

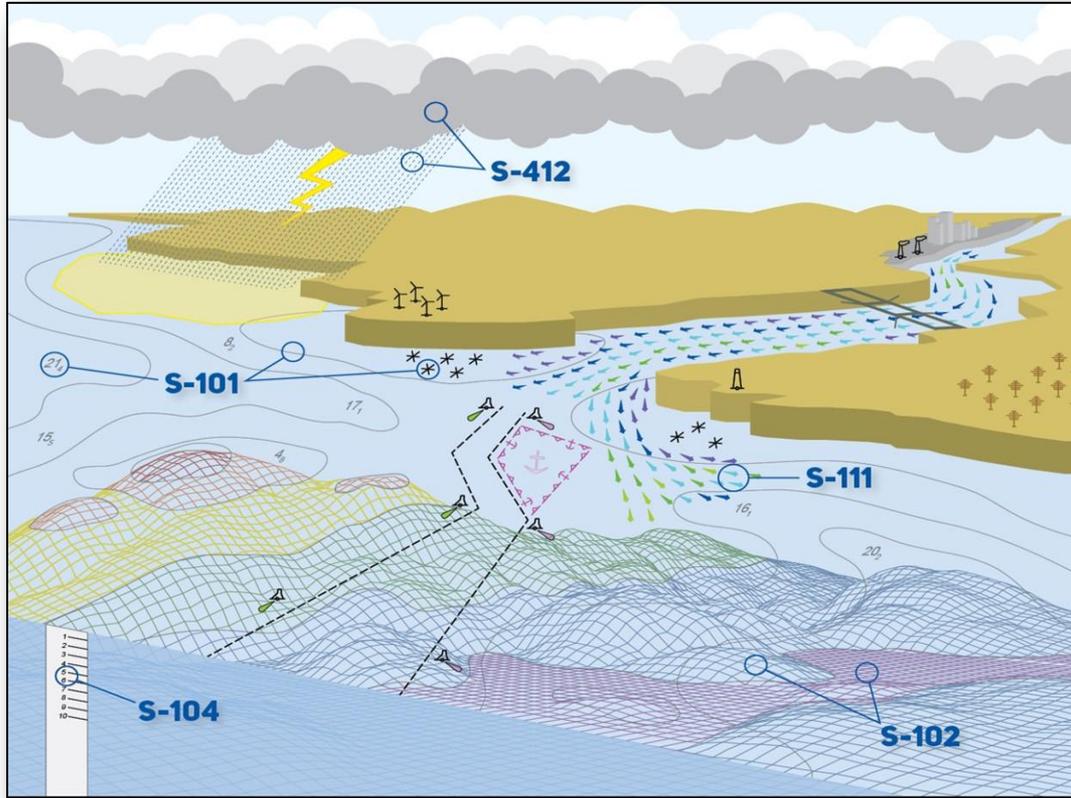
Enhancing Maritime Navigation with S-104 & S-111

Water Levels and Surface Currents
Presented by: John Kluge - NOAA Affiliate

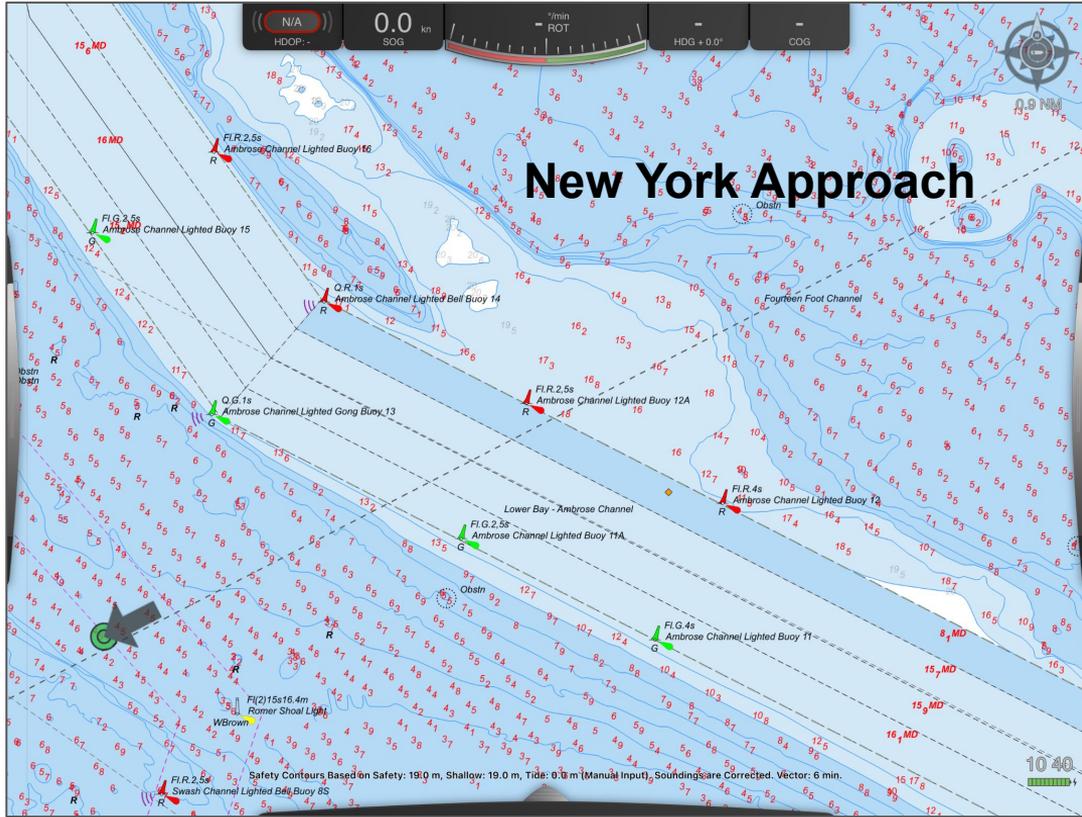
S-100 Data Framework

NOAA S-100 Data Products

- **S-101:** Electronic Navigational Charts (ENC)
- **S-102:** Bathymetric Surface
- **S-104:** Water Level Information
- **S-111:** Surface Currents
- **S-41X:** Weather Overlays

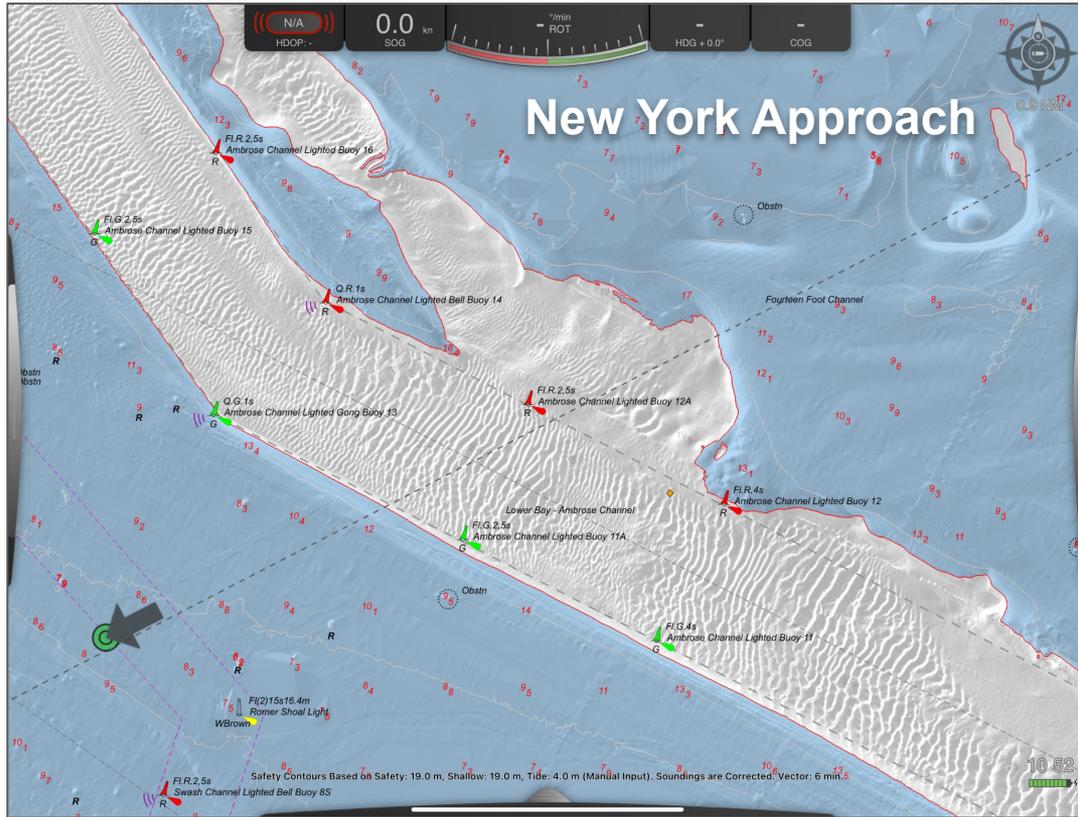


S-101 ENC of New York Approach



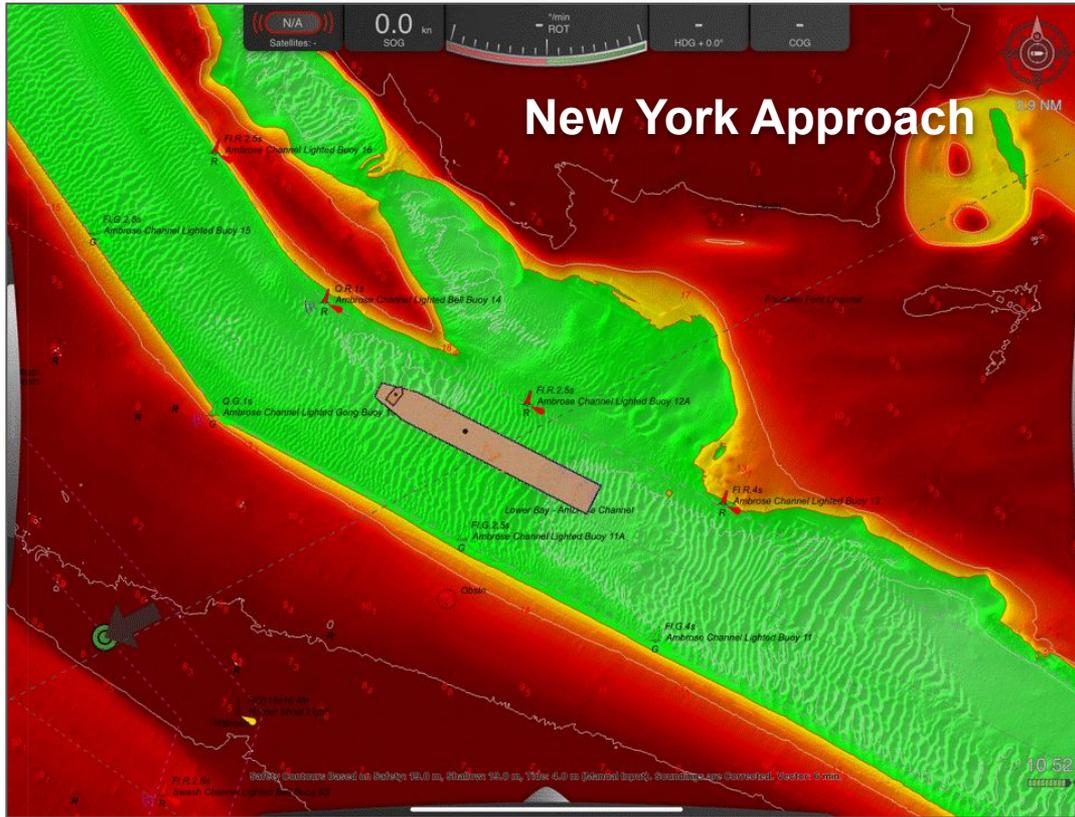
Trelleborg SafePilot - Portal Pilot Unit Display

S-102 Bathymetry Data Overlay



Trelleborg SafePilot - Portal Pilot Unit Display

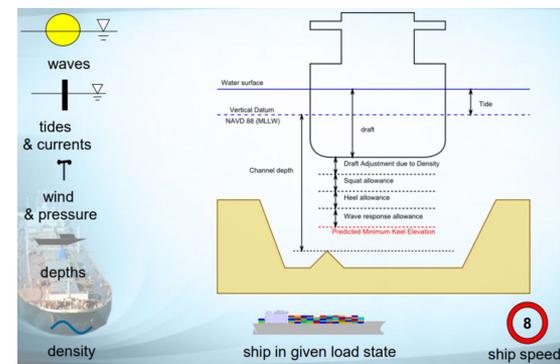
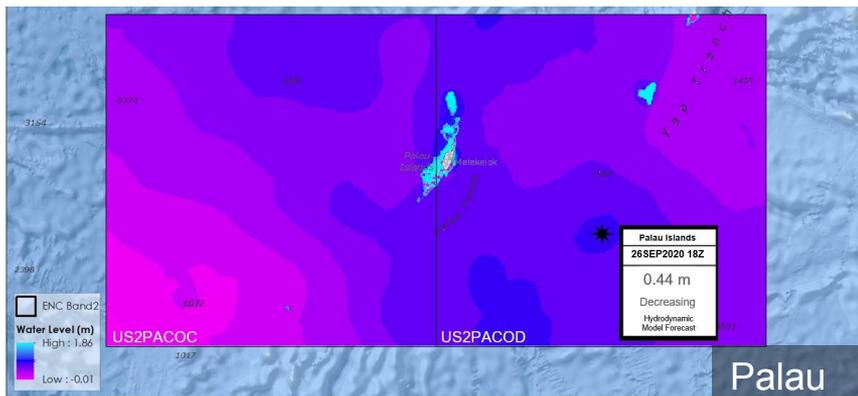
Integrated S-104 Water Level and S-102 Bathymetry Heatmap



Trelleborg SafePilot - Portal Pilot Unit Display
(Potential Future Capability)

Navigation Support: S-104 Water Levels

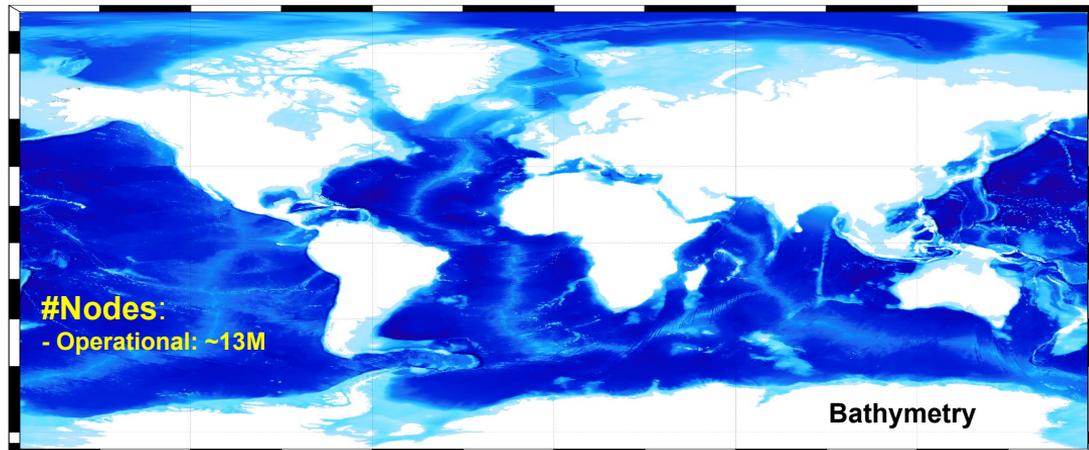
- One of our biggest challenges: our coastal ocean models are initially referenced to a geoid/global MSL or NAVD88. **For charting/navigation, we need to use chart datum, e.g. MLLW or LAT.**
- STOFS forecast guidance is being encoded in formats following IHO's S-100 Universal Hydrographic Data framework
- For example, **S-104 Ed 2.0.0 water levels relative to chart datum**
- Mariners can use water level forecasts for improved route monitoring



Credit - Saeed Moghimi & Gregory Seroka - NHC Marine Workshop 2025

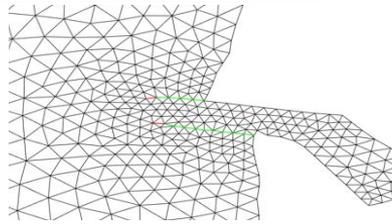
Prototype S-104 water level forecast guidance from STOFS-2D-Glo, produced and displayed on Electronic Navigational Chart (ENC) Band 2 tiles for Palau in the Pacific Ocean.

STOFS-2D-Global v1.1.1 → v2.1.0 Description



Bathymetry

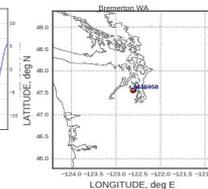
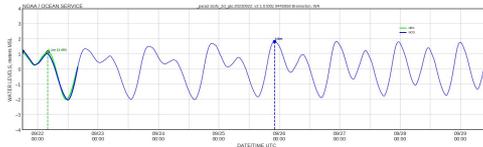
- **Core Model: ADCIRC -- ADvanced CIRCulation Model for Oceanic, Coastal and Estuarine Waters**
- Driven by **GFS** winds, MSLP, ICE
- 4 cycles/day
- 6 hr nowcst, **7.5 day fcst water levels:** tides, surge, combination
- **Grid resolution:** coastal resolution at least 1.5 km globally, up to ~30-120 m for US coasts. AK, HI



Tillamook Bay, Pacific
(~50m resolution mesh + Jetties)

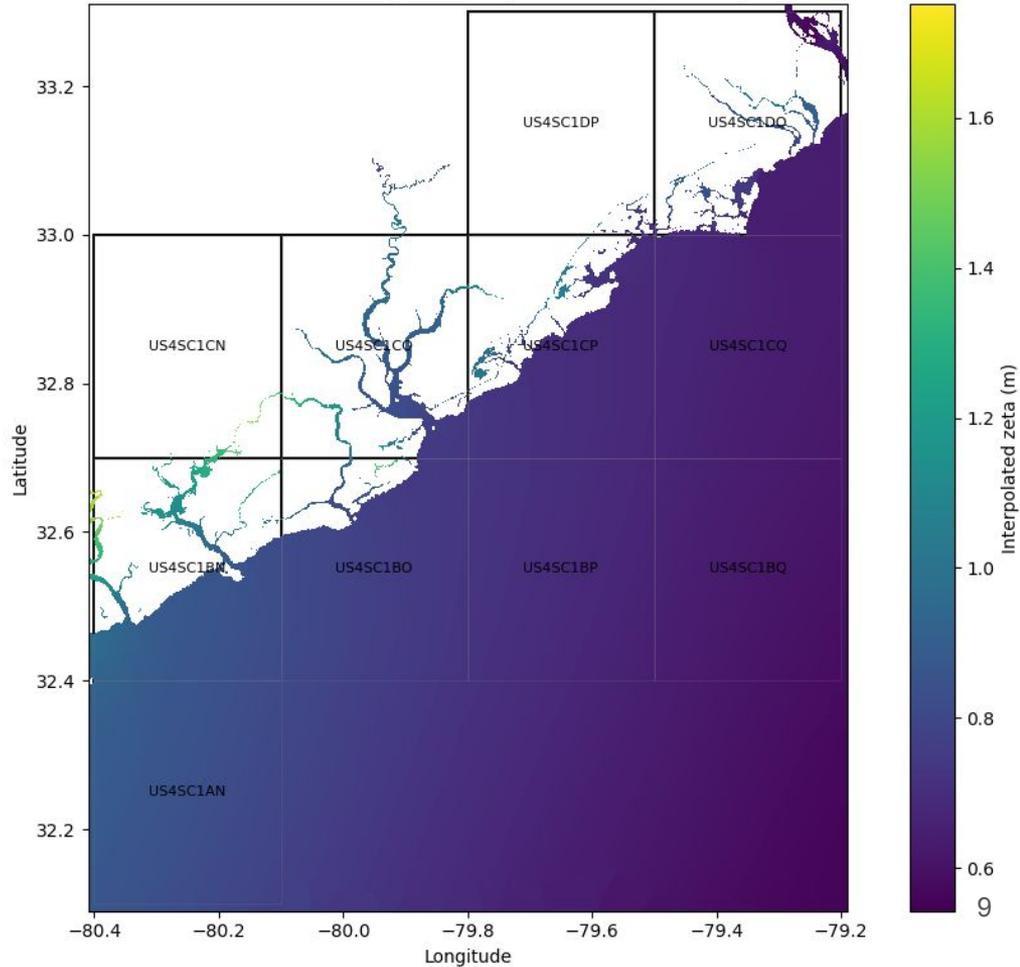
Operational: v1.1.1 Upgrade (v2.1) (bug fix Aug 15, 2024):

- Include 5-day nowcast **bias correction at stations** where NOS/CO-OPS obs are available (same method as ETSS)
- **Improved atmospheric (GFS) forcing** temporal resolution (hourly out to 5 days, then 3 hourly; currently it is all 3 hourly)
- **Improvements to coastal topobathy, mesh, and friction**
- **Added Bremerton WA 9445958 for Seattle WFO**



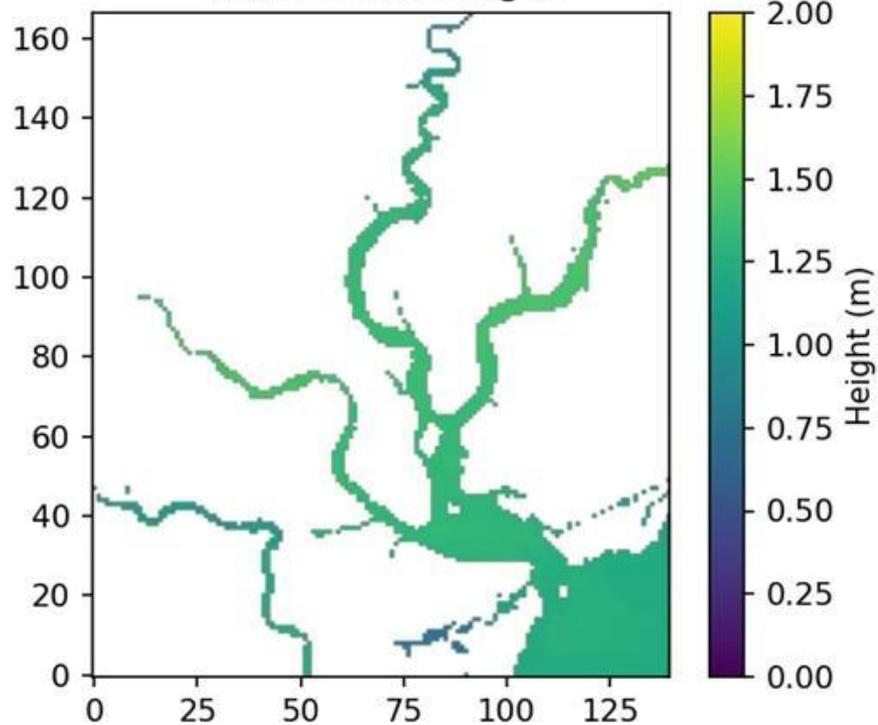
STOFS-2D 180-Hour Forecast to S-104

- S-104 dataDynamicity allowed values are:
 - 1: Observation
 - 2: Astronomical prediction
 - 3: Analysis or hybrid method
 - 5: Hydrodynamic model forecast**
- NOAA is only producing S-104 files from 5: Hydrodynamic model forecasts
- Some countries do not have hydrodynamic models and are converting observations and/or astronomical predictions to S-104 format

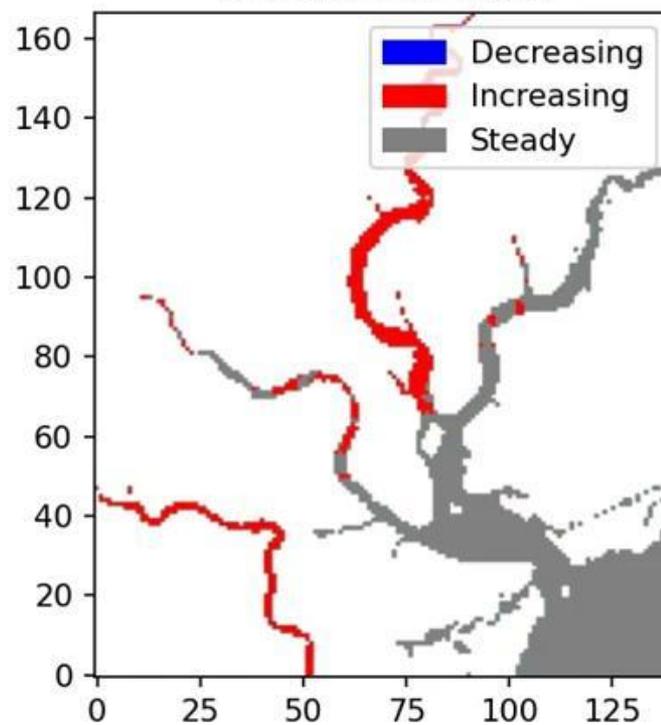


Time Step 2 - Group_002

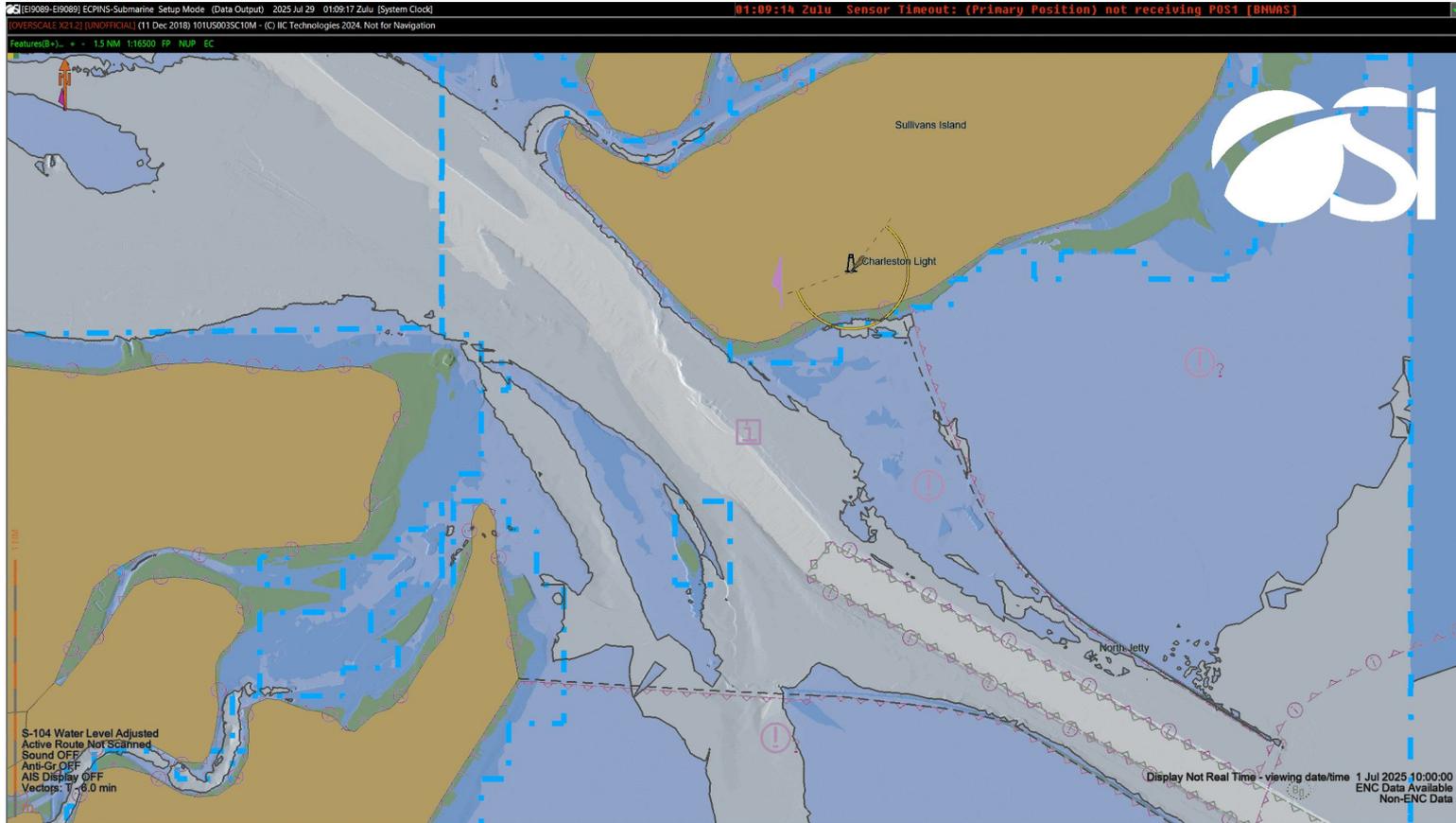
Water Level Height



Water Level Trend

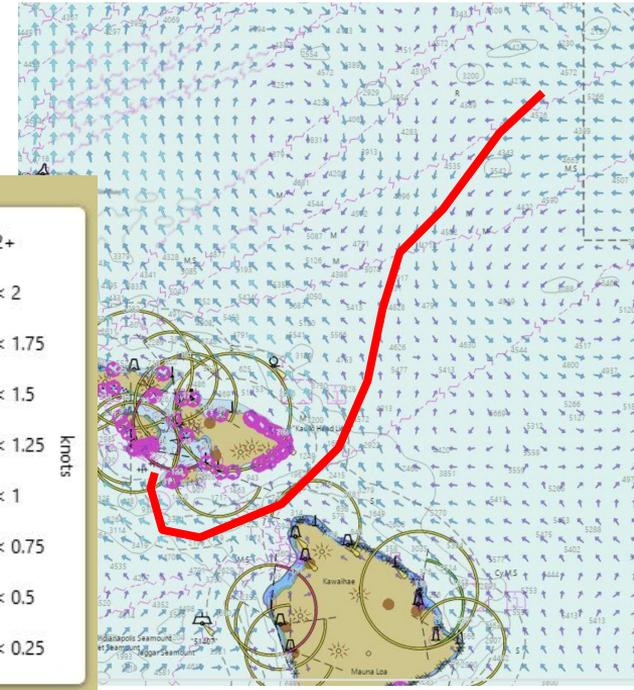
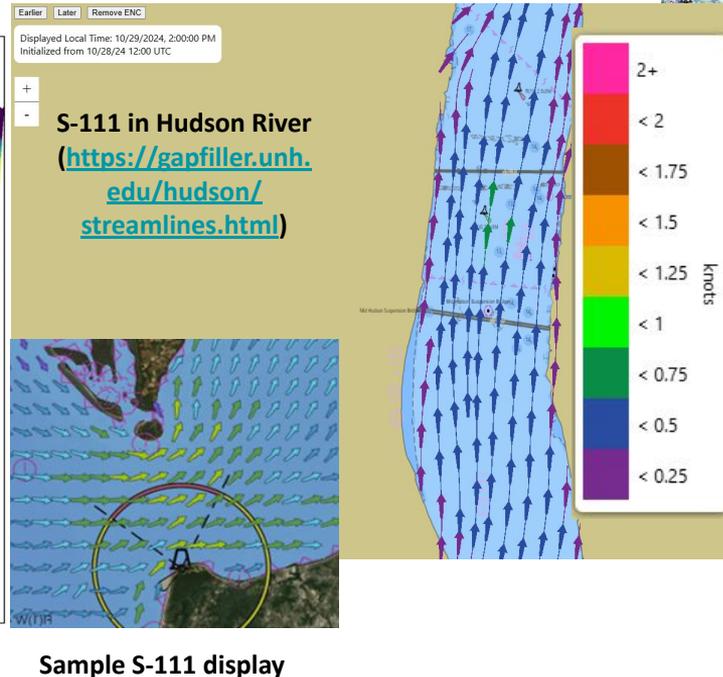
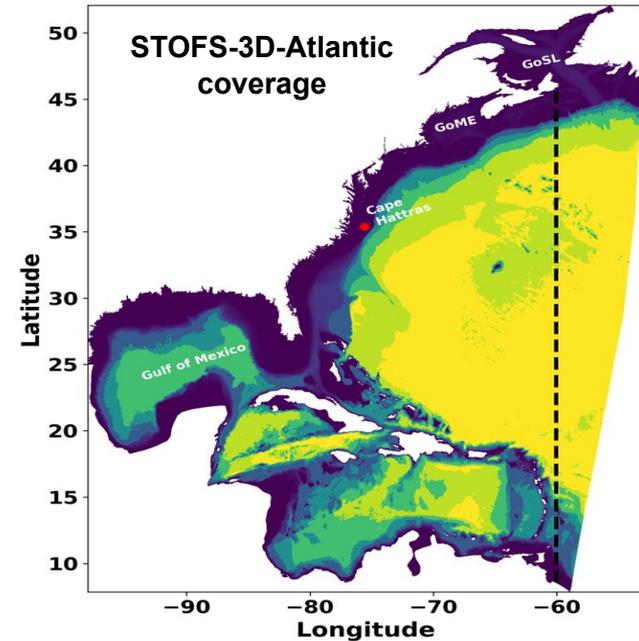


NOAA S-101, S-102, and S-104 Data with Water Level Adjustment



Navigation Support: S-111 Surface Currents

- We are also working to produce S-111 Ed 2.0.0 surface currents from STOFS-3D forecast guidance
- Mariners can use current forecast guidance to plan optimal routes, avoid hazards



Credit - Saeed Moghimi & Gregory Seroka - NHC Marine Workshop 2025

Thank you