We still (probably) have a mass balance issue

After some many odd months, I found CGEM-SA only **blew up** when I turned on sinking, and only because of unexpected (to me) anomalies in the data.

However

- Without outgoing BC's, we *expect* buildup at the boundaries.
- With realistic hydro, we *expect* extreme upwelling events. (Yes?)
- SCHISM itself is expected to have perfect mass balance, therefore we *expect* mass balance even in storm surge and hurricane conditions. (Unless the SCHISM manual warns otherwise?)
- It's possible that numerical instability (from buildup *plus* high velocities) is the sole driver of the imbalance, but I need to assume that's not likely.

Thus: CGEM-SCHISM coupling still needs work.

First, allow me to address the other elephant in the room…

Everyone here has written code or a script

When you write a new script, how long does it take?

How long until it generally works without crashing?

How long to confirm it does the task correctly for all possible inputs?

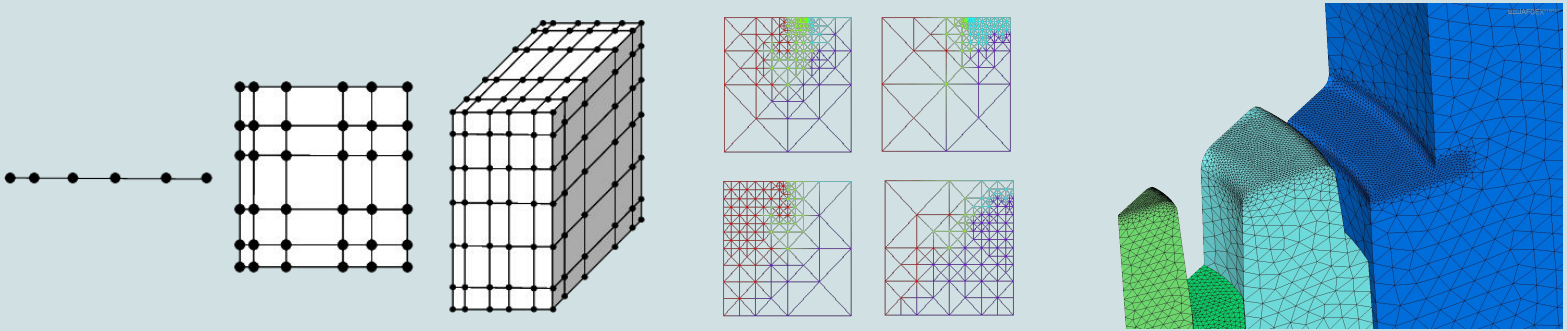
…and when it's done…

How much do you **dare modify it** before **rerunning** to check if your changes broke anything?

Now: Port your 1D script to a 3D script

Your script does calculations on a 1D vector. It needs to work on a 3D array.

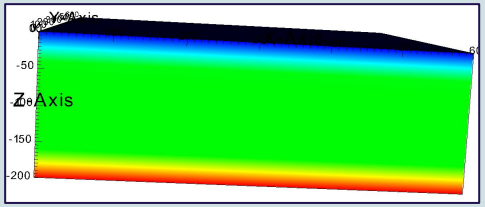
Should be easy right? The algorithm works. Why should it be harder to test just because it is a different ‘grid’?



Your script does calculations based on someone else’s data. They need to provide you with that data, and you need to work with whatever they provide...

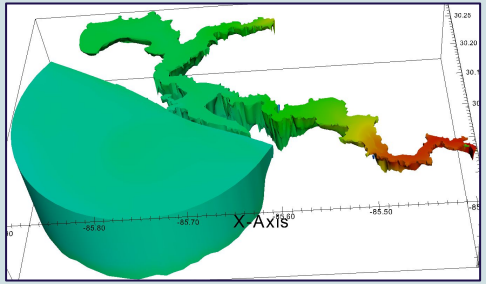
Back to me…

It took months to develop scripts just to efficiently look at simple plots of data from the **Box** model. I actually pushed changes to *developer code* for the SCHISM VisIt plugin to get it to work on a Mac, and had to write instructions for hacking CMake to get the Linux version to work.



The next **smallest dataset available** for testing was a **Bay**:

- The shortest, meaningful computational test takes over an hour to run and analyze on a national supercomputing resource.
- It takes two days to run and analyze a full year model run.
- **(Recall**…didn't you rerun that script after every small change?)
- The data is too large to analyze on a local computer, and remote visualization is often slow with severe lag time; in addition to being very time consuming, it's extremely frustrating.



And: My FTE on this project is 6.5 months *over the entire 5 years*.

This was an impossible task

Running a model

You-all run *established, well tested models*. You don't worry about bugs in SCHISM or ROMS or SWAT. The test is whether model data matches measured data.

Writing a model

I'm writing a new model. Initial tests are mass balance, convergence, numerical accuracy and stability, rogue factors of 2, integer divides, and just plain, dumb, typos.

When writing a fluid dynamics code, you don't go from the 1D shock wave to a supernova explosion. Luckily, CGEM is not relativistic magnetohydrodynamics, but the basic principles of testing are the same: You never go from a ***Box*** *to a* ***Bay****.*

This was clearly a communication issue which I'll take responsibility for.

Maybe part of me likes the idea of accomplishing an impossible task...

What Now?

Apologies for my failure to communicate. Here is a plan and a suggestion.

Me

- I am writing new CGEM code to go from a column to a cell and to track CNP instead of stoichiometry. I can't spend time on the old code, even given a smaller grid.
- I will test the new code on Box, Toy-Hybrid, and a preliminary run with SA, to confirm it gives the same results, this time expecting problems with high sinking rates.

You-all (?)

- I sense pressure to produce DO2 model results. If so, please use COSINE.
- Take care to design modular and reusable scripts; the processes to create and analyze data are the same - only names, file paths, and maybe a few unit conversions will change.

What Next?

To deliver CGEM-SCHISM with full confidence it should work for your purposes, **I need a testing grid with:**

- LSC2 hybrid coordinates, if that's what you are ultimately using
- Wetting and drying, elevation changes
- Movement, but 'expected' movement: fast flow is expected from rivers but not from outer boundaries; no singularities or vortices*****
- Negative/zero temperatures might cause problems*****
- *****It can have weird crap, but just please warn me about it
- Solar/wind forcing is desirable but not strictly necessary
- **Full year run with double-precision CGEM in ~5 hrs or less.** Less is better.

Baby steps are preferable. Mass imbalance likely correlated to properly handling change in volume. I can test most kinks if the next grid is:

- LSC2 hybrid coordinates, no wetting or drying, main difference from the Toy being changing elevation, **runs full year CGEM in 30 minutes or less**.

I will rewrite and test CGEM, and I'm behind in other projects; no hurry for the new grid.