DEVELOPING AN EFFICIENT MODELLING FRAMEWORK TO EVALUATE NATURE-BASED SOLUTIONS TO COUNTERACT ESTUARINE SALT INTRUSION

Rutger Siemes[1]*, Trang Minh Duong[1], Bas Borsje[1], Suzanne Hulscher[1]

[1]University of Twente, Enschede, Netherlands

*Correspondence: r.w.a.siemes@utwente.nl

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UNIVERSITY OF TWENTE.

Estuaries connect our rivers and oceans, supporting densely populated regions worldwide. These estuaries are increasingly threatened by salt intrusion due to climate change and side effects of human interventions, limiting freshwater availability. Nature-based solutions (NBS), e.g. artificial sand waves, wetlands or bivalve beds, impose a roughness on the water motion. Consequently, they are able to reduce saltwater intrusion in estuaries. An efficient modelling framework will be developed, that is able to evaluate NBS to counteract salt intrusion, for a whole estuary, taking into account climate change. With this framework, the potential of NBS to mitigate estuarine salt intrusion can be explored.

Keywords: estuaries, salt intrusion, ecomorphology, nature-based solutions, numerical model.

Methods

A process-based, numerical modelling framework will be created to explore the impact of estuarine development, related to nature-based solutions (NBS), on salt intrusion. Hereto, various relevant timescales are identified. To improve efficiency of the framework, the timescales are separated in three modelling approaches (Figure 1).

These approaches are elaborated below:

- Salt intrusion modelling: On a timescale of days, hydrodynamics of extreme events (droughts, storm surges or both) are modelled in 3D.
- Ecomorphological modeling: Estuarine development, related to NBS, is explored using models that simulate ecological- and morphological development, for simulation periods of 1 year. This is performed in 2DH.
- Long-term modelling: To study the impact of climate change, the snap-shot approach, as proposed by Duong et al. (2016), is applied. With this approach, a model validated for present day conditions is adjusted to represent future scenarios, according to local climate change projections. Subsequently, it is applied to model snap-shot simulations of future scenarios.

Using these approaches, a modelling framework is developed. A stepwise approach of the whole modeling framework is displayed below (Figure 2).

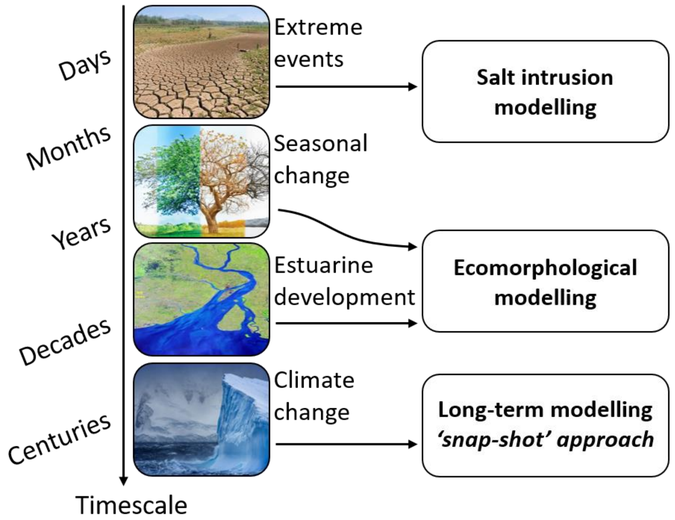

Figure 1: Relevant timescales and temporal processes and their respective modelling approach within the framework.

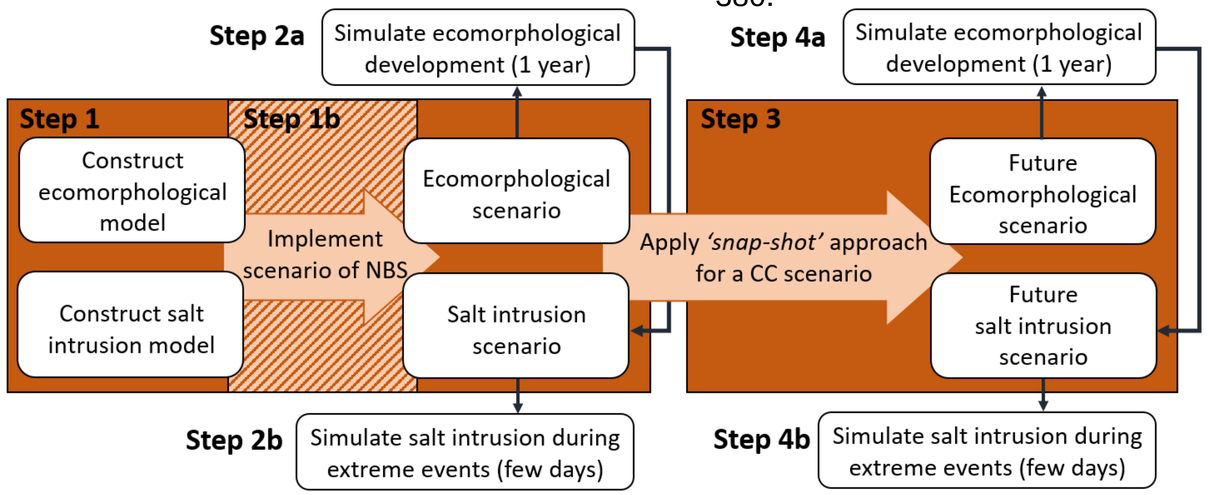

Figure 2: Schematization of the modelling framework. Model development is addressed within the brown boxes. Model simulations are outside of these boxes.

Expected results

By reaching the set objective, and constructing and applying this modelling framework, this research will lead to the following results:

- Insights will be gained on development of a whole estuary due to various NBS, under a changing climate, and;
- understanding on how this development, related to NBS, affects salt intrusion will be improved.

Bibliography

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