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Density-dependent 3D FE modelling of a recharge drain to mitigate saltwater contamination at the Venice farmland

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Saltwater intrusion in coastal aquifers is one of the most challenging and worldwide environmental problems, severely affected by human activities and climate change. It represents a threat to the quality and sustainability of fresh groundwater resources in coastal aquifers. Saline water is the most common pollutant in fresh groundwater which can also compromise the agriculture and the economy of the affected regions. Therefore, it is necessary to develop engineering solutions to restore groundwater quality or at least to prevent further degradation of its quality.

For this purpose, the goal of the Interreg Italy – Croatia MoST (MOnitoring Sea-water intrusion in coastal aquifers and Testing pilot projects for its mitigation) project is to test possible solutions (such as underground barriers, cut-off walls, recharge wells and recharge drains) against saltwater intrusion properly supported by field characterization, laboratory experiments, monitoring of hydrological parameters, and numerical models.

This works shows the preliminary results of an ongoing modelling study carried out for a coastal farmland at Ca' Pasqua, in the southern part of the Venice lagoon, in Italy. A three-dimensional finite-element density-dependent groundwater flow and transport model is developed to simulate the dynamics of saltwater intrusion in this lowlying area. The model is used to assess the potential effects of a recharge drain recently established at 1.5 m depth along a sandy paleochannel crossing the organic-silty area. The goal of the intervention is to mitigate the soil and groundwater salinization by spreading freshwater supplied by a nearby canal. The beneficial consequences of the recharge drain should be enhanced by the higher permeability of the paleochannel.