SEA CHANGES: California Coastal Waters
Small Sea Changes: Big California Impacts Workshop
May 25, 2010
Scripps Institution of Oceanography, La Jolla, California
Plumes from Mission Bay, Point Loma, and Tijuana River are visible. Also Los Buenos Creek visible in Mexico.
• ~20 million people, representing roughly 25% of the coastal population of the U.S., live within 50 miles of the coast
• Beach usage in California is higher than the other 49 states combined
• 175 million users spend over $10 billion annually on tourism
• Ports are part of the West Coast economic engine
• Active Fisheries Management
• Large Navy presence
Many ocean sampling platforms
ATMOSPHERIC OBSERVATIONS

Recent Meteorological Observations
Winds, Air Temp, Air Pressure, Sea Surface Temp

COAMPS 5 km Modelled 10m Wind Fields – Hourly Forecasts
California
Shore Station Program

18 Stations – CA, OR, WA
Volunteers
Temperature
Salinity
Once-per-day
Shore Station Data Sheets

94-year data record extraordinarily valuable
Sardine is the only Federally Managed Stock With an Environmentally-based Harvest Policy

Policy linked to decadal variability in sardine productivity
If mean drops to 16.85°C, allocation drops to 5% of the harvestable biomass

**MEASURING 61 YEARS OF CHANGE . . .**

*California Cooperative Oceanic Fisheries Investigation*

A Joint Commitment by NOAA & the State of California

**GRID SINCE 1985**

- 20 Sea Days
- 60 Scheduled Stations
- 110,000 nm² Surveyed

The Great Grid Occupied 1949 - 1969
‘Spray’ Underwater Glider

- Speed ~ 25 km/day
  ~ 0.5 knot
- Range ~ 3000 km
- Max depth 1500 m
- Duration ~ 4 months

- 2 meters long
- 100 pounds

- A cycle to 500 m takes ~3 hours
- GPS navigation
- Iridium communication

- Kbytes per profile
- Commands for operation
Ocean Sampling with gliders initiated in 2006

~70,000km travels
~3400 days at sea
~33,000 profiles
SCCOOS Glider Operations

- Continuously monitors coastal velocity, temperature, salinity, and phytoplankton
- SCCOOS gliders are able to profile from the surface to 500m and back in 3 hours, while moving horizontally 3 km
- Example of successful deployment
  - 21 April 2005 offshore of La Jolla: completed ~ 700-km section 19 May (line 93)

Water properties show not only the large-scale structure typical of the region, but also meso- and fine-scale features that a glider can resolve continuously.
SUBSURFACE OBSERVATIONS CONSTRAIN OCEAN MODELS

- Regional Ocean Modeling System (ROMS)
- US West Coast: 20km resolution
- Southern CA: 1km
- One-Way Nesting From Low to High Resolution
- Groups working on a state-wide grid

JPL/UCLA group running realtime models

Challenge – models output large volumes of information.
Glider Sections of Chlorophyll – March April 2010

3/24 – 3/31/2010


4/5 – 4/8/2010

Burt Jones - USC
“Major” Events in 2006 & 2007

Caron and Jones - USC
Strong correlation between toxins in surface waters and marine mammals and birds testing positive for domoic acid in 2006 and 2007

Caron and Jones - USC
HAB SURVEILLANCE PROGRAM

HAB Product – various delivery methods (web, email)
CA Prop 40/50
$21M for funding
Coastal current Monitoring program
Point Loma HF Radar site
For mapping ocean currents
Example of radial velocities measured from the Border Station
2007 Annual average surface velocity fields
2007 Annual average surface velocity fields
Larval Retention Areas

Connectivity maps based on measured surface currents show what waters are influencing MPAs and the potential extent of surface water larval transport.

Color Map: Location of waters 40 days ago (red), 30 days ago (yellow), 20 days ago (green), 10 days ago (cyan), and 5 days ago (blue) before reaching the labeled MPA (magenta).

Poleward propagation of ocean signals – coastal trapped waves

Along-coast Connectivity

S.Y. Kim – in prep

Figure 26: Hovmuller diagram of the alongshore component of the surface currents in California (May 2007-August 2007). The hourly surface currents with 6 km spatial resolution are averaged in 40 hours time window and 8 km radius. Coastal area are indicated: San Diego (SD), Long Beach (LB), San BuenaVentura (VT), Santa Barbara Channel (SB), Port San Louis (SL), Monterey Bay (MB), San Francisco (SF), Point Reyes (PR), and Point Arena (PA)
Eddies off coast found to play a role with larval retention.
• Inspection of Hyperion Outfall Pipe (never internally inspected for 50 years). Serves City of Los Angeles. One of the world’s largest coastal populations.
• Close to a billion gallons of sewage to be diverted to an in-shore/shallow outfall.
• Concern of extent of impact and public health risk in the Santa Monica Bay.
Realtime trajectory tool implemented at surfacing outfall. Provides indication of beach impact.
COASTAL DATA INFORMATION PROGRAM

- Based at Scripps since 1975
- 37 Wave Stations
- 14 People
- Funded by:
  USACE
  CDBW
  (SCCOOS BEACON ONR...)

Wave Observations and Models

CALIFORNIA OCEAN CURRENTS MONITORING Program

- $21M initial funding
- Funded by:
  Coastal Conservancy
  SCCOOS IOOS
  Statewide Program

Surface Currents
Marine Operations
Safety, Navigation and Search/Rescue
Ports and Harbors

San Pedro Channel

currents

wave observations, Nowcasts and forecasts.

Model output using WW3 forecasts and buoy observations as input.
Automated messages for threshold exceedence – Jacobsen Pilots, LB

If 3 day forecast shows >12 seconds Waves.

Important for super tankers as they will start to pitch in long period swell.

With their deep draft, they will run the Risk of hitting the bottom.

Cost > $100,000/day to hold a tanker Offshore.
LA/LB Customized Web Interface

**Currents**
- Surface (6km)

**NOAA Charts**

**Shipping Lanes**

**Wave**
- Prediction Points
- Swell Model
- San Pedro Buoy

**Winds**
- InSitu

NOAA charts integrated with Model Output Prediction Points at key transfer locations
Overlay for Shipping Lanes, Swell Model, and Surface Currents
AIS – Automatic Identification System

Allows tracking of vessel traffic and identification of at-sea Lightering. Could be integrated with ocean information (currents/waves/winds).

Web-based display of realtime AIS data with available NOAA Charts
Oil Distribution from Cosco Busan Spill
Products: Gap filled data, Trajectories Inside SF BAY
Products: Gap filled data, Trajectories
Outside SF BAY
OSPR GIS Unit Role in the Cosco Busan Response

• OSPR GIS DOES NOT MODEL OR PROJECT OIL SLICK TRAJECTORIES
• In a major spill incident NOAA HAZMAT will generate trajectories; USCG will always default to NOAA
• (Cosco Busan Success – COCMP providing HFR Data to NOAA for GNOME)

Slide provided by Judd Muskat – OSPR GIS Specialist
In response to Cosco Busan, a tailored GIS format of HF radar data is now available to OSPR staff and has been in use in drills (Safe Seas, NPREP) and in recent responses in the Santa Barbara Channel.

NOAA HAZMAT now can access surface currents via a national standard NETCDF format (chain of command for enviro data – USCG to NOAA)

Left – OSPR generated Surface current map for the command post during the 2008 NPREP exercise
CA OSPR NOW CAN ACCESS DATA FOR SPILL RESPONSE
Deep Horizon Spill – USE OF HFR

Nearshore Surface Oil Forecast
Mississippi Canyon 252

NOAA/NOS/OR&R

Nearshore

Estimate for: 1200 CDT, Monday, 5/24/10
Date Prepared: 2100 CDT, Sunday, 5/23/10

This forecast is based on the NWS spot forecast from Sunday, May 22, and the NWS/NCEP model. NAM winds, currents, and NHC measurements were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf, TAP/GO: NAVOES, and HFR). The model was initialized from Saturday satellite imagery analysis (NOAA/NESDIS) and Sunday overflight observations. The leading edge may contain turbolls that are not readily observable from the imagery (since not included in the model initialization). Oil near bay areas could be brought into that bay by local exchange currents.

Forecast location for oil on 24 May 2010 at 1200 CDT

Sea Offshore Forecast for trajectories of oil to the south.

Mississippi Canyon 252

Incident Location

Trajectory:
- Uncertainty
- Light
- Medium
- Heavy
- Potential
- Beaching oil

This scale bar shows the meaning of the distribution terms at the current time.

Next Forecast:
May 24th PM
SAR imagery from CSTARS/UMIAMI. OI MAPPED HF RADAR
OIL SPILL IN THE GULF

Landfall could be soon

BP continues to explore solutions to Gulf oil spill

By GEOFF PENDER

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BILOXI — Despite oil continuing to spew into the Gulf, BP plans to finish a rig on May 11. BP CEO Tony Hayward said Monday that the response to the disaster has been large and “as effective as any spill response history.”

But on Monday, despite harsh weather that had helped keep the spill relatively invisible, the spill appeared to be spewing toward the mouth of the Mississippi River and last week oil washed up on beaches. There were still too few estimates of the amount of oil in the water.