

# **NOAA Ocean Forecast Systems (OFS)**

(compiled by Alexander Kurapov,  
with contributions from

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## **NOAA ocean prediction enterprise:**

- Organization changes, ocean group consolidation efforts (global: NWS, coastal: NOS)
- Modeling infrastructure frameworks:
  - Focus on Unified Forecast System (UFS) framework  
“The foundation of the framework is a library of coupled numerical models that simulate the Earth’s physical processes” (<https://ufs.epic.noaa.gov/about/>)
  - JEDI (Joint Effort in Data Assimilation)
    - Modern languages / software architecture / “workflows”...
    - Software developers and ocean modelers separated (less opportunity to contribute to community code development)

## RTOFS: global Real-Time Ocean Forecast System

NOAA NWS/NCEP

- HYCOM
- Horizontal resolution: 1/12 degree
- Forecast horizon: 8 days
- Data assimilation: 3DVAR (satellite, in-situ for the ocean and sea ice)
- Coupled with CICE (version 4)
- Atmospheric forcing: NOAA GFS

Updates planned:

- Transition to MOM6, CICE6
- Coupling within UFS framework
- JEDI DA

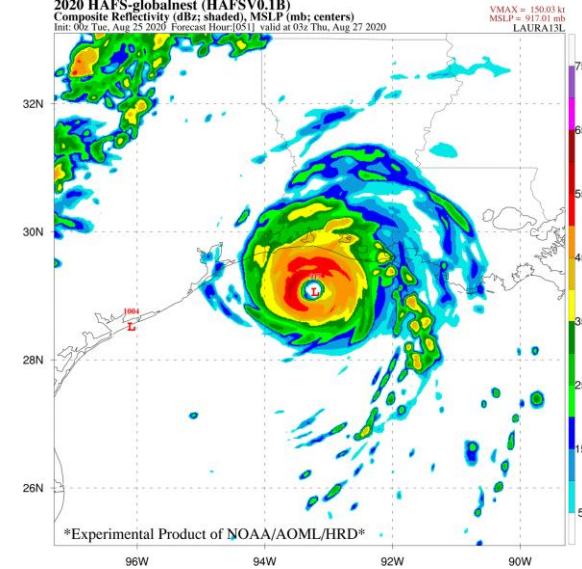
# Hurricane Analysis and Forecast System (HAFS)

Developed by AOML Hurricane Modeling group  
Transition to operations: 2023

- Coupled ocean-atmosphere model, UFS Framework
- High resolution HYCOM & MOM6; 1-13 km resolution nested mesh, finer mesh tracks-the tropical cyclone system
- GFS (FV3)
- Data assimilation for GFS (atmosphere)
- Ocean initial conditions from RTOFS

<https://www.aoml.noaa.gov/hurricane-modeling-prediction/#hafs>

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## **GFS-Wave: operational global wave model (NWS / NCEP / EMC)**

- Wavewatch III (Tolman et al.)
- Forced by GFS forecasts
- Three native grids: (Arctic Polar, Global Core, Southern Ocean)

### Postprocessed grids:

- West Coast, Eastern Pacific, Atlantic Ocean: 0.16deg resolution
- Global grid: 0.25 deg of resolution.

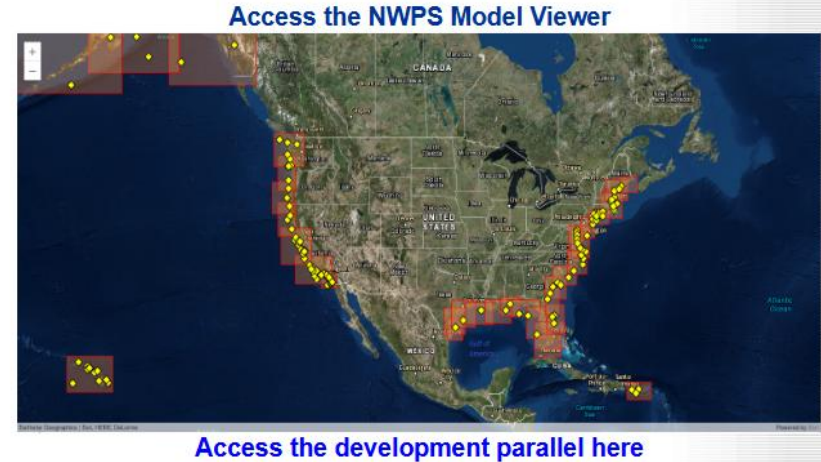
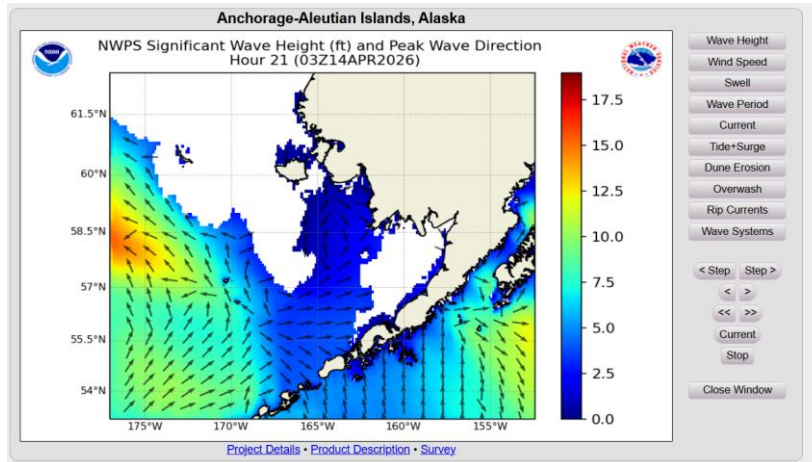
Forecast horizon: 16 days (hourly / 3-hourly)

## **Global Ensemble Forecast System: (NWS / NCEP / EMC)**

- Current operational global model for Medium Range Weather/subseasonal to seasonal forecasts
- Forecast horizon: 35 days
- Model resolution: 25 km
- Ens size 31
- Coupling with waves and aerosol

# Nearshore Wave Prediction System (<https://polar.ncep.noaa.gov/nwps/>)

- High resolution, on demand
- SWAN
- Wavewatch III boundary conditions
- Wave-current interactions: using RTOFS
- Tidal info...
- Will be replaced by the “Regional Wave Prediction System”... UFS ... AI ... DA ...



## NOAA National Ocean Service (NOS) Efforts

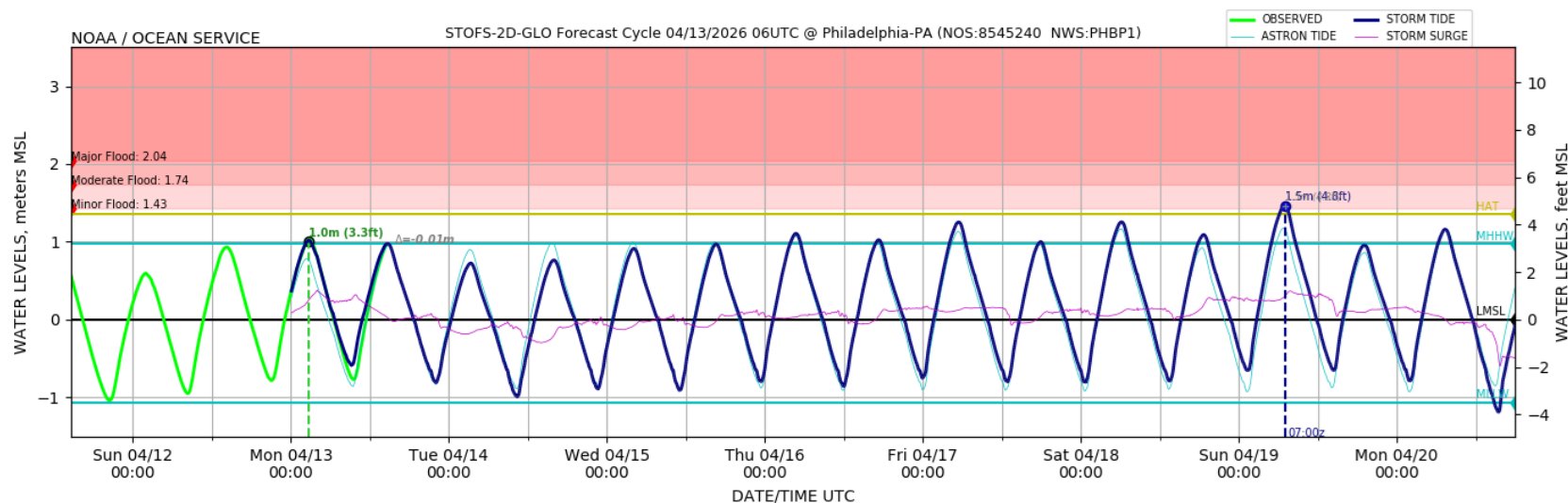
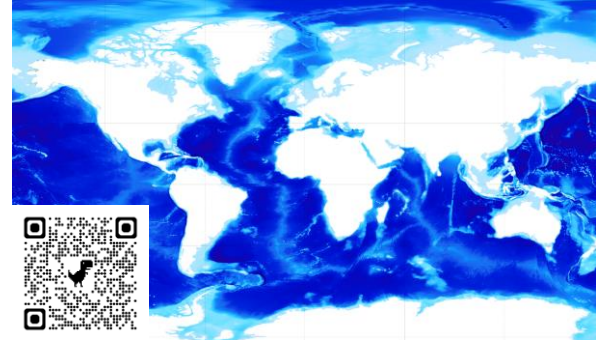
NOS mandate is navigation:

- Tides (sea level, currents: navigational channels)
- Storm Surge
- Total sea level
- Compound floods
- Estuary and shelf currents, T, S
- Regional ocean data assimilation systems
  
- WHO connection: S-100 projects (add environmental info into navigational charts)
  
- Environmental hazard response, search & rescue guidance

# STOFS-2D Global

## Storm Surge and Tide Operational Forecast

- ADCIRC, 2D
- Collaboration: U. Notre Dame (J. Westerink et al.) and NOS

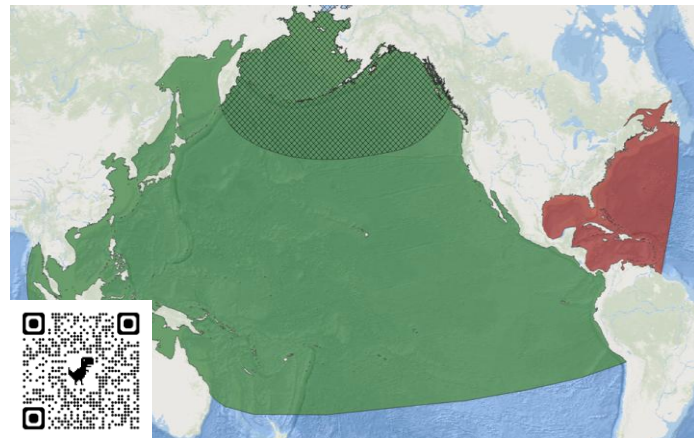


<https://polar.ncep.noaa.gov/estofs/global/index.htm>

## Operational STOFS-3D-Atlantic

### Preoperational STOFS-3D-Pacific

- NOS Storm Surge Group (Moghimi et al.) & VIMS (J. Zhang)
- SCHISM, 1-10 km resolution, triangular mesh, river channels
- Focus on coastal sea level (tides + storm surge + **non-tidal shelf dynamics**)



- + Multiple OFS focussing on tidal levels and currents in small domains: Chesapeake Bay, Cook Inlet, Delaware Bay, Columbia River estuary, NY Bay, etc.

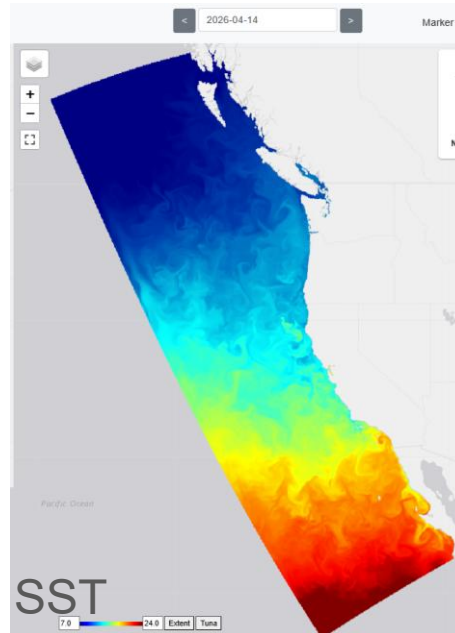
## Regional data assimilative OFS

- Operational: West Coast (WCOFS, NOS, Kurapov et al.)
- R&D: East Coast Community (ECCOFS): NOS + Rutgers U. + UCSC + Fathom Inc.

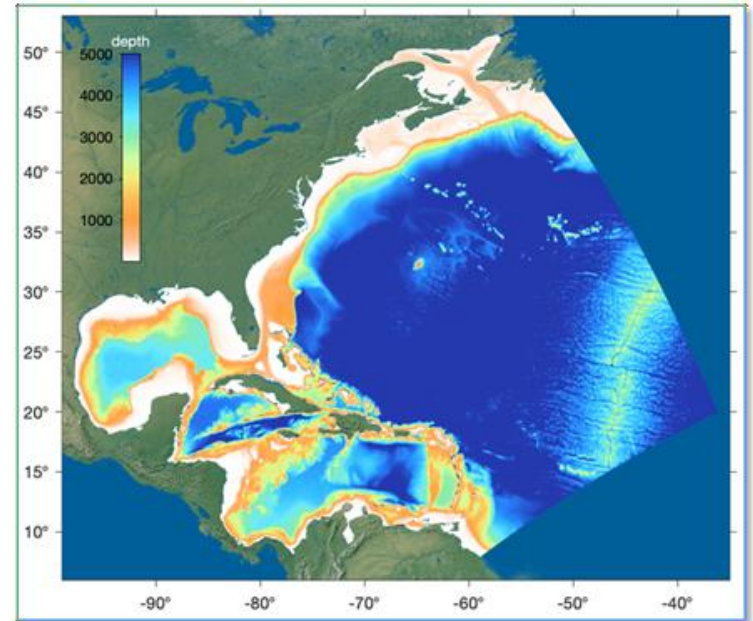
WCOFS: 4-km  
ECCOFS: 3km forecasts,  
6 km assimilation

ROMS 4DVAR (Moore et al.), 3-5 day forecasts

- Shelf currents, SST fronts, etc.
- (navigation, fisheries)

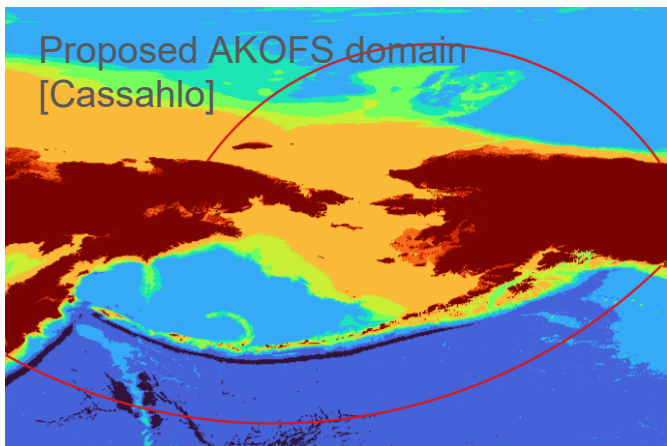


*(GloFAS, MERCATOR boundary forcing)*



## Alaska OFS: in development

- SCHISM + CICE6, UFS-Coastal coupling
- 0.5-2 km resolution
- Storm surge, ice and currents for navigation
- (waves: TBA)
- Tests for Bering Sea (Joey Smith, Scott Durski at OSU, Ufuk Turuncoglu - UFS Coastal team)



## Shelf averaged ice fraction:

