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High fidelity modelling of iceberg capsize

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One of the major questions in climate science is to improve the accuracy of sea-level rise prediction, for which mass loss of the polar ice caps has a significant contribution. In this work, the focus is on buoyancy-dominated capsize of large icebergs. The capsizes generate specific seismic signals, which in turn can be analysed and used as a unique tool to study the long term evolution of such large icebergs capsize and the glacier response.

To better quantify ice mass loss due to iceberg calving at marine terminating glaciers, coupling iceberg calving simulation and inversion of the seismic waves generated by these events and recorded at teleseismic distances is necessary. To achieve our task, a complex fluid/structure model of the iceberg capsize is required to obtain accurate forces history acting on the glacier terminus. The simulated forces can then be compared to the force inverted from the seismic signal. Therefore, based on our recent work, we implement a Computation Fluid Dynamics (CFD) approach to reach a high fidelity modelling of the iceberg capsize. First work using the experimental data of an iceberg capsize showed the need and ability of CFD computations to precisely reproduce the iceberg kinematics for different cases. We will present more advanced CFD configurations, including the contact between the capsizing iceberg and a rigid glacier front. Computation results are compared and validated against lab scale experiments, where we outline that some 3D effects cannot be neglected. We will also present full scale capsize simulations, in which the mixing of ocean layers occurs. In particular, we will quantify the transport of particles within the ocean to illustrate the potential change of nutriments distribution or of pressure experienced by local fauna due to iceberg calving.