Geophysical Research Abstracts, Vol. 8, 09370, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09370

In situ - characterisation in marine slope sediments with lightweight CPT instruments

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Pore Pressure and shear strength are crucial geotechnical parameter for the stability of marine sediments. Their importance is reflected in natural processes like liquefaction, landslides, earthquakes as well as human impact in case of static loading by offshore constructions. Therefore Cone Penetration Testing (CPT) is an effective method for in situ measurements of these geotechnical parameters with one instrument. Based on the experience of earlier marine CPT devices since the 1970's, we designed two different marine CPT probes for in situ measurement of strength (tip resistance, sleeve friction), pore pressure, tilt and acceleration. Both CPT systems rely on an industry 15 cm2 piezo-cone with the sensors at the tip and a pressure housing containing a microprocessor at the top. In addition, deceleration and tilt are monitored for vertical profiling of the penetrated sediment column. The lightweight (40-170 kg), shallow water (200 m depth) lance works completely autonomous with a volatile memory and battery package, and can be deployed from any platform, even without a winch. Length as well as weight of this system can be varied according to the sediment stiffness and allows variable penetration depth (usually less than 5 m). The design and the variable handling of the lance allow us to study the influence of the penetration velocity on the measured parameters. In consideration of pore pressure measurement the device is useful for longterm dissipation tests. Here, the lance can be left deployed over the desired period, e.g. connected to a buoy or other mooring. The sturdier, deeper water (currently 2500 m depth, anticipated 4000 m depth) system uses both power and telemetry for real-time data transmission from the research vessel, although spare batteries accommodate for limited use in autonomous mode. Initial use of the CPT systems attests their efficiency and reliability in the measurement of sediment physical properties. In a variety of estuarine and marine settings, our studies served objectives such as the

assessment of slope stability, navigability of harbours/estuaries, consultancy for cable laying and trenching, or ground-truthing of geophysical data.