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Impact and wave generation by sub-aerial slides in a fjord geometry

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Tsunamis generated by sub-aerial landslides in fjord systems affects smaller regions than mega-tsunamis generated by huge earthquakes at subduction zones. On the other hand, the local wave heights and run-up may be much larger than the ones observed even for the largest tsunamis of seismic origin. An unstable rock volume of up to 54 million cubic meters have been detected at Åknes in Storfjorden, western Norway. In relation to this future threat, an experimental investigation were conducted in 2012 at the Coast and Harbor Research Laboratory/SINTEF in Trondheim. A three dimensional model covering the inner part of Storfjorden were constructed in 1:500 scale with a total size of 36×40 meter. A block type slide is released into this model. The position of the slide was monitored by a wire and for synchronization of other measurements (see below) a system was used which sent a trigger signal when the slide started to move.

In true scale the volume corresponds to 40 million cubic meters and the velocity at impact is 39 m/s. There are two ultimate goals of this investigation. Firstly, the measurements give an indication of the consequences of such an slide in the particular fjord. Secondly, it will be a realistic and demanding benchmark problem for model testing.

The experimental investigation includes measurements of flow depth at a number of locations, in deep water regions and onshore in the two most populated villages, Geiranger and Hellesylt. Both resistance wave gauges and acoustic probes are employed to this end. Moreover, particle velocities were measured with PIV at two locations and with acoustic Doppler gauges (Vectrino) at 5 positions. The PIV system measured two velocity components with a field of view of 0.14×0.14 m. In addition, the shoreline position was recorded digitized from high speed video recordings at Hellesylt, Geiranger and at the facing slope of the slide region. Striking occurrences of located, very high waves were found in the inundation at Hellesylt, presumably due to bathymetric effects. To scrutinize these phenomena further a large scale PTV (particle tracing) measurements of surface velocities are scheduled at this location in January 2013.

In view of the size and complexity of the experimental model, the results are promising. The repeatability is good and wave gauge measurements are available at a number of locations. These, together with the inundation data and PIV measurements should facilitate testing of numerical modeling for this kind of event.