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Assessing tsunami hazard and epistemic uncertainty due to subaerial landslides in Norwegian fjords

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Landslide induced tsunami probability is more difficult to quantify than corresponding probabilities for earthquake tsunamis, both due to the difficulty of establishing well constrained temporal likelihood functions, and due to large epistemic uncertainties in landslide induced tsunami generation. Consequently, landslide probabilistic tsunami hazard analysis (LPTHA) is less standardized than PTHA for earthquakes, and related methods used to unravel the landslide tsunami hazard is expected to be much more heterogeneous. Landslides and landslides impacting fjords, lakes and hydropower reservoirs poses a tsunami threat towards the coastal population of Norway. Unstable rock slopes have been identified in several regions, among them the Lyngen fjord in Troms, in Northern Norway. We here present the initial results for a preliminary LPTHA for the Lyngen fjord. In the present study, analysis is restricted to landslide impact posed by four different unstable rock slopes identified along the Lyngen fjord. Landslide volumes are loosely identified from slope stability monitoring and geophysics, and used as input to the analysis. Because the frequency of previous events in the region are few, the opportunity to build magnitude frequency distributions (MFD) as conventionally done for earthquakes is limited. Hence, we are left with quantifying the tsunami potential of the identified unstable rock volumes, i.e. in the presence of uncertainty in tsunami generation. This study assess the epistemic variability of landslide parameters and their adverse effect on the tsunami run-up on the populated coastline. Assigning probabilities using expert judgement is necessary in the absence of firm data to constrain the landslide dynamics. We show that the geometric properties of the landslide impact and its run-out is most important for the tsunami hazard, whereas the landslide speed is of somewhat less importance. In addition, we demonstrate the hazard by presenting run-up sensitivity maps. Finally, we discuss some logical next steps in the analysis, as well as possible sources of error.