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H24C-07
Spatially Variable Compressibility Estimation Using the Ensemble Smoother with Bathymetry Observations: Application to the Maja Gas Reservoir

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Abstract:
A data assimilation (DA) framework is established to characterize the geomechanical response of a strongly compartmentalized hydrocarbon reservoir. The available observations over the offshore gas field consist of a bathymetric survey carried out before and at the end of the ten-year production life. The time-lapse map of vertical displacements is used to infer the most important parameter characterizing the reservoir compaction, i.e. the rock formation compressibility c_m. The methodology is tested for two different conceptual models: (a) c_m varies with depth and the vertical effective stress (heterogeneity due to lithostratigrafic variability) and (b) c_m also varies horizontally within the stratigraphic unit. The latter hypothesis is made to account for the behavior of the partitioned reservoir due to the presence of sealing faults and thrusts, which suggest the idea of a block heterogeneous c_m. The calibration of the geomechanical parameters is obtain with the aid of the Ensemble Smoother algorithm, that is, an ensemble-based DA analysis scheme. In scenario (b), the number of reservoirs blocks dictates the set of uncertain parameters, whereas scenario (a) is characterized by only one uncertain parameter. The outcome from scenario (a) indicates that DA is effective in reducing the c_m uncertainty. However, the maximum measured settlement is underestimated with an overestimation of the areal extent of the subsidence bowl. Significant improvements are obtained in scenario (b) where the maximum model overestimate is reduced by about 25% and an overall good match of the measured bathymetry is achieved.

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