The geotechnical characterisation of mass movements as a component of submarine landslides risk assessment: an application to the New Jersey Margin.

By

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As a contribution to the study of mass movements, Leroueil et al. (1996) proposed the geotechnical characterisation of slope movements as a framework enabling a rational analysis of landslides. It takes into account the following elements: (1) the material, (2) the slope movement, and (3) movement stage. With these elements, the slope movements are further analysed at various stages: (1) the pre-failure stage (i.e. when the sediment or rock is essentially in a state of equilibrium), (2) the failure stage, (3) the post-failure stage (describing the behaviour of the sliding mass until it essentially stops) and (4) re-activation. For each stage, we consider the following aspects: controlling laws and parameters, predisposition factors, triggering and aggravating factors, revealing factors and consequences. This approach can in fact be extended to the analysis of mass movements in general. An interesting aspect about this approach is that in can be incorporated into mass movement risk assessment in an area which has little indications of failures. We applied this framework to the case of the New Jersey Margin, near the Hudson Apron, where a particular slide area is under investigation (Desgagnés et al. 2000). Here, sediments (Wisconsinian in age) are involved in the shallow (50m or so) mass movements. They are composed of silty clays which are mostly normally consolidated.

For the pre-failure stage we considered that the revealing factors are the pre-existing slide of the area or signature of debris flow or turbidite deposits. Other revealing factors of potential instability could be the presence of pop marks (indication of potentially high pore pressure), or fissures near the slope. At the failure stage, it appears that failures were taking place in condition permitting debris flow generation, which is indicative that the failure took place quite rapidly so that undrained conditions can be postulated. Because of the nature of the sediments, we can consider that a Mohr-Coulomb failure criteria would be appropriate. The triggering factors can be associated to: gas hydrates, which are known to exist here, seepage force due to a regional groundwater flow, or a high sedimentation rate (as revealed by the presence of clinoforms). The post-failure stage is characterised by the development of debris flows and the assumed operating law would be that of a viscous mixture which could be well described by a bi-linear rheological model (Locat 1997). The consequences of these events would be significant if oil platform, communication cables or coastal structures were located along the path of the flow. Depending on the initial volume involved and its initial velocity, tsunamis could also be generated.

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