EGU21-7931, updated on 12 Jun 2021
https://doi.org/10.5194/egusphere-egu21-7931
EGU General Assembly 2021

Modelling multi-fissure zones above buried rock ridges in subsiding basins

Li yueting, Pietro Teatini, Shujun Ye, Andrea Franceschini, Matteo Frigo, and Claudia Zoccarato
Department of Civil, Environmental and Architectural Engineering, University of Padova, Padova, Italy(yueting.li@studenti.unipd.it)

Aseismic earth fissures due to the excessive groundwater exploitation have caused seriously damage in many subsiding sedimentary basins worldwide. Generally, multiple fissures almost parallel to each other with equal distances are prone to develop where a compacting aquifer system overlies impermeable and/or incompressible ridges. Here, an advanced finite-element interface-elements modelling approach is employed to understand this process within unfaulted sedimentary sequences. A simplified geological setting is initially used to investigate the effect of the ridge slope on ruptures behaviors. Then, we reproduce the case of Guangming village, China. In both the proposed scenarios, the model simulates the occurrence of multi-fissures that initiate at land surface and propagate downward, as observed in the sites. The earth fissures are formed as a result of the combination of tensile stress (bending condition) and shear stress (shearing conditions) accumulation around and above the tip and the slopes of the ridge, respectively. The numerical outcomes indicate that the steeper ridge results in higher magnitude stress accumulation above the ridge tip which favors the formation of fissures with significant opening and small or null offset, but at expense of the reduction in stress accumulation area and fissure distribution. In Guangming case, the outcomes show that two ruptures started sliding and only one year later a central fissure opened and propagated down to 15-30 m depth. The simulated maximum opening and sliding of the central and side fissures, respectively, approximate 30 cm, which are almost in agreement with the observations. The numerical results prove that the proposed modeling approach is an effective way to predict and analyze multi-fissure onset and development in subsiding basins.