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TI: A new geological model to predict anthropogenic Venice uplift
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AB: Recent numerical studies suggest that Venice may be raised by pumping seawater into Plio-Pleistocene aquifers underlying the lagoon. The prediction is based on a simplified litho-stratigraphy of the Venetian geology and a uniform injection rate from 12 wells located on a 10 km diameter circle that encompasses the city. Using 1,000 km of high-quality seismic data acquired below the Venice lagoon over the 1980s and about 100 km of new seismic lines carried out in the sea facing the Venetian coastland, along with a model designed ad hoc for simulating more accurately the injection boreholes, a novel Finite Element (FE) model is developed that addresses the actual geology of the lagoon subsurface basin and implements more realistic injection rates that are allowed to be variable both in space and time. Pumping occurs into the permeable units of the two Pleistocene formations PLS2 and PLS3 that vanish just south and north of Venice, respectively, and the Pliocene unit PLC2 which is instead rather continuous below the lagoon and can go down to as much as 1000 m. The results show that a 25-30 cm anthropogenic uplift can be expected over 10 years since the inception of pumping. Even if the same injection overpressure is used for all the wells, the computed differential displacement ρ_z does not exceed 5×10^{-5} (i.e. 5 mm per 100 m) and 1×10^{-5} in the lagoon and Venice, respectively, i.e. well below the most conservative bound normally recommended for the integrity of masonry structures, irrespective of the complex geological structure. If ad hoc overpressures are calibrated for each well, ρ_z may be even abated to 0.1×10^{-5} throughout the city.
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