Geophysical estimation of the damage induced by an observatory digging in a limestone heterogeneous vadose zone

Beauce aquifer (France)

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Context: study site, project and damage problematic

Overall of the O-ZNS project:
- Setting: agricultural site
- O-ZNS platform: Observatory of the Non-Saturated Zone (Vadose Zone)
- Observation well: 20 m-depth, 4 m-diameter
- Geological context: continental limestones
- Objectives:
  - Observe the mass and heat transfer,
  - Image the field cracking,
  - Develop new geophysical tools

This study:
- describe and model the soil layers from lab testing and direct observations
- quantify the induced damage in the host rock

Soil characterization

Laboratory testing (based on 3 reference wells, SC1, SC2, SC3 (Fig. 1)):
- Geophysical and geomechanical measurements of: density, Vp, Vs, permeability, porosity, Young's modulus

Mechanical tests for strength determination and Mohr-Coulomb criterion description:
- SC3: 1,5m
- SC3: 5,5m
- SC3: 17,5m

Global strains (step by step of digging)

Numerical model

- Digging step by step depending on the soil layers
- Including retaining walls
- Mechanical calculation
- Suction is ignored
- Water level at 21m

Conclusion and Outlooks

- Laboratory tests highlighted 4 soil layers with a last one really heterogeneous due to high fracturation
- The geotechnical Plaxis® software is used to model the induced strain and damage in the host rock
- 2m after the well damage vanishes (1,5m for the shear strain)

Outlooks
- The effect of the water table variation will be investigated to model the time evolution
- It is expected a finer resolution of the deepest heterogeneous soil layer through a developed experimental campaign including geophysical, geomechanical and hydraulic tests

We gratefully acknowledge the financial support provided to the PIVOTS project by the Région Centre – Val de Loire (ARD 2020 program and CPER 2015 -2020) and the French Ministry of Higher Education and Research. This project has been co-funded by the European Union. Europe invests in Centre-Val de Loire with the European Regional Development Fund