Failure caused by breaching in subaqueous sand

Yao You, Peter Flemings, David Mohrig

Abstract

Submarine failures can be divided into two categories: liquefaction failure and breaching failure. During liquefaction failure the sediment matrix contracts while during breaching failure the sediment matrix dilates. Dilation causes the pore pressure in the sediment deposit to decrease, thereby temporarily increasing its shear strength. The tangent of failure angle increases in proportion with the ratio of effective stress to total stress:

$$\tan \theta = \frac{\sigma' - \tan \phi}{\sigma_i}$$

Degree of dilation is greatest near the failure front and decays quadratically with distance away from failure. Finer sand or poorly sorted sand creates a higher failure angle and slower erosion rate during breaching because of stronger dilative response and lower diffusivity. In preliminary experiments we have documented pressure drawdown and identified the fraction due to dilation and the part due to change in stresses. We will present recent results from laboratory experiments and a numerical model that characterize how the behaviors of the dilative failures vary with different sand compositions.