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An underwater perspective on the significance of mass-movement processes

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Since the 1929 Grand Banks earthquake that triggered submarine mass movements along the continental slope offshore Newfoundland and the subsequent progression of submarine cable brakes and tsunami, the Earth-Science community became aware that the largest mass wasting events on Earth occur under water. With new discoveries of even lager submarine mass wasting phenomena, such as the arguably largest "Storegga Slide" offshore Norway, which displaced an estimated volume of $\sim 3'500$ km3, we now recognize these geologic agents as prominent geomorphic players in shaping the world′s ocean margins. They significantly contribute to the bulk sediment mass transfer to the final sink in the abyssal plains of the deep oceans. They also can have considerable consequences for both offshore and offshore infrastructures.
Rapidly developing seagoing technologies, nowadays allows for detailed mapping, surveying, sampling and monitoring seafloor and sub-seafloor environments, providing unprecedented scientific data to unravel nature and evolution of submarine mass-wasting processes; from failure initiation, to mass-transport and their eventual deposition. Spatial and temporal distribution of underwater mass movement have been documented to be related to both long-term as well as short-term geological processes, including global sea level change, sedimentation pattern, tectonic evolution of ocean margins and its related earthquake activity, as well as the (sub-seafloor) hydrogeology and occurrence of gas hydrates.
This presentation highlights some current underwater mass-movement research and own studies in Swiss lakes and in a submarine fold-and-thrust belt offshore Japan. This aims at providing links to common research approaches towards assessing the geomorphic significance of mass wasting processes. In subaquatic environments, the sedimentary record generally provides high sensitivity and continuity, and underwater mass-wasting products are more easily preserved and dateable than their terrestrial counterparts. This allows for detailed investigation of mass-movement frequency vs. magnitude and provides the means – when combined with geotechnical slope-stability back-analysis for critical slope-failure initiation mechanisms – to quantitatively discuss related trigger and consequences scenarios on full temporal and spatial scale.