NCEP usage and needs of ocean surface current measurements

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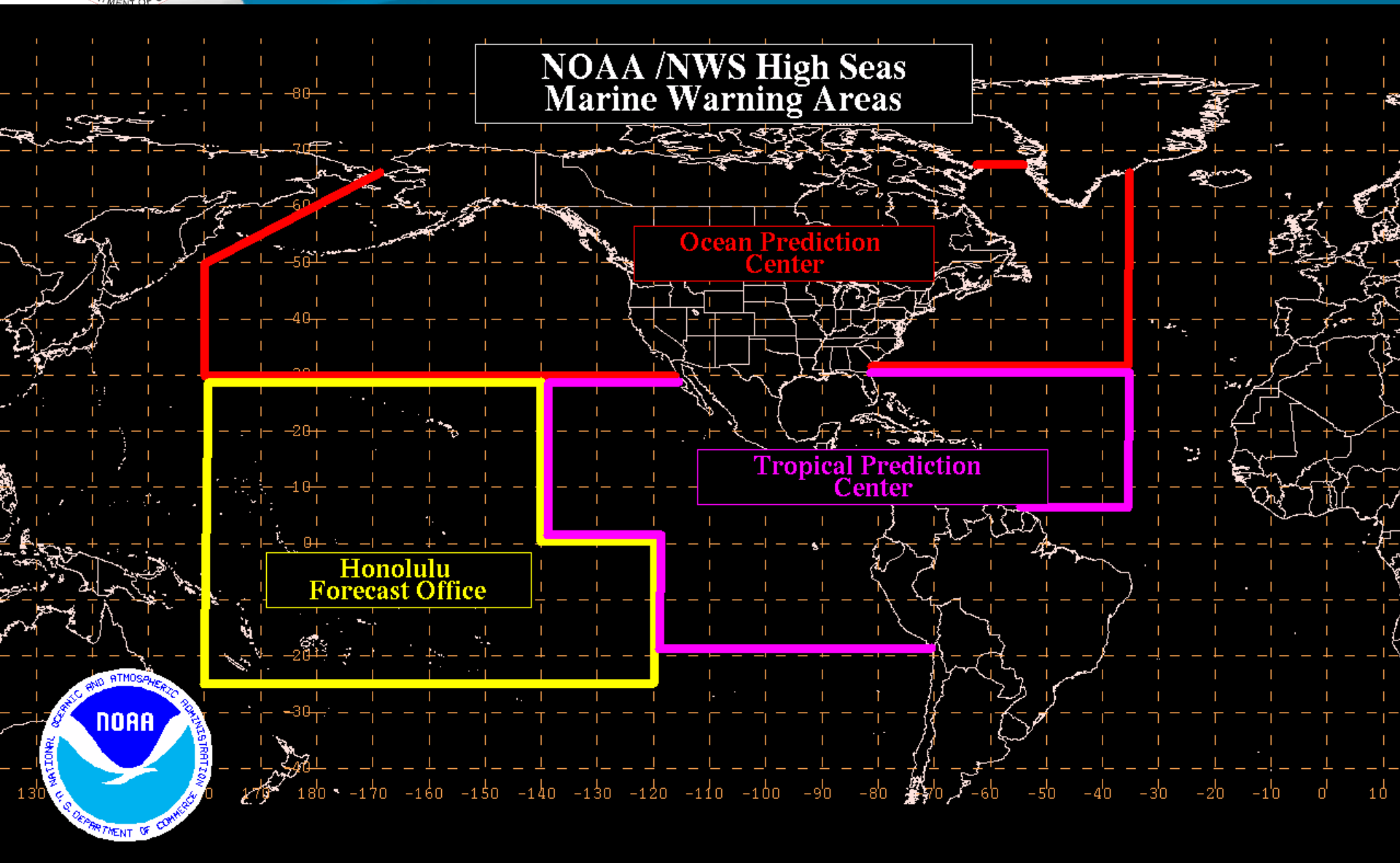
Outline

1. NCEP mission and responsibility.
2. EMC ocean forecast systems and surface current products.
3. OPC ocean surface current guidance.
4. Some ocean surface currents products requirements for real-time ocean forecasting.
5. Conclusions.

Mission/ responsibility

- NCEP Environmental Modeling Center (EMC): development, enhancements, transitions-to-operations, and maintenance of numerical prediction systems comprising NCEP's operational production suite.
- NCEP Ocean Prediction Center (OPC): Protection of life and property, safety at sea, and enhancement of economic opportunity.
  - Operational oceanographic products (text warning bulletins, graphic analyses and forecast products).
  - Forecast support of government incident response (USCG,NOAA) and operations (USCG, Navy, NOAA).

NOAA Forecast Responsibility



EMC Ocean Modeling Goals

- Establish operational high resolution (eddy resolving) ocean forecast system for short-term forecasts (approximately 1-week) with US deep and coastal waters well resolved.
- Nowcasts and forecasts of sea levels, **currents**, temperatures, and salinity.
- Provide seamless boundary and initial conditions to regional ocean physical and biogeochemical models.
- Provide ocean component for various coupled model.

NCEP ocean forecast systems

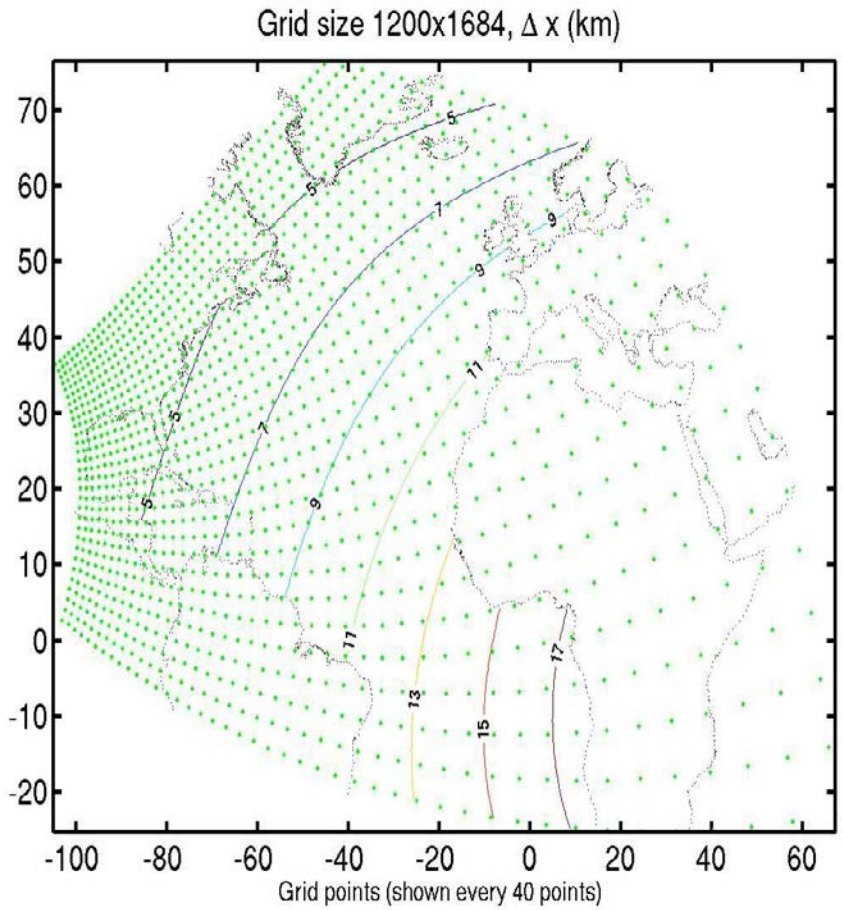
- Real Time Ocean Forecast System (RTOFS), based on HYbrid Coordinate Ocean Model (HYCOM).
  - RTOFS-Atlanitc.
  - RTOFS-Global.
- Transitioning to operations:
  - RTOFS rapid response tracers.
  - NOS coastal models.

RTOFS-North Atlantic

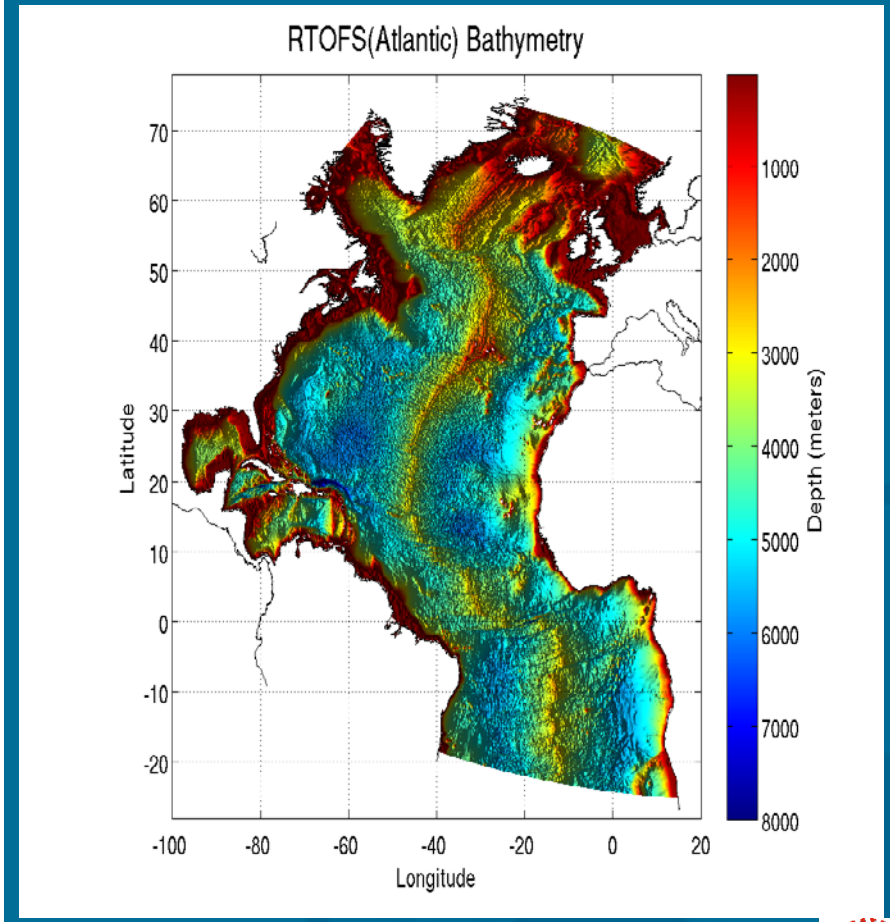
- RTOFS-Atlantic is the first basin-scale eddy-resolving ocean forecast system at NOAA/NCEP, operational from December, 2005.
- Based on HYCOM, orthogonal grid from 1/6 to 1/24 degree resolution (1200 x 1684).
- The system has 26 vertical hybrid layers (25 isopycnal, 5 z-level).
- Tides.
- Data assimilation: SST, SSH, T&S profiles .
- Forced with the NCEP GFS surface fluxes of radiation, precipitation and momentum.
- Open boundary: relax to NCEP climatology.

RTOFS-Atlantic Domain

Horizontal Grid



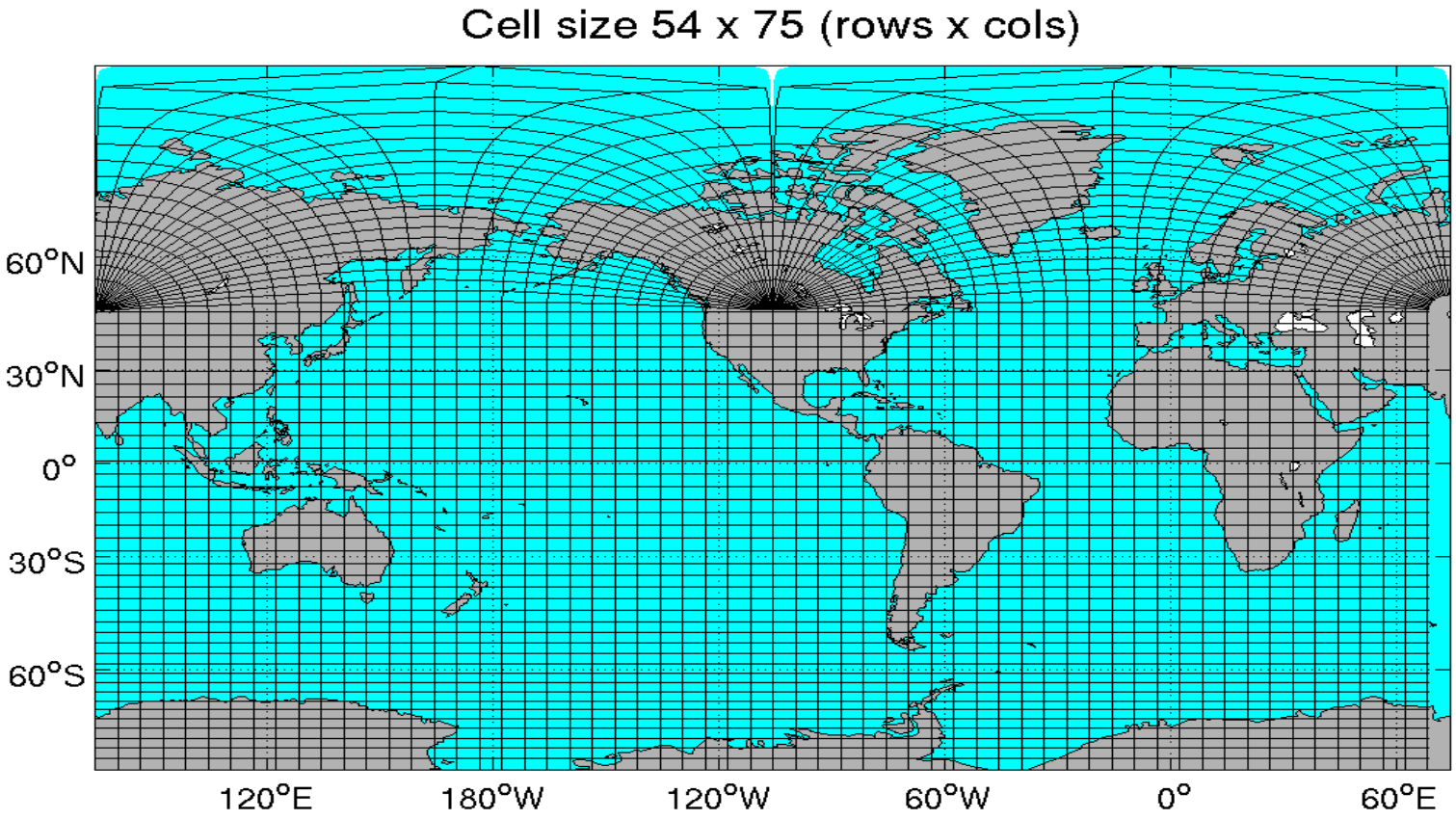
Bathimetry



RTOFS-Global

- RTOFS Global is the first global eddy-resolving ocean forecast system at NOAA/NCEP, operational from October 25, 2011.
- This global system will be based on a 1/12 degree with a Pan-Am Global Grid (4500 x 3928).
- The system has 32 vertical hybrid layers (isopycnal in the deep, isolevel in the mixed layer and sigma in shallow waters).
- No tides.
- The initialization is based on a MVOI scheme (NCODA) developed by the US Navy which assimilates daily observations (T,S, U,V and SSH) in a sequential incremental update cycle to produce analysis.
- Forced with the GFS surface fluxes of radiation, precipitation and momentum.

RTOFS-Global Domain

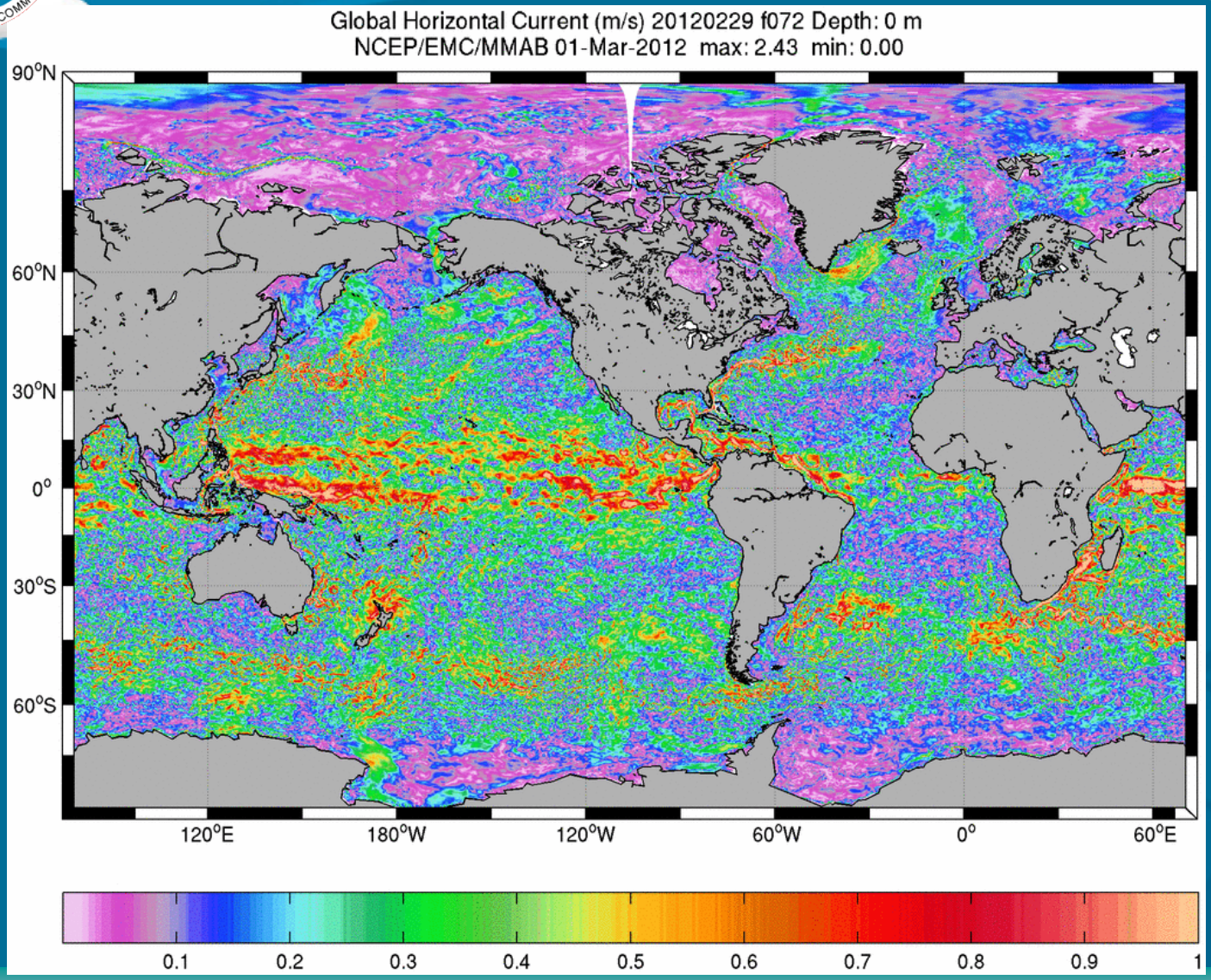


RTOFS surface currents products

- Daily: nowcast (1 day for Atlantic, 2 days for Global) and 6 day forecast .
- Surface ocean currents are produced hourly, on RTOFS native grid and several sub-region grids.
- Formats: GRIB2, netCDF
- Product dissemination:
  - NCO ftp.
  - NOMADS GDS/DDOS server.
  - NODC archives.

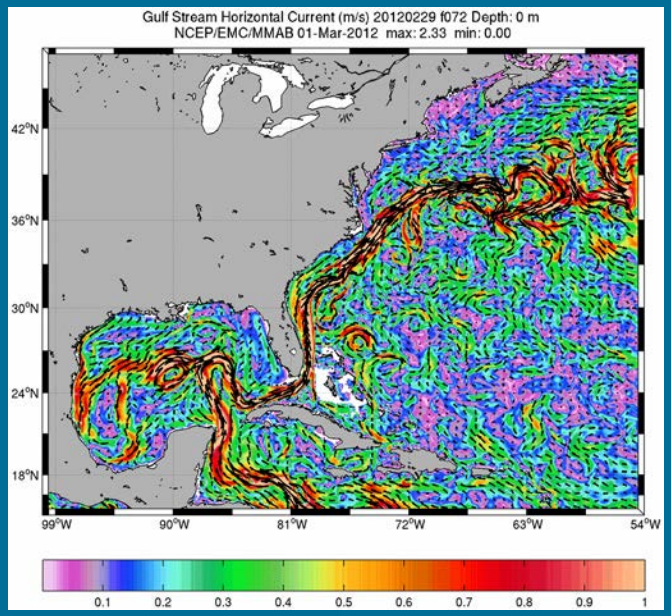
"….*While both models had us in the right area, the HYCOM was definitely more congruous with what our SLDMBs were showing and where we found our missing fishermen." Jennifer Conklin, USCG, Nov 29, 2011*

RTOFS currents

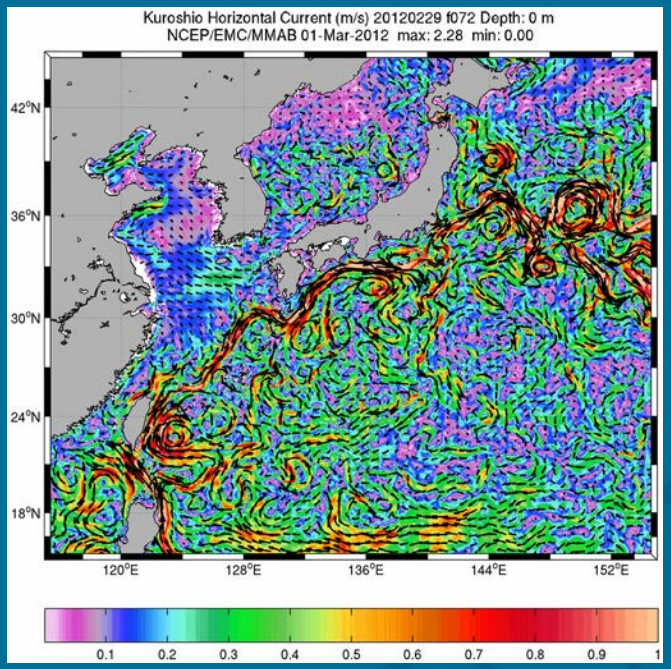


RTOFS currents zoom

Gulf Stream region

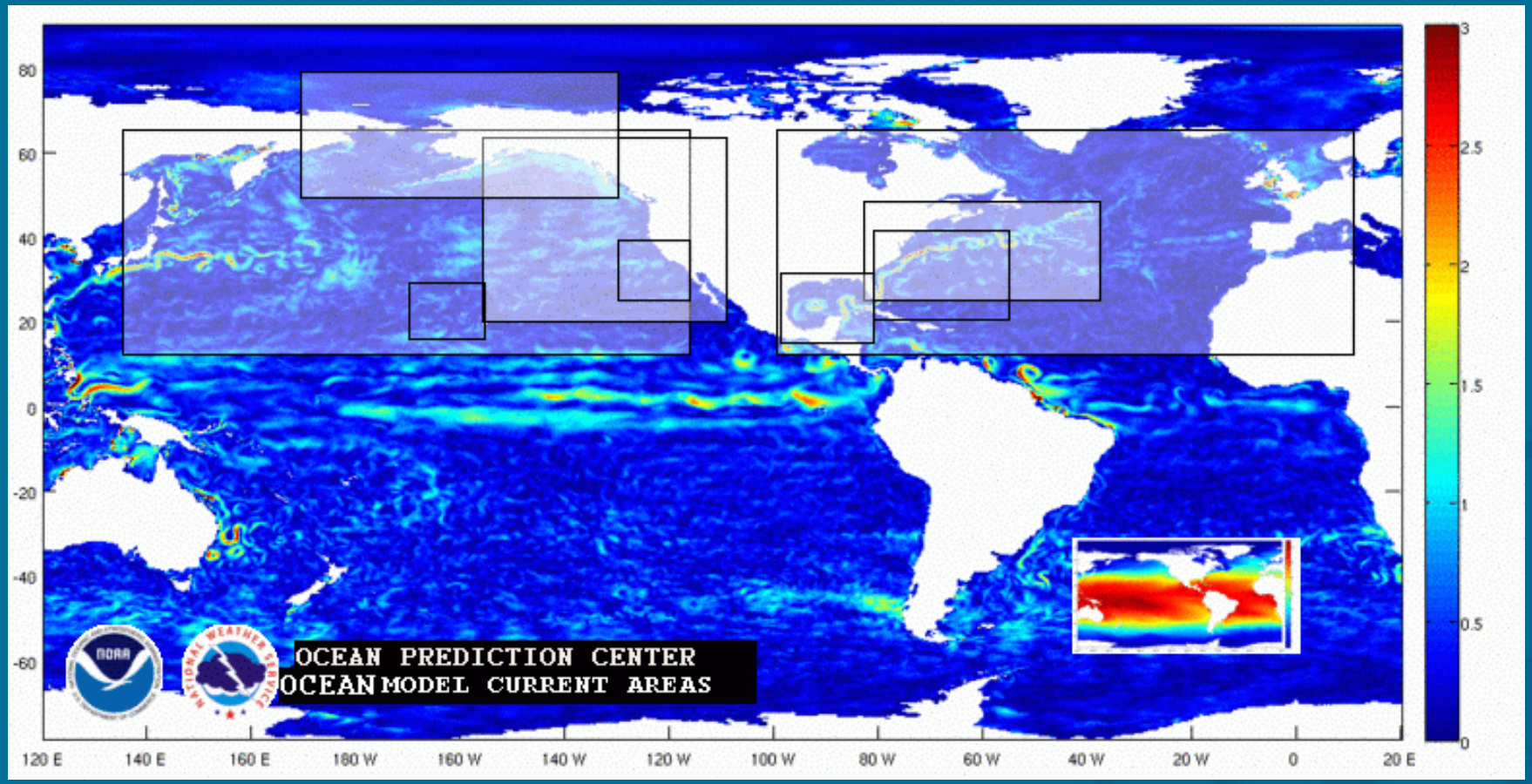


Kuroshio region

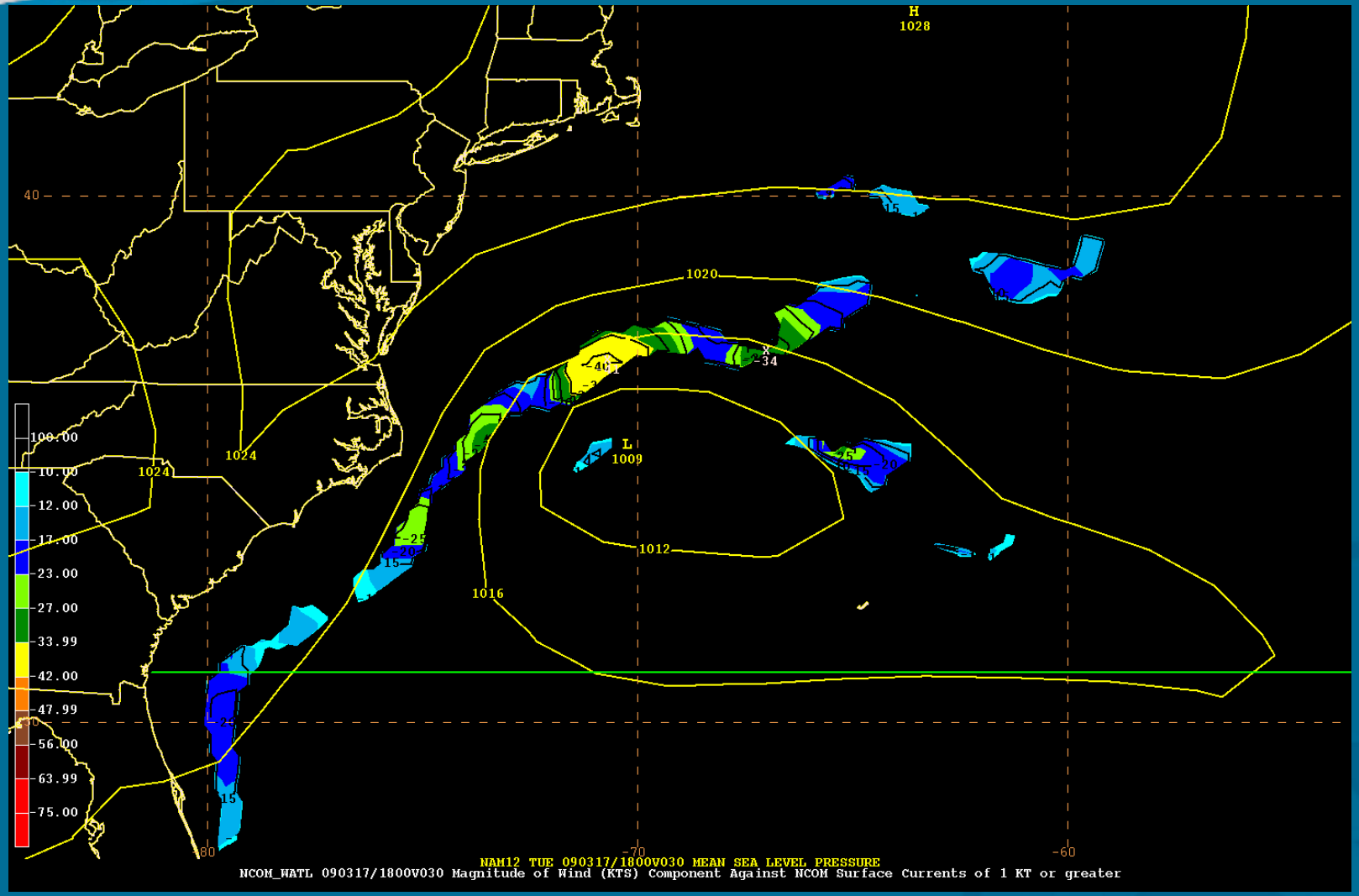


OPC NCOM Current Areas

OPC surface current product derived from NAVY NCOM



OPC Gulf Stream Guidance: Wind vs. Current



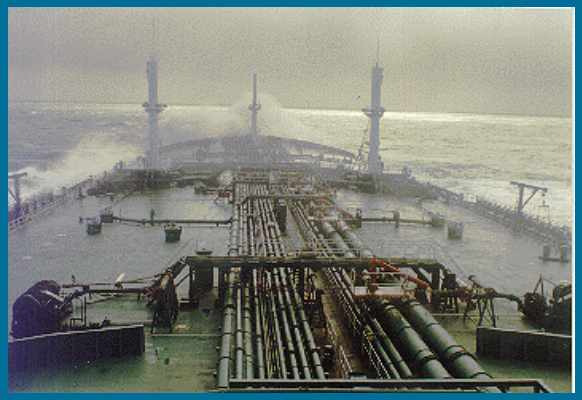
NWS Marine Weather Service

Marine Transportation

HAZMAT

Sailors

Fisherman



Special Support
(e.g., Arctic, Southern Oceans)

USCG SAROPS

Surface currents Validation assessment

Parameters	Geo Gov	Res	Mea Acc	Samp Int
Direction	Hemi US	25 km	10 deg	1 day
Direction, EZZ	EEZ US	10 km	10 deg	1 hr
Speed	HEMI US	25 km	0.1 m/sec	1 day
Speed, EEZ	EEZ US	10 km	0.1 m/sec	1 hr

Validation documentation:

- WMO Manual on Marine Meteorological Services, vol. 1.
- WMO Manual on the Global Data-Processing and Forecasting System.
- A Coastal Theme for the IGOS Partnership, Report of the Coastal Theme Team, Jan 2006.
- The Integrated Strategic Design Plan for the Coastal Ocean Observation Module of the Global Ocean Observing System.
- Memo from Subject Metter Experts.

Some Ocean Surface Currents Obs Derived Product Requirements

- Timely and stable delivery.
- Space resolution compatible with models (eddy-resolving).
- Uncertainty information.
- QC with flags.
- Spectral parameters (e.g. for filtering of tidal currents).
- Formats: netCDF and GRIB2.

Conclusions

- NCEP produce various ocean surface currents products and guidance.
- Quality ocean surface currents forecasts are crucial for the NWS users.
- There is lack of ocean surface current measurements for both data assimilation and product validation.
- Specific data requirements for real-time operational forecasting and guidance.