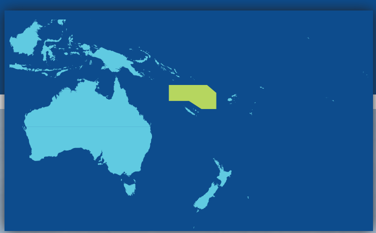
Australian Government

Pacific–Australia Climate Change Science and Adaptation Planning (PACCSAP)



Vanuatu LiDAR **Factsheet**

Australian Aid

VANUATU LiDAR and coastal risk mapping activities

Pacific Island Countries are particularly vulnerable to the impacts of climate change. With most settlements, infrastructure and industry of both atolls and high Pacific Islands located in the coastal zone there is an urgent need to better understand risks from sea level rise, coastal erosion and extreme events.

Vanuatu's *National Adaptation Programme for Action* (NAPA), the key national plan for addressing climate change in Vanuatu, identified coastal flooding as a serious issue that already threatens human lives, settlements and infrastructure. This risk will increase significantly with rising sea levels.

At only a few metres above sea level the main commercial centres of Port Vila and Luganville are highly vulnerable to flooding from tropical cyclones and storms. These centres are home to nearly a quarter of the population of Vanuatu and contain infrastructure and government services crucial to the country's economy. A large proportion of Vanuatu's rural population also live in low lying coastal areas.

In order to address these risks to Vanuatu's commercial districts and rural communities, the Government of Australia and the Government of Vanuatu are working in partnership to capture high resolution elevation data for priority areas of Efate, Malekula and Espiritu Santo and increase the capacity of the Vanuatu Government to better understand the risks of coastal flooding.

The work is being conducted in two phases:

1. The collection of high resolution topographic and bathymetric data through Light Detection and Ranging (LiDAR) technology for priority areas of Efate, Malekula and Espiritu Santo.
2. A training program for Vanuatu Government agencies on how to use the data captured, particularly for modelling of sea-level rise impacts on assets at risk.

The *Pacific-Australia Climate Change Science and Adaptation Planning* (PACCSAP) program aims to strengthen the capacity of Pacific Island countries to assess vulnerability to climate change and develop robust adaptation strategies.

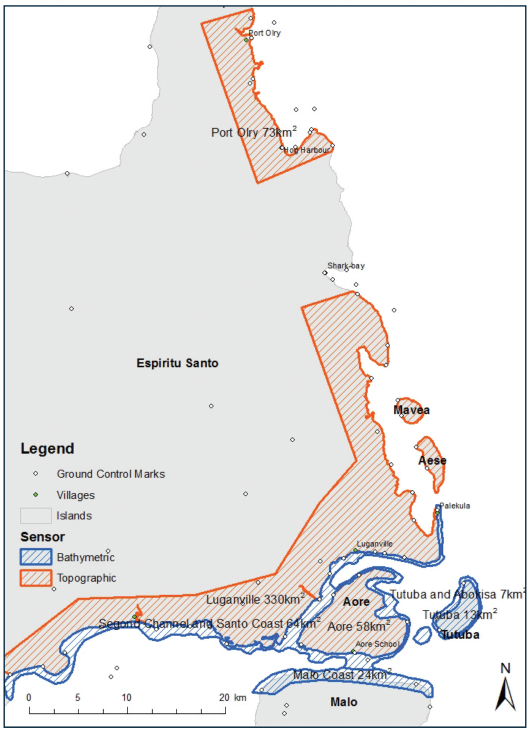
Figure 1: Aerial photo of Port Vila, Vanuatu.

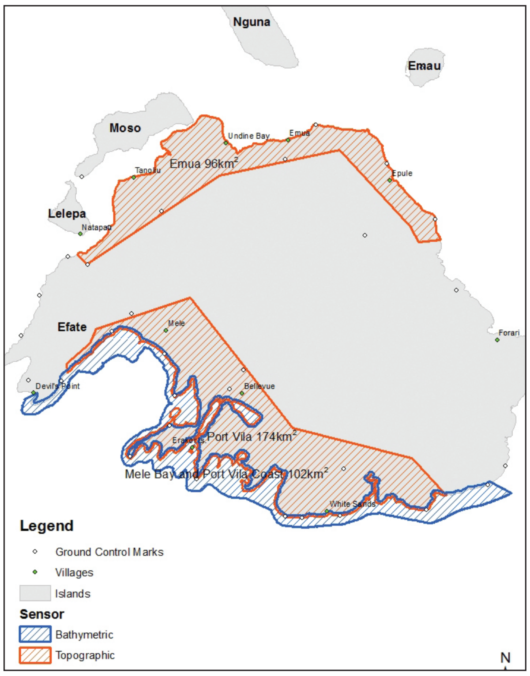
Vanuatu LiDAR survey

For populated coastal areas of low elevation, such as Port Vila and Luganville, high resolution elevation data improves the accuracy of inundation modelling and our ability to understand current and future risk to infrastructure and communities.

The topographic and bathymetric LiDAR survey for Vanuatu included high priority areas of Efate, Malekula and Espiritu Santo, as well as some of the smaller islands nearby. Airborne surveys flown between September and November 2012 captured the data for Efate and Malekula Islands. The survey for Espiritu Santo, which was initially delayed due to poor weather conditions, was completed in May 2013.

The surveys were conducted in collaboration with Geoscience Australia and the Cooperative Research Centre for Spatial Information.





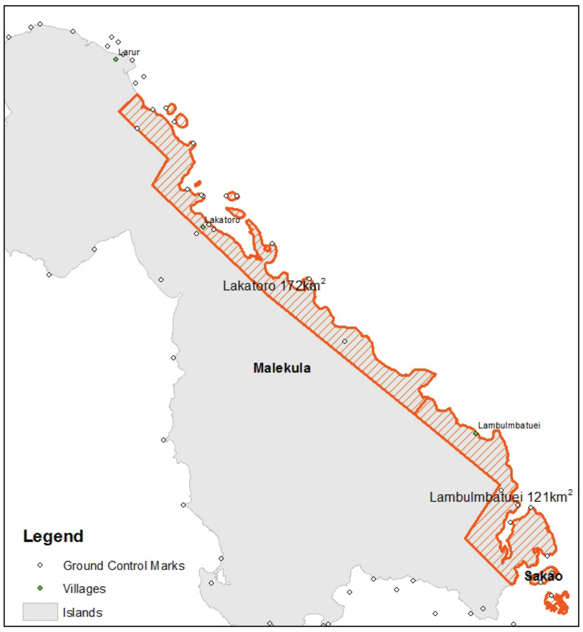


Figure 2: Maps showing extent of LiDAR capture in Vanuatu. The orange areas were captured using the topographic (land height) sensor and the blue areas used the bathymetric (seafloor depth) sensor.

Figure 3: A cross-sectional view of the Vanuatu Parliament House and across Vila Bay to Iririki Island using the LiDAR data. The data points have been coloured using aerial photos captured at the same time as the data.

Vanuatu LiDAR and imagery products

The Vanuatu LiDAR survey has generated the following products:

- Digital elevation model (DEM) – elevation of the ground at 1m resolution and seafloor at 5m resolution in ESRI grid format. The topographic and bathymetric datasets were integrated to form a seamless DEM at 5m resolution.
- Contours – elevation of the ground and seafloor at 0.5m intervals in ESRI shapefile format.
- Digital surface model (DSM) – elevation of surface features such as tops of buildings, trees and bare ground at 1m resolution in ESRI grid format.
- Canopy height model (CHM) – height of vegetation above the ground at 2m resolution in ESRI grid format.
- Foliage cover model (FCM) – density of vegetation above 2m from the ground at 10m resolution in ESRI grid format.
- 3D point cloud – all measured LiDAR points classified in LAS format, with additional reflectivity information.
- Coincident aerial photography generated in ECW and TIFF formats.

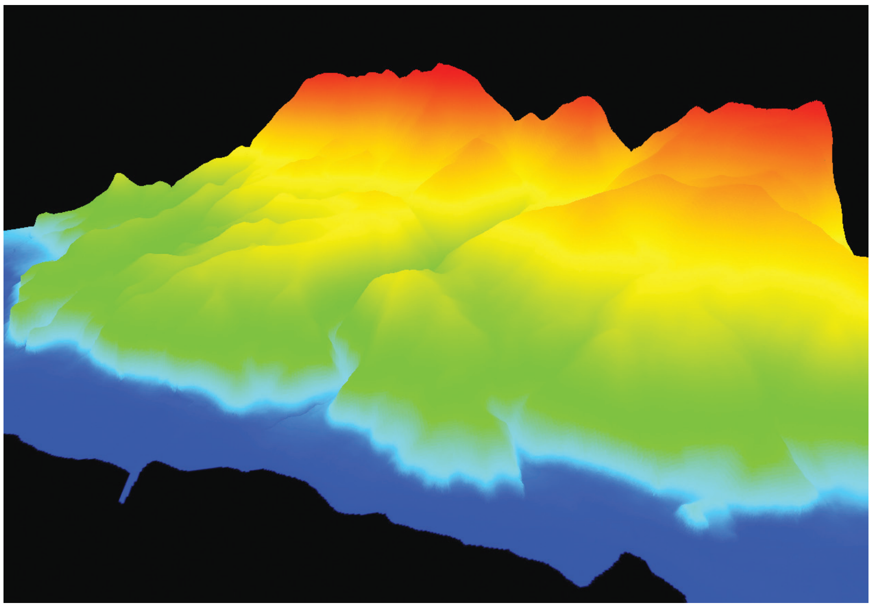


Figure 4: A 3D digital elevation model of a section of the coast of Malekula. The red areas are the highest elevation, and the blue areas are the lowest. The coastal plains and mountain ranges are clearly visible. A waterway running between the mountains can also be seen.

Vanuatu capacity building program

The data captured through this project is a significant asset to Vanuatu and will be invaluable in supporting future coastal planning and management.

The capacity building and coastal risk mapping activities will build on the LiDAR acquisition by:

- providing hardware, software and training for Government of Vanuatu personnel to support management and use of the LiDAR data;
- using the LiDAR data to undertake simple coastal inundation modelling to support an initial risk assessment of priority coastal areas of Vanuatu;
- providing training in the use of coastal inundation modelling analysis to support sustainable planning decisions.

Airborne LiDAR technology and applications

Airborne Light Detection and Ranging (LiDAR) is an optical remote sensing technology that provides extremely accurate, high-resolution elevation data. Airborne LiDAR measures distances (and therefore height or depth) by sending a pulse of light from a laser scanner towards the area being surveyed and measuring how long the light pulse takes to return. The laser and sensor are mounted on a specialist aircraft in which a GPS system is used for positioning.

For coastal risk assessment this elevation data is critical to calculating inundation levels, drainage, catchment boundaries, water flow and water sinks. It is also valuable for many other uses including infrastructure planning, evacuation planning and natural resource management.

For disaster planning the data can be used to model storm surge and tsunami inundation.

Topographic LiDAR can be used in conjunction with aerial imagery to produce maps of roads, structures and water courses. Industry can use the data to plan construction sites, monitor land subsidence, determine pipeline routes and detect changes in vegetation growth.

Bathymetric LiDAR can be used to map coastal erosion, benthic habitats and coral reefs. It can also be used in nautical charting and tidal boundary determinations. Industry can use the data in ports and harbour operations, and in the development of breakwaters.

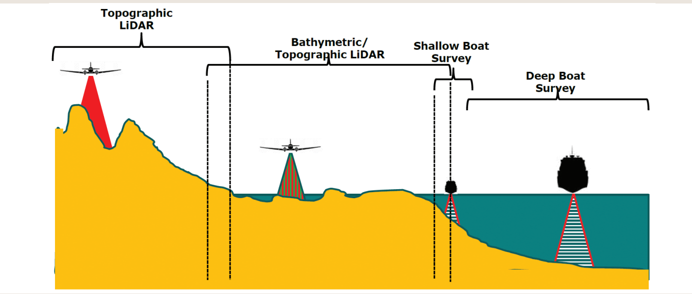


Figure 5: Diagram of technologies used to obtain elevation data.

Contact us

For further information about the *Pacific-Australia Climate Change Science and Adaptation Planning* program, please contact the International Adaptation Strategies team:

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For information about other Australian Government aid projects in the Pacific visit **www.dfat.gov.au**

For information about other Australian Government LiDAR acquisitions visit **www.ga.gov.au/elevation**

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