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Improving sustainable water resources management in coastal aquifers using stochastic inverse modelling and optimization techniques, incorporating satellite imagery as secondary information.

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Coastal aquifer systems often provide the principal water supply for domestic, industrial, or agricultural demands. Therefore, it is important to develop appropriate management models for optimal design of a pumping network and for assessing the maximum pumping rates while protecting the wells from saltwater intrusion. A management model in the Mar del Plata aquifer, where intensive groundwater exploitation until the late 1970s caused a significant advance of the saline intrusion interface, is designed using stochastic inverse modelling combined with optimization techniques. In our case study, transmissivity and storage coefficient fields are highly heterogeneous. Thus, high permeability zones well connected to the seawater boundary result in preferential paths for incoming seawater. The presence of this higher permeability channels are of extreme importance for the optimal management of this aquifer. Spatial variability of these parameters is addressed by the regularized pilot points method (Alcolea et al., 2006a,b), including satellite imagery as external drift to reproduce the spatial patterns. The simulations of the transmissivity and storage coefficient fields are conditioned to transmissivity, storage coefficient and head variation data, and their uncertainty is evaluated. Finally, optimization techniques are used to determine the optimum pumping configuration. The application of the proposed methodology will provide us with a tool to objectively assess sustainable management alternatives in this aquifer as well as to correct the current salinitation problem.

Keywords: stochastic inverse modelling, optimization, coastal aquifer, satellite imagery, management model.