Simulating submarine slide tsunami inundation of the Shetland Islands

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The ~8.15 ka Storegga submarine slide was a large (~3000 km^3), tsunamigenic slide off the coast of Norway (Fig. 1; 1). The resulting tsunami had run-up heights of 10-12 m on the Norwegian coast, 3–6 m on the Scottish mainland coast and over 20 m at the Shetland Islands. A modern day event of a similar scale has the potential to cause significant loss of life and damage to key infrastructure. Indeed, there are few other natural events that could have such a disastrous impact on the UK. However, the conditions required for submarine slides to generate hazardous tsunami and the frequency of such events in the Arctic Ocean and surrounding seas are poorly understood.

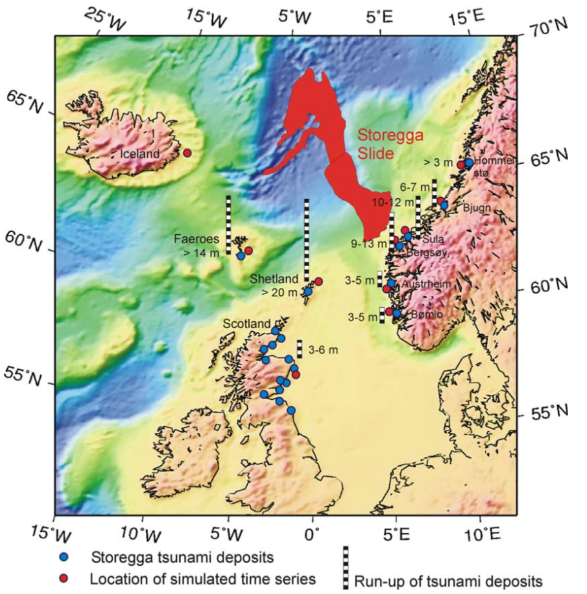

Figure 1: Map of the Storegga Slide, showing locations of tsunami deposits (blue dots) and inferred run-up heights based on deposit elevation [from 1].

The Shetland Islands are an excellent archive of Holocene tsunamigenic landslides in the Norwegian and North Seas. As well as their prominent geographical location, extensive coastal blanket peats and numerous lakes provide high-fidelity, datable depositories for tsunami sediments [2]. Detailed field studies of the Shetlands have quantified run-up heights from the Storegga tsunami at several localities and identified two additional, more recent tsunami deposits not yet associated with known landslides [3]. The aim of this project is to use these tsunami deposit observations to constrain models the of Storegga tsunami and identify possible source locations for the two more recent tsunami deposits on the Shetlands.

The Project Tsunami inundation of the Shetland Islands will be simulated using a coupled numerical modeling approach. Submarine slide tsunami generation and propagation to the Shetlands will be modeled for Storegga, a number of other Holocene submarine slides, and additional potential source locations, using an established multiscale model [4]. TELEMAC (http://www.opentelemac.org/) will then be used to propagate these wave signals onto the Shetland coast. Recent observational constraints on sea level change and models of isostatic adjustment in the region will be used to derive accurate palaeobathymetry. Model results will be compared with inferred tsunami run-up heights and inundation distances based on tsunami deposits.

The successful Candidate will join, and be supported by, a vibrant and dynamic research group with world-class expertise modelling geophysical flows. They will be trained in state-of-the-art numerical methods for tsunami generation, propagation and inundation modeling, mesh generation and high-performance computing. The candidate will have the opportunity to develop their career and profile by presenting at international conferences and publishing in high impact journals. Candidates for PhD positions should have a good mathematical background and a good degree in an appropriate field such as earth science, geoscience, physics, mathematics, computer science or engineering.

[1] Bondevik, S. *et al. Marine and Petroleum Geology* 22, 195–208 (2005).

[2] Costa, PJM & Dawson, S.. Encyclopedia of Complexity and System Science. RA Meyers (Ed). Springer (2015)

[3] Bondevik, S., Mangerud, J., Dawson, S., Dawson, A. & Lohne, Ø. *Quaternary Science Rev.* 24, 1757–1775 (2005).

[4] Hill, J., Collins, G. S., Avdis, A., Kramer, S. C., Piggott, M. D. *Ocean Modelling* 83, 11-25 (2014).

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Application information can be found on our website: www.ese.ic.ac.uk