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I denne avhandlingen er det undersøkt hvordan skråningsstabiliteten utvikler seg i et dypvannsområde før, under og etter et jordskjelv. Alternative prosedyrer for å kvantifisere reduksjon av jordstyrke fra syklisk degradering og udrenert kryp er utviklet. Videre er det utviklet metoder for å kvantifisere hvordan svake lag i jordsmonnet kan øke risikoen for brudd i skråningen. I tillegg til den klassiske deterministiske tilnærmingen til skråningsstabilitet ble det utviklet en probabilistisk metodikk for å estimere fare og risiko knyttet til undersjøiske skred. Det er foreslått en ny metode for å kvantifisere faren for skred i skråning fra seismisk aktivitet, med spesiell vekt på beregningen av den årlige sannsynlighet for brudd (AFP). Studien har også utviklet sårbarhetskurver for offshore konstruksjoner utsatt for skredmasser, med formål å forbedre risikoanalysen ved å kvantifisere de direkte konsekvensene av et skred utløst av jordskjelv.

Among the variety of geohazards in deepwater sites, the failure of submarine slopes on the continental shelf and continental slope is one of the most significant hazards that may impact the seabed installations, causing significant environmental and economic consequences, and threaten human lives in coastal areas. The most frequent trigger for submarine slope failures in seismic regions is the earthquake event itself, or earthquake in combination with preconditioning factors, also known as slow triggers, such as soil boundary interfaces (e.g. weak layers)

The research was focused on studying the evolution of the slope stability at a deepwater site before, during and after an earthquake event, by developing alternative procedures to quantify the reduction of the soil shear strength due to cyclic degradation and undrained creep. Additionally, the study quantified the influence of weak layers in the soil profile to induce slope failure. The classical deterministic approach to slope stability was complemented with a probabilistic approach to estimate the hazard and risk associated with the failure of submarine slopes. A major contribution of the study was a new approach to quantify the seismic slope failure frequency, with special emphasis in the estimation of the annual failure probability (AFP). The study also developed vulnerability curves for offshore structures exposed to debris flow impact, aiming to quantify the direct consequences in the risk analysis. The results of the analyses implied that the direct risk in the phase after the earthquake event is about one order of magnitude greater than the direct risk during the earthquake event.