Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-53-AC2, 2019

Earth Surface Dynamics Discussions

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

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Received and published: 2 December 2019

We greatly appreciate the feedback provided by Christoph Grüztner, who outlined specific and concise improvements that could be made to the manuscript. The most substantial changes include removing superfluous sections to streamline the manuscript and adding text to motivate the study within the abstract. Additionally, minor critiques and corrections were made throughout the manuscript. We are very thankful for Christoph's focused review.

- Franklin Wolfe

Abstract: - I recommend to add one or two sentences at the beginning of the abstract that explain the need for such a tool. What is the problem with current software, and why is it necessary to present a better one?

We appreciate this constructive feedback and will amend the beginning of the abstract to address this point.

“Manual approaches for analyzing fault scarps in the field or with existing software can be tedious and time-consuming. Here, we introduce an open source, semi-automated, Python-based graphical user interface (GUI) called the Monte Carlo Slip Statistics Toolkit (MCSST) for estimating dip slip on individual or bulk fault datasets that (1) makes the analysis of a large number of profiles much faster, (2) allows users with little or no coding skills to implement the necessary statistical techniques, (3) and provides geologists a platform to incorporate their observations or expertise into the process..”

1 Introduction: - Also see the MatLab code in:Mackenzie, D., & Elliott, A. (2017). Untangling tectonic slip from the potentially misleading effects of landform geometry. Geosphere, 13(4), 1310-1328.

The reviewer mentions a novel new method for calculating the full 3D slip geometry of a fault zone, which is very relevant for this study, and thus we include this new citation in the revised manuscript. “Several relatively complete and distinct sets of computational tools and libraries also exist for completing an array of complex topographic and fault zone analysis at the outcrop scale [e.g., SPARTA, Structure-from-Motion, etc.] (Westoby et al., 2012; Bemis et al., 2014; Hodge et al., 2019], including those that attempt to resolve the full 3D slip vector (Mackenzie and Elliot, 2017). Added to references: Mackenzie, D., and Elliott, A. Untangling tectonic slip from the potentially misleading effects of landform geometry. Geosphere, 13(4), 1310-1328, 2017.

2 Background - Lines 55-62: Although an interesting and valuable collection of case studies, I think this should be deleted in a "short communication"

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Lines 55-62 have been removed while the references remain in the previous sentence to refer to these studies.

4 Workflow: - Line 90: Do the DEMs need to be in UTM?

Yes, they do. Meters are the units best suited for this workflow. “The user first defines profiles across fault scarps imaged in high-resolution digital elevation models with UTM coordinates.”

6 Case Study – Taupo Volcanic Zone (TVZ), NZ In general: I recommend to shorten the geological introduction to the study site substantially. Although it is interesting, please only include the information necessary to show your new tool. For this, most of the background is not needed and a "short communication" is not the right format for telling the whole story

We appreciate the reviewer’s concern about the length of the geologic background and have chosen to streamline this section of the manuscript. We reduced the section from 1153 to 867 words (∼25% reduction), while keeping the most important parts and cutting unnecessary ones.

- line 181-182: "Ideally,..." Will problems arise if this is not the case?

The short answer is no. The analysis will yield faulty rates, but this can be overcome with manual intervention and is a data issue as opposed to toolkit/methodology issue. This text was removed in the process of streamlining the TPZ discussion and should no longer be an issue to the reader or user of the code. If the expected age is different than the age extracted, then the user can manually manipulate the data frame (csv file) outside of the general workflow.

- line 199: This is extremely steep for normal faults (Jackson, J. A., & White, N. J. (1989). Normal faulting in the upper continental crust: observations from regions of active extension. Journal of Structural Geology, 11(1-2), 15-36).

We appreciate the reviewers concern about the relatively high values employed for fault dip in our calculations. The values we chose for our case study are consistent with data obtained from geological observations of near surface fault morphologies made in the field by Pilar Villamor and others over numerous field excursion (Grindley 1959; Villamor and Berryman, 2001; Lamarche et al., 2006; Villamor et al., 2010, 2017). Thus, we do not seek to re-do the analysis with new values and explain later in the manuscript how these values represent near surface fault dips and are scaled to include shallower fault dips and larger fault slips at depth.

- lines 224-229: Again, this is all very fascinating, but check if it is necessary to present your tool. In the next section you argue that the results derived from your (great!) new tool agree with previous studies on the fault system, and this is surely a great outcome - but do you need it to prove that the code is right? To be clear: I do like the story with the rifting and I wouldn't mind to keep it in the paper; i just wonder if the format "Short Communication" allows for this. I'd hope so, but this is the editor's choice.

This section was removed for the reasons suggested by the reviewer. We believe that it helps to streamline and focus the discussion by leaving it out.

7 Efficiency of the MCSST Toolkit - Line 233-234: "To confirm the results, the entire process was completed again by multiple users, which resulted in similar outcomes across the board." Can you give error bars? This would be very interesting! How much do the results depend on the user's choices? We agree with the reviewer's comments that this would be very interesting to include. Unfortunately, this analysis was not saved and thus I do not have access to the results from other users. The analysis was completed during a mini workshop I conducted at GNS Science. Because of this, we believe have decided to omit this sentence from the manuscript.

Figures: - Make all figures larger. In figure 4, arrange the panels vertically and increase the size of each. Currently, the text is too small to be legible. - Figure 4c: Is this the example from Fig. 2 and 3? Perhaps show figure 4 before you explain the example profile.

Figures will presumably be larger when final versions are submitted. Panels have been rearranged vertically. Caption for Figure 4 is now corrected to state: "... For simplicity, only the Earthquake Flat Formation of the Okataina Group is shown from the Geologic Map of New Zealand Projected (GMAP). This is the formation that was analyzed in this study. The light blue box represents the map extent of part (c). c) LiDAR hillshade map of the location of the profile shown in Figure 2 and analyzed in Figure 3.

Technical corrections - line 92: scarps - line 144: could have - line 181: where - line 225: chronological - Check last line of the caption of figure 4.

Done

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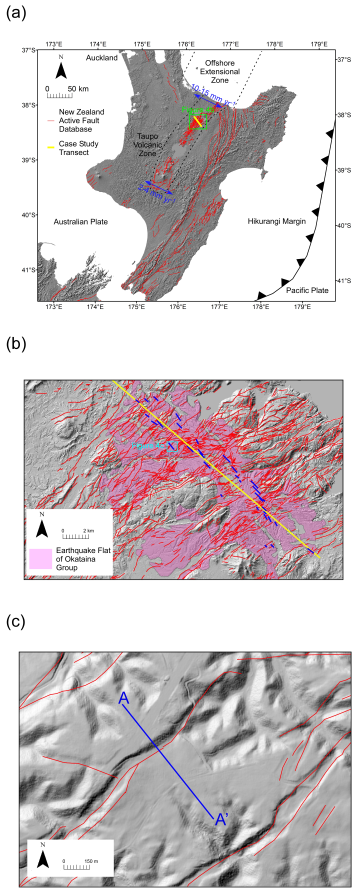

Fig. 1. Figure_4_Revised_VerticalPanel

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