3D Visualisation of Digital Terrain Model Data

Mark Stone, 108492769.   mjestone@newcastle.ac.uk

Introduction

Among the many recent innovations in geospatial science has been the on-going evolution in the three-dimensional graphical representation of topographic data. As datasets become ever larger and more complex, and computer processing power continues to increase at an exponential rate, so advances in software have progressed to allow for more modern visualisation techniques of such data. An important application of this is the visualisation of terrain data, demonstrated by the rise in popularity of Google Earth on PCs around the world, but also in many other scientific and commercial sectors where such data is used. This research investigates the latest and most advanced software offerings available for the purpose of visualising terrain data in 3D that may be suitable for potential use within Newcastle University's School of Civil Engineering and Geosciences (CEG).
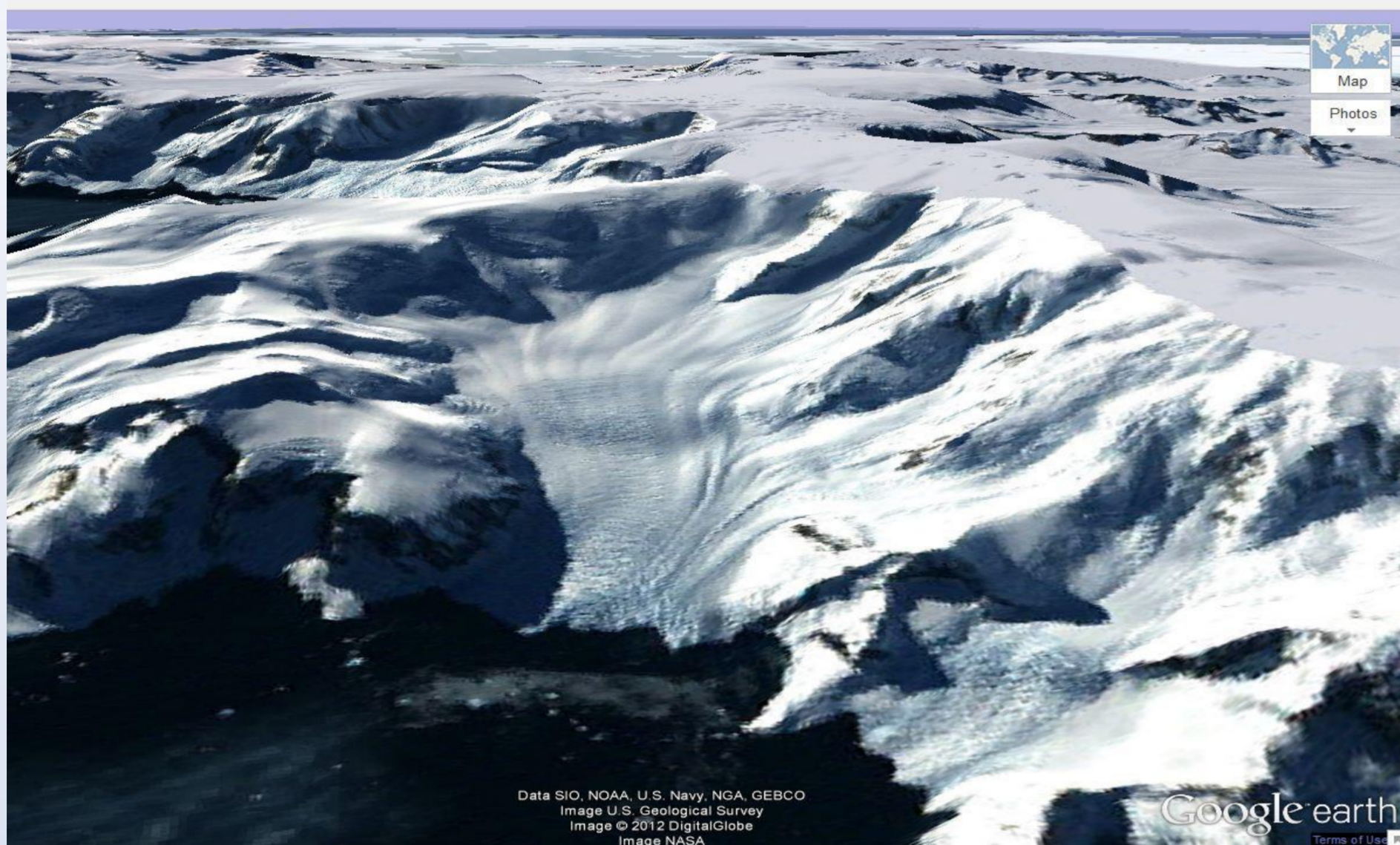

Figure 1: Google Earth image of Leonardo Glacier, Antarctica)

Background and objectives

Whilst within the geomatics department of CEG the use of Geographical Information System (GIS) software is common in undergraduate teaching and also in research activities, little time has been devoted to the investigation of how best to present data visually in a such a way that maximises the information contained therein. ESRI's ArcGIS product is the most popular piece of GIS software in use by the department, and that which is used for the teaching of GIS at undergraduate level. Whilst ArcGIS does itself have many powerful visualisation features included, many other bits of software, both commercial and open source, are available on the market which are more specialised towards this task.

- One of the principal objectives of this research has been to see how QT Modeller (software recently purchased by the department) compares to ArcGIS and how suited it is for use in an academic environment
- To test how each piece of software could best visually represent some of the department's in-house datasets, for which glacier surface models were used
- Another objective has been to perform an extensive search for other suitable applications that are geared towards the 3D visualisation of geospatial data, and to highlight those which offer the greatest potential for use within the department, or as a basis for further research into their potential benefits
- To document the online resources relating to this topic, as a basis for further research into this subject within the department

Further Info:	Mark Stone
	School of Civil Engineering and Geosciences
	Cassie Building
	Newcastle University
	Newcastle-upon-Tyne
	NE1 7RU
Telephone:	0191 2226445
E-mail:	m.j.e.stone@ncl.ac.uk

Results

QT Modeller has much better rendering capability than ArcGIS, with the ability to handle large, complex datasets with no loss of performance. This can be seen from the contrast in the resolution of the images below. However, when it comes to making 'fly-through' style animated videos, a popular presentation technique for such data, QT Modeller was found to be severely lacking, and also lost ground on its more demanding graphics hardware requirements.
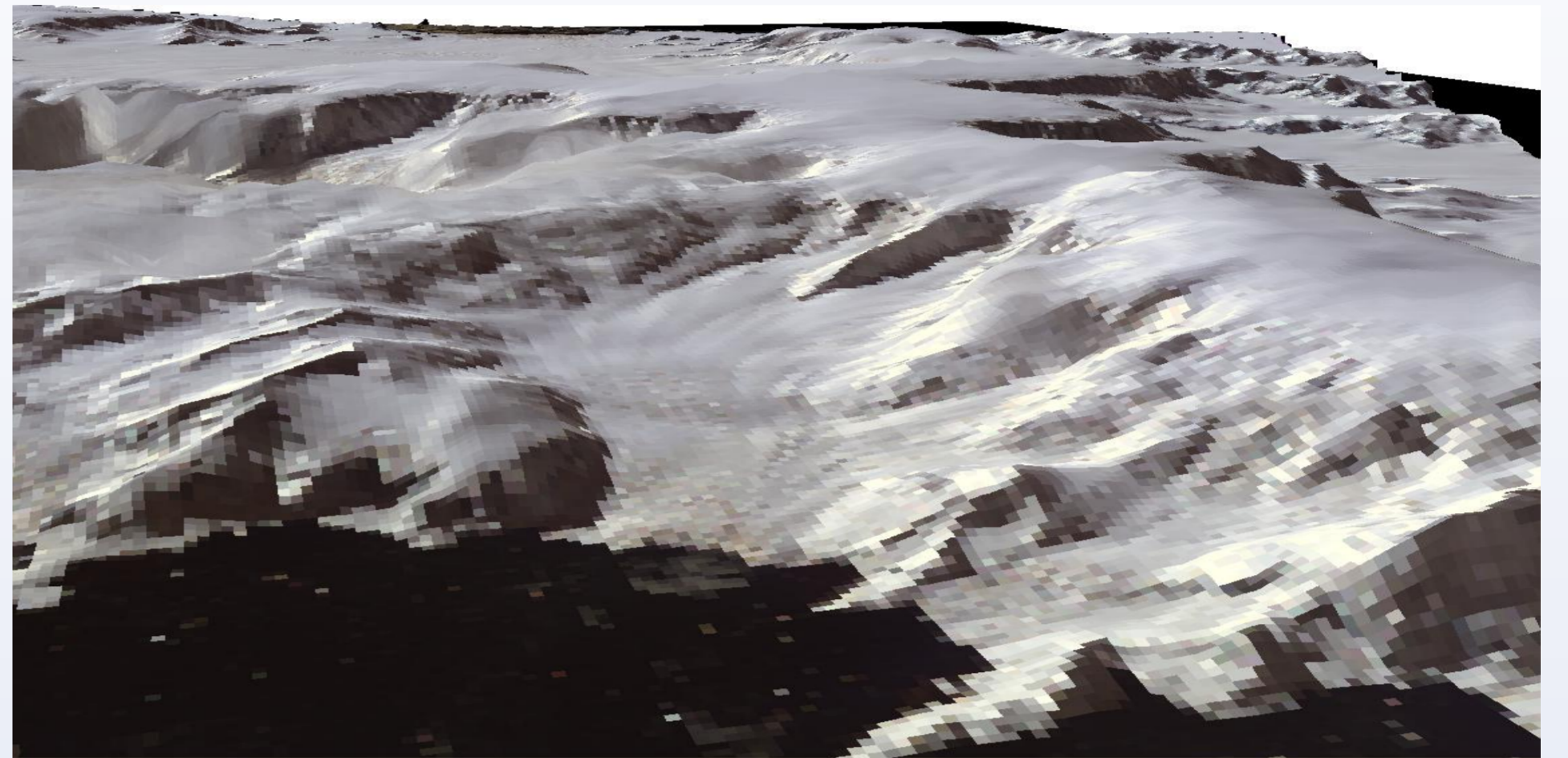

Figure 2: Default rendering of Leonardo DTM in ArcGIS (overlaid with imagery)
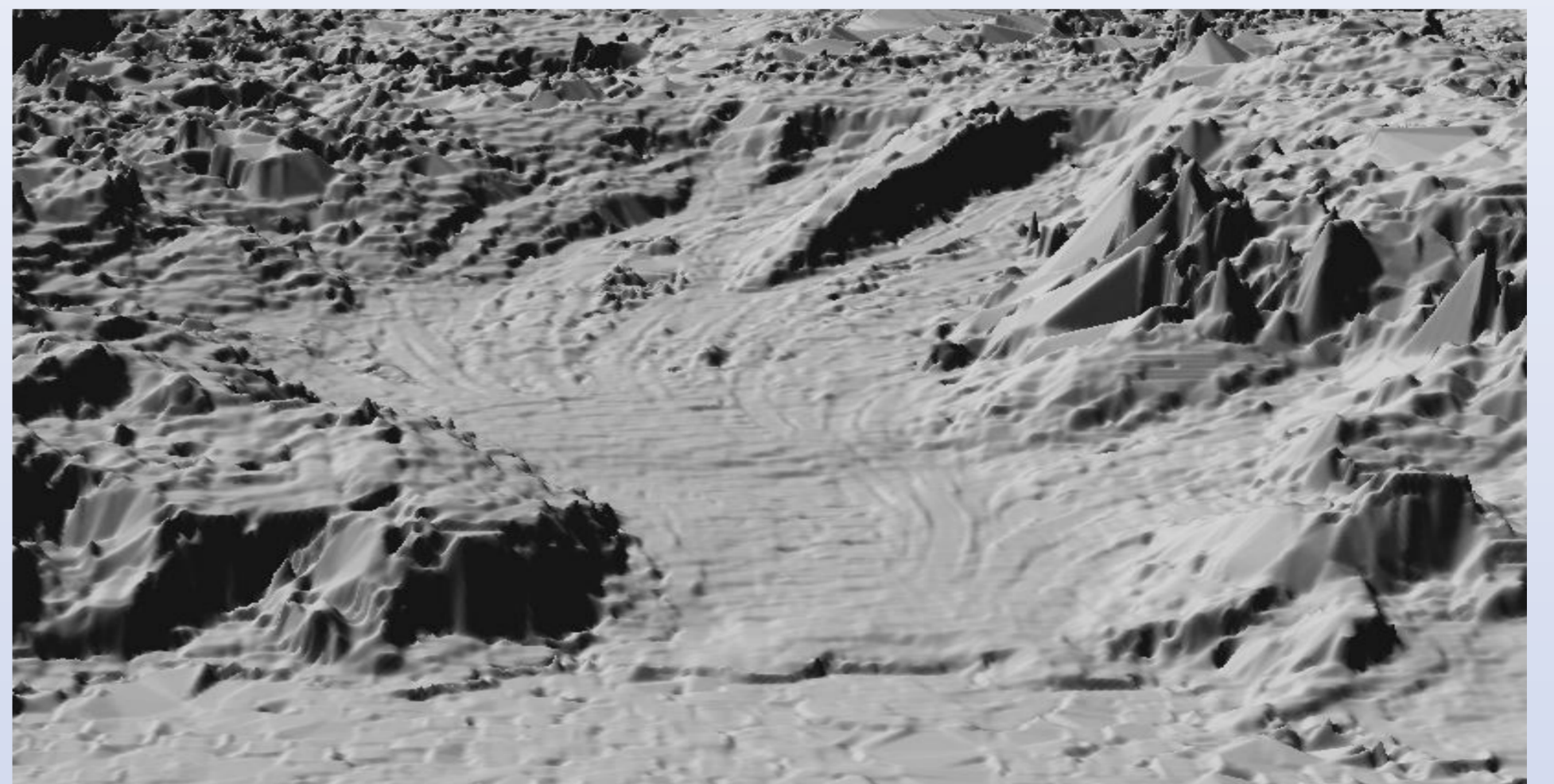

Figure 3: High quality rendering in QT Modeller (without imagery)

A large amount of other applications exist which seem capable of excelling at 3D visualisation tasks, some of which were trialled as part of this research. Open source applications were found to be lacking in comparison to their commercial counterparts.
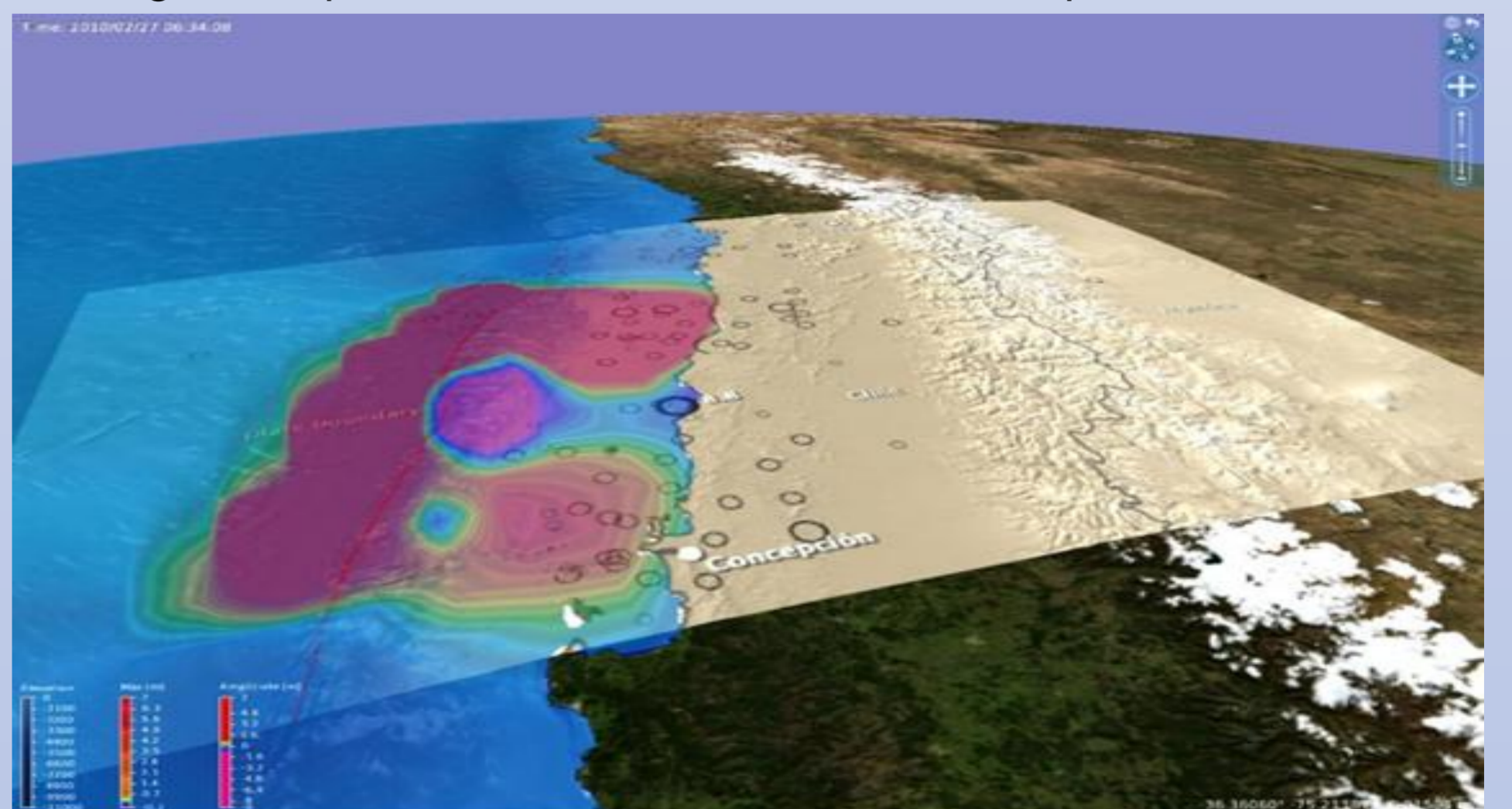

Figure 4: Chile Tsunami visualisation in a trial installation of Makai Voyager

Conclusions

QT Modeller offered no outright advantage over ArcGIS in 3D visualisation performance despite its greater data handling capabilities. There is an abundance of other software on the market that seems capable of surpassing ArcGIS in terms of visualisation features, notably Geoweb3D and Makai Voyager, though it would be necessary to run a comprehensive trial of these in order to obtain a level of certainty. New innovations ensure that this is a constantly evolving field, with, the prospect of 'true-3D' (with or without specialist hardware,) and integration of virtual reality likely to become commonplace.