Forecast Ecosystem Conditions in Gulf of Mexico OCS Habitats
Using Coupled Modeling and Climate Scenarios

Quarterly Report (Y7Q1 – Oct 1-Dec 31, 2022)
Jan 21, 2023

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This quarterly report is filed per requirements of BOEM-NRL IAA # M16PG00027 with respect to our research project focused on climate-scale ocean model simulations for the Gulf of Mexico. The focus of this study is to forecast, through year 2050, marine ecosystem conditions in the Gulf of Mexico (GoM) using RCP climate scenarios prescribed by the NCAR CESM Large Ensemble (LE) atmospheric forcing.

1. WORK ACCOMPLISHED

Completed and validated experiment 80.8, the production 1990-2020 baseline simulation. To speed run-time and processing, model output frequency was changed to daily and the biological coupling was discarded. All post processing was completed, generating transports, surface fluxes, monthly means of all variables and daily means of sea surface height. Mixed Layer Depth was computed for HYCOM and GLORYS as well. The results were interpolated to z-depths and disseminated in the form of netcdf files. HYCOM codes were upgraded to the latest version (2.3) and all issues with experiment 80.5 were fixed, including the computation of transports at the boundaries, which, to be accurate and in balance, had to be computed from layer-space files instead of pressure-level files. NCAR followed with the extensive assessment of this baseline experiment, which resulted in the preparation and completion of two manuscripts which were submitted to Ocean Modeling and JGR-Oceans.

Four new ensemble-member projection simulations were submitted. Previous attempts were discarded because an improved approach to superimpose climate trends on forcing fields was devised and the simulations were extended to start in 1990 instead of 2020. Both of these were major improvements and justified in terms of time and expense incurred.

2. PROBLEMS

With the amounts of data being generated, inefficiencies due to big data management and system security nuances were expected, but now that long-term simulations are being completed, it is calculated that a 60+ year simulation takes ~3 months from start to output-dissemination. This is due to normal system loads, but also the time it takes to post-process and transfer the data from HPC machines where the model runs to local servers and then to public-facing servers. A 3-step process that with O(terabytes) of data is expensive.

3. PLANNED ACTIONS FOR NEXT QUARTER

Continue work on projection simulations, focusing on validating the first one as it completes and completing as many as possible (2-4 simulations per quarter is the goal).

4. BUDGET

       The project amount of $390K+$132K has been received in full.
       Expenditures to date: ~$454K; NCAR subcontract accrued at $141K.