HYBRID APPROACHES FOR PREDICTING SALT WEDGE INTRUSION IN ESTUARINE ENVIRONMENT

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MOTIVATION

In the last decade, numerous studies have pointed out that climate change-induced sea level rise (SLR) and possible altered river discharge will modify saline intrusion in estuarine environments. The modification of the behaviour of the salt wedge's length poses a threat to various ecosystems and consequent human activities carried out within them, including industrial and agricultural uses, which could be compromised. Tian (2019) concluded that the main factors that control the salt-wedge intrusion in an estuary are the river flow, sea level and estuarine geometry. Therefore, with the aim of reproducing the saline behavior, a new model including the effect of these variables is presented.

METHODOLOGY

To create a fast predictive tool, we propose a hybrid methodology which combines three-dimensional numerical model simulations and data mining techniques (Camus et al., 2011). Initially, sampling (LHS) and selection (MDA) approaches are used to choose a representative number of examples that will be numerically simulated using Delft3D. Next, an interpolation-based salt-wedge incursion tool (RBF) is created, utilizing the pre-run case library as a basis. Although these hybrid approaches have been effectively utilized in the past to analyze other dynamics, like wave reconstruction and water level this is the first time that they have been applied to the study of salt-wedge evolution in an estuarine environment. An estuary in northern Spain has been the site of field campaigns conducted over various meteorological seasons to calibrate this methodology. The aim of this study is to develop a high-resolution forecasting system for salt-wedge behavior that is quick, reliable, and portable. This tool has a lot of potential for studying adaptation strategies to stop the salt wedge from spreading as a result of climate change.

RESULTS

The saline behavior in estuarine systems is highly variable and complex. The developed study enables the reproduction of salt concentration patterns during a tidal cycle in the water column (Figure 1a and Figure 1b). Figure 1c displays a scatter plot of the reconstructed salt concentration during a tidal cycle and the salt concentration modelled. The root mean square error (RMSE) was computed for the salinity concentration.

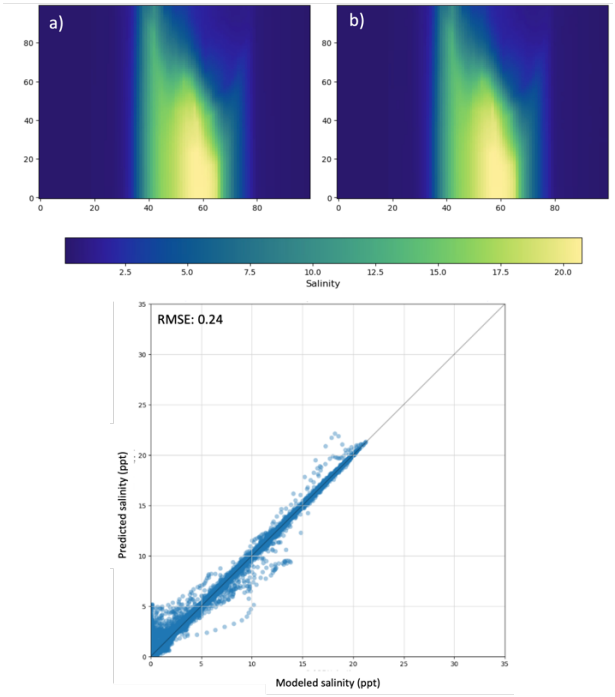

Figure1. a) Salt concentration in the water column over a tidal cycle b) Hybrid reconstruction of the salt concentration c) Scatter plot of salinity modeled and salinity predicted by the hybrid methodology.

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