The combination of soundings and remotely sensed bathymetry in the GEBCO grid

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Introduction

The Centre for Coastal and Ocean Mapping at the University of New Hampshire provides a range of courses aimed at developing an understanding of bathymetry, its acquisition, data processing, and its applications.

The 2009 GEBCO/NIPPON scholars participating in the Bathymetric Spatial Analysis class at UNH embarked upon developing a marine GIS of the south Pacific, encompassing the region 150E-150E, 10N-40S. As part of this GIS development, an improved bathymetry grid for the region was developed that incorporated shallow water bathymetry from satellite imagery. This has been especially important becuase much of the south Pacific lacks extensive, publicly available, shallow water bathymetry. It is envisioned that data assembled as part of this project could add further geomorphic detail to shallow water areas in the GEBCO global bathymetry grid.

Global-scale bathymetry is an important datasets for geological, geophysical and oceanographic research. It is the aim of GEBCO to provide the most accurate global bathymetry dataset that is publicly available (GEBCO).

This poster reports preliminary findings about combining remotely sensed bathymetry with GEBCO echosounder datasets (08 version). This research has concentrated primarily in the vicinity of New Caledonia (fig. 1) where coral reefs create extensive shallow water regions. The sub-area included in this study lies between 160-170E and 17-15S.

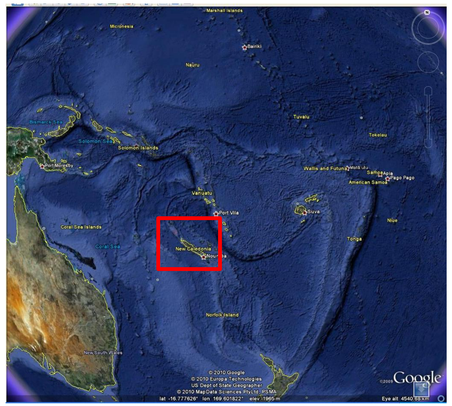

Figure 1. Google maps image of the south Pacific Ocean region. New Caledonia is contained within the red box

Global Bathymetry

The world's oceanic areas remain poorly mapped overall and present a challenge for compiling global bathymetry maps (GEBCO). Sparse data commonly leads to artifacts during the gridding processes. These artifacts are a result of both a poorly constrained grid and the gridding method itself. Continental shelves are one region that suffers from a lack of data. These areas can be further constrained by adding fine-interval contours or compiling additional soundings compile additional echo-sounder depths. GEBCO bathymetry in the vicinity of New Caledonia provides data for 12.5% of the study area at a 0.01 degree grid resolution (fig. 2). These is little to no bathymetry in shallow water (less than 30m deep).

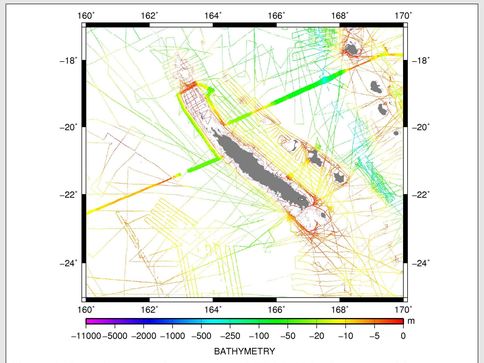

Figure 2. Soundings used to generate GEBCO 08 bathymetry grid.

Remotely Sensed Bathymetry

Shallow water creates many issues for bathymetric mapping, including the inefficiency of multibeam sonar surveys in such depths is also important. Remote sensing provides a potential alternative for mapping broad scale, shallow water bathymetry.

Robinson et al., (2000) describe an approach to data compilation and coral reef bathymetry mapping using the SeaWIFS satellite utilizing the method of Stumpf et al., (1999). The resulting bathymetry compilation is a composite of a total of 53,835 individual scenes combined to a depth map spanning the east/west extent of the globe between 35° N to 35° S at 0.01° resolution (36,000 x 7,000 pixels). This remotely sensed bathymetry of the New Caledonia provided depth data for 4% of the study area, specifically in depths less than 30m .

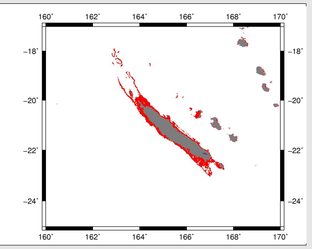

Figure 3. Presence of shallow water Bathymetry derived from SeaWIFS satellite imagery.

Combination of GEBCO bathymetry and remotely sensed bathymetry

Consistent with the production of the GEBCO grid, was the open source Generic Mapping Tools software (Wessel and Smith, 1991) used to process the two datasets. The shallow water bathymetry and GEBCO bathymetry was combined and regridded using the flowing method.

- The shallow water bathymetry was filtered using a 3x3 median filter using the GRDFILTER function in Generic Mapping Tools
- A perl script was then used to extract all bathymetry values less than 30m depth
- All bathymetry values in the GEBCO grid that has soundings associated with them were extracted from the GEBCO08 grid using the GRDTRACK function
- The two resulting bathymetry datasets were gridded together using the SURFACE function at a 0.01 degree resolution.

Figure 4. Bathymetry images GEBCO08 grid (below) and the bathymetry grid with remotely sensed bathymetry added (right). Significant improvements in the outlines of coral reefs can be observed at the north west and south east extents of New Caledonia.

Conclusions

Remotely sensed bathymetry has added significant detail to the shallow waters around New Caledonia (fig. 4). After adequate ground truthing with sonar datasets, it may be possible to use remotely sensed bathymetry over more extensive, tropical areas in the GEBCO bathymetry grid. This could provide more accurate representation of the extensive reefs and atolls around the globe for inclusion in regional or global scale bathymetric grids.

Acknowledgments

Funding for my study at UNH was provided through a GEBCO/NIPPON scholarship.

The Nippon Foundation

Literature cited

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