Overview of NOS Coastal Ocean Operational Forecast Systems

Aijun Zhang

NOAA/NOS
Center for Operational Oceanographic Products and Services (CO-OPS)

Frank Aikman III

NOAA/NOS/OCS
Coast Survey Development Laboratory (CSDL)

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What is NOCMP

The primary objective of the National Operational Coastal Modeling Program (NOCMP) is to develop and operate a national network of Operational Nowcast and Forecast Hydrodynamic Model Systems (called OFS) to support NOAA's mission goals and priorities. The OFS will perform nowcast and short-term (0 hr. - 48 hr.) forecast predictions of pertinent parameters (e.g., water levels, currents, salinity, temperature, waves) and disseminate them to users.
TARGET COVERAGE OF NOS OFS

Oceanographic Forecast Modeling Systems
- Under Development
- Operational
- Planned

Tentative Schedule
FY14: SFBOS, NEGOFS, NWGOFs
FY15: CIOFS, GLOFS-Lake Erie (Upgrade)
FY16: GOMOFS, rest of GLOFS (Upgrade)
      NYOFS (Upgrade)
FY17: MRGOFs, H-E Corridor,
      CREOFS & SJROFS (Upgrades)
FY19+: WCOFS, ECOFS, PSOFS, WFOFS

NOS CENTER FOR OPERATIONAL OCEANOGRAPHIC PRODUCTS AND SERVICES
NOAA Partnership and Roles of NOS OFS Project
As Detailed in Concept of Operations (CONOPS)

**NOS/CO-OPS**
- Mission and Requirement Analysis
- NOS OFS Framework Development (COMF)
- System Development and Demonstration
- Operation, Maintenance and Routine Update
- Product generation and Service Delivery
- Outreach and User Services

**NOS/OCS**
- Requirement Analysis
- NOS OFS Framework Development (COMF)
- OFS Development and hindcast assessment
- Routine Updates

**NWS/NCEP**
- Computer System Technical Support
- Implement NOS OFS on NOAA’s High-Performance Computing Systems (WCOSS)
- Operation, Maintenance and Routine Update
- Product Delivery on the NOAA’s Web Operations Center (WOC)

**Community Model Developers**
- Maintain operational version of model codes
- Develop new capabilities and modules based on NOS OFS requirements
- Routine model code updates
World-Class NOAA High Performance System
(Weather Climate Operational Supercomputing System - WCOSS)

• High Performance Compute (HPC)
  – 620 dx360 M4 nodes, 20 Hot Spare Nodes
  – Full bisection fat-tree IB4X FDR interconnect
  – Login, management, service nodes (x3650’s) and infrastructure

• HFS and SSS Storage Systems
  – 12 x3650 M4, 20 DCS3700
  – HFS IB4X FDR interconnect
  – SSS 10GbE System Separate from HPC

• TSM Backup, Recovery System
  – TSM x3850 Server; DS3512 Disk
  – 5 LTO5 Tape Drives in single rack library

• Two Identical Systems
  – locate in different locations. One is production, the other is backup.
  – NOAA’s atmosphere operational forecast systems (e.g. NAM, GFS, etc.)
  – NOAA’s ocean forecast systems (e.g. RTOFS, HYCOM, GLOFS, CBOFS, DBOFS, TBOFS, NGOFS, CREOFS)
  – Easy to access all forcing dataset on the shared computer systems
“Operational” Defined

- Reliability, stability & commitment
- Built to well-defined standards for operations and assessment
- Facilitate ease of operations and interoperability
- Runs regularly & automatically
- Continuous quality control monitoring and user services support (24 x 7)
- Automated product generation and dissemination
Coastal Ocean Modeling Framework (COMF)

*COMF is a set of standards and common tools to develop, operate, and assess NOS OFS. It is standardized for any model and any domain*

- Single common framework for all OFSs
- Facilitate ease of operations and interoperability
- Minimize redundant efforts and ensure a high time-and-cost efficiency for OFS development, transition, and O&M
- Standard tools for data handling & maintenance
- Standard tools for graphics and web products
- Standard skill assessment and evaluation tools
- **various models allowed in COMF:** ADCIRC, ECOM, EFDC, ELCIRC, FVCOM, POM, ROMS, SELFE
REAL-TIME DATA INGEST

Real-time Data Tank:
- Atmospheric Forcing
- Coastal Boundary Conditions
- Riverine Fresh Water Inputs

OPERATIONAL MODELS (COMF) on NOAA’s HPCS

PRODUCTS and archives
Linux Server in CO-OPS

FORECAST MODEL GUIDANCE
(water level, water temp, currents, & salinity)

PRODUCES
(web pages and digital pt. & gridded data)

FOR USERS

tidesandcurrents.noaa.gov

QA/QC (CORMS) 24 x 7

Skill Assessment Monthly

Individual Model systems
Continuous Operational Real-Time Monitoring System

**CORMS** is the primary system to perform real-time QA/QC on all real-time data, OFS, and products in the CO-OPS domain, supported 24 x 7.

### New York/New Jersey Model Runs Flag Status

**New York/New Jersey OFS Model Runs Flag Report**

**FOR: July 22, 2008**

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**Green** indicates proper operation.

**Yellow** indicates a warning.

**Red** indicates a failure.

**Black** indicates an error code problem.

**Gray** indicates not used for this cycle.

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![Image of a control room with computer monitors and a person working at a desk]
NOS OFS PRODUCT FLOW CHART

http://tidesandcurrents.noaa.gov

- Real-Time Observations
- Model reanalysis and forecast products

Forcing Data on WCOSS

WCOSS

NWS Web Operations Center (WOC) and Distributed Brokered Networking (DBNet)

ftp

CORMS

CO-OPS Server

- ftp access model outputs on WOC
- Produce graphic products.
- Produce NOS OFS web pages on CO-OPS web.
- Archive Operational Products (NAS)

ftp

Public

THREDDS Data server Opendap / webservices
NOS OFS Nowcast/Forecast Schedule

- 6 hour nowcast
  - 00z
  - 06z (now)
  - 12z
  - 18z
- 2-3 day Forecast
1. **Graphics on CO-OPS Web Site:**
   1. Time Series Plots (24 hour nowcast and 48 forecast) of water levels, currents, temperature, salinity, and surface winds at selected locations (all PORTS and NWLON stations and more)
   2. Contour and vector map plots and animation of water levels, currents, temperature, salinity, and surface winds

2. **Model data set on OPeNDAP and NOAA’s WOC:**
   - Station/point NetCDF files (6-minute output):
     time series model nowcast and forecast at selected stations for water levels, currents, temperature, salinity, surface winds
   - Field/gridded model output NetCDF file (hourly output)
     - 2-D water levels and surface winds,
     - 3-D currents, temperature and salinity on every model grid.
Strategy of Developing Hydrodynamic Operational Forecast Systems

Global Model (G-RTOFS and Navy’s HYCOM) → NGOFS (Coastal/Shelf Models)
(Bridge between Global model and Estuarine/Bay models) → Bay/Estuarine Models
(high-resolution to resolve navigational needs)

NWGOFS

NEGOFs
Number of Nodes: 84,653
Number of Elements: 160,444
Element Size: 60 m – 3.5 km
Rivers: 22

Matagorda Bay PROTS
70 m – 550 m

Houston/Galveston PORTS
80-530 m

Sabine Neches PORTS
60 – 540 m

Lake Charles PORTS
70 -560 m

Thin Dam
NWGOFS Model Bathymetry

Nested boundary location
APPLICATIONS OF NOS OFS

❖ Support of safe & efficient navigation
  • Water levels for under-keel clearance
  • Currents for right-of-way, maneuverability

❖ Emergency response
  • OR&R (Hazardous Material dispersion, Oil Spill, etc.)
  • Search & Rescue
  • Homeland Security

❖ For environmentally sound management of the coastal zone
  • Ecosystem applications (forecasting of HAB, Sea nettle, Hypoxia, Pathogens, etc.)
  • Marine geospatial applications
Sea Nettle Nowcast Procedure

1. Model the nowcast surface salinity and temperature fields
2. Geo-reference salinity and SST fields
3. Apply habitat model
4. Generate image illustrating the probable distribution of *Chrysaora*
CHALLENGES

- Better understanding in physical mixing process (stratification and plume)
- Accuracy of Forcing Conditions
  
  - Algorithm of heat flux calculation near coast, Surface forcing conditions along boundaries of land and waters
  - Fresh Water inputs

- Spare observations for Data Assimilation and model assessment
  
  - Currents, T & S real-time observations, Vertical profiles
  - Less observations in offshore waters

- Ecological/biological Operational Forecasting
  
  - Understanding ecosystem processes, which are very complicated (forecasting HAB, Sea nettle, Hypoxia, Pathogens, etc.)
  - No standard mature models are available
  - Spare observations for ecosystem model assessment
LESSONS LEARNED

- **Standardized Ocean Models**
  - A standard shared COMF is critical
  - Community-based models
  - Collaborate with model developers
  - Take advantage of scientific and technological progresses from academic and research community

- **Users to be involved to improve OFS products**
  - Let users be involved from the beginning, and understand users’ needs (user-driven)
  - Deliver model data in standard format at one data portal
  - Produce user-friendly products

- **Reliability**
  - Always prepare backup plans
  - 7x24 O&M and User services support
  - Disseminate reliable and timely products
THANK YOU

http://tidesandcurrents.noaa.gov/models.html