GeoQuEST Blog entry

The vulnerability of reef islands in Isabel Province, Solomon Islands GeoQuest blog

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Sea-level rise caused by melting ice caps and thermal expansion of the oceans is predicted to have wide-reaching effects on the world's coastlines over the 21st century. Given the fact that coastal areas are often densely populated, this is likely to have significant impacts on communities and infrastructure. However, the effects of sea-level rise will not be felt uniformly; some coastal landforms, such as reef islands, are considered more vulnerable than others.

Reef islands are formed when broken-down corals accumulate on reef platforms in tropical oceans. These landforms are dynamic and respond to environmental changes and anthropogenic impacts by readjusting their size, shape, and position. In some cases, they may be able to keep pace with sea-level rise as new coral sediments are deposited; in other cases, the islands may be adversely affected by saline intrusion, inundation, and erosion. But we don't yet fully understand what drives these contrasting landform responses.

With support from the GeoQuEST Research Centre, for my PhD I am investigating the vulnerability of reef islands in a part of the world that is unknown to many people, but where reef islands have been eroding at an alarming rate; northwestern Isabel Province in the Solomon Islands. In this area, five reef islands have completely disappeared over past decades, and more are continuing to shrink.

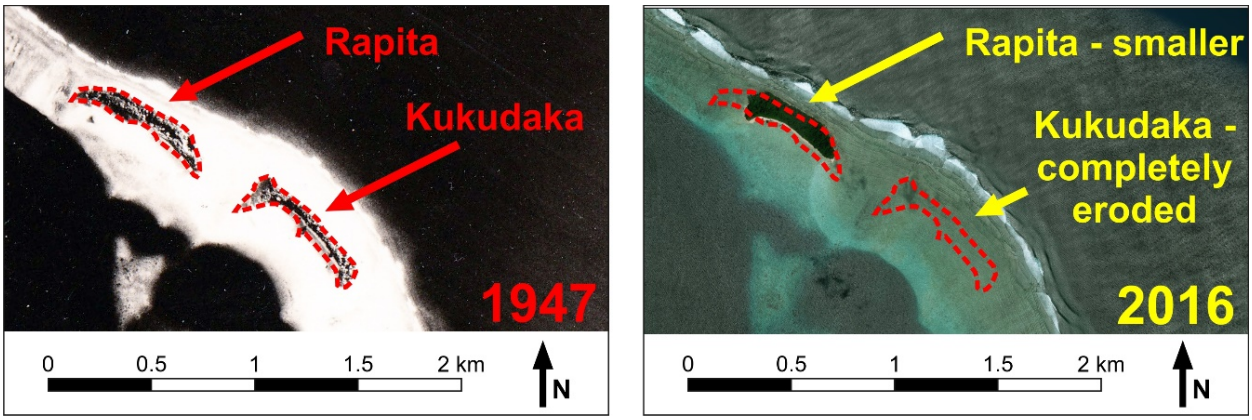

Figure 1: Island erosion in Isabel Province, Solomon Islands, as seen from aerial photos and satellite imagery.

To find out what's happening in this area, I'm visiting five of the remaining islands over multiple years to quantify island changes and relevant geomorphic processes. When I first travelled to this area in November 2017, I found a diversity of island morphologies, sedimentology, and vegetation. I mapped the islands using a DJI Phantom 4 drone, surveyed many beach profiles, and collected sediment samples. On some islands I also found clear evidence of human impacts, particularly tree felling; this was somewhat surprising, as all that I'd read previously about these islands suggested that they were uninhabited and largely 'untouched'.

Figure 2: (top left) topographic surveying on Sogomou, (top right) Sasahura Ite, (bottom left) eroded area of Rapita, and (bottom right) drone photo of the eroded easten end of Hetaheta.

While this 'snapshot' dataset of island morphology was interesting and enabled me to compare characteristics between islands, it gave no insight into the rates of present-day processes causing island change. To find this out, I would have to return!

As such, a return visit was organised for September-October 2018, almost one year on from the first visit. Many of the field tasks were repeated (drone mapping and island surveying), with the addition of some new tasks. This included measuring the bathymetry of the reefs surrounding the islands, measuring the dissipation of wave energy as it traverses the reef platform to do work on the island shorelines, and interviewing local island landowners on the history of island changes in the area.

I am now analysing the differences between the two datasets. This involves developing 3D digital elevation models from the drone imagery and correcting them to match accurate elevations and GPS coordinates. One model can then be subtracted from the other in order to quantify the volume of island change. I am also analysing the survey, sediment, bathymetry, tide, and wave data that was collected.

There is much more work to be done, including a third and final fieldtrip to the study area in May 2019 to collect another dataset in a contrasting season; this will enable me to evaluate whether there is any significant seasonal influence on the study islands. I hope that by the end of this journey I will contribute to a greater understanding of the drivers of landform change on small islands, and identify the characteristics that influence their vulnerability to erosion. Such insights can help inform effective adaptation to the effects of 21st century sea-level rise.

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