Review of the paper NHESS Sci. Discuss., 3, 2015: ***van Zeyl, D.P., Stead, D., Sturzenegger, M., Bornhold, B.D., and Clague, J.J.: Structure, stability and tsunami hazard associated with a rock slope in Knight Inlet, British Columbia***

General comments

The paper discusses the geology and morphology of the unnamed mountain at Adeane Point based on data collected by different methods. Possible failure mechanisms are discussed and stability analyses by limit equilibrium is performed. Volume estimates of potential rock slope failures are given. Rough estimates of tsunami heights generated by potential slope failures and the related hazard are also included.

The paper is well written and clear (with one possible exception, see next paragraph) and can be useful for possible future work on rock slope stability in the region.

We cannot see that the volumes larger than 0.5 Mm^3 given in Table 4 and the summary are justified in Section 5 Stability analysis.

Section 6 Wave height estimate is weaker with relatively scattering results based on empirical formulas only.

The manuscript could perhaps benefit from using the classification system described by Hermanns et al. (2013).

More specific comments

2. Regional setting

P 165, line 1 and 2: "..could render….and rockslides": more than what and why?

4. Rock slope characterization

P 167, second last line: replace Fig. 2 with Figs. 3 and 4.

6. Wave height estimate

Four different empirical formulas are used to predict the wave heights in the fjord. Such empirical models are often conservative, based on experiments in two-dimensional (confined) geometries. Moreover, they are sensitive to the input parameter values such as rockslide thickness, characteristic water depth outside the slide area, or the underwater travel time of the slide, i.e. quantities that cannot be determined exactly in irregular geometries. Slingerland and Voight (1979) warn about these problems themselves.

As an example, another simple computation is here made by the Slingerland and Voight model (1979). Assuming a slide volume of 500 000 m^3, a slide impact velocity of 30 m/s, a rockslide dynamic volumetric density of 2 tons/m^3 and radial wave damping (i.e. the wave height is inversely proportional to the square root of the travelling distance), gives surface elevations of approximately 5 m, 12 m, and 30 m at a distance 200 m away from the slide area with significant water depth in the slide impact area of 100 m, 50 m, and 25 m respectively. As seen, the elevations are strongly dependent on the significant water depth that cannot be exactly specified in an irregular geometry, in addition to the slide parameters also encumbered with uncertainties.

Such big differences in the estimated wave heights are also seen in the present paper. The scaling relationship by Huber and Hager (1997) gives the highest wave estimates, even though it is based on 3D experiments and returns wave heights as much as 2500 m away from the slide area. Anyway, these wave heights are not used further. However, also the three other forecasting methods give substantial differences in wave height estimates (6-26 m). These differences should be elaborated further and used to discuss what are the more reliable estimates to justify a tsunami hazard analysis.

P. 176: No need to cite Slingerland and Voight (1979) for equation (1) that comes from basic energy considerations. Rather give citation for the selected value of $\tan\varphi_{s.}$ Further, the equation has no velocity dependent resistance and gives unreasonably (infinitely) high rockslide velocities for long slopes. The shoreline velocity estimates of 85-105 m/s are unusually high. On the other hand, lower shoreline velocities would give more critical conditions for wave generation (Froude number closer to unity).

The Froude number of a landslide normally uses the flow height of the landslide as characteristic length (rather than the water depth applied here). To motivate for the Froude number commonly used in connection with wave generation, perhaps state that this Froude number is the ratio of landslide impact velocity to speed of wave propagation (which is of course important for the build-up of the wave in the generation phase).

Where is the still water depth (500 m) measured? See above for the importance of this value.

P. 177: A Stokes-wave is a periodic wave in deep and intermediate waters (relative to wavelength). It is thus contradictory to describe Stokes-like waves travelling in a group with the primary wave being the largest (obviously not periodic).

P. 178: second last line; "...the wave height is 1.2 times the wave height" should be replaced by "...the wave height is 1.2 times the wave amplitude". It should be noted that the term 'amplitude' should rather be used for harmonic waves, while 'surface elevation' is a better alternative for non-harmonic waves.

7. Summary

P. 181: There is a small mismatch when saying that you use four different forecasting techniques and obtain wave heights from 6 to 26 m. This interval is based on three techniques only (excluding Huber and Hager, 1997).

References

Adams and Atkinson (2005). Text says '2003' (p. 164).

Tables

Tables 4 and 5 could be better linked by including the names of Noda, Huber & Hager, Fritz, and Zweifel also in Table 4 (instead of η, H, a_m^1, and $a_m^{2,}$).

Figures

Figure 4: n = north gully: cannot see 'n' in the figure.

Recommendation

In conclusion, we recommend this manuscript for publication after minor revision.

Additional references cited in the review above

Hermanns R L, Oppikofer T, Anda E, Blikra L H, Böhme M, Bunkholt H, Crosta G B, Dahle H, Devoli G, Fischer L, Jaboyedoff M, Loew S, Sætre S & Molina Y (2013). Hazard and risk classification for large unstable rock slopes in Norway. Italian Journal of Engineering Geology and Environment – Book Series (6).

Vidar Kveldsvik and Carl B. Harbitz
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