EGU21-6369, updated on 20 Jan 2022
https://doi.org/10.5194/egusphere-egu21-6369
EGU General Assembly 2021
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Unraveling anthropogenic causes of subsidence in the coastal plain of Friesland (NL)

Kay Koster[1], Thibault Candela[1], Joana Esteves Martins[1], Peter Fokker[1], Aris Lourens[1], Willem Dabekaussen[1], Madelon Molhoek[2], Merijn De Bakker[2], Manon Verberne[1], and Andrei Bocin-Dumitriu[1]

[1]TNO, Geological Survey of the Netherlands, Netherlands (kay.koster@tno.nl)
[2]TNO, Data Science

The coastal plains of the Netherlands are subject to anthropogenic and natural subsidence with rates which are an order of magnitude higher than sea-level rise. Because one-third of the Netherlands lies below mean sea level, subsidence may threaten the country's subsistence with major socio-economic consequences. Subsidence is a normal natural process but is overprinted and accelerated by anthropogenic activities which drives deep or shallow processes. Deep processes are caused by the extraction of hydrocarbons and salt, whereas shallow processes are primarily caused by lowering of phreatic groundwater levels. At present, the relative contribution of each process to total subsidence (i.e. natural plus anthropogenic) is unclear. Such information is important for stakeholders to support decision making on subsidence mitigation and it should be substantiated with independent scientific studies.

We present the outline of a hybrid Artificial Intelligence (AI) big data and model workflow to disentangle different subsidence forcing and we report on preliminary results for an area covering a gas field in the peat-rich Friesland coastal plain. The proposed workflow is a hybrid approach between a knowledge-based physical model and machine-learning techniques. The big input data comprises a suite of static (structural model) and time-dependent subsurface data (phreatic groundwater level, reservoir pressure), and geodetic measurements. Geomechanical models provide the connection between the drivers (groundwater levels and reservoir pressures) and the surface movement.