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Unravelling shallow causes of subsidence

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Subsidence of the surface is an important social issue especially in the Netherlands. This is mainly due to the enhanced risk of flooding and damage to buidlings and infrastructure. Several natural and antropogenic processes can result in surface movement. For instance the construction of buildings, roads and tunnels, peat oxidation, clay compaction, earthquakes, the extraction of hydrocarbons and geothermal production. Each process has its own characteristic temporal and spatial scale on which it affects the surface movement.

At present, we focus on the unravelling of the natural, shallow causes of subsidence: settlement, clay compaction and peat oxidation. We have develloped an inversion scheme which utilizes the Koppejan (1948) equations for primary and secondary settlement and an exponential model for peat oxidation. The inversion procedure uses all available geological information to derive a model estimate for each process. The method incorporates both the prior model covariance matrix and the data covariance matrix, which contain the temporal and spatial correlations between the model parameters and data, respectively. Taking the model correlations into account through the covariance matrix enhances the influence of the data on the inverted model estimate.

The method is applied to the Krimpenerwaard, a polder in the western Netherlands. As a first step, the method is validated by using all geological information in an inversion of synthetic data. Once the method has been proven to provide a proper model estimate for each process, the method is applied to the levelling data available for the polder. We will show the results of these inversion exercises.