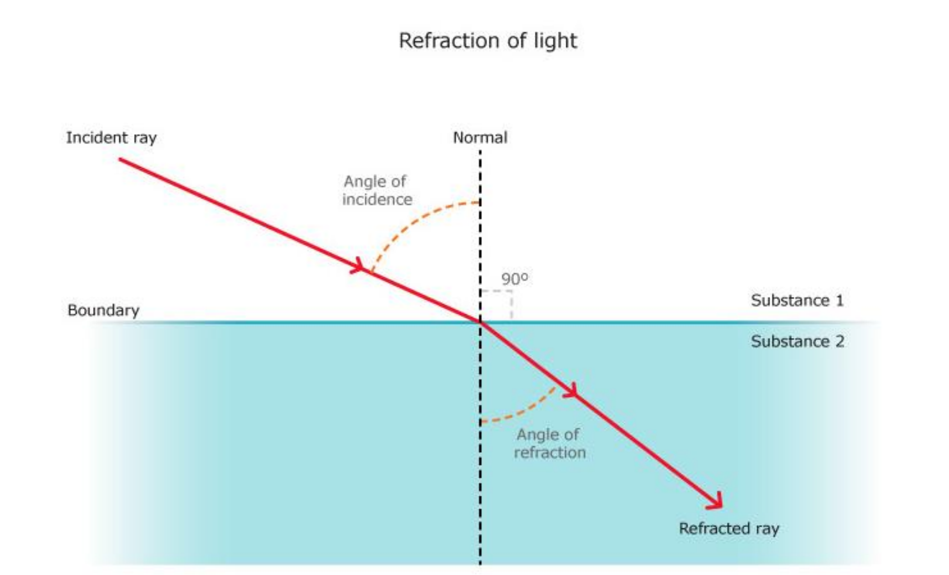
For bathymetry applications, i.e., high-resolution mapping of the sea bottom and coastal areas, a 532 nm laser source is often used because it represents the best compromise between high transmission in pure water and limited backscattering from submarine particulates. Figure 213 shows an application where two wavelengths are used in LiDAR bathymetry. In this case, an NIR pulse (typically at 1064 nm) is reflected from the water surface while 532 nm light penetrates the water surface and is reflected from the sea bottom.

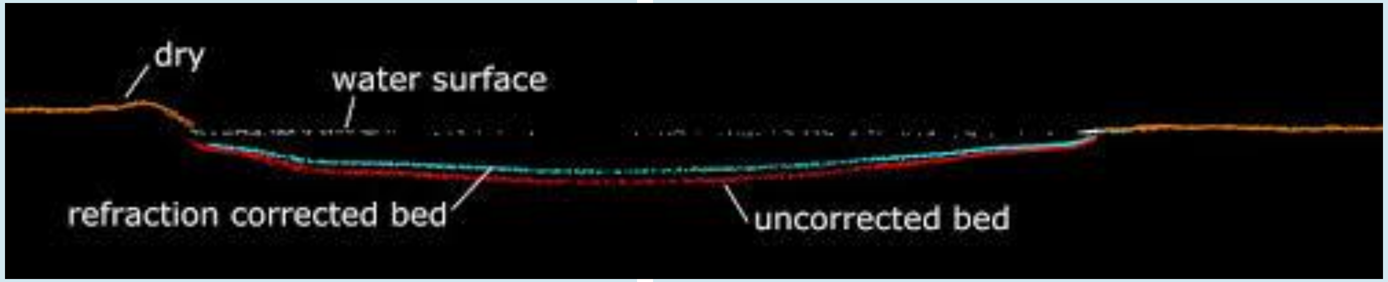


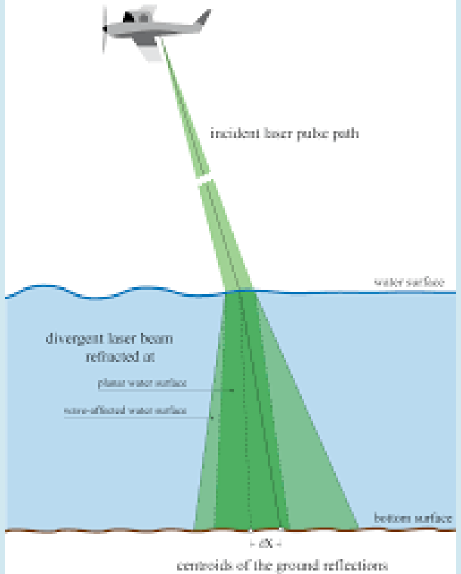


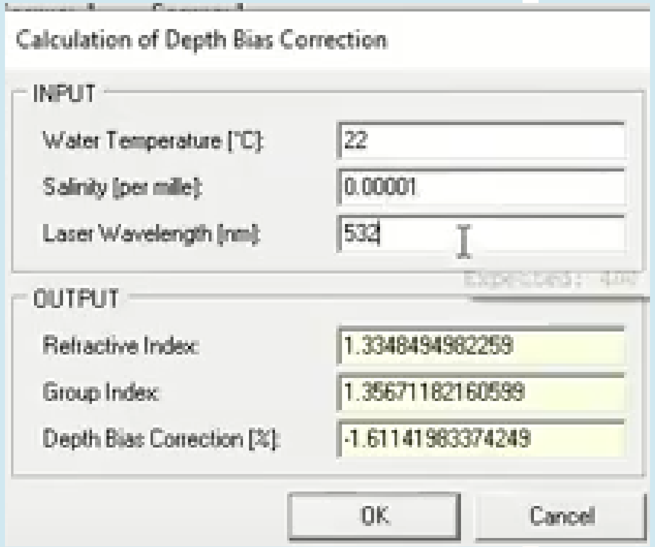
LANDPRO.

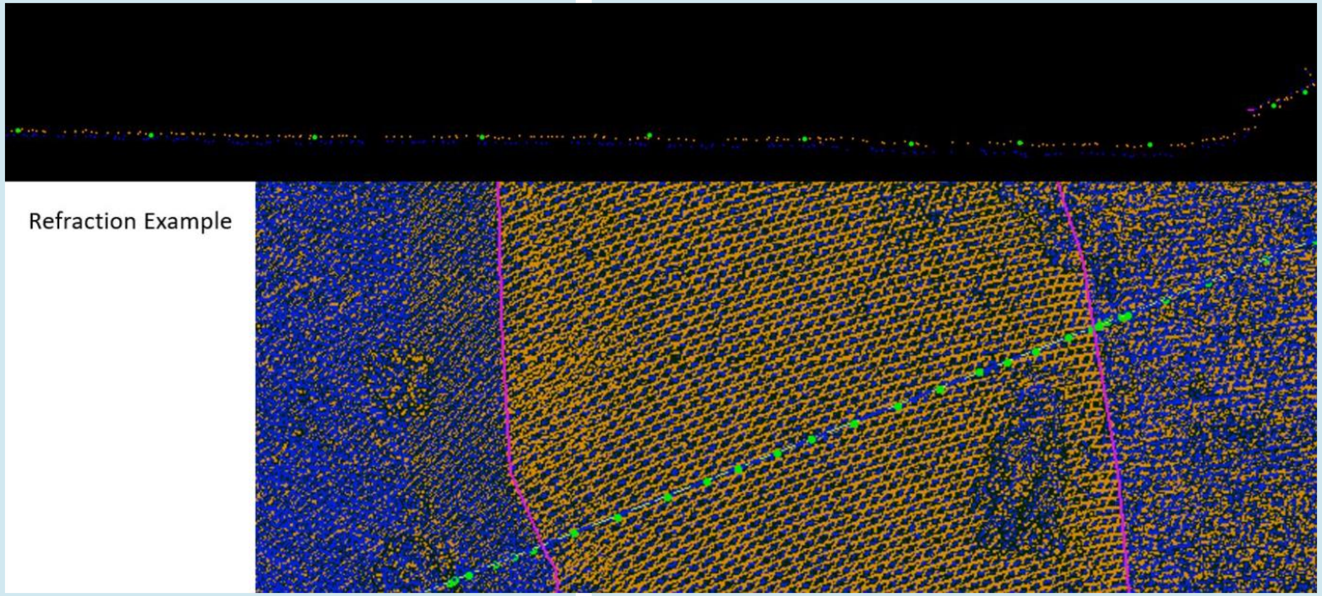
Refraction Corrections



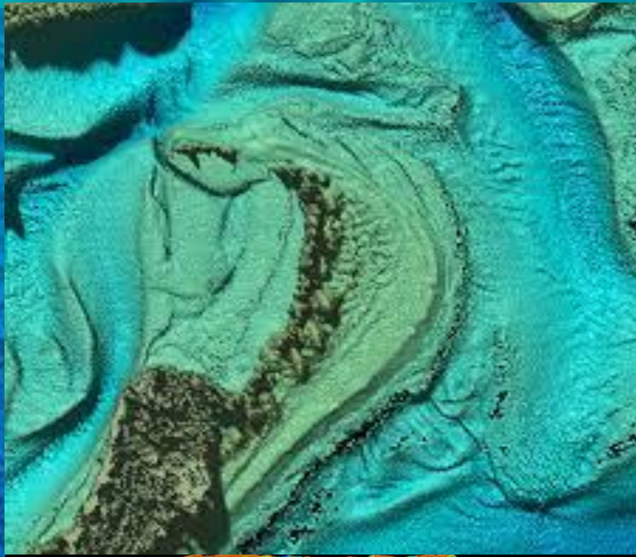


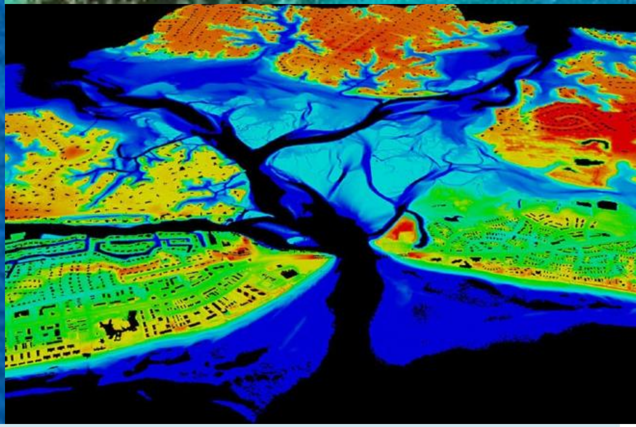




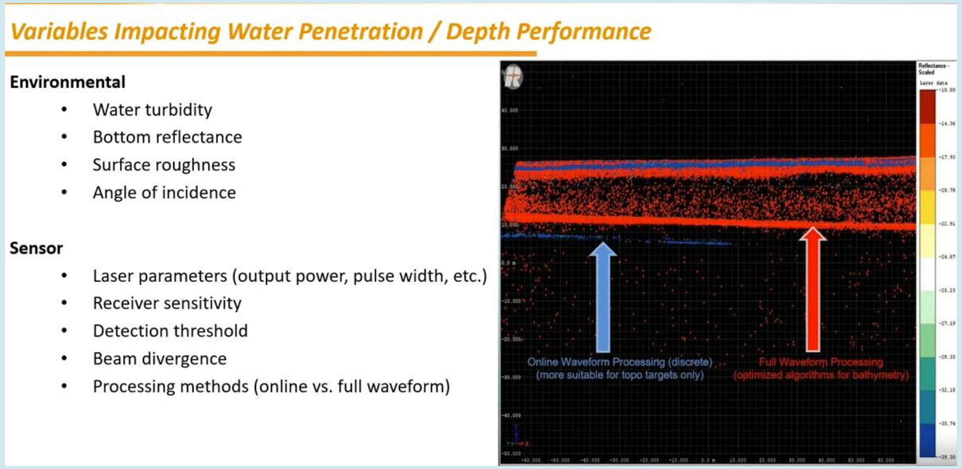


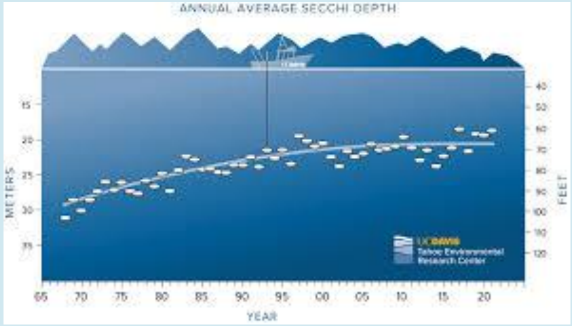
Bathymetric LiDAR Data



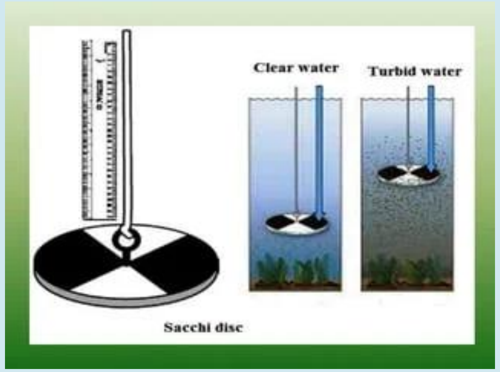


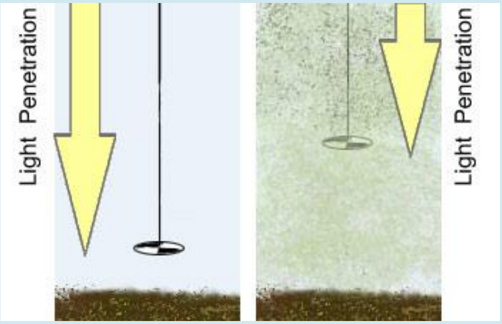
Bathymetric LiDAR Depth Penetration

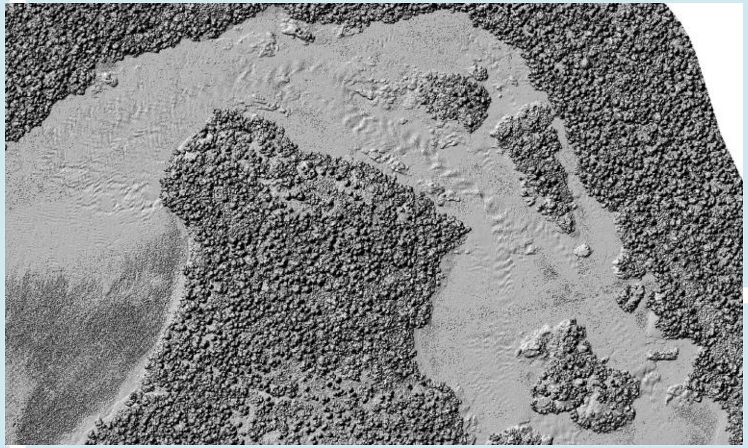


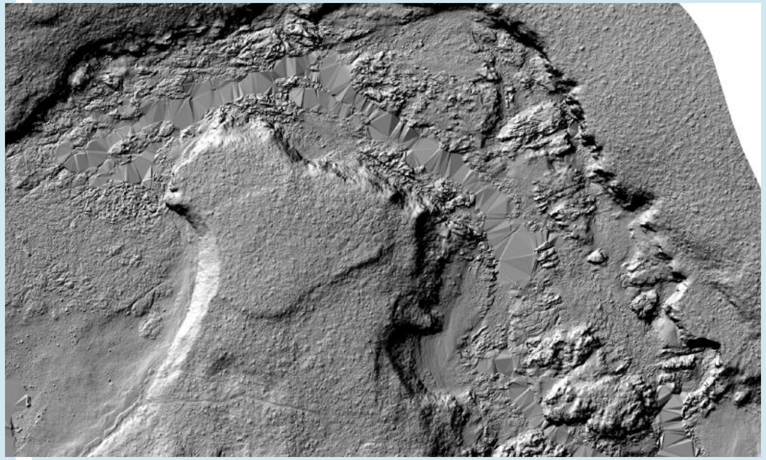


LANDPRO

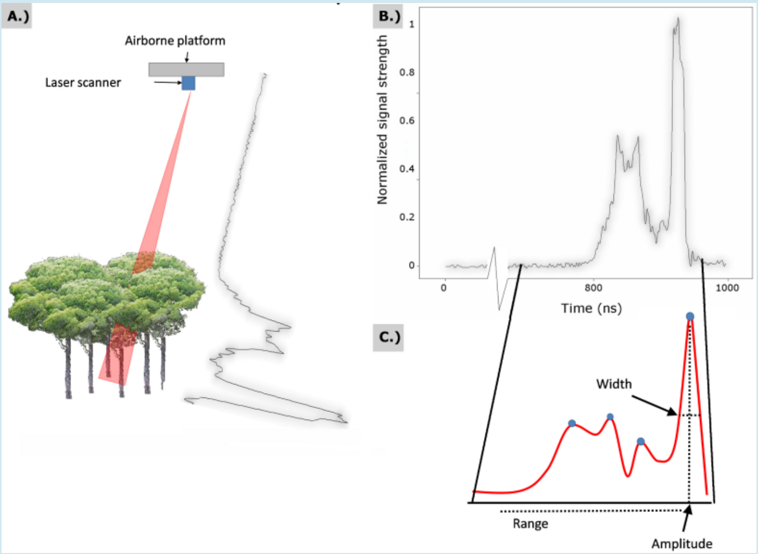






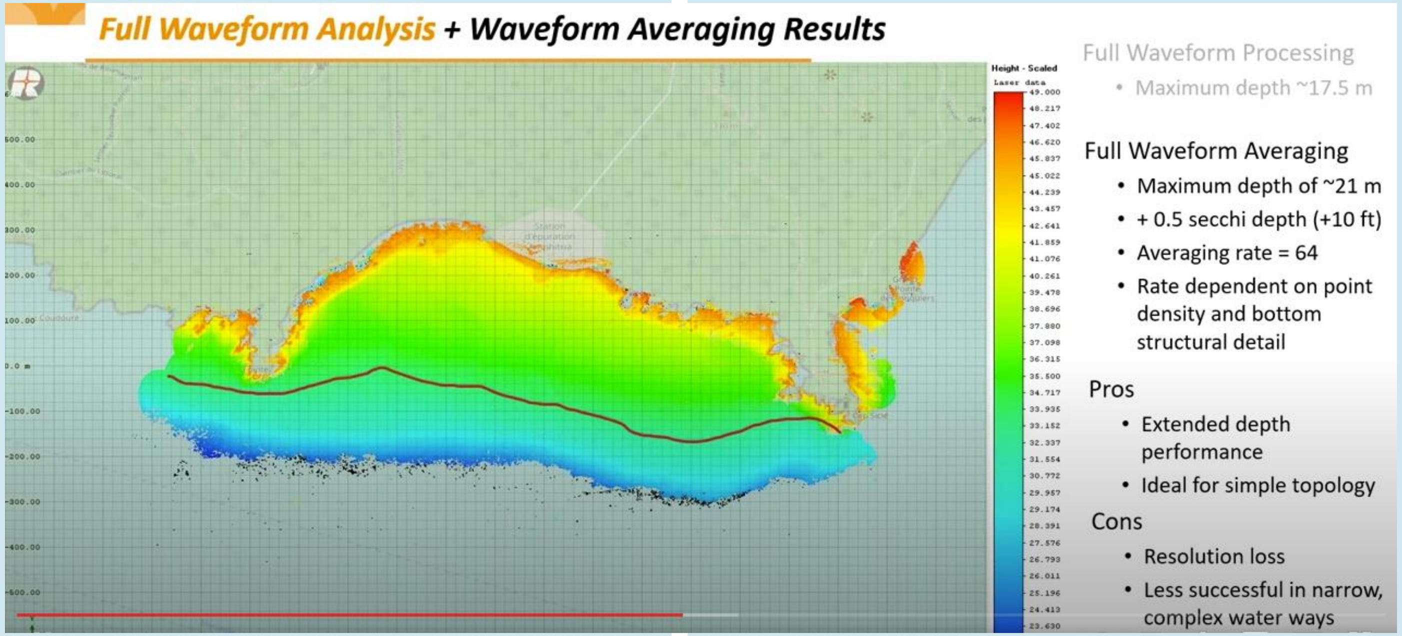


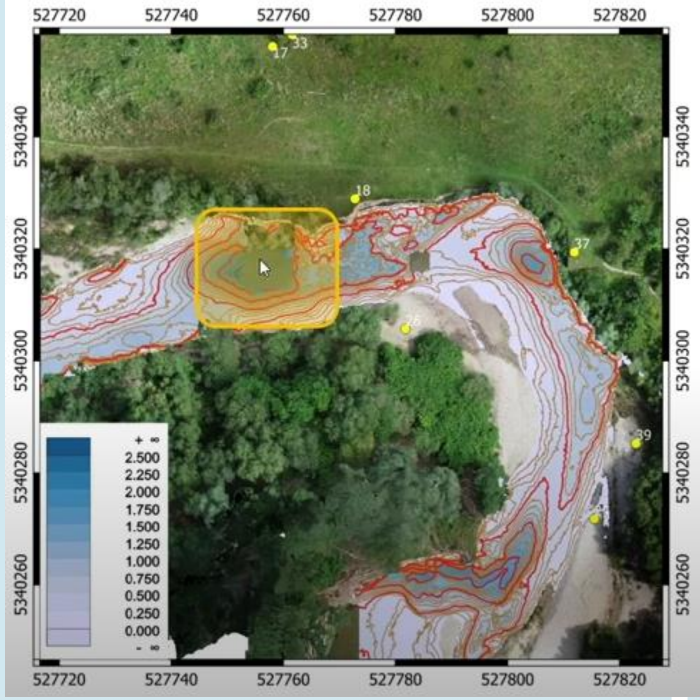
Online vs Full Waveform Processing

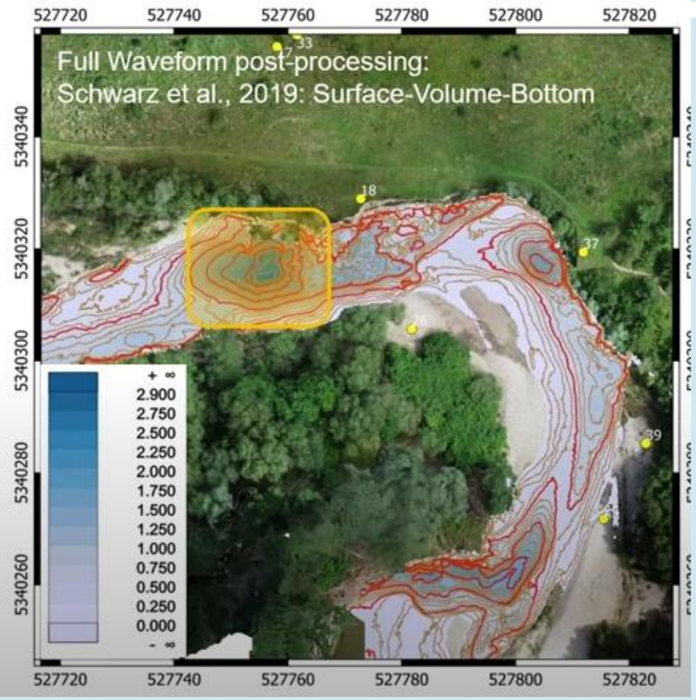


PARAMETER	ADVANTAGES	DISADVANTAGES
Online Waveform Processing	Low noise	Poorer detection
	Less water surface bias	No detection confidence
	Smaller data volumes	
Full Waveform Processing	Improved detection	More noise
	Higher accuracy	Larger data volumes
	Additional attributes	Longer processing efforts
	Pre-classification	
Waveform Averaging	Extended depths	Data generalization
		Cant be used on complex topology
Receiver FOV	Improved detection	Sensitive to saturation
Beam Divergence	Resolution Improvement	Altitude restrictions (MPE)

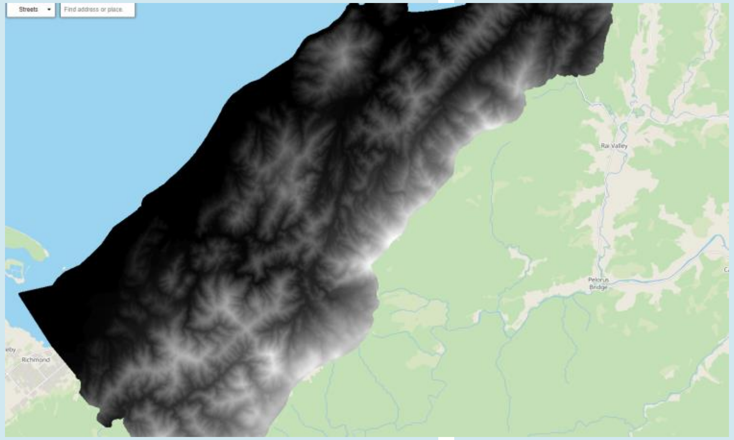
LANDPRO.

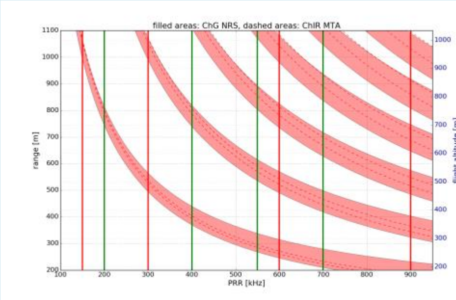


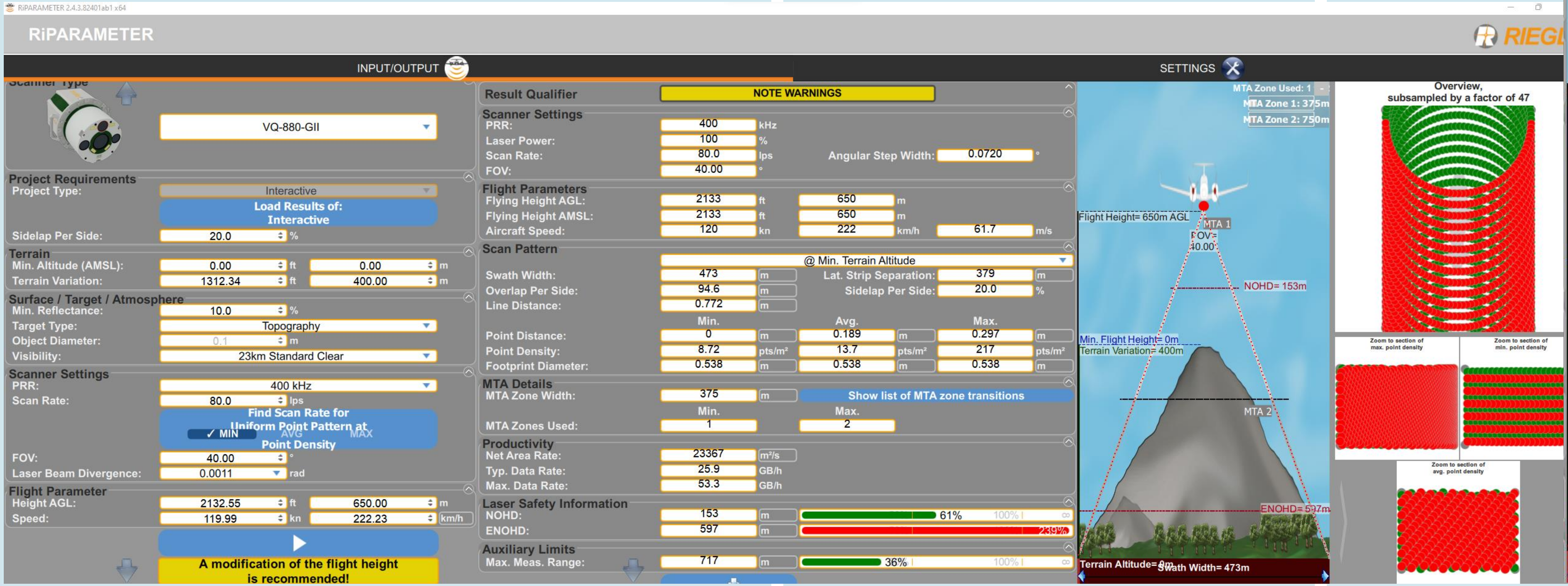


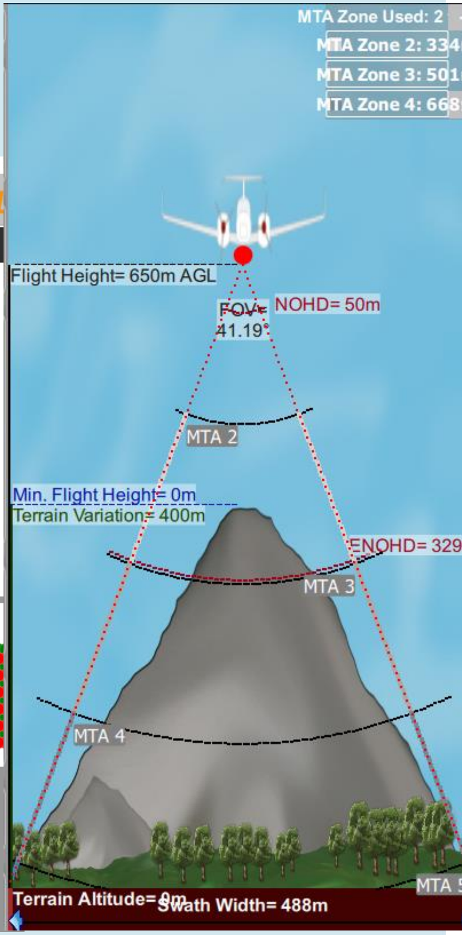


Green Beam LiDAR Planning

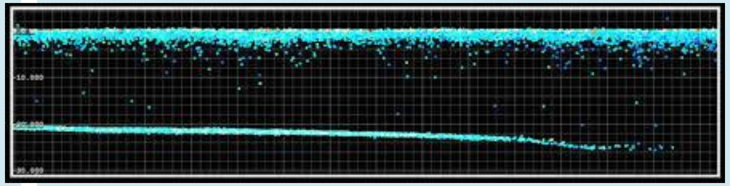


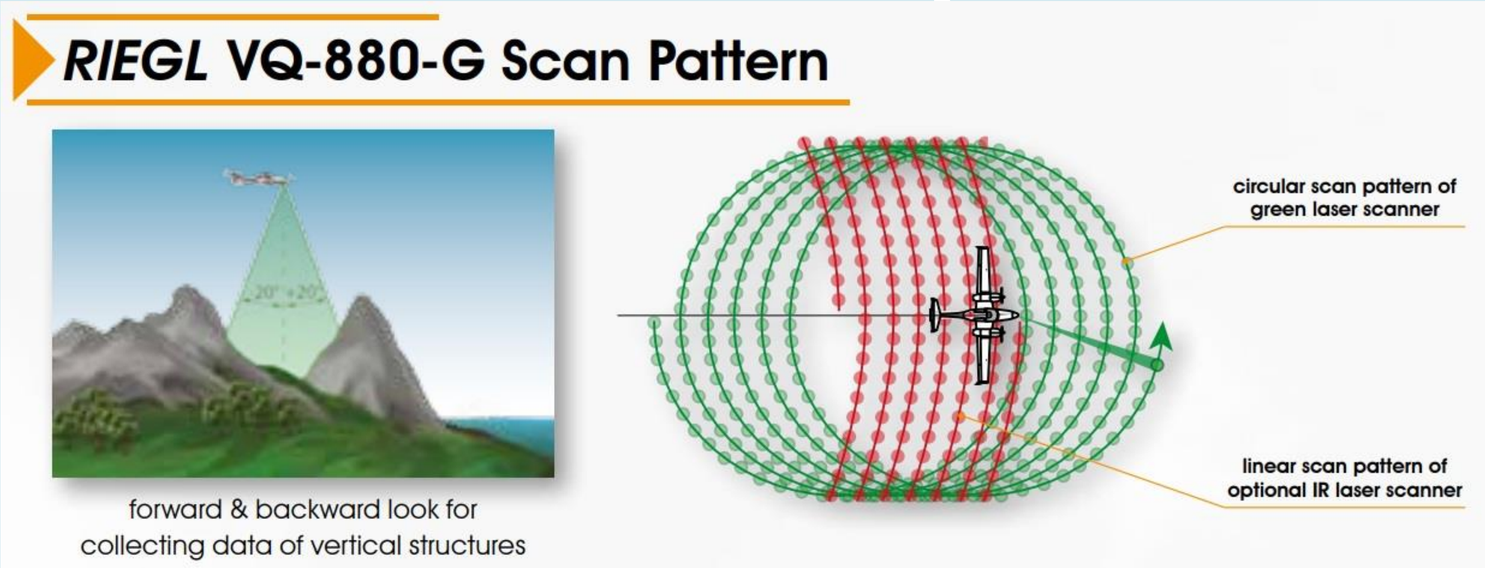


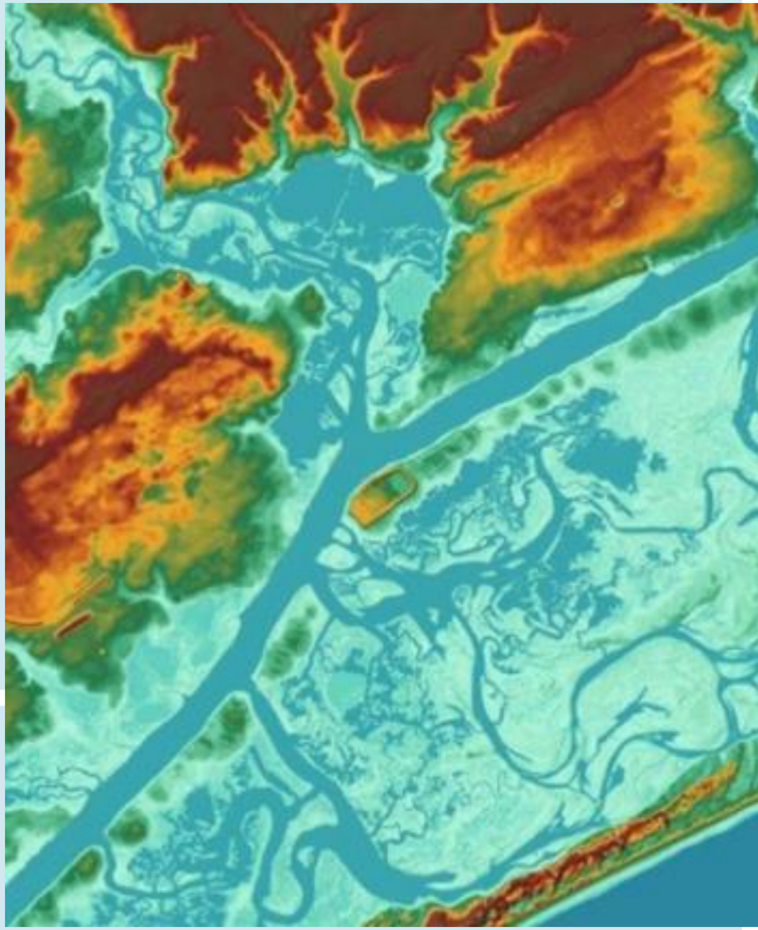


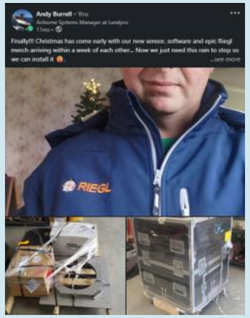


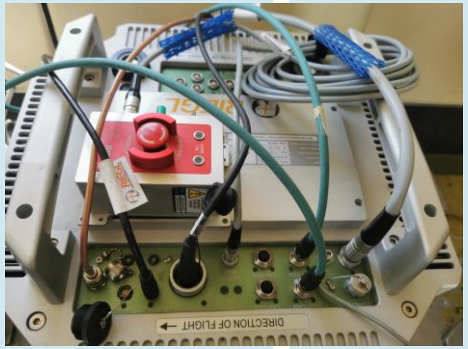
Landpro Sensors and Platforms





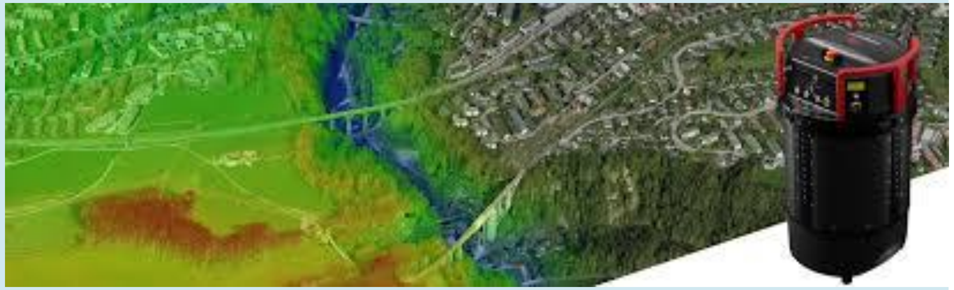






LANDPRO.

Landpro Sensors and Platforms



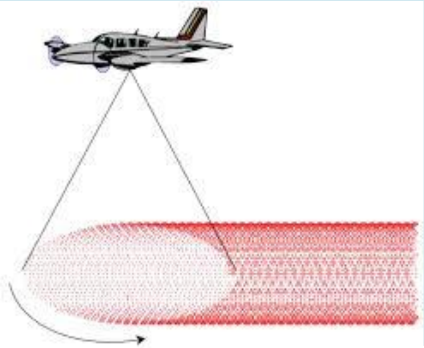
Leica ADS100 Line Scan Camera on PAV100 Gyrostabilized mount

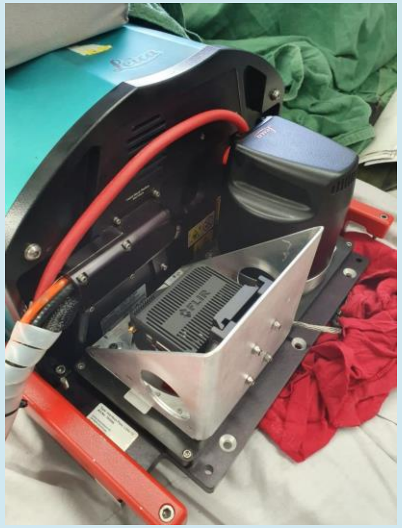
Leica Terrain Mapper 2 LiDAR with RCD30

Leica RCD30 RGBN 80MP medium format camera with FMC

FLIR Thermal Imaging

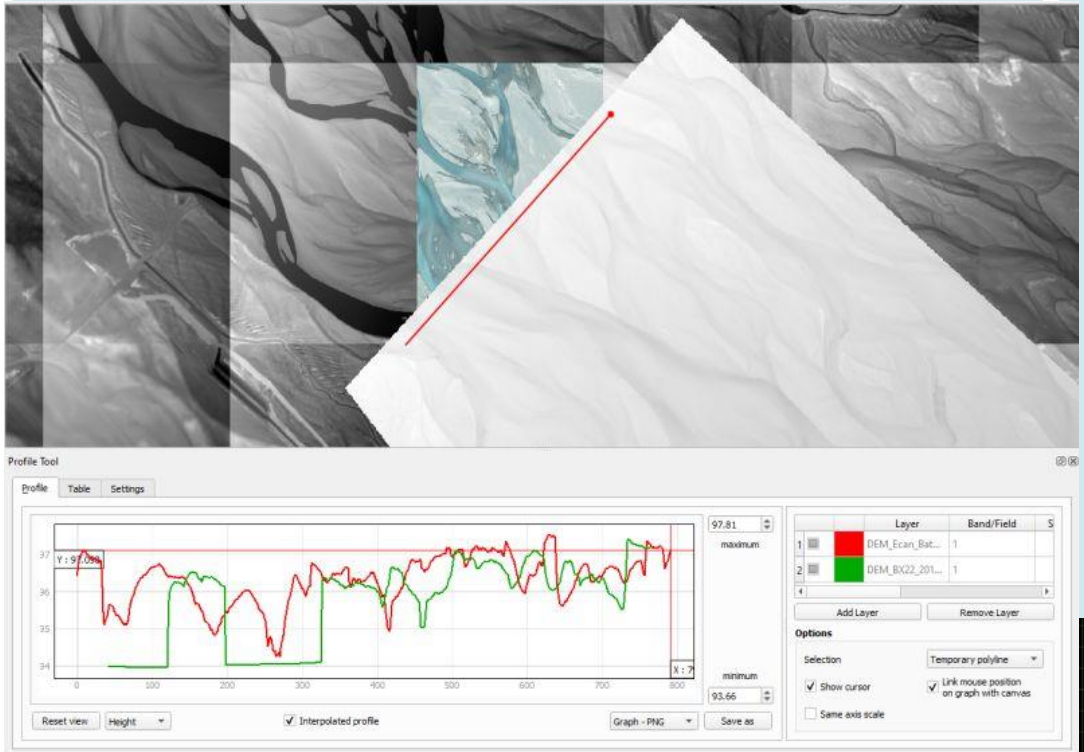
Riegl VQ880 GII Topo/Bathy LiDAR with 100MP PhaseOne camera

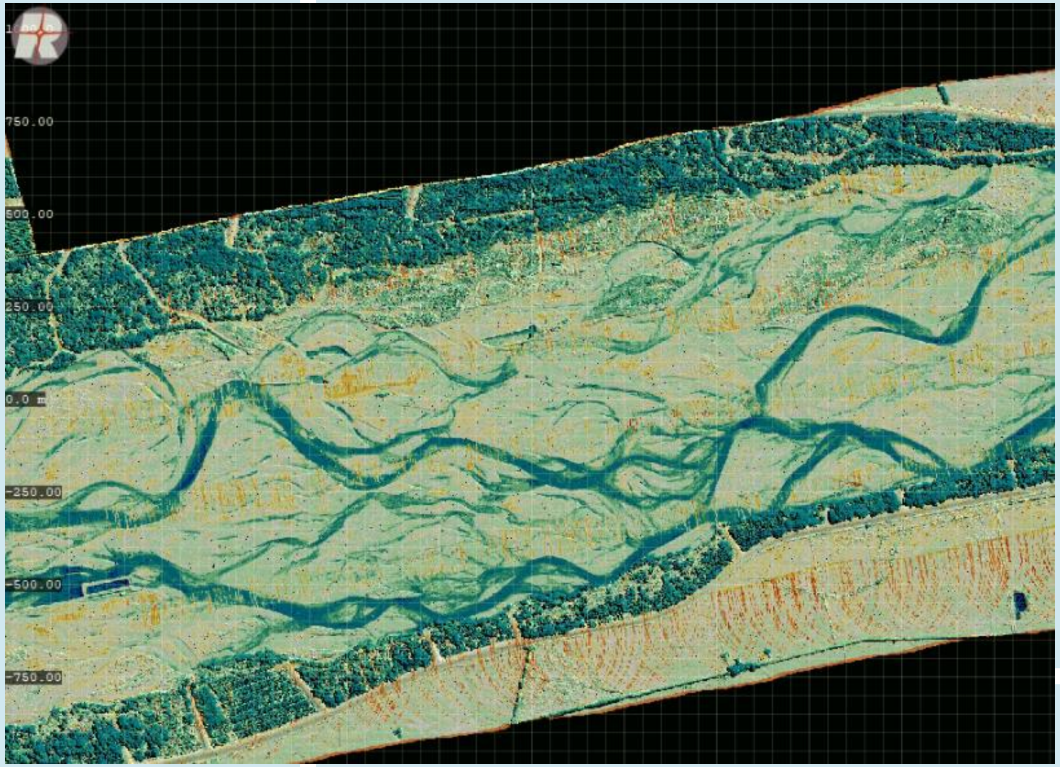


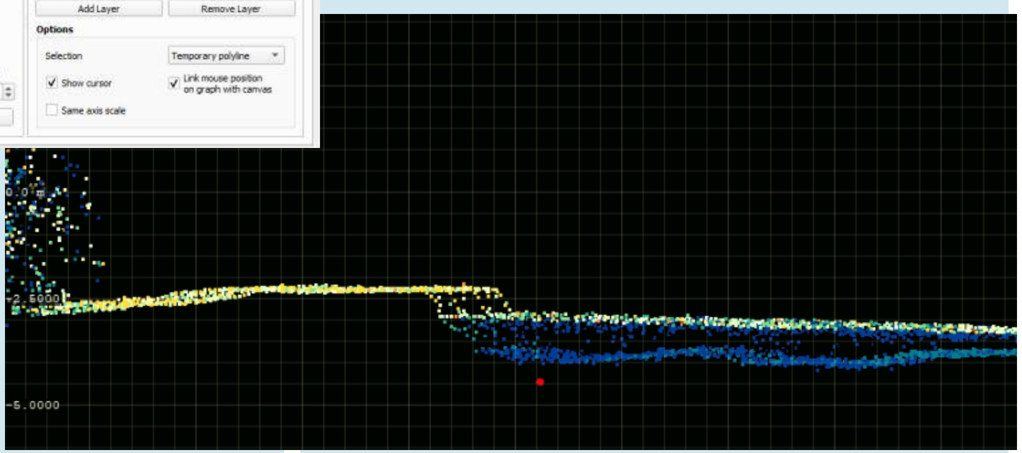


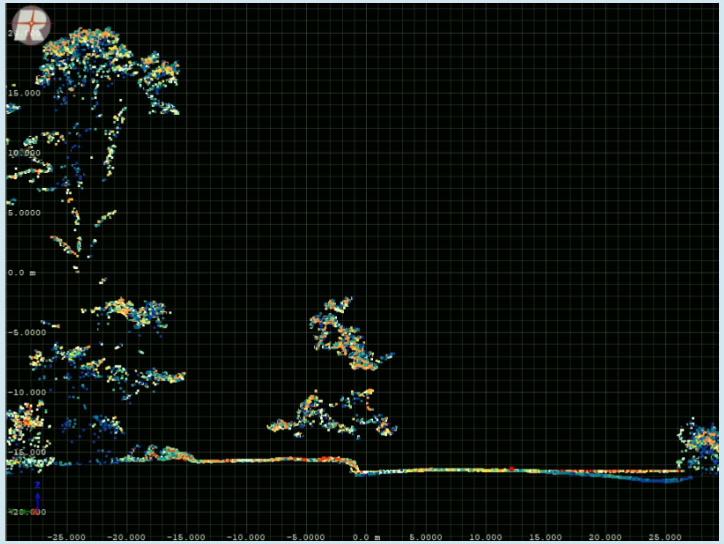
LANDPRO

Case Studies
- New Zealand Rivers



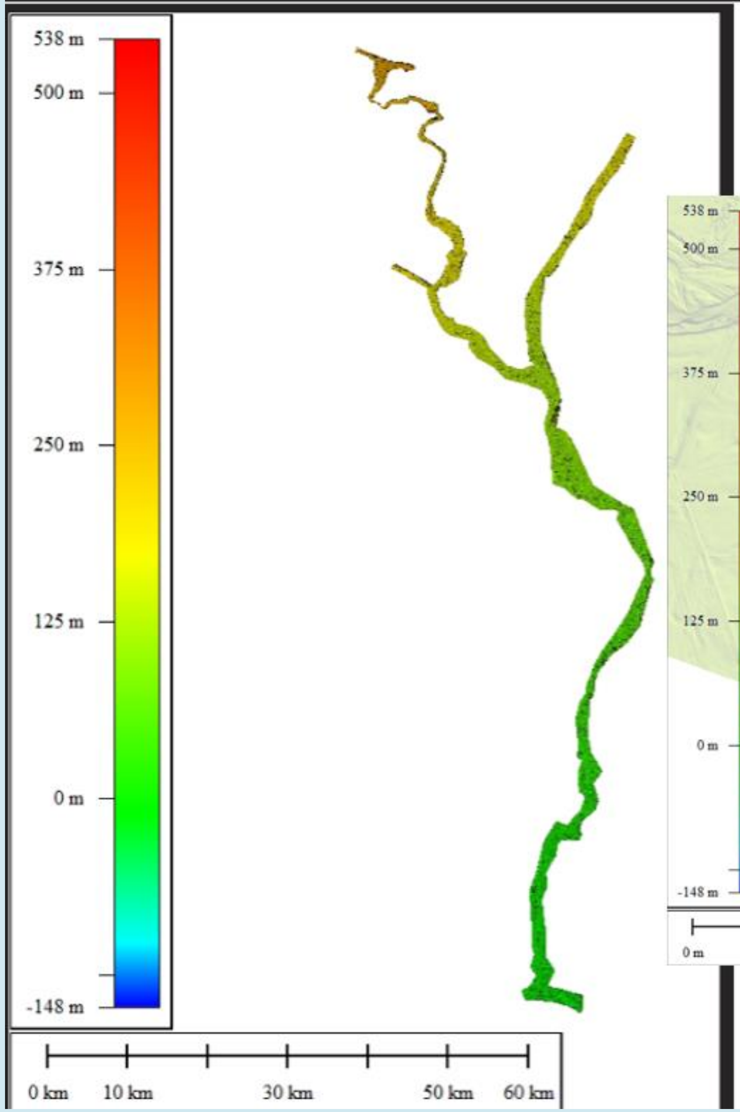


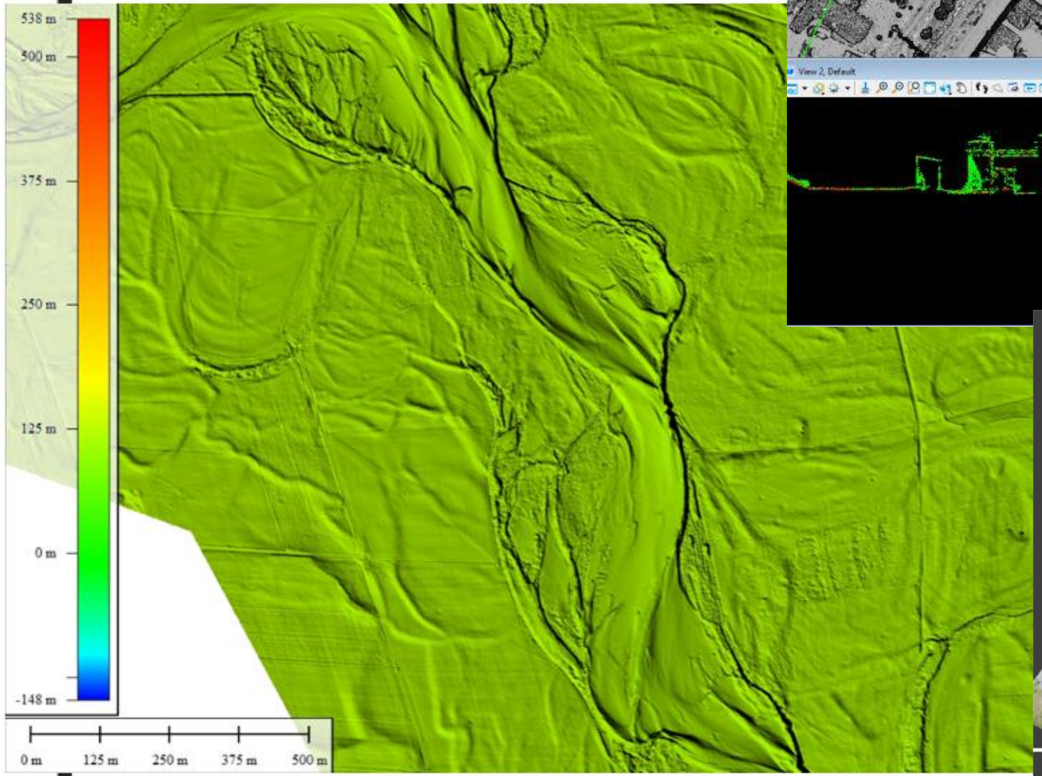


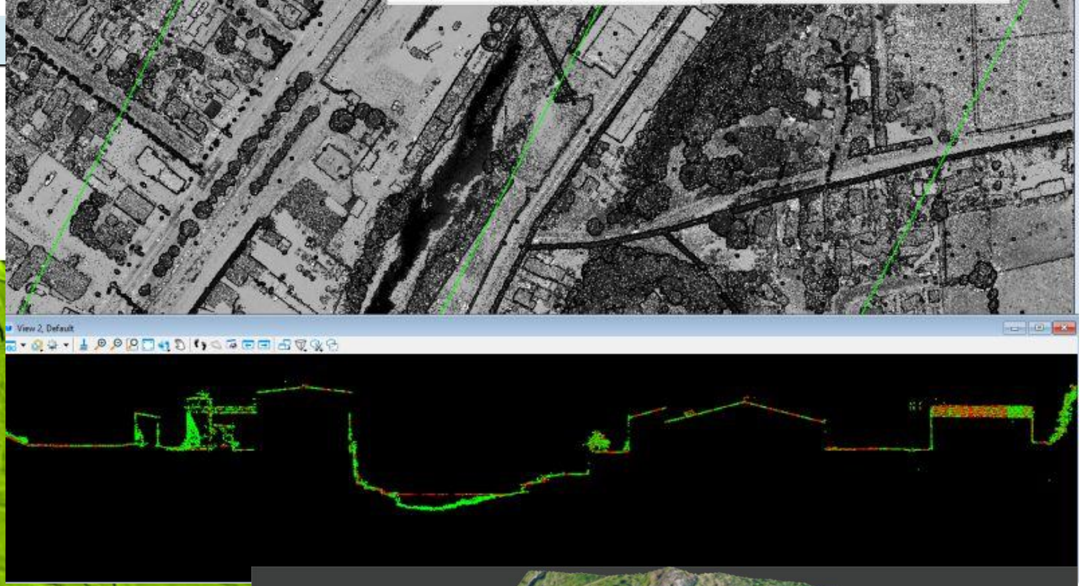


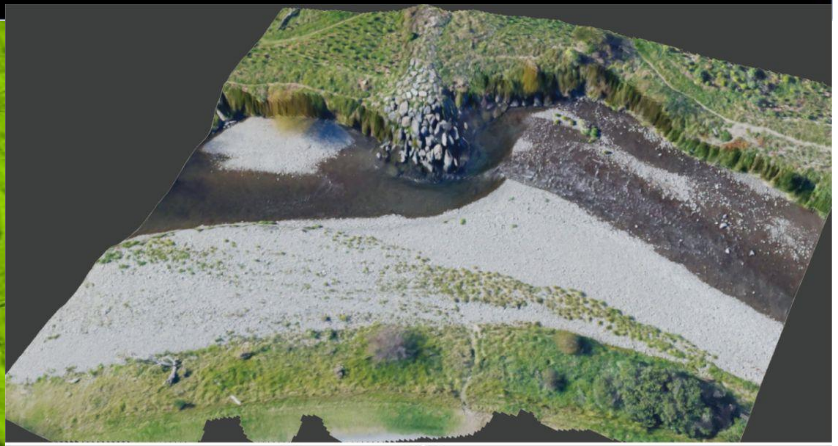
LANDPRO

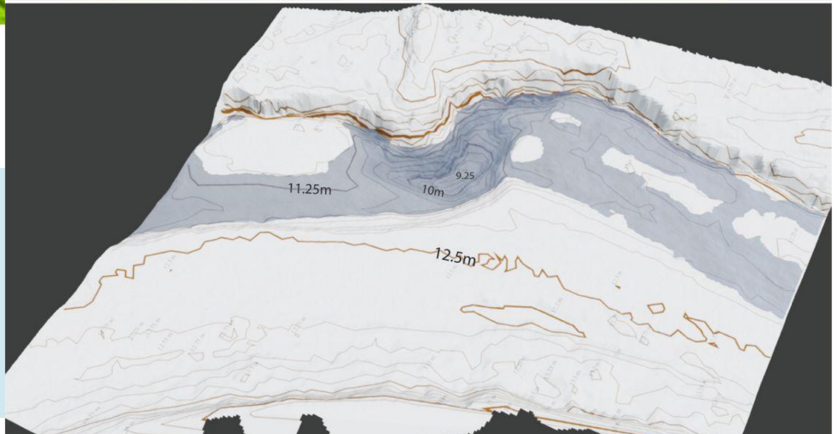
DEM Example





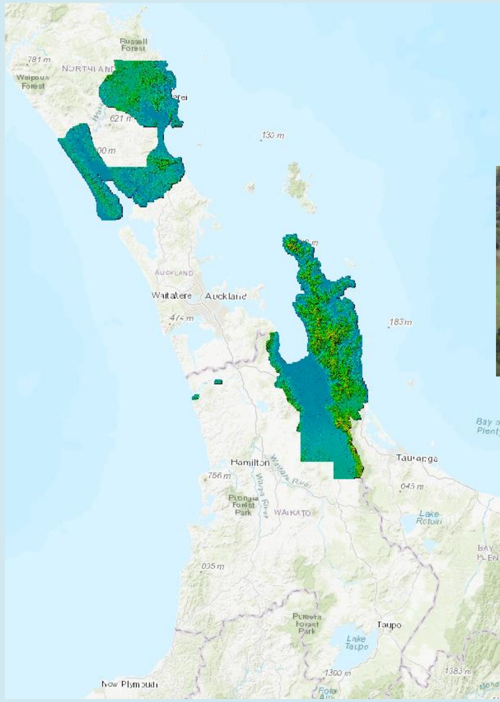






LANDPRO

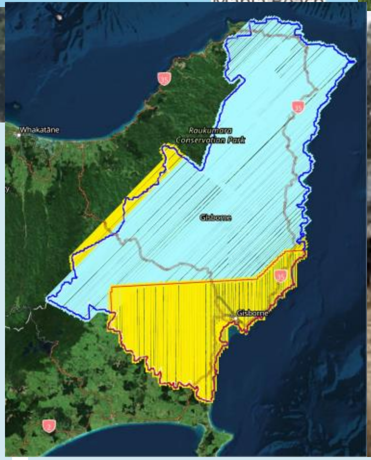
Case Studies
- Cyclone Gabrielle



20,000sqkm of LiDAR at 20ppm with co captured 10cm RGBN Imagery

- Deliverables

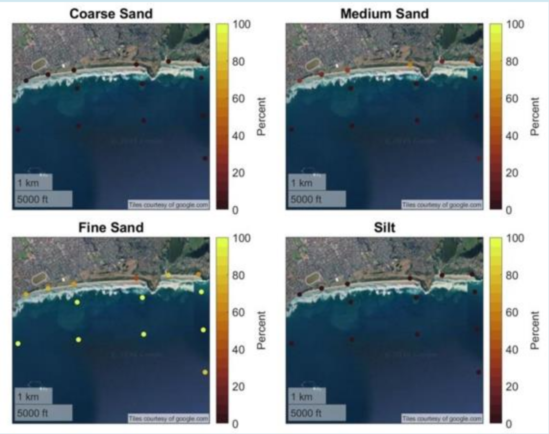
LINZ Spec classified LiDAR
1m DEM, DSM, CHM
10cm RGBN Ortho Imagery

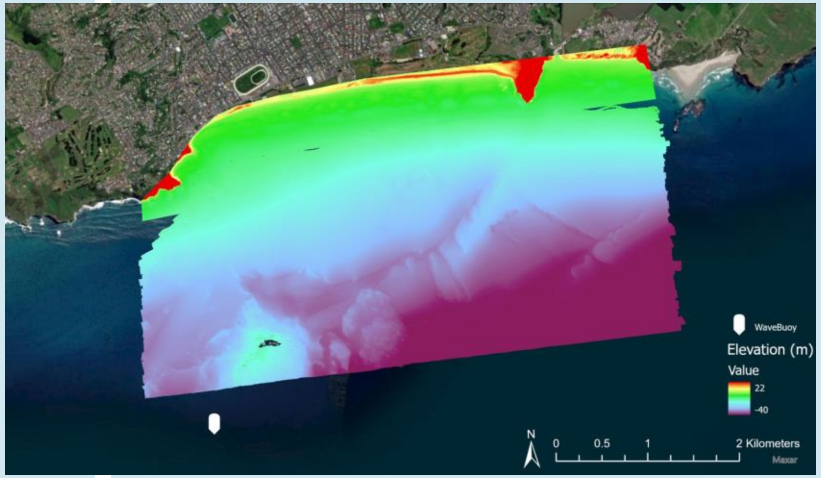


LANDPRO.

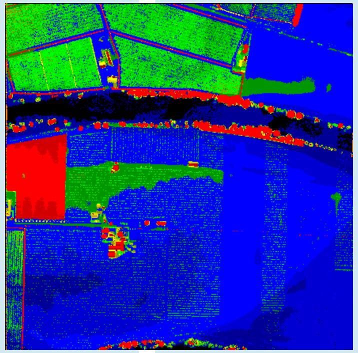
Case Studies
- St Clair Beach

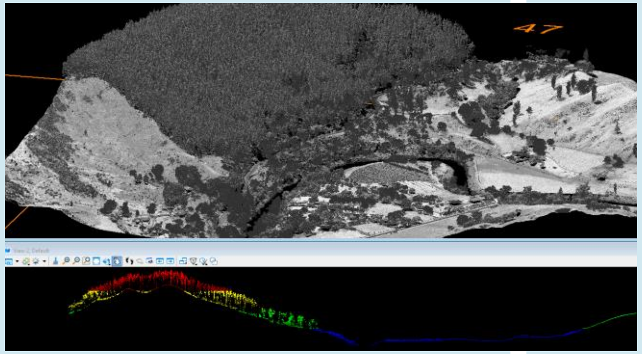
LANDPRO

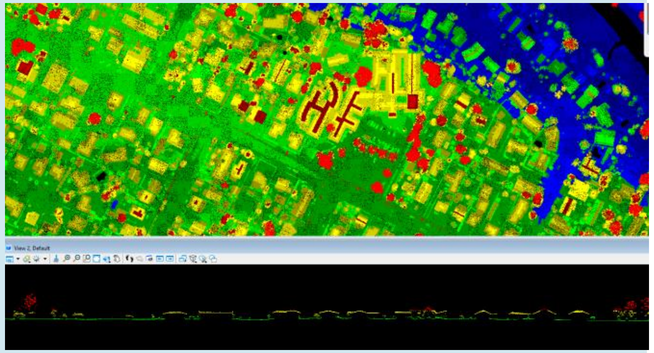


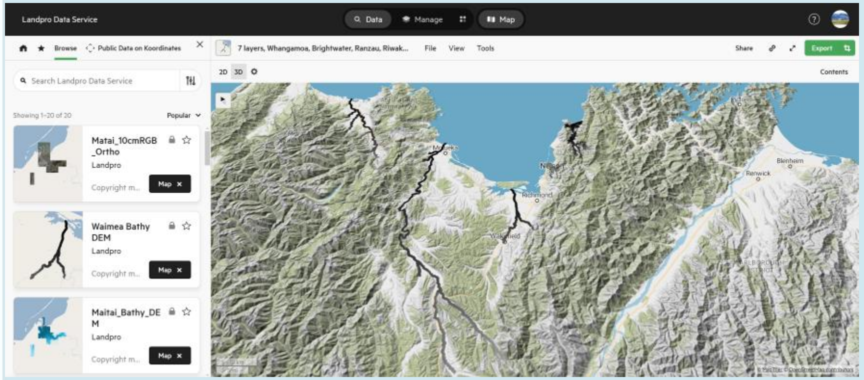


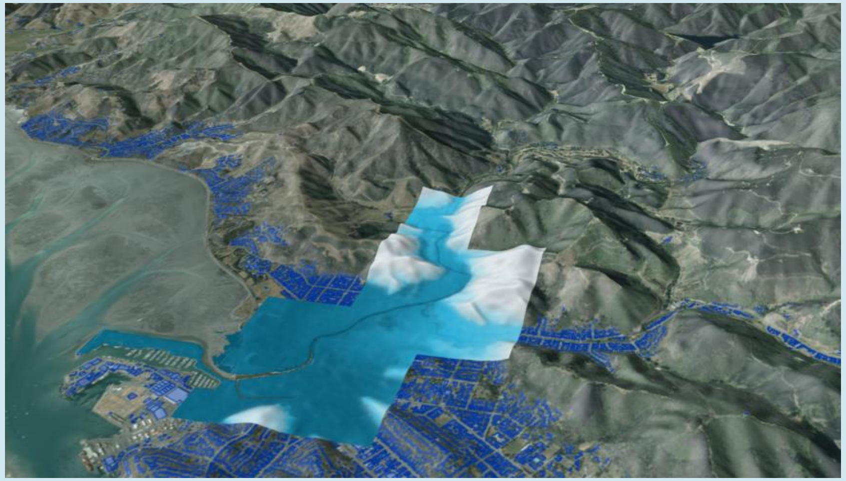
Case Studies
- Tasman Rivers





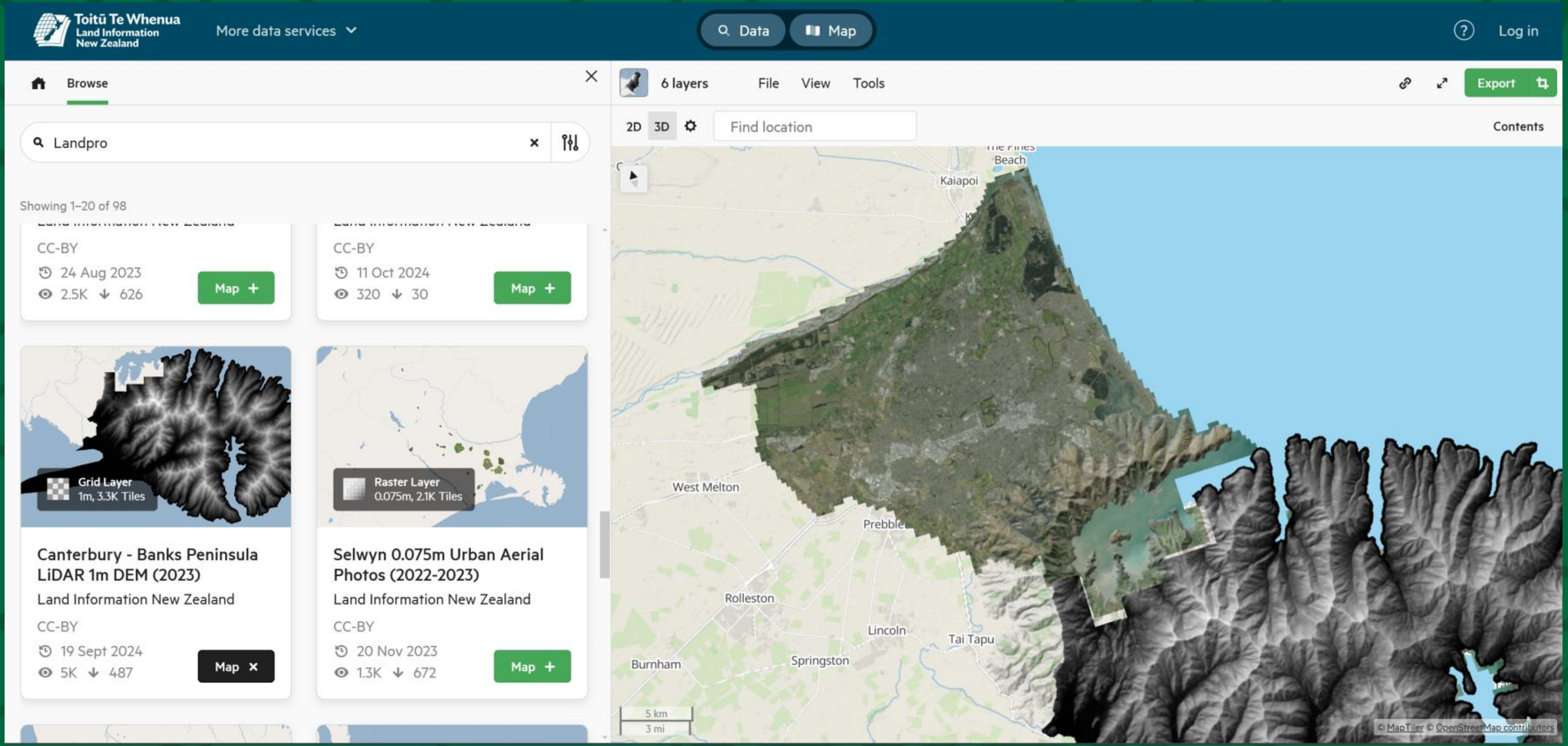






LANDPRO

Live Demonstration of LINZ Data Service



Questions and Discussion

LANDPRO