

## ***Interactive comment on “Model-driven optimization of coastal sea observatories through data assimilation in a finite element hydrodynamic model (SHYFEM v.7\_5\_65)” by Christian Ferrarin et al.***

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### General comments

"Model-driven optimization of coastal sea observatories through data assimilation in a finite element hydrodynamic model (SHYFEM v.7\_5\_65)" is a well written manuscript concerned with using data assimilation to improve coastal modelling capabilities and optimise monitoring networks. The article contains a fair comparison of data interpolation (DI) and data assimilation (DA) methods, along with a further comparison of two

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different DA approaches.

The Lagoon of Venice application involves a complex spatial domain with sensitive coastal dynamics. The objective of the numerical experimentation is clearly stated. Results are clearly presented in a number of attractive figures. In the conclusion, the objective is fulfilled and recommendations are made for modifying the monitoring network.

### Specific comments

\* I particularly liked the introduction to DI and DA philosophy given in the paragraph starting on line 37.

\* Equations (6)–(7) could perhaps be introduced in a better way. There is a lot of notation all at once, some of which is not referred to in the text. For example, it would be good to elaborate on what is meant by the superscript "a" for "analysis" (although this does become clear at the end of Section 2).

\* In the paragraph beginning on line 201, it would be beneficial to clarify how unforced boundary conditions are represented within the shallow water model. Forced boundaries are mentioned, but the implementation of unforced boundary conditions (for example in urban areas) is unclear. Are free-slip conditions used?

\* The statement on lines 274–275 claims that "results improved at all stations". However, there appears to be one exception at station 12, where the control simulation RMSE is 4.5 but the DA-EnSRF RMSE is 4.7. This should at least be mentioned and a sentence suggesting a reason for the anomaly would be beneficial.

### Technical corrections

There are a small number of typos and grammatical errors in the current manuscript:

\* Line 65: "been already" -> "already been"

\* Lines 70–76: Inconsistent notation "pa" vs "p\_a"

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- \* Line 222: "We run also several preliminary tests to empirically found the best cut-off distance for the local analysis" needs rewording.
- \* Lines 287–288: "using DA-Nudging resulted to be higher and slightly out of phase than the observations" needs rewording.
- \* Line 288: "interesting" -> "interestingly"
- \* Line 298: "composed by" -> "composed of"
- \* Line 312: "give" -> "gives"

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-61>, 2020.