INJECTING SEAWATER UNDERGROUND TO RAISE LOWLYING HIGH-VALUE COASTLAND: A PILOT PROJECT AT VENICE, ITALY

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Field measurements carried out over the past decade show that injecting fluids underground can induce a land uplift up to a few tens of centimeters over a time interval that may range from months to years. Such evidences support the idea of using this approach as an innovative defence from and a substantial mitigation to flooding that plagues high-value coastal lowlands. Recent modeling studies suggest that injecting seawater into a 600-800 m deep brackish aquifer underlying the Venice Lagoon might help raise the city uniformly by 25-30 cm over a 10-yr time. This would lead to more than 90% reduction of the most severe floods experienced by the city since 1872. To test the feasibility of an actual programme of anthropogenic Venice uplift a pilot project is designed with the aim at investigating the expected heave over a limited lagoon area. The planned project consists of three injection wells located on the vertices of an ideally equilateral triangle with 800–1000 m length sides and three additional boreholes to measure the pore water overpressure, the injected formation expansion, and the upper aquifer system compaction. Land uplift is monitored in time and space with the aid of the most advanced technology, including satellite radar interferometry. Experiment modeling simulations are based on the best presently available hydro-geomechanical data and indicate that a constant pumping rate of 0.012 m^3/s from each single well might produce a quite uniform land uplift achieving a maximum value of about 7 cm over a 3-yr time, i.e., the expected duration of the project. A maximum overpressure less than 10% of the initial condition ensures the mechanical integrity of the aquifer caprock, with very small gradients of the ground displacements raising no concern for the stability of the infrastructures located close to the experimental site.