An Introduction to Southern California's Ocean Observing System

How to use ocean observing system data related to water quality assessment

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December 12, 2012
Introduction Outline

• What is U.S. IOOS®?
• What is SCCOOS?
• How are we funded?
• What do we do?
• How does it apply to water quality in California?
• What’s in store for the future?
What is U.S. IOOS?

• US contribution to **Global Ocean Observing System**
• Program Office in D.C. within NOS / NOAA
• Includes global (satellites, drifters, etc.) and coastal components
• Coastal component includes 17 Federal agencies, 11 regional associations and 2 other consortia
  – Federal backbone of coastal component includes tide gauges, NDBC buoys, USGS river gauges, ect.
Purpose of U.S. IOOS

To enable the nation to track, predict, manage and adapt to changes in our ocean, coastal and Great Lakes environment for the purposes of:

- Enhancing our Economy
- Protecting our Environment
- Improving Safety
IOOS Coastal Component
11 Regional Associations; 17 Federal Agencies
What is SCCOOS?

- **Southern California Coastal Ocean Observing System**
  - SCCOOS is one of 11 regional ocean observing systems that contribute to the US Integrated Ocean Observing System (IOOS)
  - A collaborative network of scientists and research teams from universities, institutions, and industry in Southern California that collect and aggregate coastal ocean data and provide a single online portal for its distribution

Where is SCCOOS?

SCCOOS program office is located at Scripps Institution of Oceanography in La Jolla, California

The Southern California Bight extends from Point Conception to the US/Mexico Border

www.SCCOOS.org
How is SCCOOS funded?

• Primary funding is via 5-year grant from NOAA/IOOS (Federal)
  – Year 1 (6/11-5/12): ~$1.75M to SCCOOS
  – Year 2 (6/12-5/13): ~$2.1M to SCCOOS
  – Year 3 (6/13-7/14): ?????????

• Other smaller current and anticipated funding sources include:
  – NOAA HABs (SCCOOS)
  – OCSD (SCCOOS and CeNCOOS)
  – ASBS (SCCOOS)
  – CA Dept. of Boating & Waterways (SCCOOS Manual Shore Program)
  – US Army Corp of Engineers (SCCOOS Wave Data)

• In the past, significant funding came from:
  – California State Coastal Conservancy
SCCOOS Program Office Staff

Executive Director: Julie Thomas (15%, 1/08)

Technical Director: Eric Terrill (10%, 2/05)

Data & Information Advisor: Lisa Hazard

Data & Information Manager: Darren Wright (50%, 10/12)

Public & Government Relations Coordinator: Chris Cohen (40%, 2/10)

Program Coordinator: Danielle Williams (100%, 5/12)
What does SCCOOS do?

Manage an “end-to-end” coastal ocean observing system …

- Data collection
- Data management
- Data dissemination
- Numerical model simulations and forecasts
- Product development
- User outreach and facilitation

... to benefit USERS in four broad focus areas:

- Water quality
- Ecosystems and climate
- Marine operations
- Coastal hazards
What else does SCCOOS do?

The foundation is a network of ocean observing assets that measure:

- Physical and chemical properties (e.g. temperature, salinity, dissolved oxygen)
- Biological properties (e.g. Harmful Algal Blooms, chlorophyll fluorescence)
- Waves
- Meteorological conditions
- Surface currents

Observational assets include:

- Shore stations
- Gliders
- Land-based high frequency radar stations
- Ship-based surveys
The result is an integrated picture of the ocean environment that is useful for a multitude of purposes.

Data are from the Jan-Feb 2012 timeframe.
Data collected include:

- Temperature & salinity
- Chlorophyll fluorescence & turbidity or transmissivity
- Dissolved oxygen, pH, & water level
- Meteorological variables
- Phytoplankton & algal toxins to detect Harmful Algal Blooms
Nearshore Measurements

Short-term event detection; e.g. tsunamis


Long-term climate records

- Sea Level since 1855
- Sea Surface Temperature since 1880
- Ocean pH and pCO2 trends since 1993
- Salinity since 1916
- Wave Height Trends since 1950
- Coastal Upwelling trends since 1960
Automated Shore Station Page

http://www.sccoos.org/data/autoshorestations/
Manual Shore Station Page

Please note:
Manual shore station data are updated periodically not continuously. As a result, the data repository may lag behind the actual data collection.

http://www.sccoos.org/data/manualshorestations/
Integrated Pier Pages

http://www.sccoos.org/data/piers
SCCOOS Support HAB detection which contributes to Cal HABMAP

http://www.sccoos.org/data/habs/index.php

http://www.habmap.info/data.html
SCCOOS support ocean acidification efforts by collecting oxygen & pH levels in coastal waters

http://www.sccoos.org/projects/2012OA/

What is SCCOOS doing?

SCCOOS plans to add ocean acidification monitoring to its ongoing observations of the coastal ocean.

Sensors that monitor pH, pCO$_2$, and dissolved oxygen can be added to pier stations and gliders.

These observations will support continuous measurements of acidification in the Southern California Bight and will allow for improvements to be made to the models that forecast climate change.
Durafet pH sensors have been installed at 3 CeNCOOS and 2 SCCOOS shore stations and 1 LOBO estuarine mooring.

Water samples are being collected weekly for analyses at Scripps.

Help establish pH variability in coastal ocean and determine best methods to measure it.
Gliders are controlled remotely via satellite, and autonomously collect data in the water column along a transect.

- Measure temperature, salinity, chlorophyll fluorescence, current velocity, dissolved oxygen (and pH and aragonite saturation via proxy relationships for acidification monitoring).

- Data is assimilated into numerical models, and used in studies of climate change and its impacts on California’s coast.
How Gliders Work…

- Weight: 50 kg, Length: 2 m, wingspan: 1 m
- Profiles by changing buoyancy
- Steers by changing center of mass
- 2-way Iridium communication
- GPS navigation
- Pressure, temperature, salinity, velocity, chlorophyll, fluorescence, acoustic backscatter, nitrate, optical backscatter, ...
SCCOOS Glider info

These are the current active gliders in California

http://www.sccoos.org/data/spray/?r=0
Possible Future Capabilities

- Surface wave gliders

4 wave gliders were launched on Nov. 7, 2011 out of San Francisco. During their 33,000 nautical mile journey, they will travel across some of the world’s most challenging environments.

- Ambient noise and acoustic tag monitoring

Acoustic tags, small sound emitting devices, have been mounted on various pelagic fish. Receivers on moorings and wave gliders detect tagged fish that are within 400 - 800 m, and the information is relayed to shore via satellite. Other types of receivers detect ambient noise. Other types of animal tags measure oceanographic properties as well as animal’s position.
BREAK!!

Meet Back in This Room in 15 Minutes, Thank you!
Coastal Data Information Program
Wave Buoys

Mission: Monitor and predict near shore waves and shoreline change.

- Based at SIO since 1975
- 35 Wave Stations
- LIDAR & In-Situ Beach Surveys
- $3.5M+ / year budget
- Funded by:
  - USACE
  - CDBW (SCCOOS NOAA, CCC, ONR…)

Investigators:
- Richard Seymour
- Robert Guza
- Bill O’Reilly

Current CDIP Measurements
Contribute To Baseline & Sustaining Data

Storm and El Niño enhanced sea levels during an extreme tide

Ocean Beach Feb 1983
Swell Model

http://www.sccoos.org/data/waves/?r=0
Meteorological Observations

http://www.sccoos.org/data/mets/

Orange County Sea Surface Temperature - 63°F
Weather Research & Forecasting 12.5 km Model

http://www.sccoos.org/data/winds/
Remote Sensing Sea Surface Temperature and Chlorophyll

http://www.sccoos.org/data/modis/modis_california.php
HF Radar Surface Current Maps

Differences between the measured speed and the known speed of the waves are the ocean surface currents.

System directly measures the speed of the waves that scatter the radar signal.
Real Time Processing of HF Radar-Derived Surface Current Mapping Data

- Retrieve radial current fields from each site each hour
- Form vector maps
- Fill spatial gaps
- Compute surface particle trajectories
- Estimate tomorrow’s velocity fields based on recent mean current and tidal fluctuations
- Produce netCDF file for GNOME model with 48 hr observations and 24 hr forecast

COCMP
Coastal Ocean Currents Monitoring Program
Why is surface current mapping with high frequency radar (HFR) important?

Local, state, and federal agencies, educators, scientists, and the general public can use web based products to:

- Tracking oil and other pollutants to improve water quality and reduce exposure
- Manage marine fisheries – larval transport maps, MPA management, help design conservation areas
- Increase efficiency & safety of maritime shipping
- Aid USCG search and rescue operations
- Track planned and unplanned coastal discharges
- Aid recreational boaters – sailing races, boat deliveries, ect

As a long term time series of surface currents are established, HF radar derived surface currents have the ability to:

- Monitor climate change
- Assess the impacts of climate change on coastal habitats
- Increase precision in weather and climate forecasts
- Predict storm surge
- Mitigate coastal erosion
Numerical Ocean Models

- 1-2 km resolution models in Monterey Bay & SCB
- California 3 km resolution model
- 12 km resolution model running on the US West Coast
- Drop-a-drifter tool
- Virtual moorings
- Coupled physical-ecosystem models under development
1-2 km resolution models in Monterey Bay and Southern CA Bight

Temp (°C, color), Current (m/s, arrows) at 0m for 11/06/2010 at 3 GMT

http://www.cencoos.org/sections/models/ROMS.shtml

http://www.sccoos.org/data/roms/
3 km resolution model covering ocean off California Coast

http://ourocean.jpl.nasa.gov/CA/

ROMS Nowcast - Temperature
12 km resolution model within the California Current System

http://www.cencoos.org/sections/models/UCSC_ROMS.shtml
If you wish to determine the origin of something found floating or on the beach, please use the multiple drop mode and: select an end time of whenever it was found and a start time previous to the end time, then drop multiple drifters over a large area to see the most likely origin.
SCCOOS Virtual Moorings

http://www.sccoos.org/data/roms/virtual/
Biological and Geochemical Forecast Models Under Development or Consideration

• Statistical models relating ocean conditions to HABs
• Linked hydrologic, ocean, atmosphere models to forecast salmon populations
• Coupled physical/NPZD (nitrogen, phytoplankton, zooplankton, detritus) models for ecosystem forecasts
• Geochemical modeling to identify natural and outfall-based sources of nutrients
Lunch...Yum!  We will resume 1 hour, Thank you!