Mechanical properties of sediments issued from giant submarine landslides in the shallow subsurface of the Amazon fan

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Résumé

The equatorial Atlantic margin to the north of the Amazon is strongly affected by gravitational processes presenting all forms of rupture of submarine slopes, representing a major geological hazard. The potential causal factors of these underwater landslides were studied from the integration of marine geophysical data (sediment sounder) and physical properties of sediment collected during the AMAGAS campaign (French Guiana-Brasil, 2023). The main geomechanical properties studied were density, compressive strength (Cu), P-wave velocities (Vp) and undrained shear strength (Su). These parameters represent good proxies of the mechanical state of slope sediments, such as overall erosion and level of consolidation. Acoustic anomalies observed in sub-bottom (chirp) profiles such as chaotic facies or acoustic wipe-outs indicated the presence of significant free gas content in the investigated sediments. Partial and total losses of Vp measurements were also consistent with the presence of gas or possibly gas hydrates.

We measured unexpectedly low values of density and resistance, leading us to infer that the presence of free gas has a negative effect on density and resistance. A few preliminary studies comparing the high resolution seismic chirp data of the logged coring sites to the Cu measures and density measures have shown good correlations. They could lead to different comprehension and interpretation of Chirp data. Many other studies such as oedometric, triaxial and in vane tests are programmed as soon as the cores will probably confirm our hypothesis.

On the basis of onboard data, we propose that slope failures observed along the studied area are likely controlled by reduced sediment strengths due to low effective stresses driven by the presence of free gas. The campaign has revealed numerous fluid escape features that raise the question of broad and massive slope failures in the Amazon fan.

Mots-Clés: geomechanical properties, slope failure, Amazon fan

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