

How Surface Currents and Wave Information Can Assist with Oil Spill Response



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Coastal Data Information Program – Program Manager

COCMP

HF RADAR COVERAGE

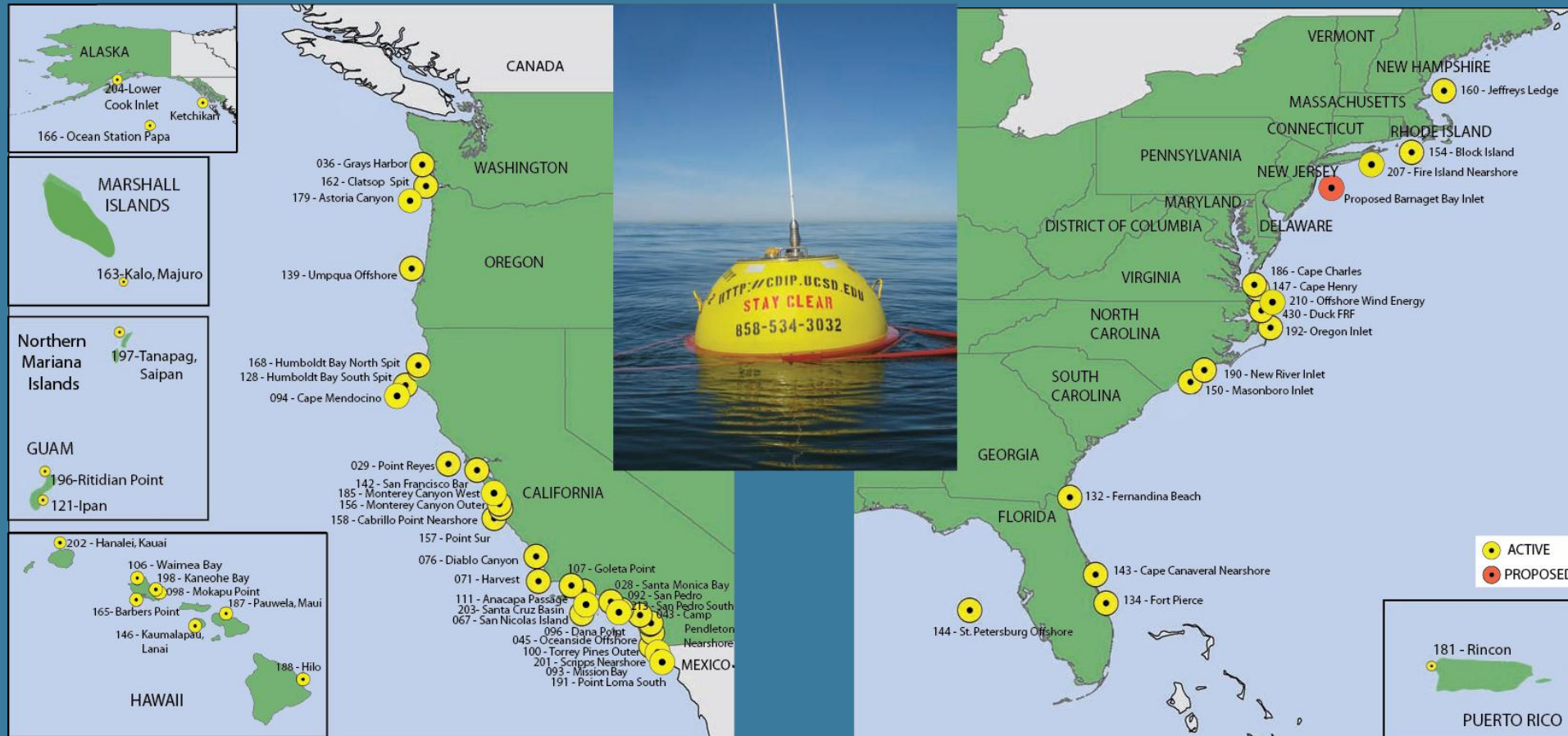
CA Prop 40/50

\$21M for funding

Coastal current
Monitoring program



COASTAL DATA INFORMATION PROGRAM



6/2014



US Army Corps
of Engineers



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

SCCOOS Observations

6 Harmful Algal Bloom Stations since 2005

4 Automated Shore Stations since 2005

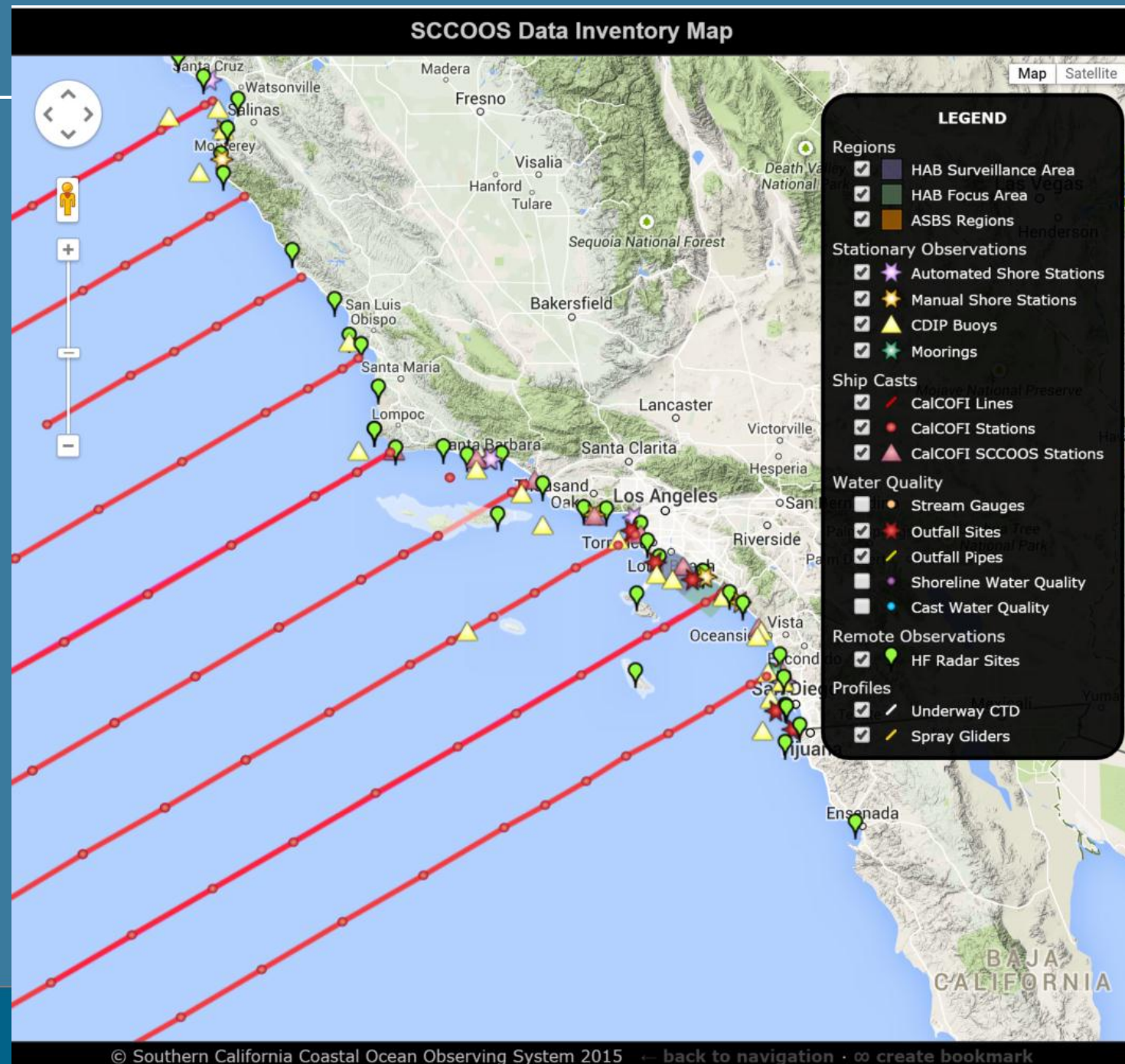
6 Manual Shore Stations since 1916

13 Wave Buoys Since 1975

9 Nearshore CalCOFI stations since 2003

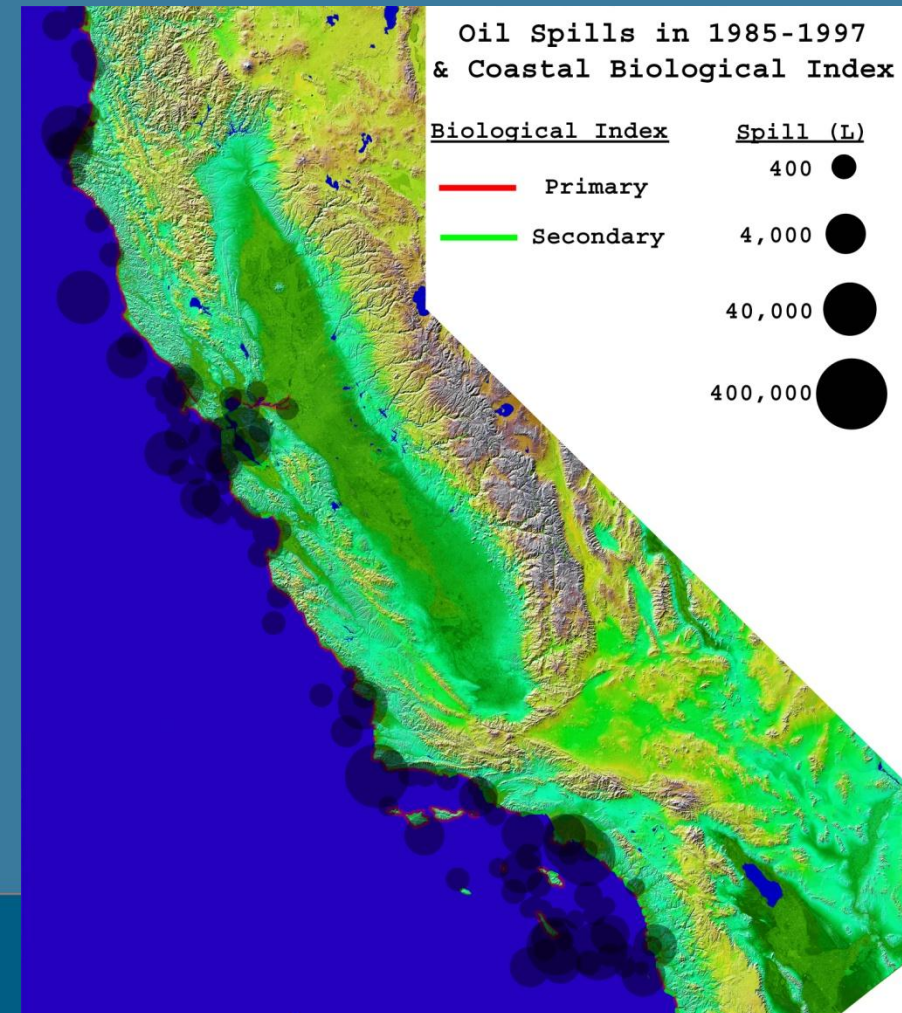
53 High Frequency Radar Stations Since 2001

3 Autonomous Profiling Gliders Since 2007



Drivers for a CA Coastal Observing System – regional needs

- population distribution
- location of permitted wastewater ocean discharges
- coastline sensitivity and areas special biological significant
- oil spill probability

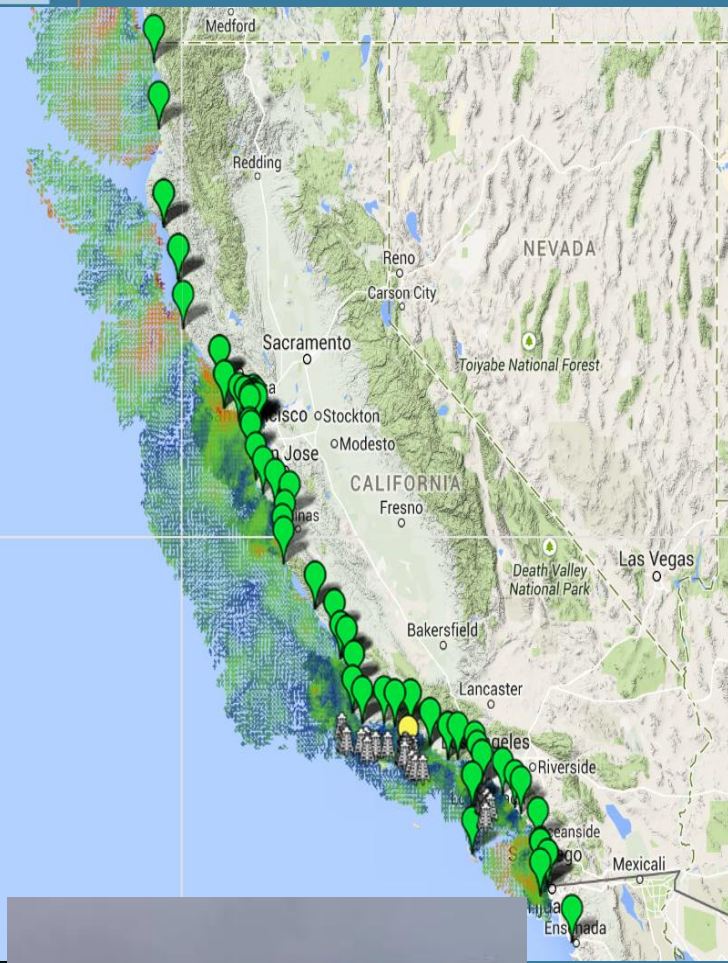


Marine and Coastal Safety

High Frequency Radar (HFR) derived surface currents maps (above) provide critical support for Maritime Operations.

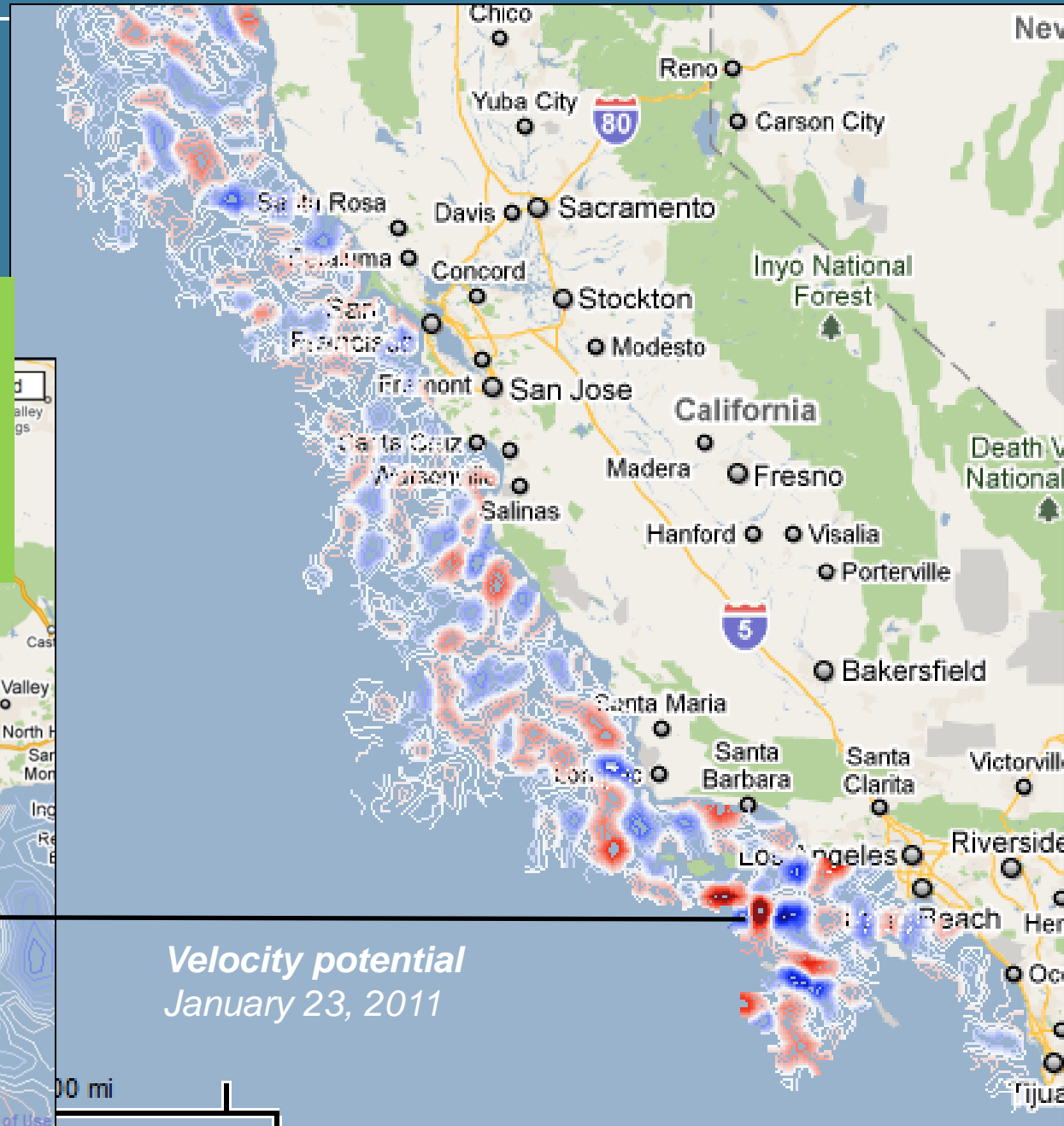
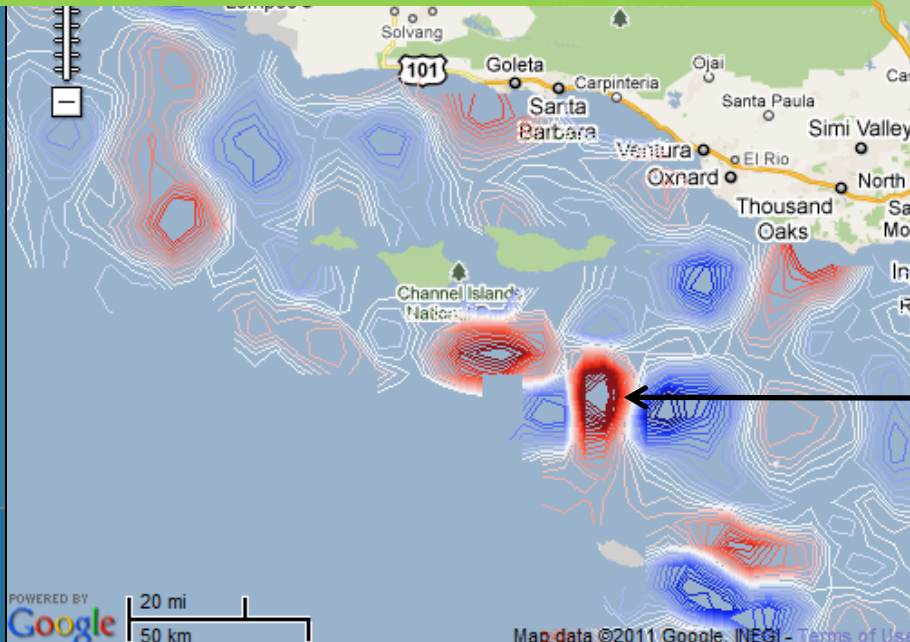
For instance:

- 1) The Navy and Marines require updated information on sea conditions for coastal flights, and target recovery
- 2) The Coast Guard upload surface current to their and search and rescue operations (SAROPS) maps
- 3) California's Office of Oil Spill Prevention & Response uses surface currents in live and training exercises



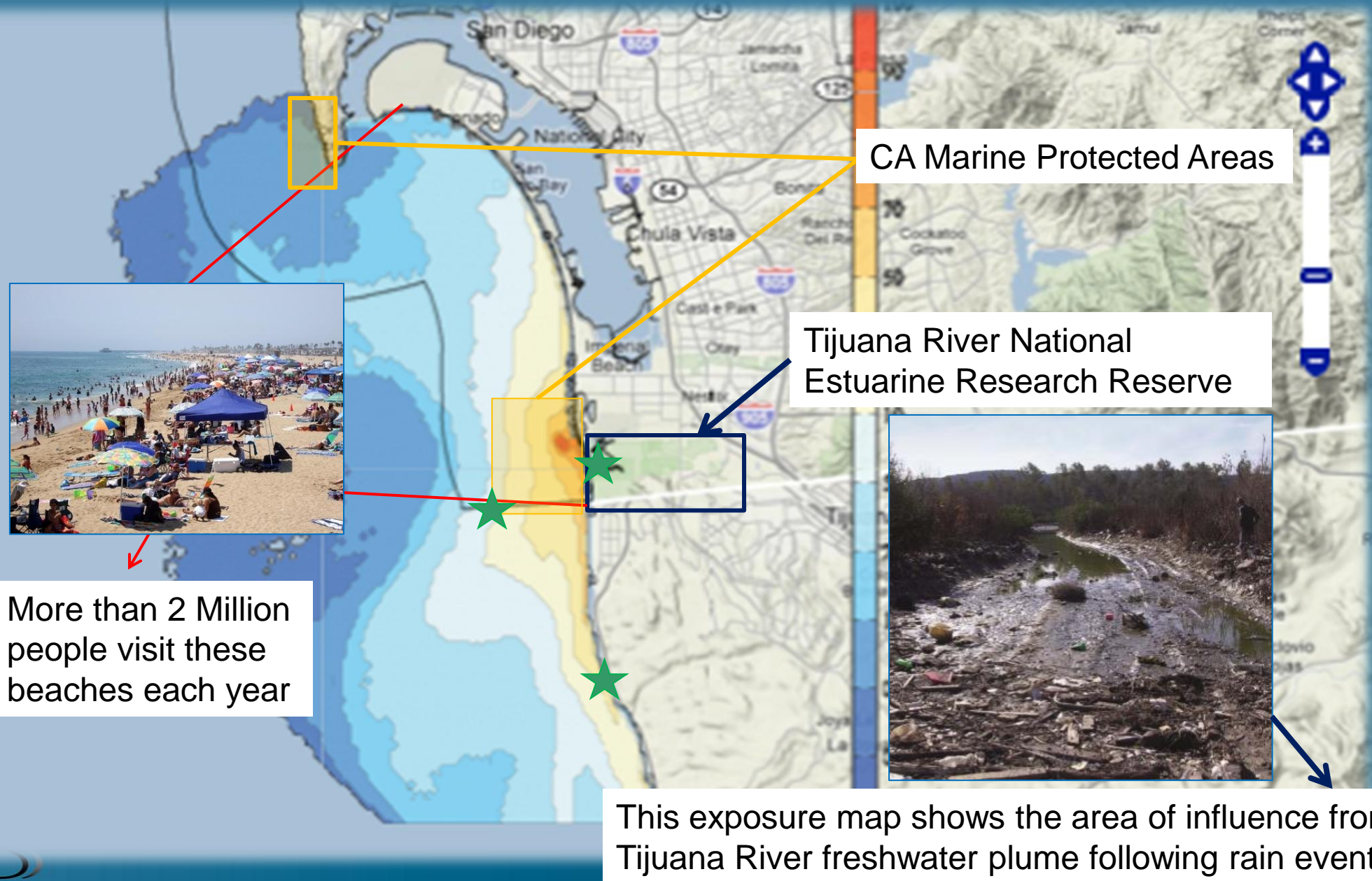
Surface Current Time Series Shows Upwelling and Downwelling

- **Stream function:** Indicates eddies with clockwise or counter-clockwise rotations
- **Velocity potential:** Shows upwelling (red) and downwelling (blue)

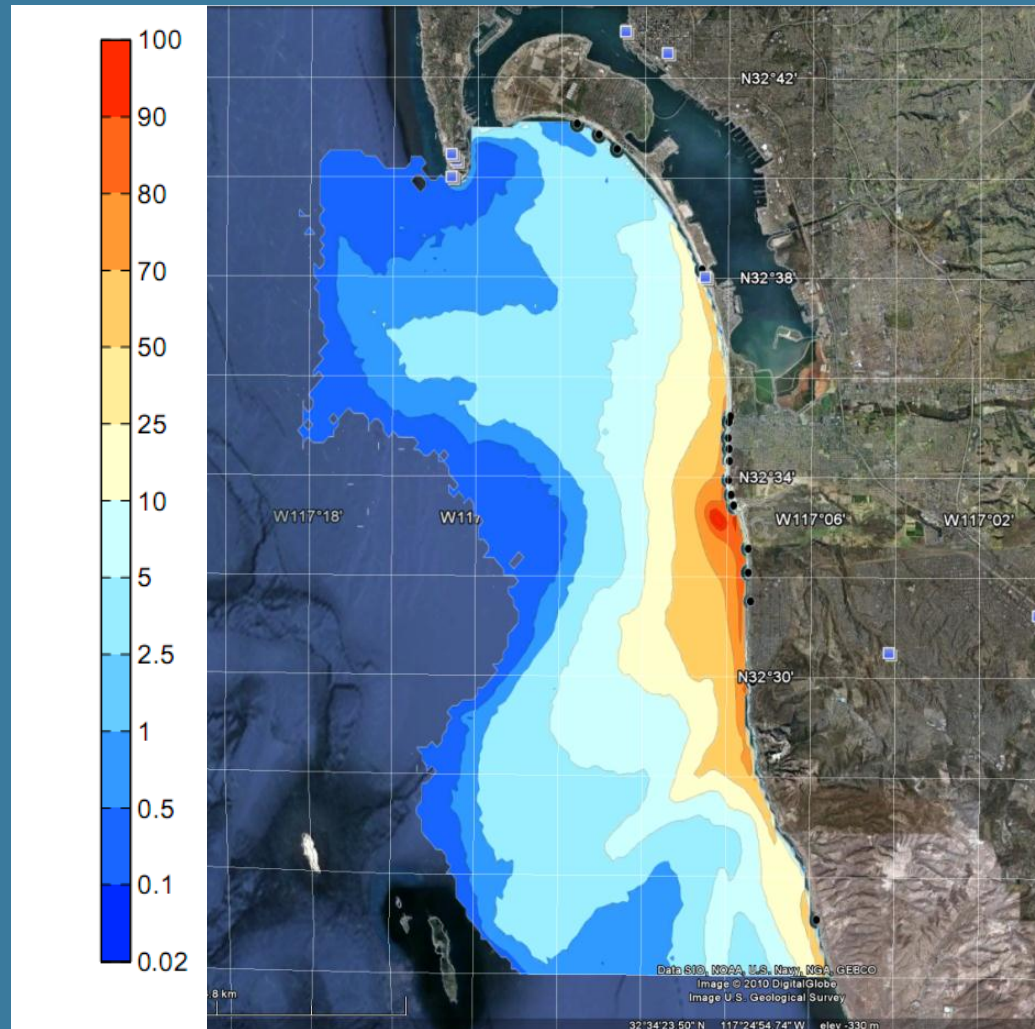


*Velocity potential
January 23, 2011*

Water Quality – The U.S./Mexico Border Region



Water Quality Applications – Tijuana Plume Tracker



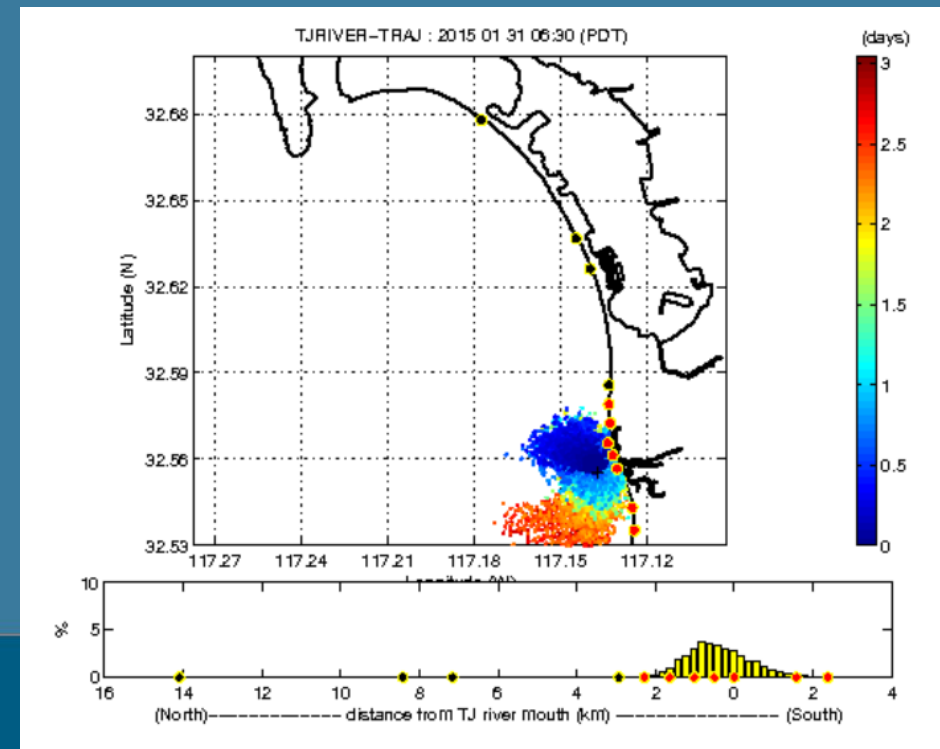
Stormwater Plume Tracking

Tijuana River Flow Rate

Latest Observations	24hr Maximum	24hr Minimum
0.00 MGD	0.00 MGD	0.00 MGD
0.00 cm/s	0.00 cm/s	0.00 cm/s
2015-02-05 20:00:00 UTC	2015-02-05 20:00:00 UTC	2015-02-05 20:00:00 UTC

MGD = Millions of gallons per day. cm/s = Cubic meters per second.

Values in red indicate the data is greater than 24 hours old. Otherwise values are displayed in black.



SCCOOS
SOUTHERN CALIFORNIA COASTAL
OCEAN OBSERVING SYSTEM

Areas of Biological Significance (ASBS) Explorer

Layers

- Near Real-Time Point Observations**
 - ☐ Meteorological Station Data
 - ☒ San Diego ASBS Outfall Stations
 - ☐ San Diego ASBS Bacteria Stations
 - ☐ Harmful Algae & Red Tides
- Static Point Observations**
 - ☒ California ASBS Boundaries
 - ☒ Historical Probability Maps
- Spatial Observations**
 - ☒ HF Radar Surface Currents
- Models**
 - ☐ ROMS
 - ☐ NCEP SST (nowcast)
 - ☐ NAM Winds
 - ☒ WWIII Wave Height
- Special Studies and Documents**
 - ASBS #31 San Diego-Scrrips
 - Regional Monitoring
 - Ecosystems Assessments

Map Date Time (Local) 10/09/2014 12:00 **UTC Map Date Time:** 10/09/2014 19:00 **Current UTC:** 10/09/2014 22:38 **Current Local:** 10/09/2014 15:38

Location Bookmarks: [La Jolla](#) [SD](#) [SoCal](#) [CA](#)

Time Series Graph
Height of Combined Wind, Waves and Swells
WWIII Wave Height

Legend

WWIII Wave Height

Wave Height (M)	Color
0.00 - 0.88	Dark Blue
0.88 - 1.75	Blue
1.75 - 2.63	Light Blue
2.63 - 3.50	Green
3.50 - 4.38	Yellow
4.38 - 5.25	Orange
5.25 - 6.13	Red
6.13 - 7.00	Dark Red
7.00 - 7.88	Dark Purple

HF Radar Surface Currents

Current Strength (cm/s)

Current Strength (cm/s)	Color
0	Blue
10	Green
20	Yellow
30	Orange
40	Red
50	Dark Red

Historical Probability Maps

Probability	Color
90% PoE	Dark Red
80% PoE	Red
70% PoE	Orange
50% PoE	Yellow
25% PoE	Green
15% PoE	Light Green
10% PoE	Blue
5% PoE	Dark Blue
1% PoE	Dark Purple

Location: Agua Hedionda

California ASBS Boundaries

Layer: WWIII Wave Height

Display time: ☐ UTC ☒ Local

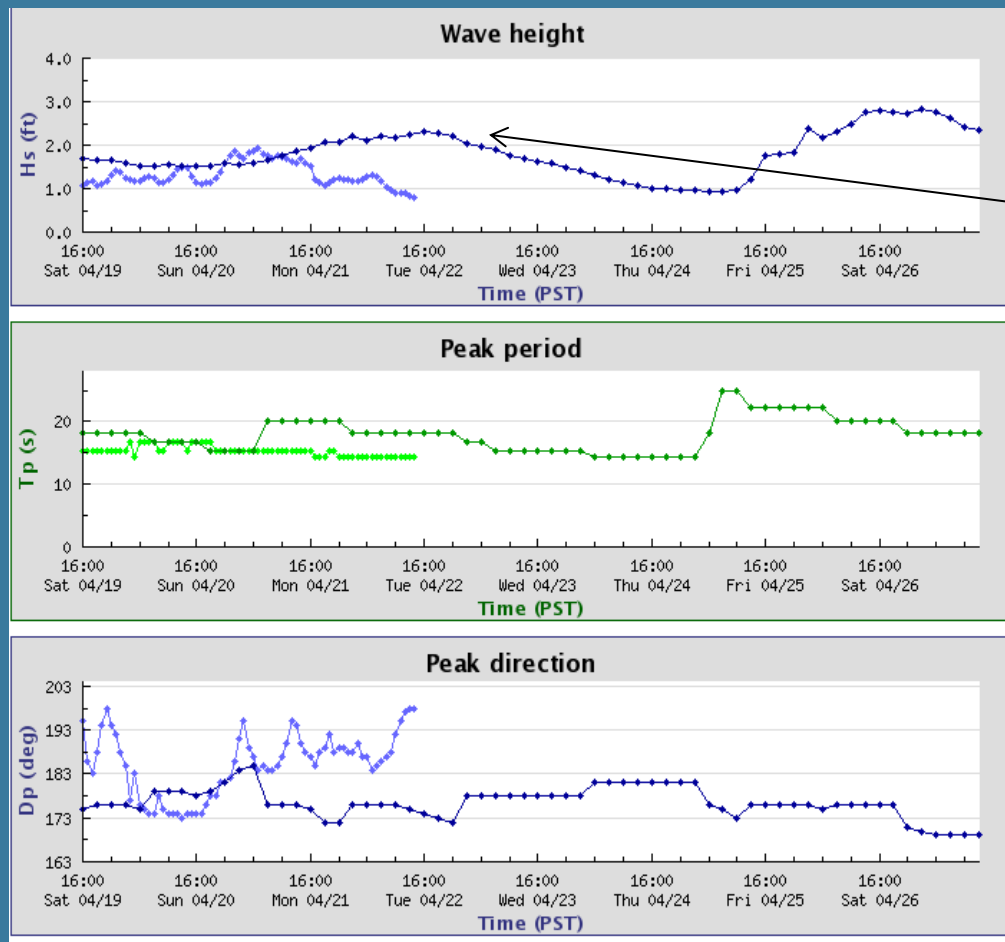
Time Span:

- ☒ current date/time, duration: 1 week
- ☐ pick a start date: mm/dd/yyyy
- ☐ pick an end date: mm/dd/yyyy

Submit/Refresh

This online tool allows them to interpret data through information management.

REAL TIME WAVE MESSAGING TO COMMERCIAL PARTNERS



Model is over predicting by
>1 ft Significant Wave
height.



San Pedro Buoy observation vs WW3 Model Predictions
April 2014

CASE STUDY: Long Beach – Under Keel Clearance Project

Location:

Port of Long Beach shipping channel

Partnerships:

Jacobsen Pilot Servic, Inc.

The Marine Exchange of Southern California

National Oceanic and Atmospheric Administration (NOAA)

NOAA's National Weather Service (NWS)

National Center for Environmental Prediction (NCEP)

Office of Coast Survey (OCS)

Oil Spill Prevention and Response (OSPR)

Operational Oceanographic Products and Services (CO-OPS)

Port of Long Beach (POLB)

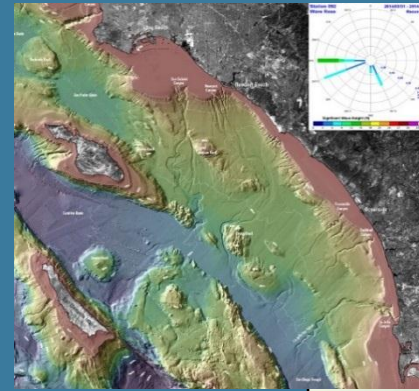
PROTIDE

Tesoro

U.S Integrated Ocean Observing System (IOOS)

Economics:

The Port of Long Beach and Los Angeles are the busiest ports U.S, CDIP helps ensure safety of marine operations contributing to our national and global economy.

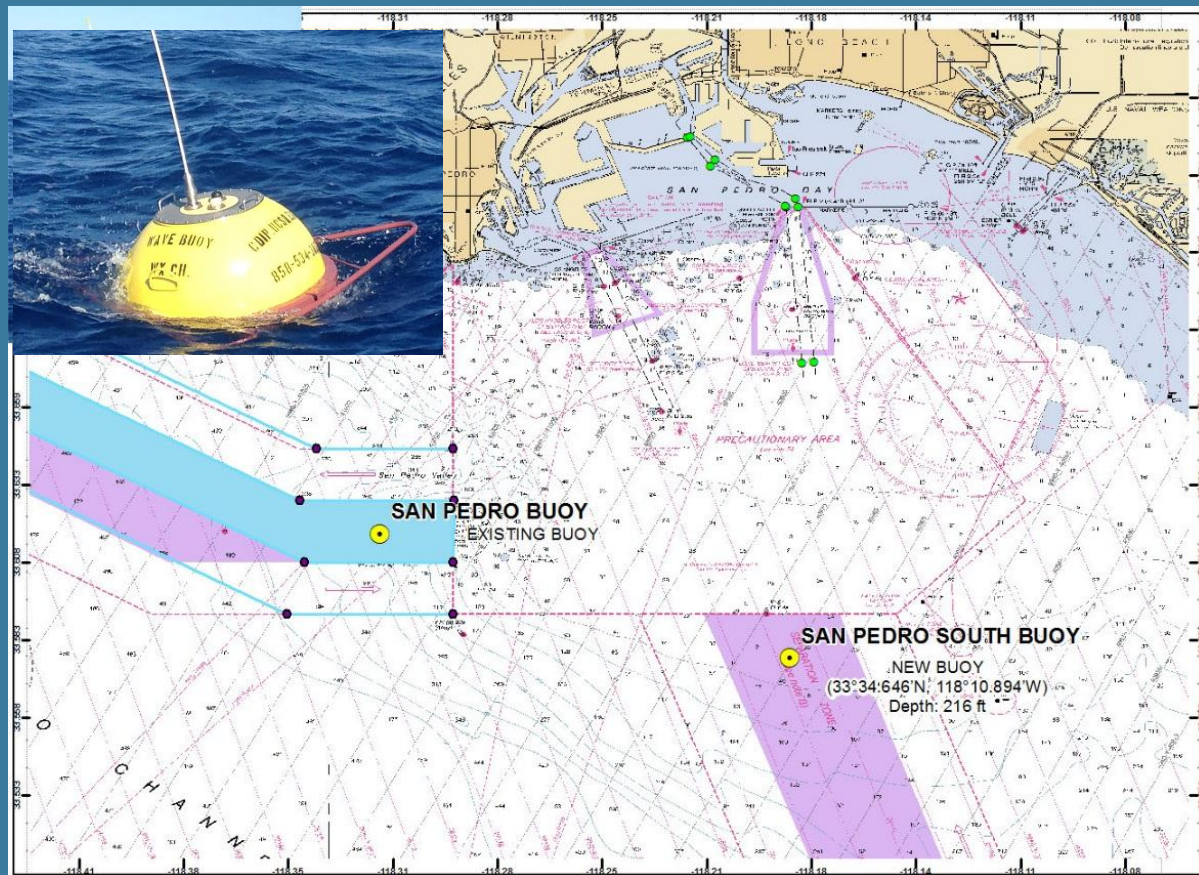


VLCC – 1200 ft length



June 2014 - San Pedro Wave Buoy measured 21ft peak, at 13-14 sec. An ATC Oil Tanker rolled 10 degrees at the Long Beach Breakwater entrance. The vessel had a 55 ft draft, 160 ft wide. The roll increased the draft to 64 feet. (Channel currently dredged to 69ft)

Marine Planning



Port of Long Beach, Buoy Deployment

October 15, 2014

Contributing factors:

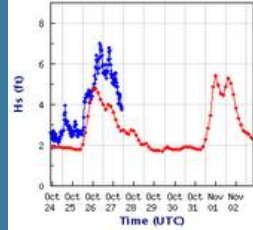
- Shipping lanes
- Ship Traffic
- Bathymetry
- Swell model verification
- Swell direction
- Fishing



Data Products

Observations: CDIP buoy 092
Forecast: NOAA WW3 46222

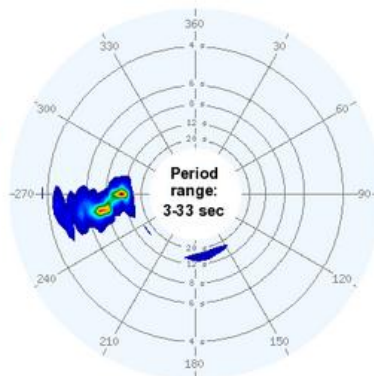
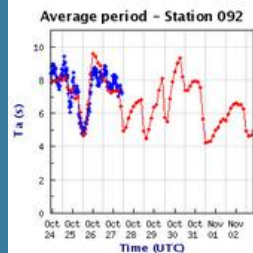
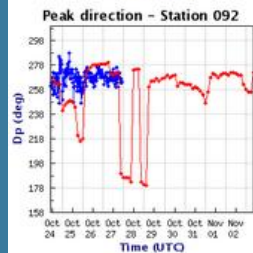
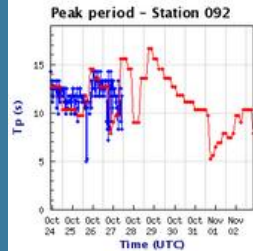
Wave height - Station 092



092 San Pedro

8 records

Date (PDT)	Hs (ft)	Tp (s)	Dp (deg)	Ta (s)	SST (F)
2014-10-27 15:06	3.87	11.76	265	7.29	68.4
2014-10-27 14:36	3.74	8.33	264	7.17	68.4
2014-10-27 14:06	3.87	12.50	267	7.32	68.7
2014-10-27 13:36	4.00	9.09	264	7.41	68.9
2014-10-27 13:06	4.36	10.53	267	7.64	68.7
2014-10-27 12:36	4.49	11.11	267	7.71	68.4
2014-10-27 12:06	4.04	10.53	272	7.30	68.0
2014-10-27 11:36	4.30	9.88	271	7.38	67.6

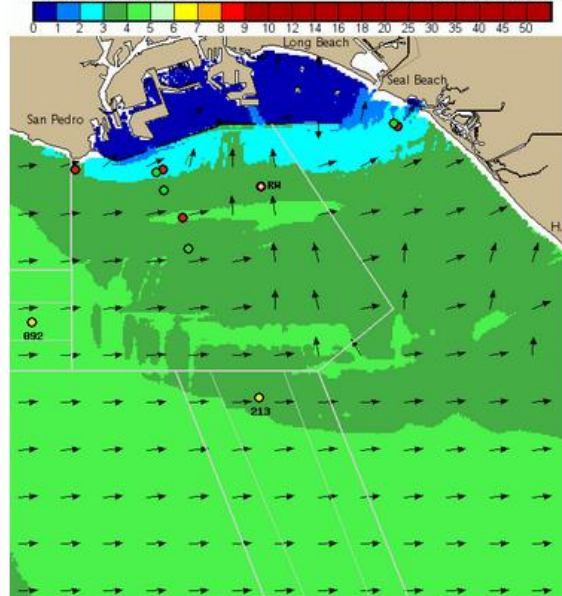


Energy density, $m^2m/Hz/deg$

Station 092 2014-10-27 22:06 UTC



CDIP/SIO Experimental Los Angeles Long Beach Sea and Swell Model
Wave Height (ft) and peak dir



California Department
of
Boating and Waterways



U.S. Army Corps of Engineers
Field Wave Gaging Program

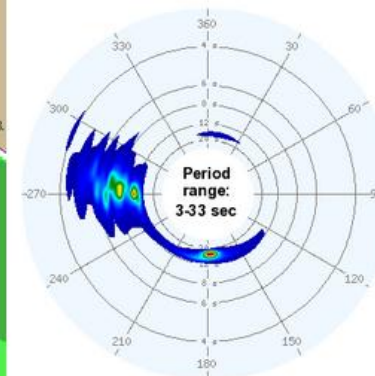
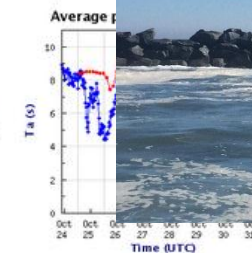
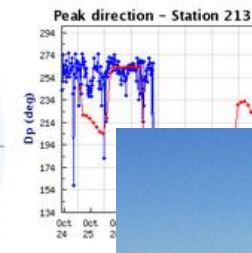
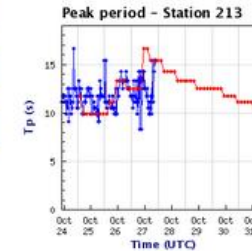
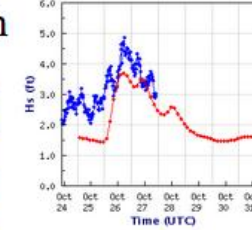
213 San Pedro South

8 records

Date (PDT)	Hs (ft)	Tp (s)	Dp (deg)	Ta (s)	SST (F)
2014-10-27 15:03	2.95	15.38	171	7.76	71.6
2014-10-27 14:33	3.02	15.38	192	7.87	71.6
2014-10-27 14:03	2.89	15.38	181	7.73	71.6
2014-10-27 13:33	2.95	14.29	195	7.33	71.4
2014-10-27 13:03	3.02	15.38	179	7.58	71.4
2014-10-27 12:33	3.44	11.11	267	8.06	71.4
2014-10-27 12:03	3.58	11.76	261	7.87	71.2
2014-10-27 11:33	3.51	15.38	174	8.00	70.7

Observations: CDIP buoy 213
Forecast: NOAA WW3 46253

Wave height - Station 213



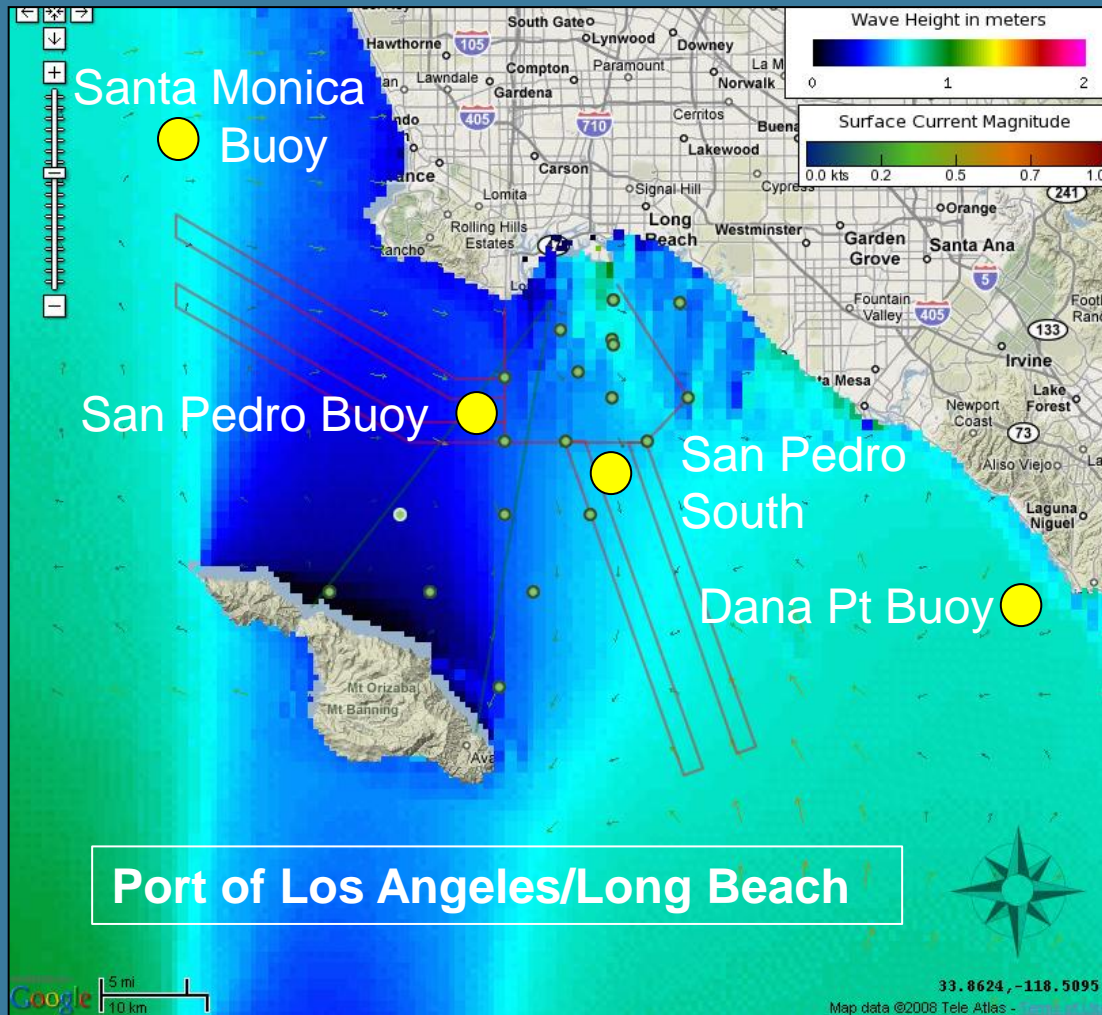
Energy density, $m^2m/Hz/deg$

Station 213 2014-10-27 22:03 UTC

22:55:19 UTC



Wave and Surface Current Operational Products



This customized site is used for maritime traffic for either near real-time decisions as to their immediate transit, or for planning purposes through available forecast information.

1. **Wave data** from California Data and Information Program (CDIP).
2. SCCOOS provides **HF radar surface currents, wind, meteorological data, sea surface temperature, and tide data**.
3. The **HF radar technology** is supported by the State of California through its Coastal Ocean Currents Monitoring Program.
4. NOAA provides **nautical charts, and shipping/ferry routes**.

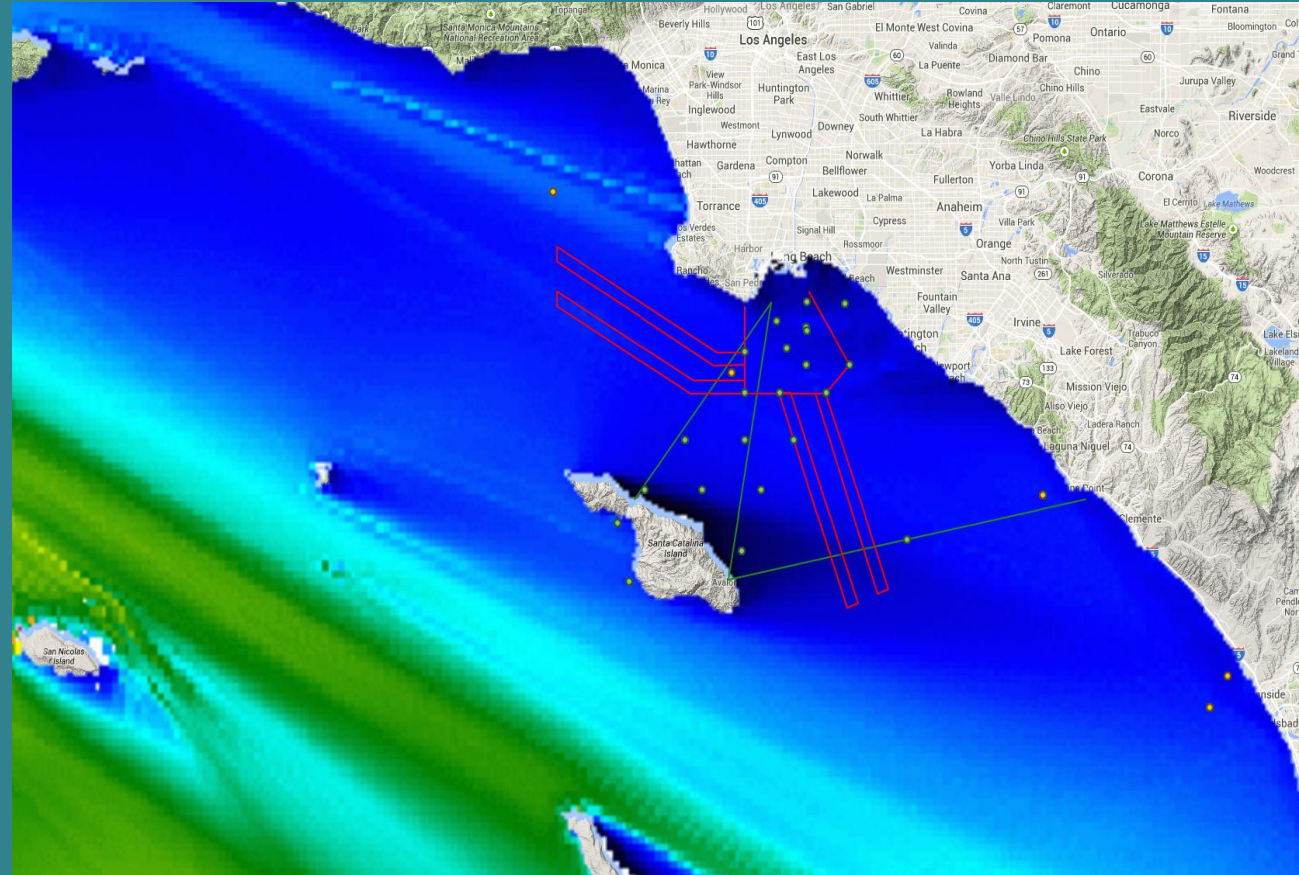
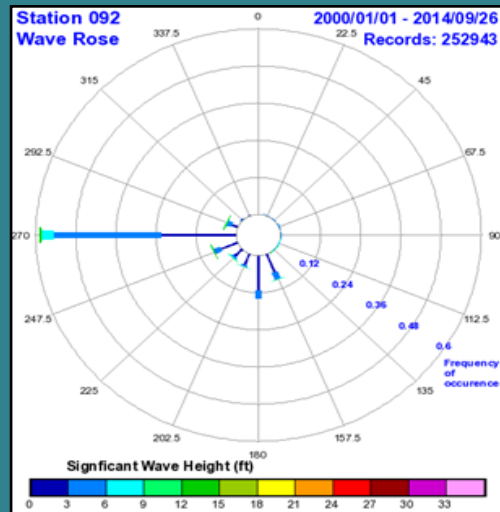
Vessel Lightering offshore Southern California

"The side-by-side mooring arrangement used in a typical lightering operation is only practical in low-to-moderate seas under reasonably good weather conditions. If the weather turns severe and waves reach a certain height, the operations must be suspended and the vessels separated."

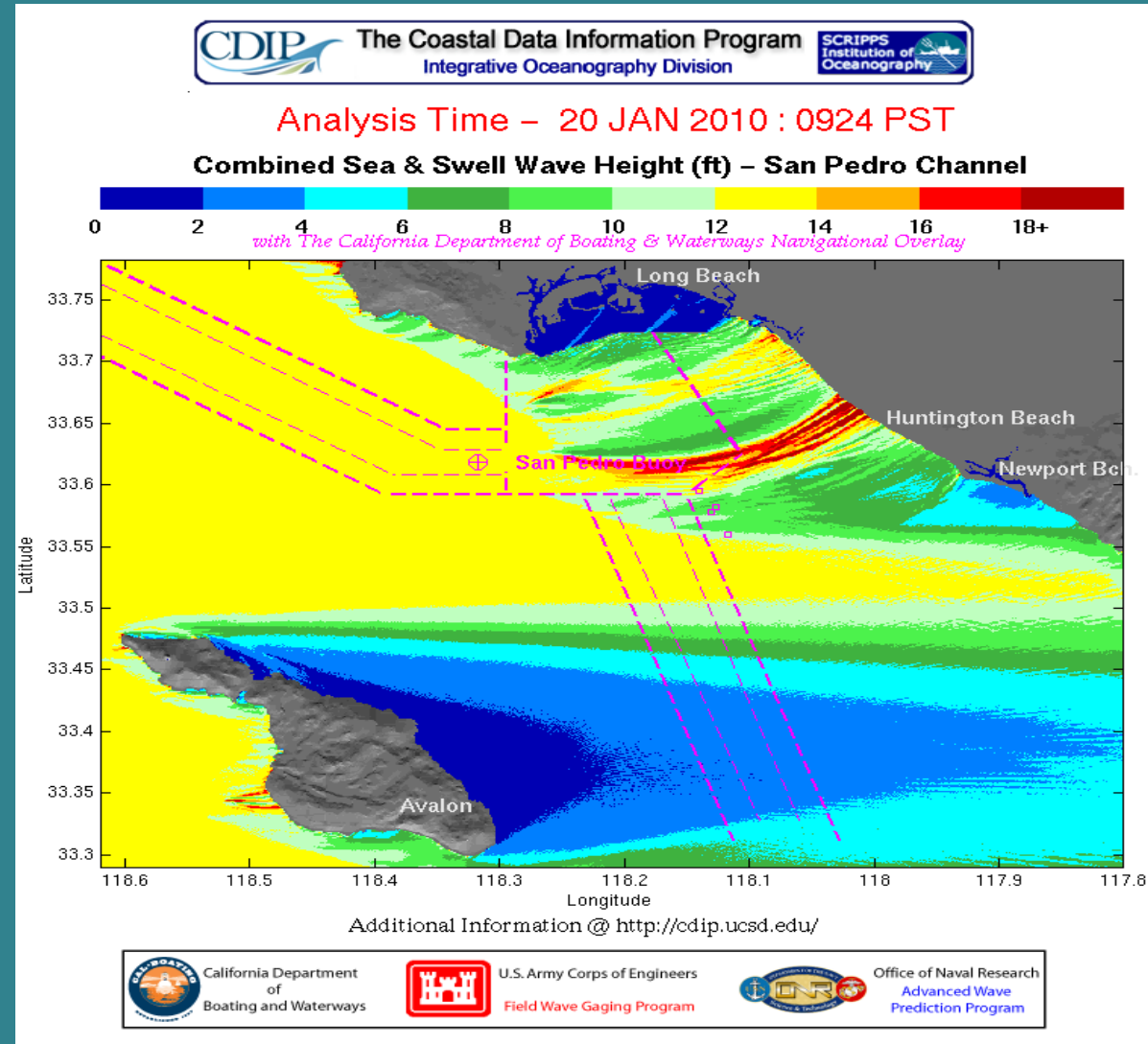
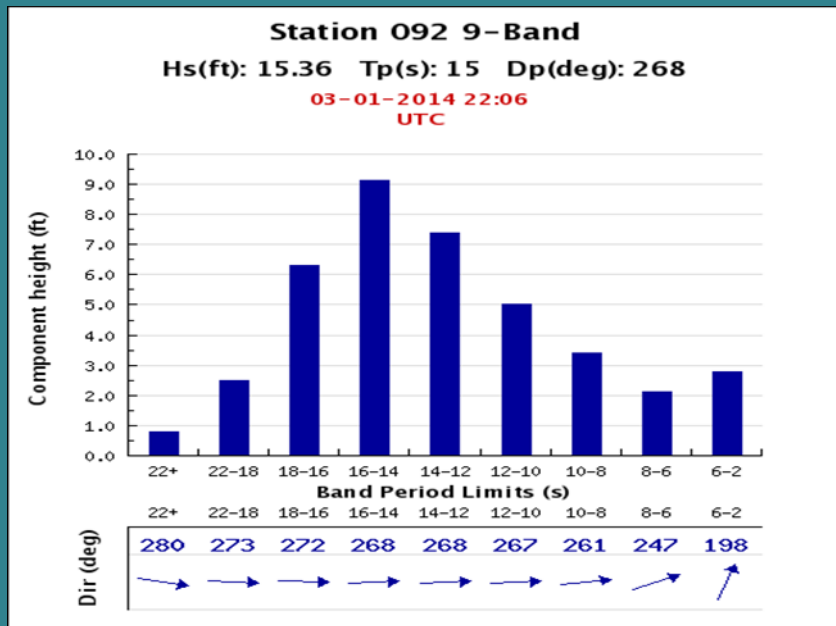
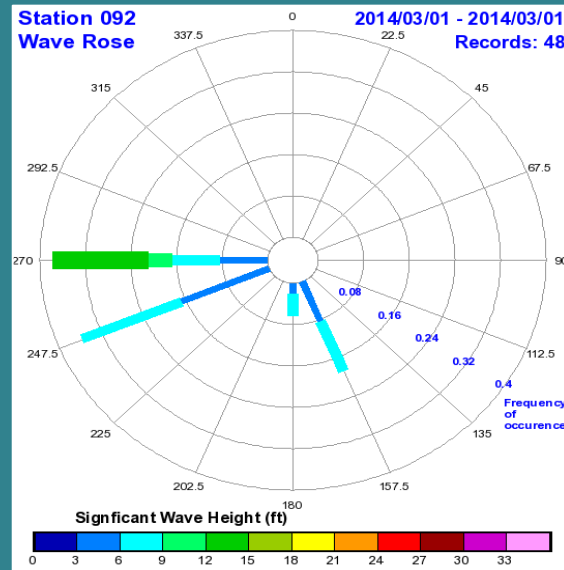
(*Marine Board: Oil Spill Risks from Tank Vessel Lightering, 1998*)



Full Directional Spectrum exposure for San Pedro buoy (2000-present)

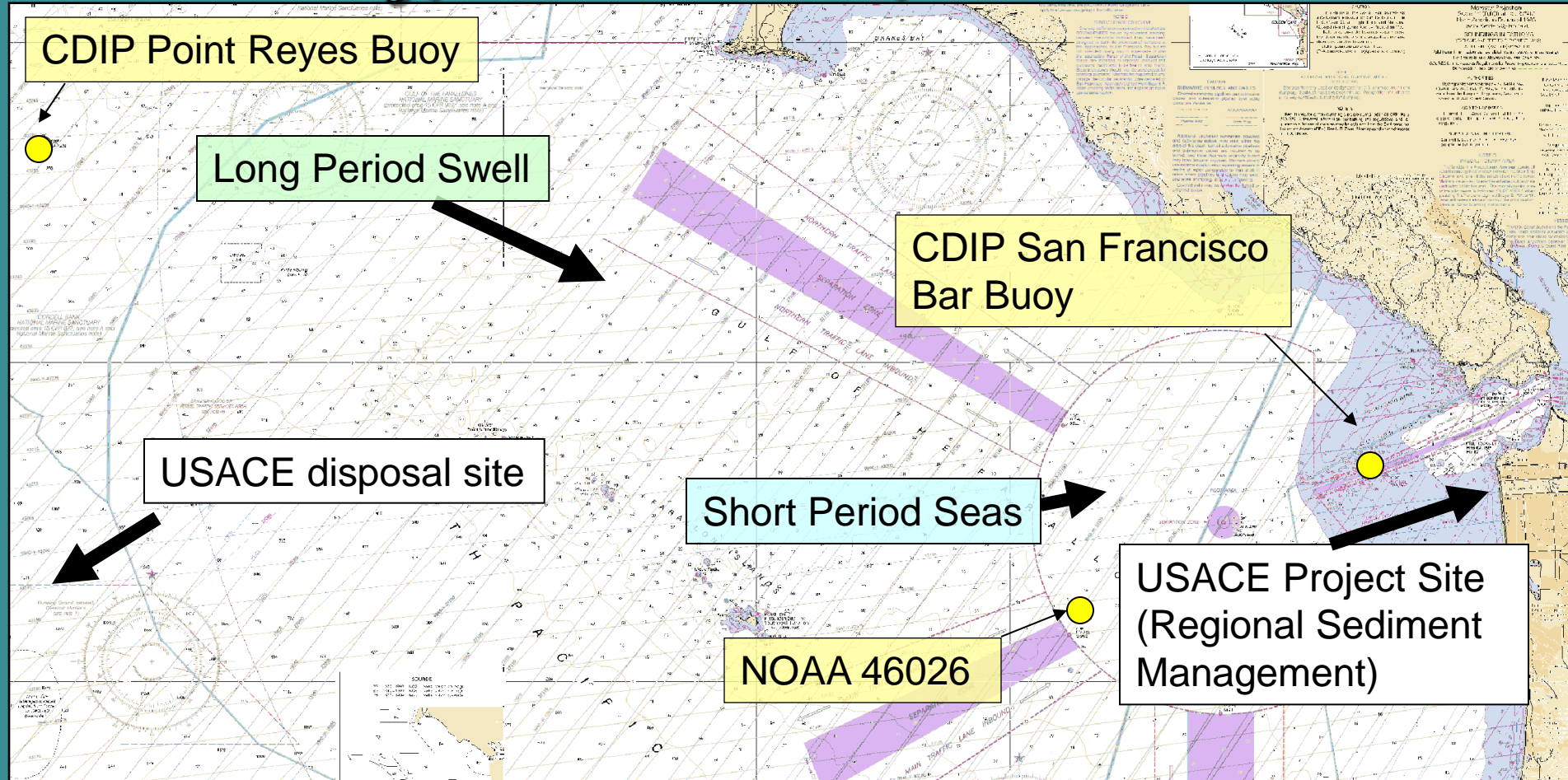


Wave Models and Exposure West Swell



San Francisco

Safety, Economics, Environment



THANK YOU!

sccoos.org

cdip.ucsd.edu