Newcastle University Anegada Expedition 2013

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Aim

The aim of this expedition was to assist the island to address the effect of climate change using Geomatics techniques.

Introduction

Anegada as shown in figure 1 is situated to the North East of the British Virgin Islands archipelago. It is also the only one of the Islands with a non volcanic base, it is instead based on coral. The island is roughly 16km by 3km. Due to it's geological composition and position Anegada is at risk of coastal erosion.

Figure 1 – Showing the Location of Anegada Relative to the US and the BVI.

In the Caribbean, sea-level rise has been close to 3mm a year since 1993.The combination of sea-level rise and tropical storms has resulted in the erosion of coastlines. Anegada is the most northerly of the British Virgin Islands (BVI) and it therefore endures the worst of these conditions. It has been highlighted as an island at risk and has been undergoing some monitoring to try to predict and lessen the effect of coastal erosion. The expedition intended to enrich this existing data set using techniques learned on the undergraduate degree programme.

Objectives

- Create a semi-permanent control network using Geomatics techniques.
- Survey and map the coastline and investigate the coastline retreat.
- Analyse the quality of the data collected.
- Support local people managing the island's coastline through the public availability of data.
- Gain personal and professional experience in research and survey techniques.

Methods

GNSS

GNSS stands for Global Navigation Satellite Systems, these systems can also be used for millimetre accurate positioning on the earths surface. This was therefore the chosen method for establishing a semi-permanent control network.

The expedition used two Leica GS15 receivers kindly loaned by way of in kind sponsorship from Leica. A number of local control stations were measured during the island reconnaissance in the first week. In the following week these control positions were used to calculate an accurate position for a local base station to be used in all further GNSS readings.

The local base was established within the grounds of the accommodation. Every morning a receiver would be set up on this station, taking a measurement every 1 second for approximately 8 hours a day. Whilst this was measuring the other receiver was taken into the field to take measurements along the coastline. The 'rover' receiver as it is known, was set to measure each point for 2 minutes also at a 1 second sampling rate. A bipod was used to keep the receiver steady at each of the sampling points.

GNSS was also used in this way to establish the control stations which would be used to detail specific parts of the coastline. The only difference being the occupation time which was increased from 2 minutes to an hour to improve the accuracy of the measurements.

All GNSS data was post processed using Leica Geo Office (LGO) software, all rover positions collected during the day were positioned relative to a corrected base position from the receiver in the accommodation grounds. This software also allowed us to analyse the accuracy of the data, another one of our objectives. A screenshot from LGO can be seen in figure 2.

Total station

A total station is a highly accurate survey instrument capable of measuring distances and angles to 0.001m. Leica also kindly agreed the loan of a brand new TS15i total station for use on the expedition.

The group set the total station up over the control points established using GNSS and detailed specific parts of the coastline deemed to be under threat. This was done by observing a prism on a detail pole, that was held on points to be surveyed. At each station Geo referenced panoramic images were also gathered. The group carried out a general topographic survey of the area along with cross sections radiating from the total station to the waterline. The group also took advantage of the automatic grid scan capability the total station whilst also carrying out manual spot heights of the area.

Each of these datasets will be used collectively to create a surface model of the respective area of the coast, using LSS data plotting software. This will then be made available to local government agencies along with raw data collected throughout the expedition.

Results & Conclusion

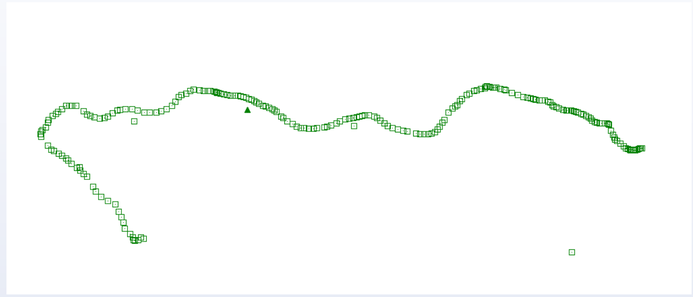

Figure 2 – LGO plot of the Northern and Western Coastline surveyed by the expedition.

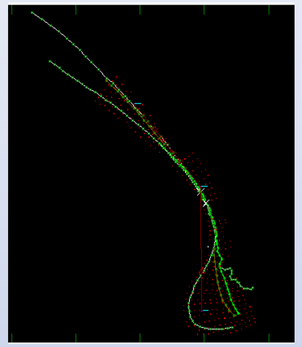

Figure 3 – LSS plot of Pomato Point on the SW corner of the island.

All data collected during the expedition has been accuracy assessed, and is currently being transformed and processed into the correct datum. Once this has been accomplished then the final datasets, including surface models and 2D plots will be made available to government agencies so that they may continue to work on combatting the effects of climate change on Anegada.

It is hoped that the expedition and the data collected therein will be a starting point for future monitoring studies of the island, by students, local or international, and agencies alike.

Acknowledgements

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