Physical experiment investigation on progressive deformation of shear slip surface of the soil slope

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The sliding surface deformation of the soil slope mainly presents progressive failure characteristics, and serial acoustic emission (AE) signals are generated during the deformation process of progressive landslide. A model test aiming at reproducing the typical shear surface deformation of a soil slope is designed. The displacement, AE data and corresponding time-frequency characteristics are comprehensively analyzed to evaluate the progressive deformation behavior. Comparisons with different granular backfills measurements show that cumulative AE count increase proportionally with the shear surface displacement, and the experiments demonstrate that the glass sand backfill exhibits remarkable AE detection characteristics and stronger correlation results. Significantly, AE signal exhibits variational dominant frequencies at different deformation stages, and there is the significant phenomenon that not only the low frequency signals generated with a significantly increase number, at the same time the continuous high frequency signals appear during the accelerating deformation stage. Furthermore, from the statistical trend of the energy percentage of the high frequency band into 312.5–500 kHz, it's found that the correlative energy proportion occupies up to 15%, or even higher during the accelerating stage, indicating that the landslide may be about to enter a severely dangerous stage. The experiments show that the frequency characteristic of the AE signal can be effectively used as the early warning index, which may be the promising reference of the field warning monitoring for the soil progressive landslides.