Earth **Surface**
Dynamics
Discussions

ESurfD

Interactive
comment

Interactive comment on "Short communication: A semi-automated method for rapid fault slip analysis from topographic scarp profiles" *by* Franklin D. Wolfe et al.

Michael Hodge (Referee)

michaelstvnhodge@gmail.com

Received and published: 6 November 2019

First a disclaimer: I am no longer an academic. I work as a Data Scientist, which means that some of my structural geology and geomorphological knowledge is now out of date. But as a Data Scientist I've now got much more experience in building code and pipelines. So, I apologise if any of my domain knowledge is rusty! I would be happy if the authors wish to speak to me in more depth about their code.

Franklin Wolfe and their co-authors do well to create new Python functions to load, analyse and extract information from fault scarp profiles using a Monte Carlo approach in their MCSST package. The implementation of a more statistical means to calculate

slip, slip rate and so forth is a useful, progressive step on previous research and tools. They provide a good use case example in the Taupo Volcanic Zone, New Zealand, stating that the tool is able to process this information faster than previous methods.

The manuscript therefore appears to be primarily focused on the development of a new Python tool, and less so on its application and new knowledge gained in the TVZ, which is completely acceptable for a journal such as this; however, I do have some concerns that I feel need addressing, which I present below. I believe addressing these concerns will highlight Wolfe's excellent work even more.

It is in my opinion that the paper spends much time talking about ArcGIS and QGIS, i.e. background and steps to pre-processing scarps and post-visualisation. However, the novelty of this work is the Python scripts and what they can do, which should the authors should highlight more. The selection of profiles across scarps, points along profiles et cetera has been covered in work previously, and whilst it is important and imperative for the pipeline of this work (and therefore rightly sits in the User Manual) too much space is used for this in this manuscript.

Developing and publishing code is challenging, not only because of the language dependencies and software requirements, but also because successful code needs to be maintained and updated. When I created SPARTA I was not wise enough to this, and as such, the code has become stale (and could be much more efficient!); however, the research paper it is shown in has some new insights into a particular fault in southern Malawi, meaning that if in the future no one uses the code, the insights found using it may still useful (hopefully!).

Here, the paper is about the code, and the case study is an short case study application more so. Therefore, my main recommendation is for the author and code developer to choose their battle: ArcGIS scripts or Jupyter Notebooks. It will be hard to update both during the rigours of academia. I propose the latter (Jupyter), because as the author mentions ArcGIS is commercial software (they give a great reason in point five

C2

of 'section: Principles of Design for MCSST' as to why the focus should be on open source software), and also because I envisage a greater shift towards Python by Earth Scientists soon (whereby your users may not even use QGIS to select profiles, but use a pure Python approach instead). That is not to say you cannot mention that you have spent effort in creating ArcGIS plugins for those who want them, but this should be a side-feature of your work.

Specific comments

Abstract (and throughout)

The use of the word 'rapid'. Rapid in this sense is relative to what you compare it against. The authors are right that it is rapid compared to traditional methods, but if someone built a machine learning neural net would it be as rapid as that once training had been successful? I recommend using a softer tone that 'rapid'.

Introduction

Line 24 – This may be where my knowledge has faded. But here it looks like we are working with surface topography data. So, can we accurately calculate fault slip? Or can we only calculate surface displacements?

Background

Lines 46 to 47 – Later you use the word component to talk about the hanging-wall, scarp and footwall. I like that, or feature, rather than 'variable' used in line 47.

Principles of Design for MCSST

Lines 78 to 86 – as mentioned in my general comments I think this section can be removed, or at least shortened.

Define Fault Scarp Profiles in QGIS or ArcGIS and Extract Data for Profiles

Both sections don't contain anything novel or imperative to the manuscript; perhaps

C3

this should just be covered in the manual and replaced here with a simple paragraph stating that 1) the user creates fault trend (perpendicular?) profiles across the scarp, 2) extracts elevation from the DEM (and optionally, geological age) at spaced intervals. Then more information can be found in the user manual.

Line 89 – the authors don't address whether the profiles should be perpendicular to the scarp trend, or parallel to local/regional extension direction. I think this needs to be a little clearer and the reasons for it (changes to scarp dip etc). Also, the next sentences 'To do this' 'Within this layer', make little sense to me and probably don't need to be here (save for the User Manual).

Lines 95 to 96 - citation needed for "A spacing of 1-5 meters has proven to be adequate in defining meter-scale features".

Lines 98 to 99 – "If geologic ages are not defined within the GIS environment, the user can manually generate these features with a few simple steps outlined in the user manual." I've only have a brief look at the code, but can you not add something to the code to skip this if it's not included in the input variables. Rather than get the user to time-consumingly add this to GIS before they start calculating scarp information?

Monte Carlo Slip Statistics Toolkit (MCSST)

Line 117 – 'previous method' are these methods published? If so, needs a citation. If not, would be interesting to compare how the functionality has improved (time spent?)

Check Your Selections

Line 123 – 'checked for accuracy' – by whom? The user?

Case Study

For me I'd like to see more of the rational as to why this area was chosen. Has it proven too large for previous methods? What are the limitations of this area compared to other dip-slip fault scarps in other areas? This can be resolved either by using the

tool elsewhere or commenting on the limitations etc of the tool.

Efficiency of the MCSST Toolkit

Lines 232 to 233 - "To confirm the results, the entire process was completed again by multiple users, which resulted in similar outcomes across the board." I'd love to see the results from multiple users. This sort of thing really interests me as no matter how we develop code, or who uses it, there will always be a degree of bias. Limiting that bias is the aim, not creating perfect code for a single user.

Technical corrections.

Introduction

Line 29 – Possibly rewrite this sentence. "When Light Detection and Ranging (LiDAR) data have adequate resolution, the images can be used to identify submeter scale geomorphic features from a workstation". The resolution of LiDAR is relative to the distance captured from the object. For me, it only needs "LiDAR can be used to identify submeter scale geomorphic features from a workstation", then give a citation.

Line 33 – lower case 't' on The.

Principles of Design for MCSST

Line 65 – add a : after 'to'.

Define Fault Scarp Profiles in QGIS or ArcGIS

Line 92 – 'In this example' – which one?

Extract Data for Profiles

Line 95 – remove 'user-defined', unneeded.

Monte Carlo Slip Statistics Toolkit (MCSST)

Line 109 – add 'scarp' after fault? If we are looking at scarp components that is.

Lines 110 to 112 – Possibly rewrite as "'To make it easier for the user, a slider has been included to select the distance along the profile each scarp component exists at".

Lines 132 to 134 – I found the sentence "If the hanging wall and footwall strain marker surfaces are not parallel, as is commonly the case, the calculated vertical separation is a function of horizontal distance to the fault and the dip slip calculation requires a knowledge of the position or projection of the fault tip onto the scarp." difficult to read.

Calculate Slip Statistics

Line 146 – maybe 'calculates' rather than 'conducts a calculation for', simpler.

Figures

All are difficult to read as font is too small.

Other

Use of capitals in headers needs addressing

Interactive comment on Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2019-53, 2019.