Towards semi-automatic delineation of submarine landslides

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Symposium Theme: Numerical and Statistical Analysis

Keywords: Semi-automatic detection, Geomorphometric parameters, Landslides

Semi-automatic detection of submarine landforms from bathymetric data is a developing field of study. The main benefit of such an approach is that it reduces subjectivity in landform identification and delineation. A semi-automatic detection approach has worked well for symmetrical seafloor features such as pockmarks, dunes and ripples. However, the non-uniqueness of landslide headscarps and run-out structures makes their semi-automatic identification and delineation considerably more challenging. The discrepancy in the value of morphometric parameters as identified by independent analysts was highlighted in a recent study of the Valdez slide offshore of Chile, where the standard deviation of calculated landslide parameters was significantly greater for parameters that require increased user input. Consequently, semi-automating the landslide delineation process and the subsequent calculation of morphometric parameters is of utmost importance if we are to compare landslides in different tectonic settings and/or that have been analysed by different scientists.

In this study we calculate a variety of geomorphometric parameters (including slope gradient, aspect, the full suite of curvatures and roughness, as well as their standard deviation) from the digital elevation data of several submarine landslides on both active and passive margins. We then use Principal Component Analysis as a means of amalgamating the different geomorphometric parameters and reducing the total number of dimensions, before calculating empirical distribution functions for the parameters and their principal components. This statistical analysis further contributes to reducing the subjectivity of analysis. The results of these processes are then used to semi-automatically detect the landslide outline for further morphometric analysis.

This study sets the groundwork for developing a semi-automatic detection method to map submarine landslides exposed at the surface, and the subsequent non-subjective, semi-automatic determination of landslide parameters such as scarp perimeter length, total length, total height drop and volume. The ultimate goal of the study is to improve global

submarine landslide distribution maps and facilitate their global comparison. This will, in turn, help to answer important (open) questions about the magnitude-frequency relationships and slide dynamics.