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3D finite element modeling of hydraulic efficiency of drainage trenches

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In this work the hydraulic efficiency of a drainage trench system is evaluated by means of a series of fully coupled, transient 3D finite element simulations. A parametric study has been conducted to investigate the influence of such relevant aspects of the problem as the slope inclination and trench length, which are not taken into account in currently available, simplified 2d solutions. Starting from a real case study as a reference, an ideal slope has been considered, made of silty soil. From the computed space-time evolution of the pore water pressures and hydraulic head, the evolution with time of the average hydraulic efficiency, from the construction phase of the drainage trenches to the final steady-state conditions has been determined, as a function of the slope inclination, the depth (H) and length (L) of the trenches, the spacing (s) between the trenches. The results indicate that a major role in defining the hydraulic efficiency is played by the trench spacing and depth. However, for relatively steep slopes and short trenches the influence of slope inclination and trench length may be significant. The comparison between the obtained results and the available 2d solutions can provide useful indications on the range of applicability of the latter in practical applications.