What can we learn from the pattern of subsidence above the Groningen gas field? A study of the sensitivity of the subsidence to the subsurface structure and deformation processes

Marius Wouters[1], Rob Govers[1], Samantha Kim[2], Femke Vossepoel[2], Esther Stouthamer[1] & Ramon Hanssen[2]
[1] Utrecht University
[2] Delft University of Technology

This work is part of the "Subsidence" DeepNL project which aims to identify subsurface drivers of subsidence above the Groningen (the Netherlands) gas field, and to forecast future subsidence. The aim will be to do this by assimilating geodetic time series into geophysical models. Part of the project is to develop the geophysical model of the sub-Holocene (reservoir and overburden), and to identify the relevant mechanisms and parameters responsible for the subsidence. Since data assimilation can be computationally intensive, a key question is: which model details produce surface responses that can actually be detected in the geodetic data? To answer this question for the Groningen area, we perform a sensitivity study. We start off with a numerical finite element model of a simplified geometry and iteratively test combinations of categories and degrees of complexity, by imposing a local pressure drop as a synthetic production forcing. Examples of tested complexities in Groningen subsurface are the high lateral variabilities in lithological thicknesses, especially of the evaporitic caprock, and the (active) faults in the reservoir, which have been imaged in detail by the operator of the gas field (NAM). We will present the preliminary results of our sensitivity study.