

Analysis of Unsaturated Seepage in the Loess Vadose Zone Based on Column Tests

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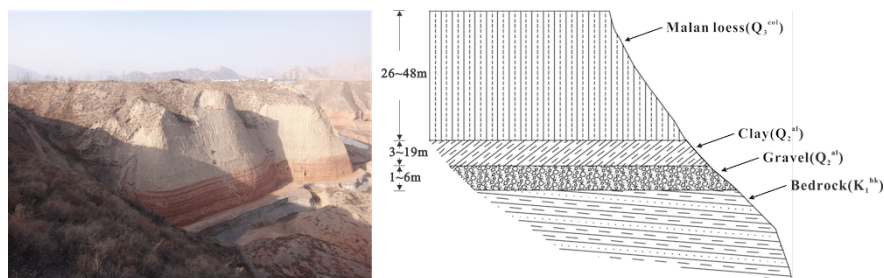
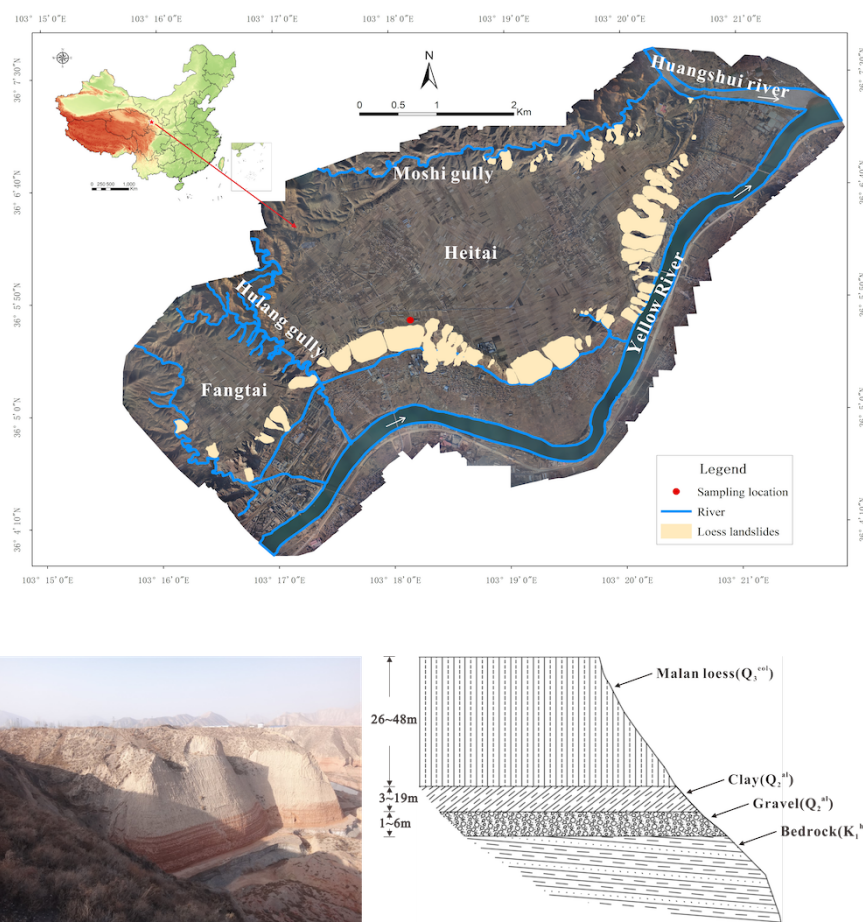
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Abstract

Previous studies have shown that the rise of the groundwater table has induced a large number of landslides on the Heifangtai terrace, but it is not clear how the irrigation water flows into the loess and whether it affects the groundwater directly when infiltrating the ground below. In order to understand and analyze the unsaturated seepage in the loess vadose zone, water infiltration was investigated in this paper using a 6 m high remold loess column and artificial tracers. According to the analysis of the different infiltration stages, the existence of unsaturated seepage was indirectly proven. In addition, by comparing the tracer effects of the chloride and bromide ions, it was concluded that though the apparent moisture content was unchanged in the deep vadose zone, the regular downward enrichment of chloride ions demonstrated the existence of unsaturated seepage. We recommend that chloride ions be used as the soil tracer, and bromide ions be used as the water tracer during the in-situ monitoring of unsaturated seepage in Heifangtai. A numerical simulation was also constructed using COMSOL Multiphysics to analyze the solute transport. The results show that unsaturated seepage is not affected by the second irrigation, and the effect of the rising groundwater table is small and is limited to the transition zone between the saturated and unsaturated zones. Therefore, this study provides new insight into landslide mechanisms in Heifangtai based on the analysis of unsaturated seepage.

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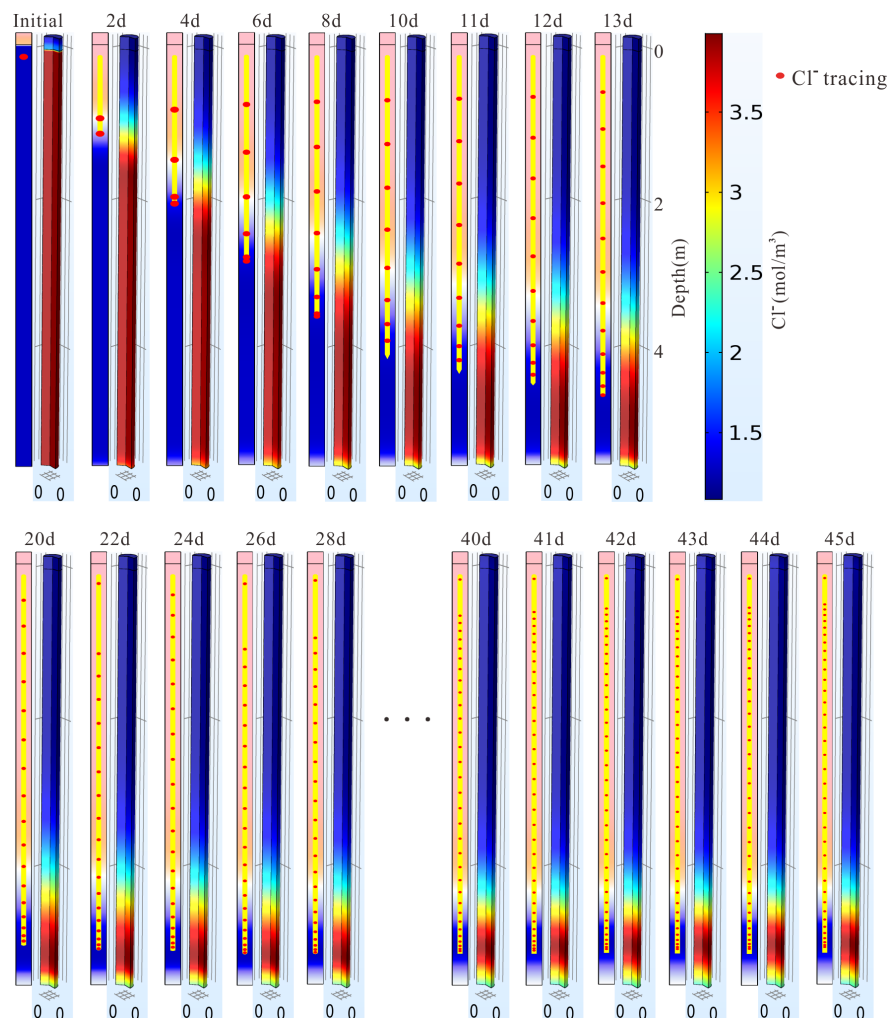
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