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Stochastic computational modeling of reservoir compaction due to fluid withdrawal

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Abstract. The compaction of poroelastic heterogeneous reservoirs during oil production in the primary stage is investigated within the framework of stochastic computational modeling. The impact of reservoir heterogeneity upon the magnitude of the stresses induced in the solid matrix due to reservoir consolidation and surface subsidence is analyzed. By performing an ensemble average over realizations of a log normal distribution of the permeability coefficient, we show that for a fixed discharge prescribed on the boundary, the presence of geological heterogeneity leads to an increase in the effective stresses in the rock matrix and to an earlier appearance of the plastification zone. A classical consolidation problem of a weak reservoir due to oil withdrawal is considered. Numerical results illustrate the effects of the variability in the absolute permeability and uncertainty upon the geomechanical predictions of the evolution of the Mohr-Coulomb function.

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