Getting grip on spongy behaviour of soft clay

Modelling the volume changes in clay deposits due to drainage and chemical changes

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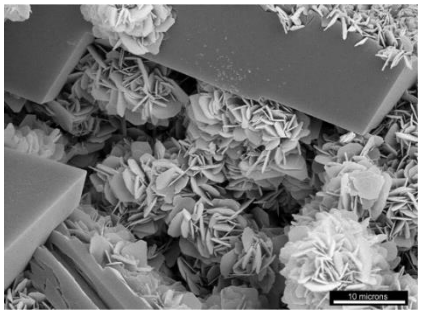

Project description

Deltaic areas are threatened by declining surface elevation due to rising sea levels and land subsidence. These processes aggravate the risk of existing geohazards, such as floods, storm surges, saltwater intrusion and eventually the loss of land. The rates of sea level rise are frequently exceeded by those of land subsidence. Land subsidence is partially natural and unavoidable due to natural compaction, tectonics and isostasy. However, there are as many anthropogenic drivers too, including loading, the extraction of resources such as groundwater and hydrocarbons, and drainage of soft soils.

Drainage is an important driver of land subsidence in the coastal and fluvial parts of the Netherlands, due to the presence of soft sediments in the Holocene subsurface: peat and clay. The sediment volume in the Holocene sequence is susceptible to change and thus land subsidence. Geomechanical models are used to predict volume changes based on physical processes, calculating volume changes (compaction) based on effective stress changes. However, the compaction behaviour of shallow clay deposits depends on more factors, such as the clay mineralogy and the chemical composition of the pore water.

The aim of this project is to build a compaction model, specifically for Holocene clay deposits by adapting a model set-up developed to simulate volume change in shallow peat deposits. Followed by incorporating chemical characteristics and processes in the model.

The expected deliverables are a mechanical shrink-swell model (built from scratch) that is applicable to chemically different types of clay deposits in combination with a concise report on the use, validation and performance of the model.

The project thus mostly consists out of a literature study and modelling. If lockdowns are installed again due to Covid-19, this does not influence the work of the student, only the location. The number of meetings depends on the need and is flexible. We start with a meeting frequency of once a week.

Job requirements

Python experience is strongly preferred before the start of the project. A free online course can be provided in advance. A background in (geo)hydrology is preferred.