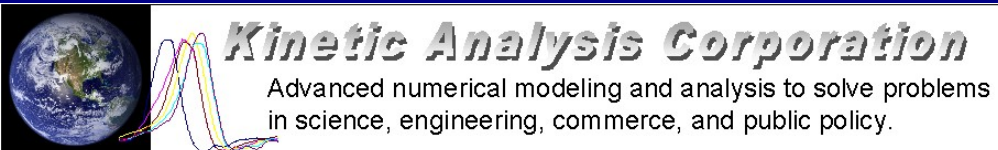


Comments on EFDC enhanced grid configuration for Savannah Harbor Expansion Project Analysis

Charles C. Watson Jr.
Kinetic Analysis Corporation



Introduction

Review of conclusions of 18 May 2005 report

Review of 21-23 Sept 2005 email discussions

Summary of remaining objections by KAC

- Model stability
- Marsh Depiction
- Extreme event modeling

Conclusions

Recommendations

Note: excerpts from 18 May 2005 report are in green.

Conclusions of UA (18 May 2005)

- 1) Enhanced Grid (ENHG) model was unable to complete the same suite of tests as the TMDL model due to the model runs aborting (crashing). “This restricted our ability to fully assess the uncertainty in the model in a similar fashion to the TMDL model. Therefore, KAC does not recommend the use of the ENHG model for primary decision making until such time as the source of the instability can be properly diagnosed, corrected, and a seven year run can be conducted.”
- 2) For the tests that were completed, the ENHG model demonstrated decreased uncertainty.
- 3) Further development work and validation were recommended, or at least an intense series of additional tests, “Otherwise, doubts will remain as to the stability of the model”.

Review of 21-23 Sep 05 emails

TetraTech (Tt) asserts the reason for the Dec 2000 crash was a result of a grid cell going dry. They assert that this is due to a rare set of circumstances (tides, flow rates) not encountered in the data sets being used to evaluate the project. The ENHG model does not handle wetting and drying primarily due to WASP linkage (the water quality model).

New concerns arose with respect to extreme event modeling (not in scope of UA).

While Tt did a good job within the time and resource restraints, KAC stands by 18 May report that model needs additional study before acceptance.

Summary of Major Concerns

Grid stability

KAC is concerned the Dec 2000 crash is a symptom of an underlying grid stability problem which may compromise the quality of the overall results.

Marsh Depiction

Uncertainty is highly dependent on tide phase. The lack of wetting and drying remains a concern. Marsh storage and release may not be as good as required.

Extreme event modeling (new concern)

The methodology used for extreme event modeling is potentially defective.

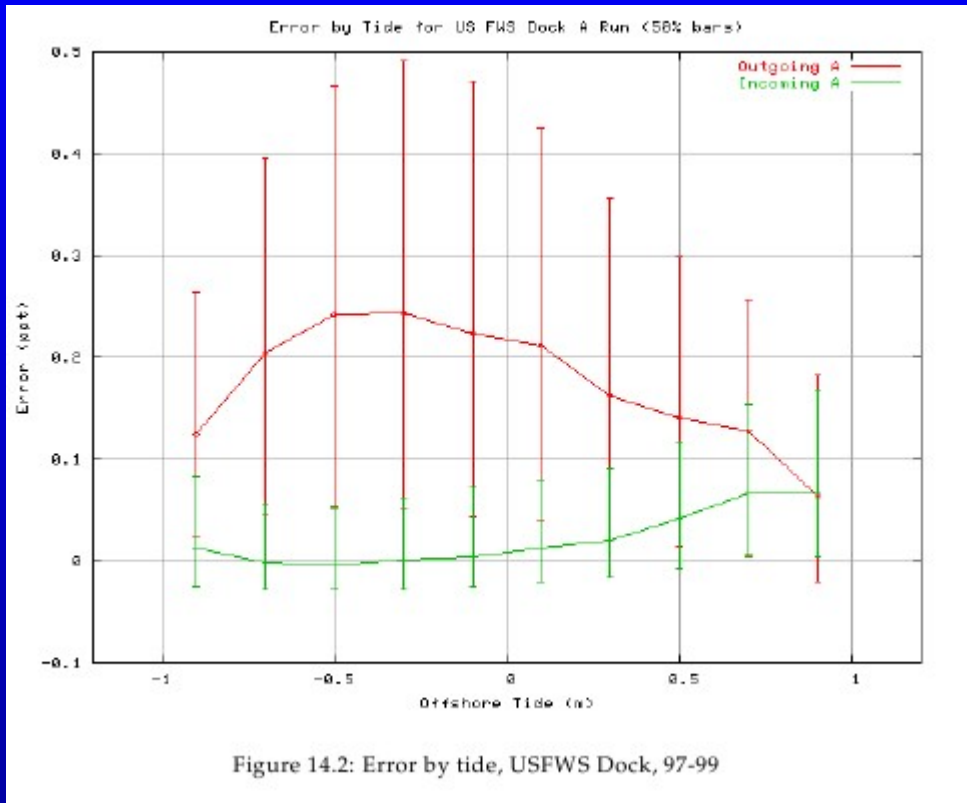
Stability

“Unlike the TMDL model, which was run with multiple, alternate scenarios to more fully assess the potential uncertainty in forecasts, the ENHG grid was only run operationally using the provided configuration. Tests were run with alternate configurations, however, some were stable while others were not. Therefore, these alternate scenarios were not analyzed.”

The stability issues may go beyond the Dec 2000 crash. A full UA could not be conducted on the ENHG model as was done on the TMDL model. Crashes occurred at other times, during low tide/low flow conditions. Note that these are considered critical from a water quality standpoint.

CFL diagnostics indicated marginal stability under low flows. Time did not permit further examination.

Marshes: Error by Tide Phase



The model error is highly dependent on tide phase.

Could indicate incomplete marsh depiction – storage and release, or the wetting and drying issue, or grid configuration.

“The graphs in chapter 14 contain plots showing error by phase of the tide cycle. It is interesting to note that the model has higher errors in the outgoing phase of the tide cycle than on the inbound phase. One potential source of this phenomena is marsh depiction and storage, although there are many other possibilities, including bottom roughness, channel geometry, bathymetry, and so forth.”

Extreme Event (Hurricane)

It used boundary forcing based on Hurricane Hugo tide gage readings at Charleston. Coastline configuration is different between Charleston Harbor and Savannah, and the surge hydrograph would be different. ENHG treats coastline as a vertical wall (no overland flow). Large surges in Savannah area result in significant overland flow, and a realistic impact assessment should include that aspect.

Even with physics problems, 0.5-1.0 ft is approximately same increase in surge seen with more sophisticated models for events producing a 15ft surge, and equates to several million in additional damage. For perspective, a 100 year storm (~18ft surge) would cause about a Billion in damage (April 2000 SEG presentation)

The Bottom Line

No model is ever perfect,

so,

Is the model of acceptable quality to answer the questions
being asked of it?

KAC Conclusions

For the purpose of basic modeling of the altered channel configuration on commonly encountered conditions of tides and flows, the ENHG model is *probably acceptable*, but in light of the importance of the model to decision making it should be subjected to a few additional test runs and a focused field data collection effort to ensure this conclusion.

For the purpose of modeling marsh succession, alternate sea level scenarios and uncommon combinations of tides and flows, the model *may be acceptable*, but marsh depiction and the lack of coupled wetting and drying may cause inaccurate results. Tests could confirm this.

For the purpose of modeling extreme events (hurricanes), the model and, more importantly, the methodology, are *clearly inadequate*.

KAC Recommendations

A focused, 3-4 month study including simulations and field data collection should be made to ensure the model is in fact acceptable for the purpose of conducting the majority of the required simulations (**originally suggested July 04, again in January 05**). Given the potential that the model will be acceptable, this could be conducted in parallel with ongoing work and should not impact the schedule. If alterations are needed, they can be directed towards scenarios most likely to be in error and would probably not result in significant delays.

The need for extreme event simulations should be re evaluated, given their low probability and already large consequences. From past work and experience the incremental impacts of the deepened channel will be small. If they are required, a different model should be used for that analysis that includes impacts over land.