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# Discrete element method-based prediction of areas prone to buried hill-controlled earth fissures

**Key words**: discrete element method (DEM); MatDEM; buried hill; earth fissure; prone area

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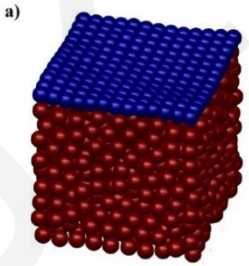
An earth fissure is a type of geological disaster associated with rapid economic growth and has caused considerable financial losses in past decades.

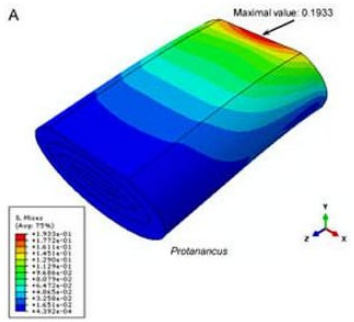
## How to predict the prone areas by numerical simulation?

**DEM???**

**Particles**
**Large deformation**
**Cracking**

**Or**



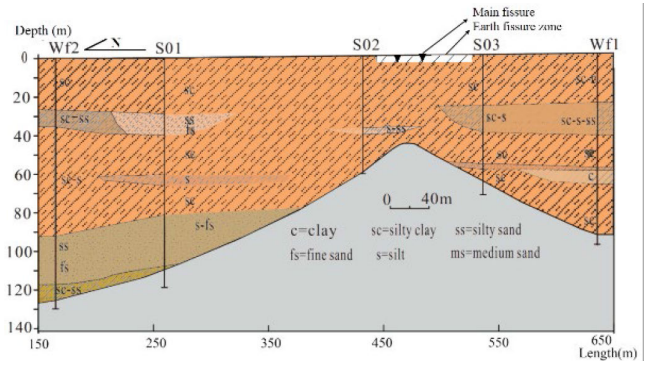



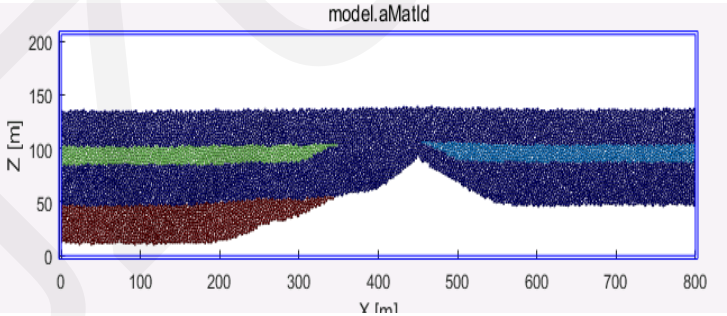

**FEM/FDM???**

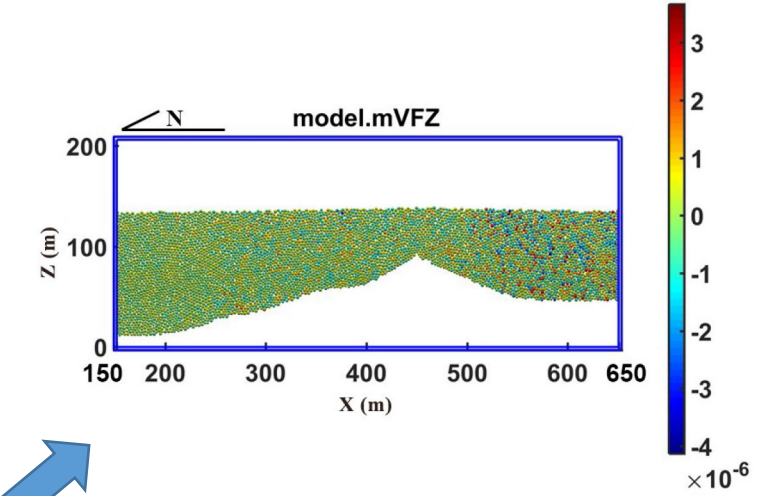
**Continuum**
**Hard to simulate cracking**

# Innovation point

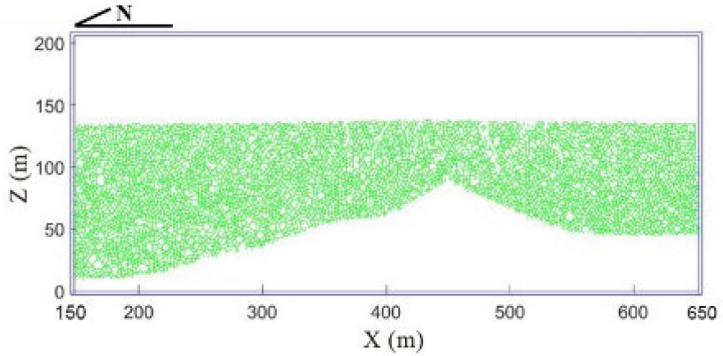
**A discrete element method was proposed to simulate earth fissures caused by water level drawdown.**



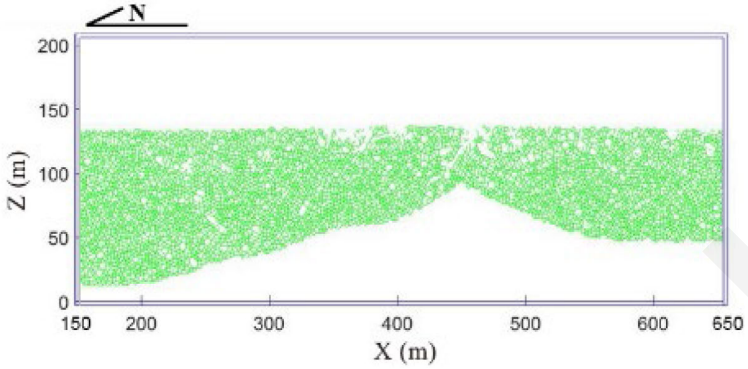



# Innovation point

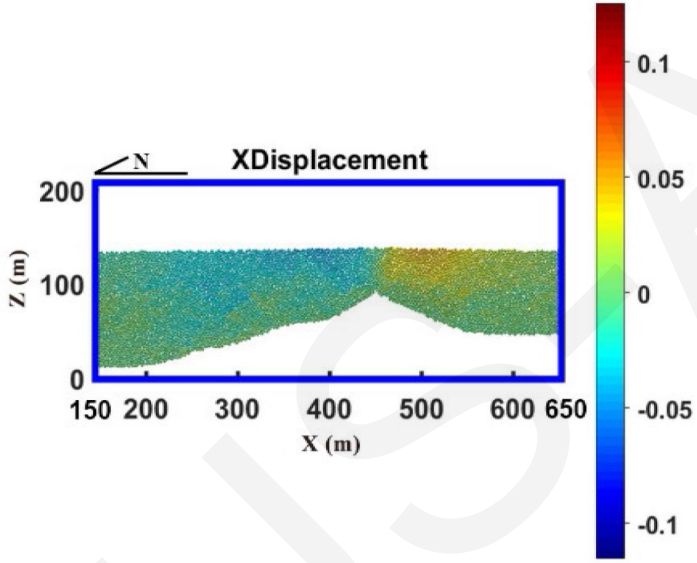



Before simulation

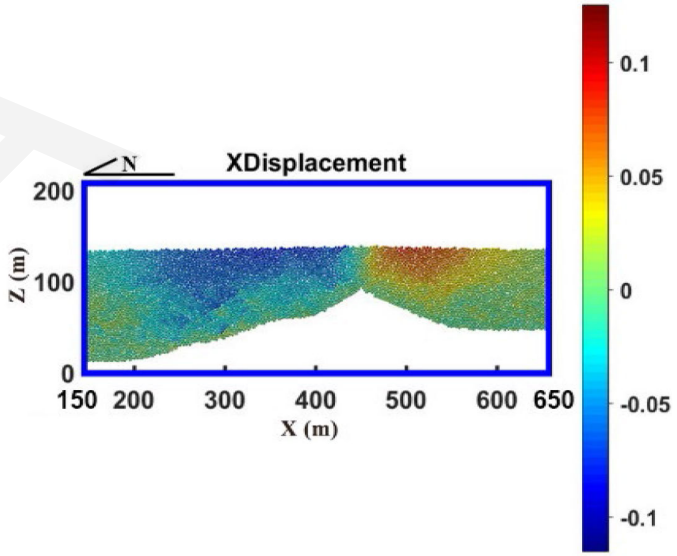



Simulation results

Unit connection




Groundwater drawdown at 40 m




Groundwater drawdown at 80 m

**Displacement in the X-direction due to groundwater drawdown**

**It is proposed to predict the prone area of earth fissures based on unit connection and horizontal displacement.**

# Conclusions

- The *Z*-direction displacement above the ridge was smaller than that on both sides of the buried hill, resulting in a bending effect on the soil near the ground surface. It can be inferred that bending due to an uneven settlement during the groundwater drawdown is the main mechanism of the buried hill-controlled earth fissures. The mechanism can also be verified by the X-direction displacement near the ground surface, which is opposite around the ridge of buried hill, and the breakage of the unit connections of particles above the ridge. Therefore, the displacement and unit connections of particles can be considered indicators for the development of earth fissures.

- MatDEM is a reliable and intuitive numerical simulation method to solve the discontinuous problems, such as earth fissures that is simplified by considering the interaction between particles. The method can be used to predict the prone area of buried hill-controlled earth fissures and study the evolution process of earth fissures.