OPTIMIZATING THE DETECTABILITY OF MICROSESIMICITY ASSOCIATED WITH STRESS-RELIEF MECHANISM BY RELATIVE RAYLEIGH WAVE VELOCITY CHANGE

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SUMMARY: The major terrestrial hazards throughout the globe are caused by Stress Relief Mechanisms (SRM) associated with material instabilities, which growth with time and lead to final collapse. The seismic signals emitted by these SRMs have their specific frequency range, duration and spectra. If these singles are properly understood, the mitigation of major hazards like landsliding, erosion, structural health and sinkholes collapse can be done through strengthening the Early Warning Systems (EWSs).The problem lies at the detectability of signals in highly attenuative medium like clay and low signal to noise ratio (SNR), as is the case with tropical Brazilian clay.
The present study is a novel attempt in order to understand SRM associating with prototype laboratory scale experiment. The experiment was conducted in the experimental field of University of Brasilia, Brazil. The experimental setup consists of a shear box full of compacted Brazilian tropical clay. This tropical clay is highly attenuative that makes the detection of signals challenging. That's why instead of signal noise is used. This shear box is pulled on the two metered scale grass free corridor with constant velocity. This setup is assumed to be the same as happening in the real landsliding when the two surfaces slide past each other.

The Rayleigh wave velocity, sensitive to the stress changes in the medium, were monitored by a very dense network of short period seismometers (Sercel L4C-3D) deployed in three circular arrays with radius varying from 2 meters, minimum, to 10 meters, maximum. These sensors were time synchronized by 20 GPS. The data was recorded with dataloggers (RefTek DAS-130/3) in continuous mode at sampling rate of 500 Hz for 30 minutes.

The noise processing was done by the MSnoise software. After initial processing, the green function (GF) or impulse response was calculated between each pair of sensors by cross correlation at time step of 4 second. All individual GFs, for entire period (30 minutes) were stacked to obtain a single reference GF. The changes in Rayleigh wave velocity (dv/v) with time were determined by subtracting individual GF from average GF. In this way stretching (dt/t) in waveform is calculated. Through this stretching change in Rayleigh wave is obtained as dv/v=-dt/t. The results of this experiment can be applied to real landslide as an optimizing tool for the detection of stress relief mechanism caused by the dynamism of unstable slopes.

KEYWORDS: SHEAR BOX, RAYLEIGH WAVE, EARLY WARNING SYSTEMS.