Predicting the Long-Distance Larval Dispersal in the Intra-Americas Sea

A Data-Assimilative Decision Support Tool for Effective Living Marine Resource Management

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Bonefish & Tarpon Trust

powered by

NASA Ecological Forecasting Award: 80NSSC21K1471

Research Team

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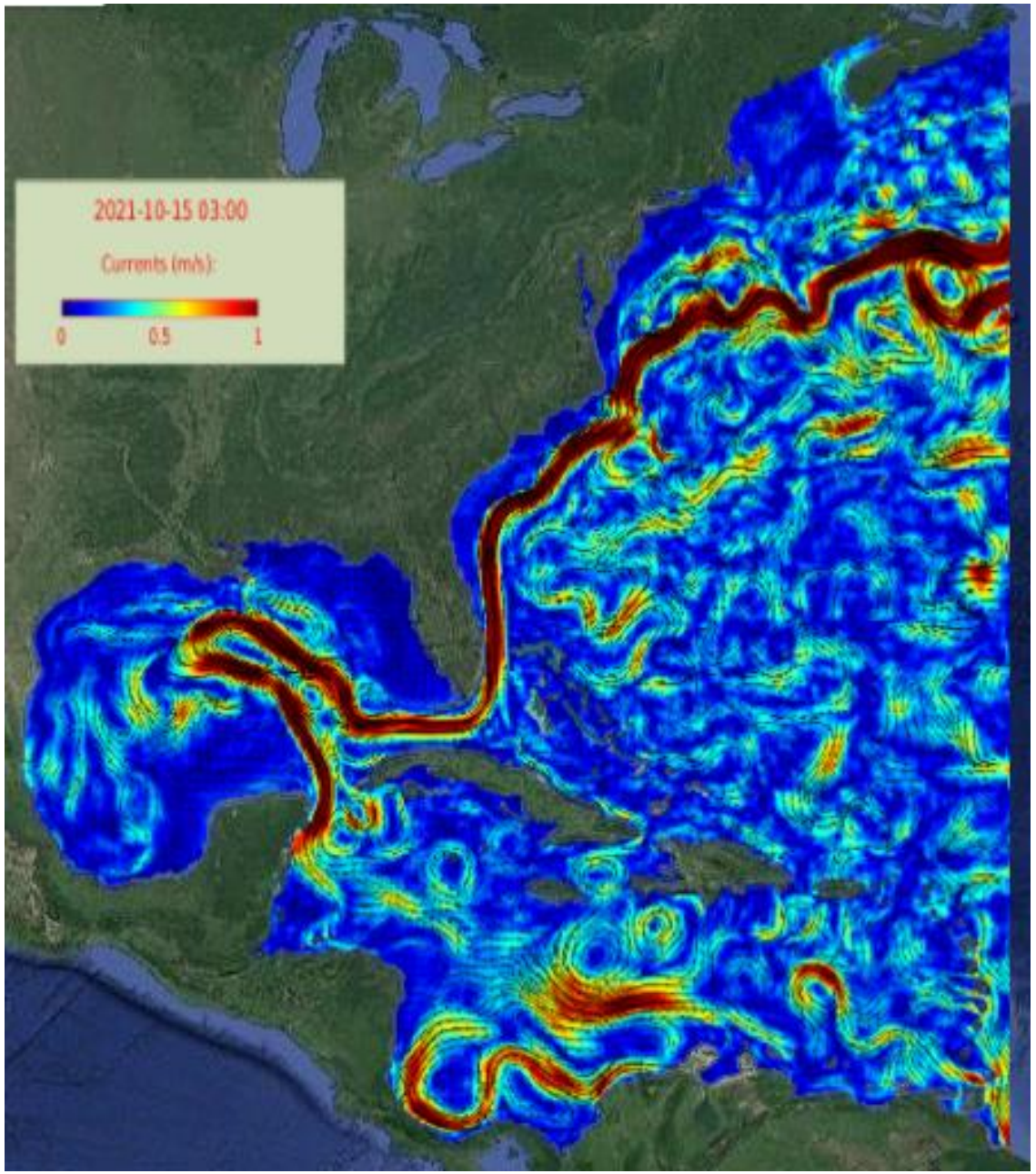
Research Area



Research Goals

1) Tracking larval transport for bonefish, tarpon, and permit from known spawning sites.

2) Investigating the effects of seasonal and interannual changes in oceanographic dynamics on larval transport.

3) Predicting the effect of high-impact weather events on larval transport, including tropical storms/hurricanes and winter extratropical storm /cold fronts

4) Forecasting how ocean circulation may change with global warming and how this could change larval transport patterns, thus impacting existing populations.

Existing ocean/climate datasets are insufficient in space and time resolutions

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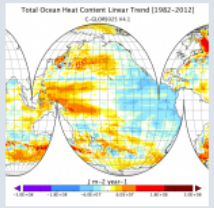


CMCC Global Ocean Reanalysis System (C-GLORS)

Years of Record: 1982/01 to 2013/12

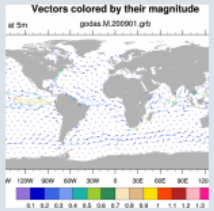
"The CMCC Global Ocean Physical Reanalysis System (C-GLORS) is used to simulate the state of the o... consists of a variational data assimilation system (OceanVar), capable of assimilating all in... data, and a forecast step...

Main variables and Earth System components:

Ocean | Ocean Heat Content | SST - sea surface temperature | Salinity | Sub ... Salinity | Sub Surfac... depth | sea surface height | u, v current components

Formats: netCDF **Timestep:** Daily,Monthly,Weekly **Domain:** Global

See Expert Guidance by Storto, Andrea



GODAS: NCEP Global Ocean Data Assimilation System

Years of Record: 2016/01 to 2016/12

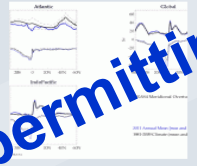
GODAS is a real-time ocean analysis and a reanalysis. It is used for monitoring, retrospective analysis as initial conditions for the CFS. Both temperature and synthetic salinity profiles are assimilated in a 3DVAR ... 2007, altimetry sea level...

Main variables and Earth System components:

Ocean | 3D Velocity | SST - sea surface temperature | Salinity | heat flux | isothermal layer depth | mixed l... temperature | salt flux | sea surface height

Formats: netCDF | GRIB **Timestep:** Monthly,Pentad **Domain:** Global

~1/4 degree, eddy-permitting



ORAS4: ECMWF Ocean Reanalysis and derived ocean heat content

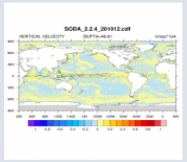
Years of Record: 1958/01 to 2013/04

ECMWF's current ocean reanalysis uses a sophisticated data assimilation methodology which includes a model bias correction. The ocean model used is forced by atmospheric daily surface fluxes, relaxed to SST and bias corrected. The Balmaseda et al (QJRMS 2013) reference provides excellent peer...

Main variables and Earth System components:

Ocean | Ocean Heat Content | Salinity | Sea Level | potential temperature | u, v current components

Formats: netCDF | ascii **Timestep:** Monthly **Domain:** Global



SODA: Simple Ocean Data Assimilation

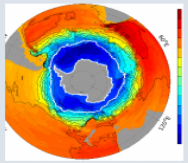
Years of Record: 1869/12 to 2010/12

The Simple Ocean Data Assimilation, or SODA, analysis is an ocean reanalysis data set consisting of gridded variables for the global ocean, as well as several derived fields. The goal is to provide an improved estimate of ocean state from those based solely on observations or numerical simulations.

Main variables and Earth System components:

Ocean | 3D Velocity | SST - sea surface temperature | Salinity | potential temperature | sea surface height | u, v current components | wind stress

Formats: netCDF **Timestep:** Monthly **Domain:** Global



Southern Ocean State Estimate (SOSE)

Years of Record: 2005/01 to 2010/12

The Southern Ocean State Estimate (SOSE) is a model-generated best fit to Southern Ocean observations. As such, it provides a quantitatively useful climatology of the mean-state of the Southern Ocean. Technically, SOSE is a solution to the MITgcm. SOSE is a gridded dataset at 1/6...

Main variables and Earth System components:

Ocean | 3D Velocity | Bottom pressure | SST - sea surface temperature | Salinity | Sub Surface Temperature | mixed layer depth | sea surface height | u, v current components | wind stress

Formats: binary **Timestep:** Daily,Monthly,Weekly,Annual **Domain:** Antarctic, SH - Southern Hemisphere, Southern Ocean

See Expert Guidance by Mazloff, Matthew

Global Ocean Physics Reanalysis

GLOBAL_MULTIYEAR_PHY_001_030

Metadata provided by CMEMS

Credits: E.U. Copernicus Marine Service Information

Copernicus Europe's eyes on Earth | Copernicus Marine Service

1/12 degree, eddy-resolving

INFORMATION | DOCUMENTATION | DATA ACCESS | NOTIFICATIONS

PRODUCT IDENTIFIER

GLOBAL_MULTIYEAR_PHY_001_030

OVERVIEW

Short description:

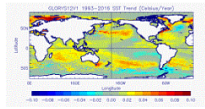
The GLORYS12V1 product is the CMEMS global ocean eddy-resolving (1/12° horizontal resolution, 50 vertical levels) reanalysis covering the altimetry (1993 onward).

It is based largely on the current real-time global forecasting CMEMS system. The model

GEOGRAPHICAL COVERAGE

90

-180



HYCOM

Consortium for Data Assimilative Modeling

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GOFS 3.1: 41-layer HYCOM + NCODA Global 1/12° Reanalysis

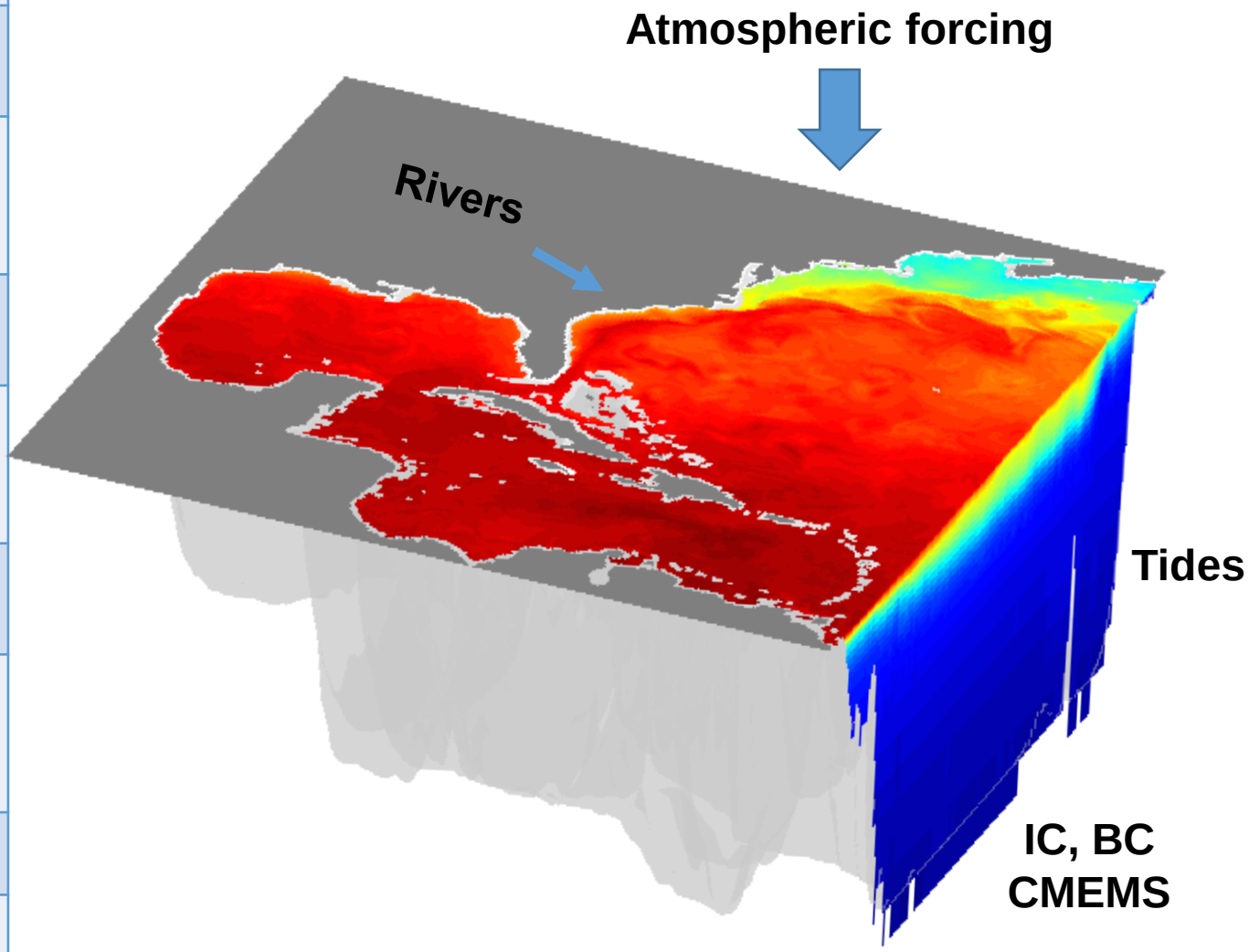
ACCESS DATA HERE **Need support?** Email forum@hycom.org

Title:	Global Ocean Forecasting System (GOFS) 3.1 output on the GLBv0.08 grid
Resolution:	0.08° resolution between 40°S and 40°N, 0.04° poleward of these latitudes
Institution:	Naval Research Laboratory: Ocean Dynamics and Prediction Branch
Date/Data Range:	1994-01-01 to 2015-12-31 [missing data]

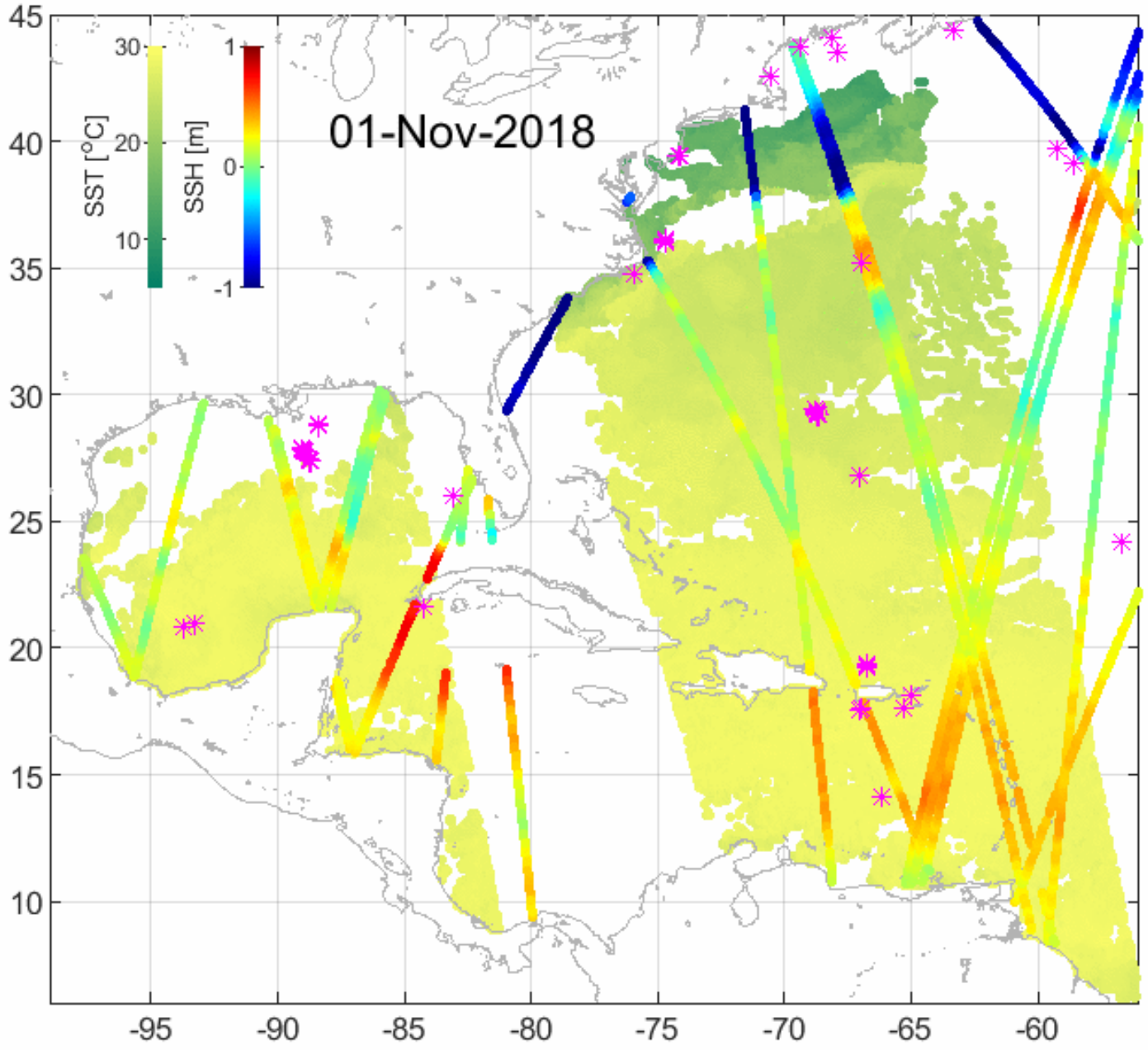
- Datasets
  - GLBy0.08
    - expt_93.0 ←
  - GLBv0.08
    - expt_93.0
    - expt_92.9
    - expt_57.7
    - expt_92.8
    - expt_57.2
    - expt_56.3
    - expt_53.X

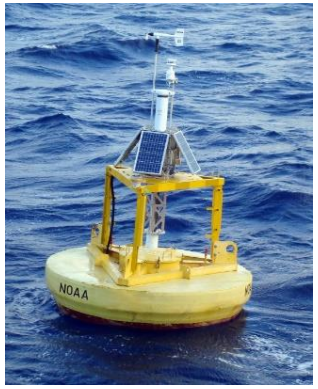
Developing a Northwest Atlantic Ocean Reanalysis (NWA-OR) System

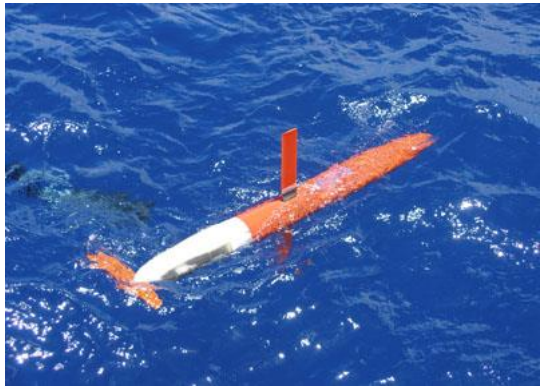
Model	Regional Ocean Modeling System (ROMS)
Horizontal resolution	4 km
Vertical resolution	50 vertical layers, with high resolution towards surface and bottom boundary layers
Surface forcing	ECMWF ERA 5
Open boundary forcing	1/12 degree CMEMS GLORYS
Tidal forcing	OSU TPXO tide model, 10 major tidal constitutes were considered
River forcing	120 rivers (US rivers are from National Water Model, rivers in other nations are set as climatology
Time span	January 1993 – June 2021
Output frequency	Daily



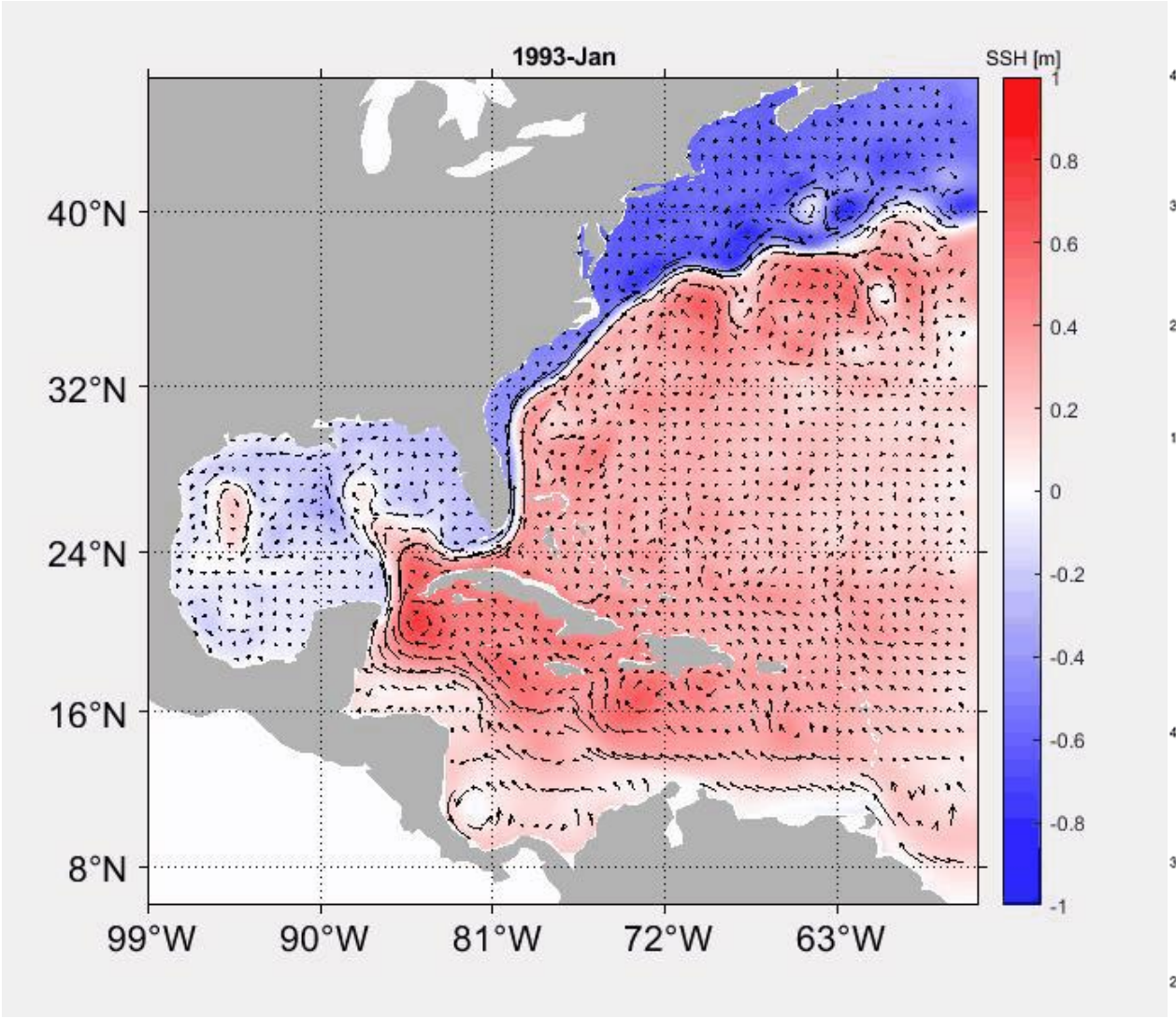
NAW-OR assimilates both satellite (SSH, SST) and in situ observations



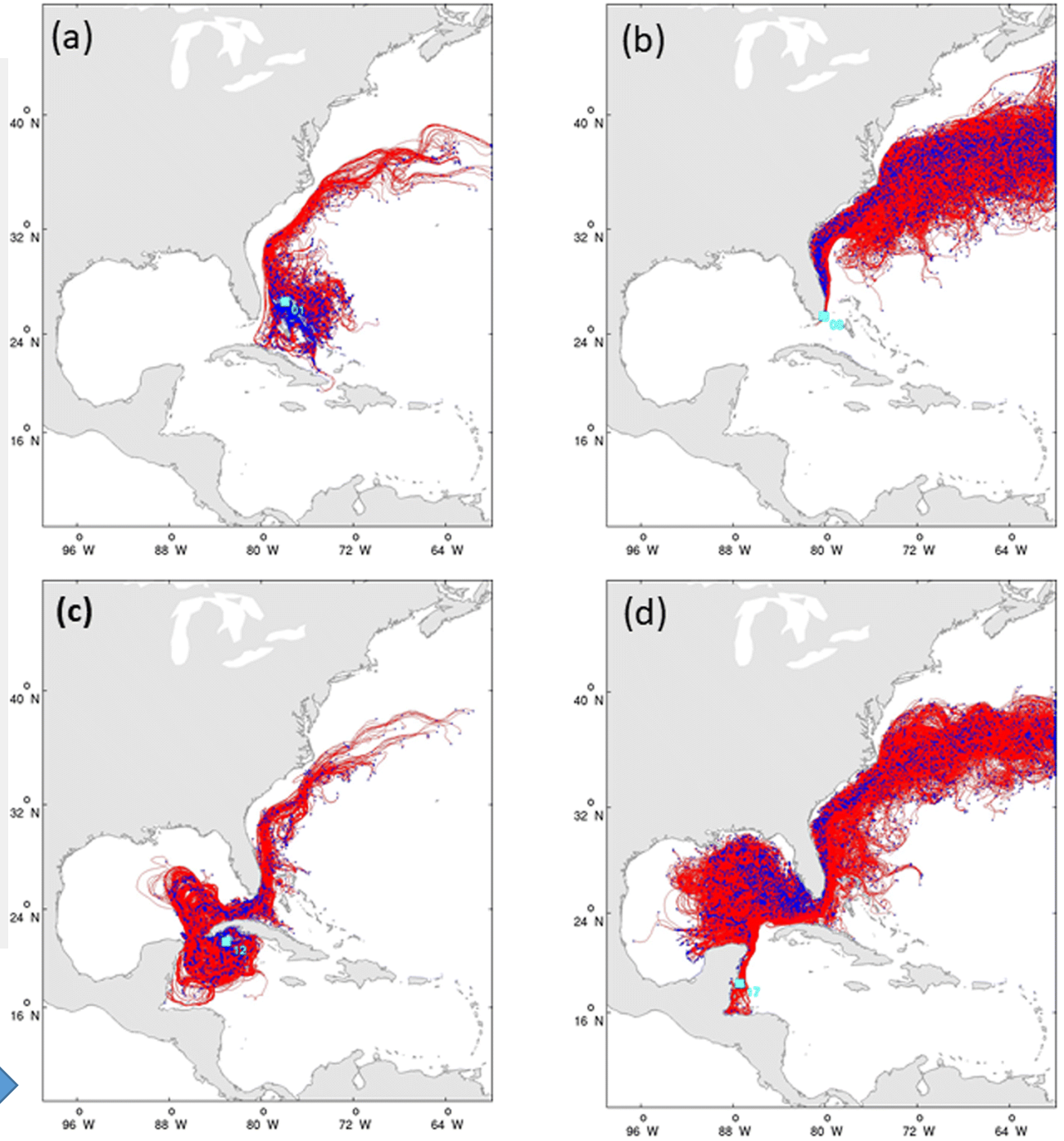




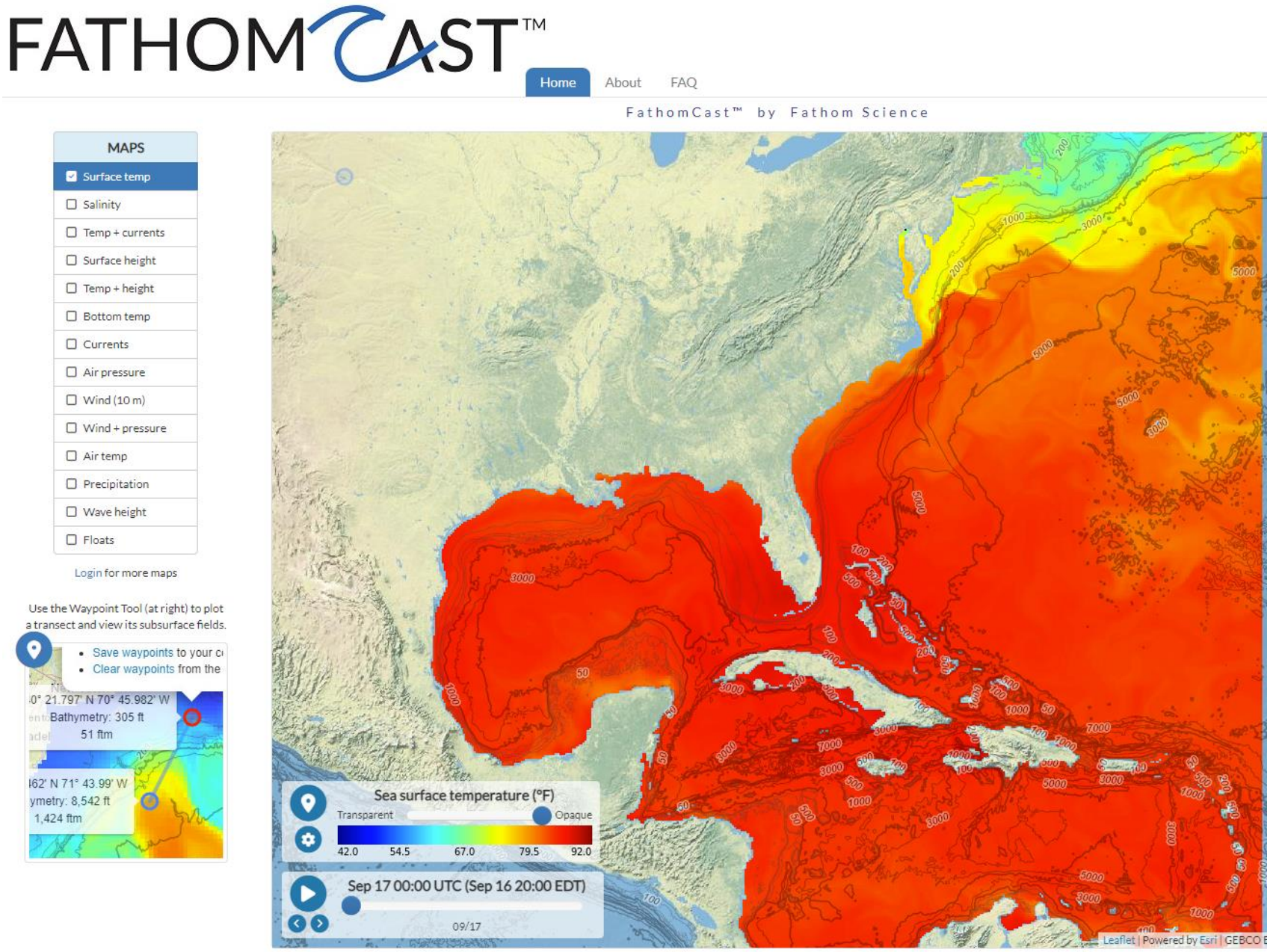
NWAC Ocean Reanalysis (1993-2021)



Larval transport modeling combining hydrodynamics and biological behaviors to quantify connectivity and explore marine resource management scenarios.



Online mapping tool



End Users

- Research scientists
- Resource managers
- Stakeholders (fishers)
- …

Engagement platforms

- Direct interaction
- Public forums
- Workshops
- …

The International Bonefish & Tarpon Trust Science Symposium November 4-5, 2022

The Gulf and Caribbean Fisheries Institute conference, 2023

Summary: Progress-to-date

- A new high-resolution (4 km), daily Northwest Atlantic Ocean Reanalysis (NWA-OR) was generated for 1993-2021.

- NWA-OR can also be used to support other climate change studies and Blue Economy development
  - ✓ Sea level change
  - ✓ Marine heat waves
  - ✓ Marine fishery & ecosystem variability
  - ✓ Resource assessment
  - ✓ Extreme values analysis
  - ✓ …

- Developing and implementing NWA larval transport modeling and online interactive tools.

- Engaging end users for applications and R2O implementation.

Thank you!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http://go.ncsu.edu/oomg


919-513-0249

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