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Coupling approach in shallow, unconfined aquifers in the Po Plain area: A preliminary study for future ground monitoring purposes.

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The use of the coupling approach in analyzing the interaction between the flow field and the stress field in shallow, unconsolidated aquifers allows a better description of the involved phenomena. We perform our study on an area in the Po Plain (northern Italy) in the province of Bologna in Emilia-Romagna based on intended future studies on ground movements due to the superposition of shallow water production with deep underground gas storage.

The static geological model of the alluvial sediments, locally exceeding 500 meters of thickness, is developed via a stochastic approach in order to manage the high degree of uncertainty in the system spatial continuity and heterogeneities. Corresponding water production data and piezometric measurements are collected for simulating the dynamic behavior of the shallow aquifer. The high uncertainty in water production data are managed considering a maximum and minimum scenarios on the basis of punctual well measurements and regional trend information. Correlation law between petrophysical parameters and deformation variables are derived for technical literature. The coupling technique is then applied and some sensitivity analysis are developed to assess the effects of the correlation laws. The results are finally compared with the output from the uncoupled techniques.