Implementation of a NOAA/NOS Cook Inlet and Shelikof Straits Operational Forecast System

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² Dynalysis of Princeton
Project Objectives

• Support Known Requirements for the Region

  Marine Operations – Oil and Gas Platform and Port Facilities (Anchorage)
  Resource Management – Alaska Departments of Fish and Game and Natural Resources
  Coastal Sciences – Climate Change/ocean acidification/coastal ecology, Kasitsna Lab, Kachemak Bay NERR, AOOS, and Universities
  Oil Response – NOAA’s ORR, Coast Guard, Cook Inlet Regional Citizens Advisory Council (CIRCAC), and local communities
  Recreation – Charter sportfish industry, marine ecotourism

• Develop Improved Navigational Products for the Region

  Web enabled tide and tidal current charts and tables
  Operational Forecast System (OFS)
Overview

- Implement ROMS with Wetting/Drying
- Creation of an orthogonal curvilinear grid with finest resolution in Knik Arm (Anchorage) with if needed high resolution nests for Kachemak Bay and north of Fire Island
- Establish Realistic Model Bathymetry for the entire region
- Establish a Monthly Temperature and Salinity Climatology
- Describe Available Observations to determine model skill
- Define Model Configuration
- Provide Pathway to Operations
- Ensure Model Veracity against NOS Standards
- Continue to Participate in Multidisciplinary Efforts in the Region
Model Resolution Grid

1.8 Km
790 X 148
116,920 nodes
85 meters
800 meters
Model Resolution Grid

1.0 - 1.4 Km

100-200 meters
Model Vertical Resolution – 22 levels
Establish Bathymetry for the entire region

Map Generated by the National Geophysical Data Center

NOS Soundings
Model Bathymetry at MLLW

300 meters

20 meters

200 meters
Model Bathymetry at MLLW

- 40 meters
- 2 meters
Establish Monthly Temperature and Salinity Climatology

- Based on individual hydrographic casts from NODC World Ocean Data Base WOD98; WOD01, Changes from WOD98 to WOD01 (NEW01)
- EPIC data management system maintained by PMEL
- University of Alaska

Result of the effort is both a Standard and Digital Atlas

1 Special Thanks to Mick Spillane
2 Special Thanks to Thomas Royer’s Group
Establish Monthly Temperature and Salinity Climatology
Establish Monthly Temperature and Salinity Climatology
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Example Plot
Establish Monthly Temperature and Salinity Climatology
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Establish Monthly Temperature and Salinity Climatology
Model Configuration

- Three Open Boundaries
  - Western Entrance to Shelikof Straits
  - Stevenson and Kennedy Entrances
  - Kurpeanof Strait (North of Kodiak I/South of Raspberry I)

- Twenty Three Rivers
  - Based on historical and real-time USGS gages
Pathway to Operations

- Tides, 3D with constant stratification and wetting/drying
- Tides, 3D, synoptic hindcast (during period of a comprehensive set of observations)
- Tides, 3D, operational testing of the nowcast/forecast system at the NOAA HPC Center (including operational set of surface stresses, fluxes; i.e., 4 km Hires NAM, 5 km (2.5 km) NDFD, USGS/NOAA River Stage and Forecasts, and open-ocean lateral boundary conditions ??)
Observations

- NOS Oceanographic Circulatory Survey: 1973-75
- NOS ADCP Current survey 2002-2005
- NOS Hydropalooza Project (Kachemak Bay) 2008-2009
- University of Alaska, Coastal Marine Institute; Kachemak Bay Research Reserve 2004-2006¹
- Others ??

¹ Special Thanks to W.S. Pegau and S. Saupe
Over the course of the Three Year Effort, 92 Current Meters (Aanderaa) were Deployed.
<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>Survey Details</th>
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<td>Fire Island, 1 nm S</td>
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<td>Stevenson Passage</td>
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NOAA/NOS/Coast Survey Development Laboratory
University of Alaska, Coastal Marine Institute; and Kachemak Bay Research Reserve - CTD Program 2004-2006
Phase I – 3D Tidal

- Extract eight Tidal constituents from enpac2003 along model open-ocean boundaries
- Adjust, if necessary, to coincide with NOS tidal constituents
- Produce 35-day tidal simulation
- Perform a least squares analysis of model predictions
- Determine that predictions satisfy NOS Standards (NOAA Technical Report NOS CS 17, 2003)
- Produce new prototype web enabled tidal navigational products
Eastern North Pacific (enpac2003)

Oregon State TPX06 Global Model
K1, O1, P1, Q1, M2, S2

K1, O1, P1, Q1, M2, N2, S2, M4, M6

NOS Hydrography and ETOP2

Comparison of enpac2003 predictions with analyzed tidal heights at Puale Bay

Predictions in Phase; Under-prediction at times of maximum range
Coastal Ocean Modeling Framework Standards & Procedures

- Models, products, assessment, documentation, etc. will be as uniform as possible:

- Skill assessment criteria
  - Variable | Water Level | Currents
  - CF | 15 cm (>0.9) | 26 cm/s (>0.9)
  - POF/NOF | 30 cm (<0.01) | 52 cm/s <0.01)
Collaboration with Cook Inlet Investigators

- Sharing Observations and ancillary datasets
- Collaborating with other modelers and investigators on potential open-ocean linkages
- Investigating the opportunities in evaluation of various synoptic atmospheric forcing (Alaska Experimental Forecast Facility)
- Obtaining feedback from the user community
- Participating in multi-disciplinary activities
Back Up Slides
Resolution at Anchorage is approximately 1 km
DASHED = EXPANDED NAM-12 ; SOLID = 4KM HIRESW DOMAINS