

**SECOORA - Partnering to meet the needs of coastal communities for actionable information to protect lives and property:**

## **Regional-Scale Numerical Modeling**

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**&**  
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# Overview of the Project

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The primary goal of our project is to support all three SECOORA theme areas by developing 1) a data assimilative prediction capability, and 2) a near-real time nowcast/forecast for regional-scale marine environment conditions.

The resulting capability to model and predict the transport of heat, salt, organisms, nutrients, and pollutants bears materially upon SECOORA's ability to address important scientific and societal issues related to i) *Coastal Hazards and Climate Variability*, ii) *Ecosystems (both living marine resources and water quality)*, and iii) *safe and efficient Marine Operations*.

# Accomplishments

1993-2020 Ocean Reanalysis ( 4 km horizontal resolution, 50 vertical layers)

$$\mathbf{x}^a = \mathbf{x}^f + \mathbf{B}\mathbf{H}^T [\mathbf{H}\mathbf{B}\mathbf{H}^T + \mathbf{R}]^{-1} [\mathbf{y} - \mathcal{H}(\overline{\mathbf{x}}^f)],$$

$$\mathbf{B} \equiv \mathbf{A}\mathbf{A}^T [(\mathbf{m} - \mathbf{1})]^{-1},$$

“Kalman Gain”

$\mathbf{x}^a$  and  $\mathbf{x}^f$  are DA analysis and model forecast state variables, respectively  
 $\mathbf{x}(\eta, T, S, U, V, \bar{u}, \bar{v})$

$\mathbf{y}$ : observations ( $\eta, T, S, U, V$ );

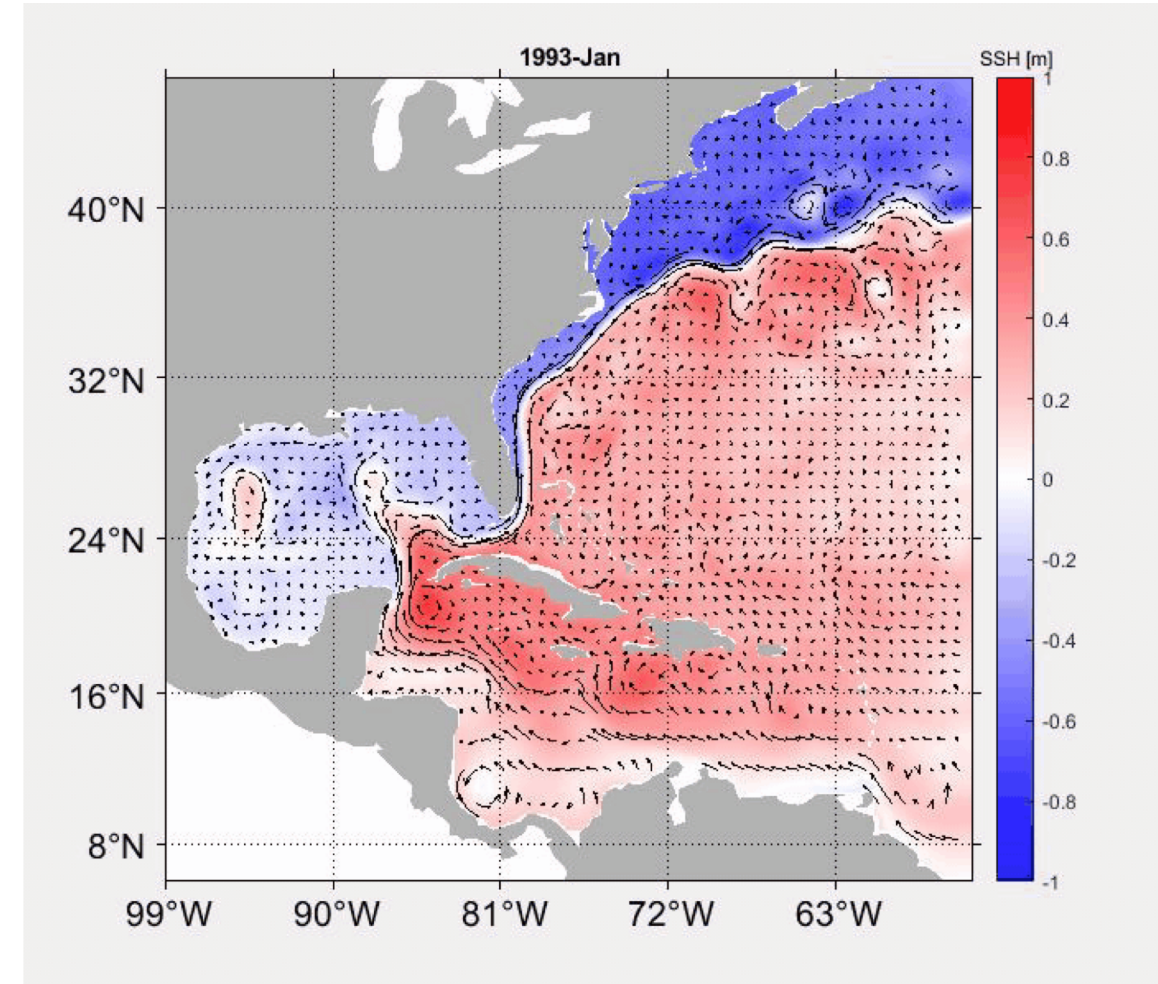
$\mathbf{H}$ : the observation sampling operator;

$\mathbf{B}$ : background error covariance;

$\mathbf{A}$ : ensemble anomalies

155 ensemble members running with perturbed initial conditions  $\rightarrow \mathbf{B}$

$\mathbf{R}$ : observation error covariance



# Challenges

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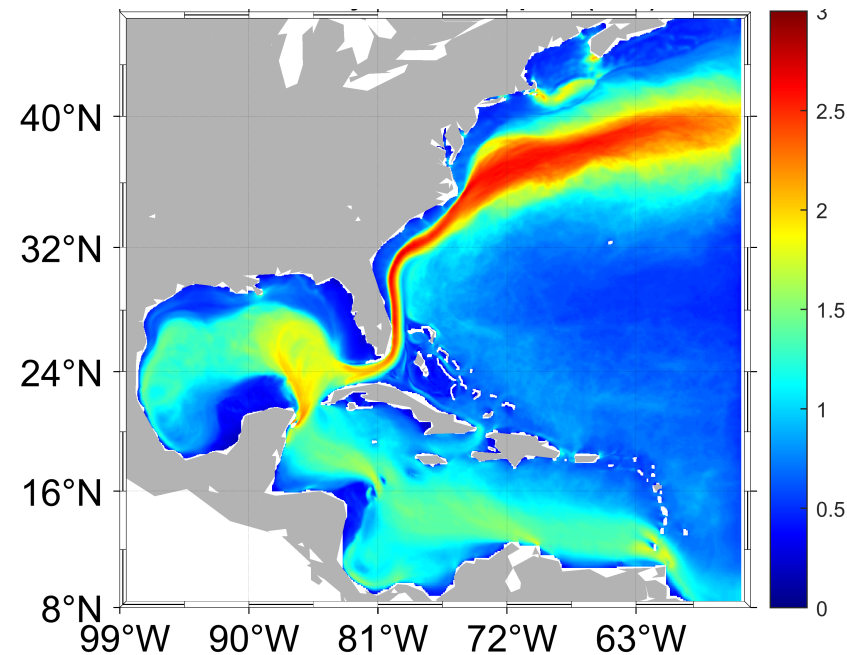
We investigated the possibility of transitioning the CNAPS modeling system to the Amazon Web Service (AWS) cloud environment. We had hoped that this would reduce CNAPS system downtime related to hardware failures of our aging local computing system.

However, **we found that AWS was not as cost-effective as we had thought to achieve our project objectives.** More investigations on other clouding computing providers and services are needed.



# Looking Ahead

the top 1% speeds at each grid point are extracted as the peak speeds



## Specific Questions and publications being worked on:

- Sea level change
- Extreme conditions (e.g., current as shown in the left figure)
- Marine heat wave and ocean heat content
- **SECOORA webinar on 6/21, noon EST**
- Biogeochemical reanalysis for 1993-2020

**We continue to conduct the quasi-operational CNAPS nowcast /forecast to deliver critical marine information to support SECOORA efforts in addressing**

- coastal hazards (e.g., storms),
- water quality (e.g., oil spills, harmful algal blooms)
- marine operations (e.g. navigation, fisheries).