Comments from Editor

Dear Shuqi,

I have had some additional reviewer comments for you to consider. Overall they are positive about the article and I believe the code is of practical use, however some confusing sections on **data assimilation and uncertainty** were identified that should be addressed prior to publication. In my view, it would be fine to **outline current limitations of the system and future potential** as suggested by the reviewer without impacting the rational to publish.

Cheers,

Jeff

Dear Jeff,

Thank you for the time and comments on our manuscript. In the revision, we have made some clarification about data assimilation and uncertainty (Please see the responses to reviewers and changes in the manuscript).

Best,

Shuqi and co-authors

Comments from Reviewer

I thank the authors for their revisions. The key revisions include the archiving of the code and the addition of a hot-start analysis. While most of my concerns have been addressed, I do have some feedback on the revisions and the revision letter

> **Reply:** Thank you for your time and comments. We made some modifications and clarifications according to your advice. Please see them bellow and in the revision.

1) The revision with track changed did not have the changes tracked so it was difficult to compare to the original document. Can they upload a version with track changes?

> **Reply:** We uploaded a version with track changes.

2) In the revision letter (Reply 6), the authors state "The hydrodynamic driver (AEM3D) is treated as a black box (as often done with OpenDA for calibration, (Baracchini et al., 2020a)), is available from Hydronumerics and could be replaced by any other executable hydrodynamic code". The idea that the executable could be replaced by "any" another executable suggests that the framework is very general. Other executables likely differ in the format of the input driver data. Does the code provided convert the format of weather forecast to the input format of "any other" model? What other steps would be required to get the forecasting system to work with "any other" executable?

> **Reply:** The code we provided here can automatically download the daily forecast and convert the necessary input variables into a .dat file for AEM3D. However, since the input format in different models varies, the user must convert these input files to the

required formats for their model if they are not going to use AEM3D. For example, we are using this approach with DELFT3D and AED-GLM.

We added some explanation in lines 216-218.

3) The authors seem to be slightly confused about "data assimilation". In the revision letter they state: "We cannot use data assimilation for model forecasting, because we do not have observations in the future to assimilate." This statement is repeated on Line 436 in the revisions and needs to be removed. You don't need data in the future for data assimilation – instead you take yesterday's forecast of today and today's observations to run an assimilation using today's data. This then sets the initial conditions (and parameters if they are included in the data assimilation) for a forecast that starts today. This forecast, observation, assimilate, and forecast cycle is done routinely in meteorological forecasting and does not require future observations. Also, since sequential assimilation only requires assimilating the new data, it is not as computationally intensive as the authors claim. Yes, re-calibrating a model using a long-time series of would be computationally intensive but that is not what is required for sequential data assimilation methods like the ensemble Kalman filter. Operational weather forecasting uses data assimilation for much larger models than here, so it is entirely feasible. Finally, why does data assimilation require modifying the source code? In the sentences following, the authors state that routines like OpenDA could be used without modifying the code. Overall, this section about data assimilation is muddled due confusion about what data assimilation means and how it can be used. I am not asking the authors to do data assimilation but they should not use an incorrect argument to justify why to not use data assimilation. It would be more useful to lay out a road

map for what would be required to use a sequential DA method (like the Ensemble Kalman

Filter) in their modeling framework.

> **Reply:** Thank you for clarifying our confusion about data assimilation. We were
>
> referring to the procedure of nudging hindcasts to match observations (e.g., NARR). We
>
> removed the statement about the computational requirement for data assimilation. In
>
> AEM3D, users are not able to easily modify restart files, which are in binary format,
>
> without access to and modification to the restart file read/write statements in the source
>
> code (aem3d_restart_v3_type.f90). That is why we cannot easily adjust the initial
>
> conditions via data assimilation. As we mentioned in lines 442-452, the road map could
>
> be using the tool like OpenDA, which has been applied to DELFT3D, to implement data
>
> assimilation.

4) The "The water level statistical metrics (RMSD and RE) were ensembled and averaged" is

confusing because the term ensemble in forecasting is often meant to represent a set of forecasts

of the same period that differ in initial conditions, parameters, weather inputs, etc. Perhaps

remove the word "ensemble."

> **Reply:** Thank you for correcting. We removed "ensemble" to avoid confusion.

5) The authors state "And the estimation of uncertainty has been included in the application of

forecast". This is confusing because uncertainty is not included in a particular forecast. Instead,

the uncertainty is in the distribution when different forecast data are combined. The manuscript

needs to clarify that uncertainty is in the evaluation statistic from combining forecast dates – not

actual uncertainty in an individual forecast.

Reply: Thank you for the suggestion. We clarify the term "uncertainty" in lines 155-157.