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Reducing uncertainty in the permeability distribution in a storage reservoir by integrated inverse modelling

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The Ketzin pilot site for CO_2 storage in Germany has been operated from 2007 to 2013 with about 67 kt of CO_2 injected into the Upper Triassic Stuttgart Formation. Main objectives of this undertaking were assessing general feasibility of CO_2 storage in saline aquifers as well as testing and integrating efficient monitoring and long-term prediction strategies. The present study aims at revising the latest static geological reservoir model of the Stuttgart Formation by applying an integrated inverse modelling approach. Observation data considered for this purpose include bottomhole pressures recorded during hydraulic testing and almost five years of CO_2 injection as well as gaseous CO_2 contours derived from 3D seismic repeat surveys carried out in 2009 and 2012. Inverse modelling results show a remarkably good agreement with the hydraulic testing and CO_2 injection bottomhole pressures (R = 0.972), while spatial distribution and thickness of the gaseous CO_2 derived from 3D seismic interpretation exhibit a generally good agreement with the simulation results (R = 0.699 to 0.729). The findings of Kempka et al. (2017a,b) successfully demonstrate how the integrated inverse modelling approach, applied for effective permeability calibration in a geological model here, can substantially reduce parameter uncertainty.

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