Velocity-dependent frictional strength of kaolinite clay under different slip rates and drainage conditions.

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Abstract

Numerous researches have suggested that the slip rate of landslides affected the strength of slip zone significantly. Moreover, according to effective stress principal, the pore pressure generating in slip zone due to slip is proposed as a dominating factor for the shear resistance. However, the studies about efficient record on this process is still scarce. This study aims to explore the influence of slip rates, drainage conditions and also temperature on the strength of kaolinite clay. A low to high velocity rotary shear apparatus was used to measure the apparent friction coefficient of wet kaolinite clay under a normal stress of 1 MPa and slip rate ranged from 10^{-7} to 1 m/s. The drainage conditions are controlled by different holder types including radial drainage and single drainage condition. The temperature on the shear plan is measured directly during the experiment by thermocouples. The experimental results show that the apparent friction coefficient μ of the wet kaolinite clay is significantly lower than that of the dry one. For the wet samples, the μ_{ss} of clay sheared using relatively impermeable holders (RD series) is somewhat higher than that of the samples sandwiched by permeable holders (SD series) because of the water content difference. The apparent steady state friction coefficient μ_{ss} versus shear velocity for the RD series shows a similar strengthening-weakening variation of the dry one. Right after the strengthening, it decreases rapidly, presenting a good consistency with the measured temperature rise. The results show the complexity of slip rate dependency strength of kaolinite clay under different drainage conditions.