A Systems Approach to Montoring and Predicting Nearshore Waves and Shoreline Change

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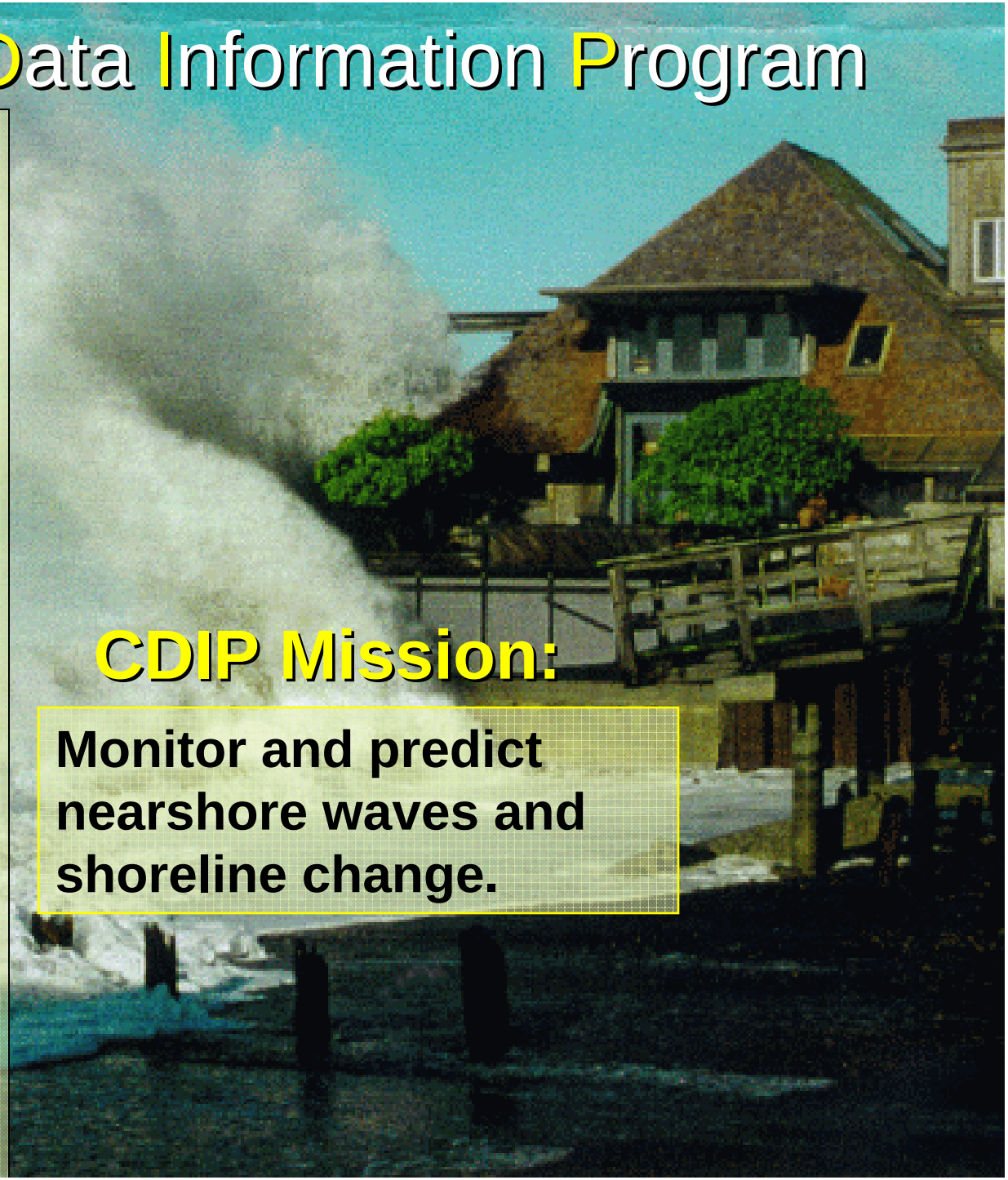
USACE – CERB/Portland
September 23, 2008

Coastal Data Information Program

- Based at SIO since 1975
- 35 Wave Stations
  LIDAR & In-Situ Beach Surveys
- 17 People
- $3.5M+ / year budget
- Funded by:

  USACE
  CDBW
  (SCCOOS
  NOAA
  CCC
  ONR…)

Investigators:
Richard Seymour
Robert Guza
Bill O'Reilly



CDIP Mission:

Monitor and predict nearshore waves and shoreline change.

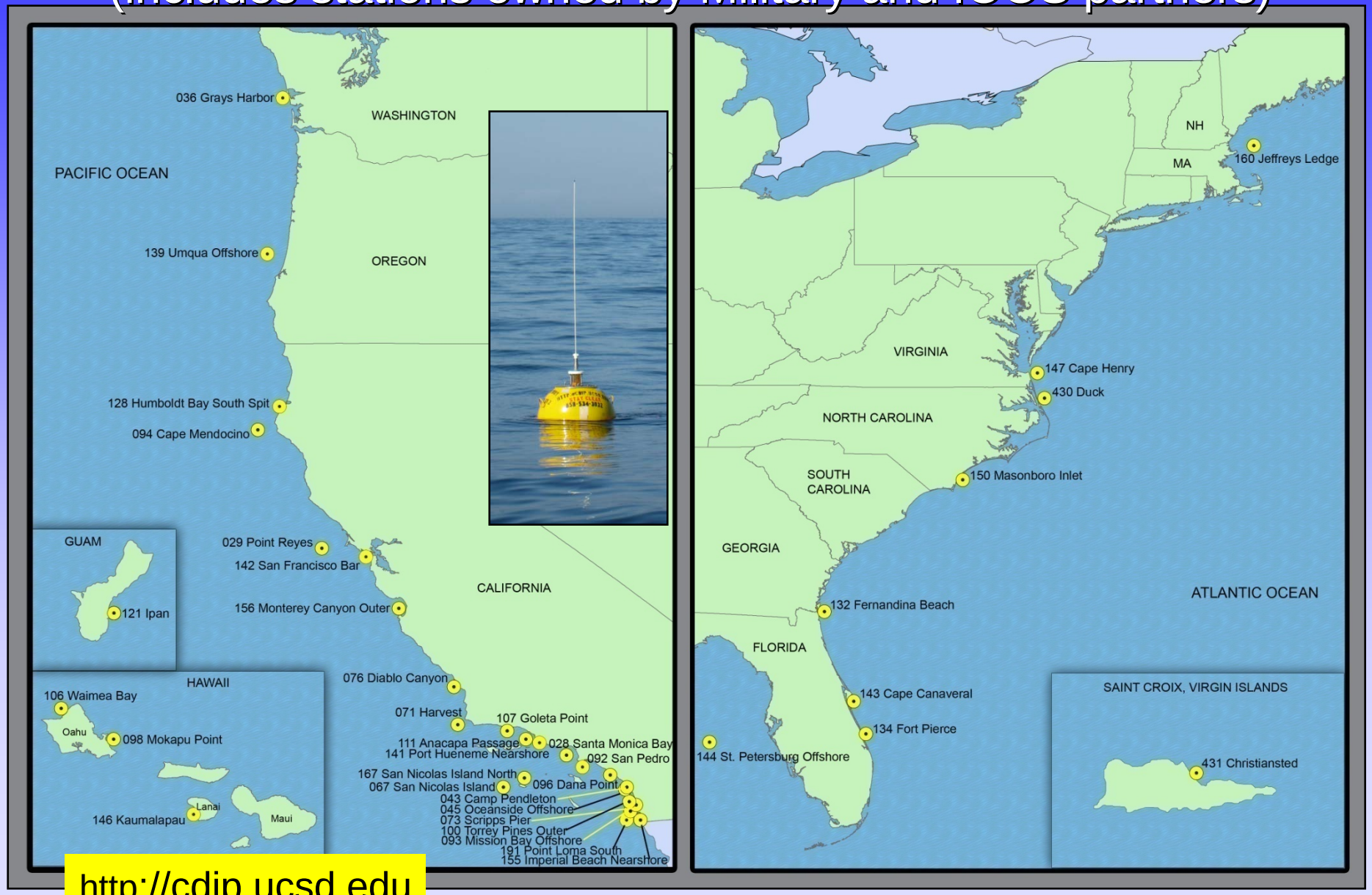
Systems Approach to CDIP Waves & Beaches

	Observations	Models	Applications
Offshore	Waves: Directional Buoys	Regional Wave Prediction	Maritime Transportation
Shelf	Waves: Directional Buoys Waves: PUVs	Nearshore Wave Prediction	Beach Safety Coastal Engineering and Planning
Surf	Waves: PUVs	Surfzone Wave & Current Prediction	Beach Safety (rips) Pathogen Transport (beach closures) Inundation
Beach	Sand: ATV & JetSki Surveys Sand: LIDAR Surveys	Sediment Transport Prediction	**RSM** (Coastal Evolution w/ Climate Change)

Information Flow

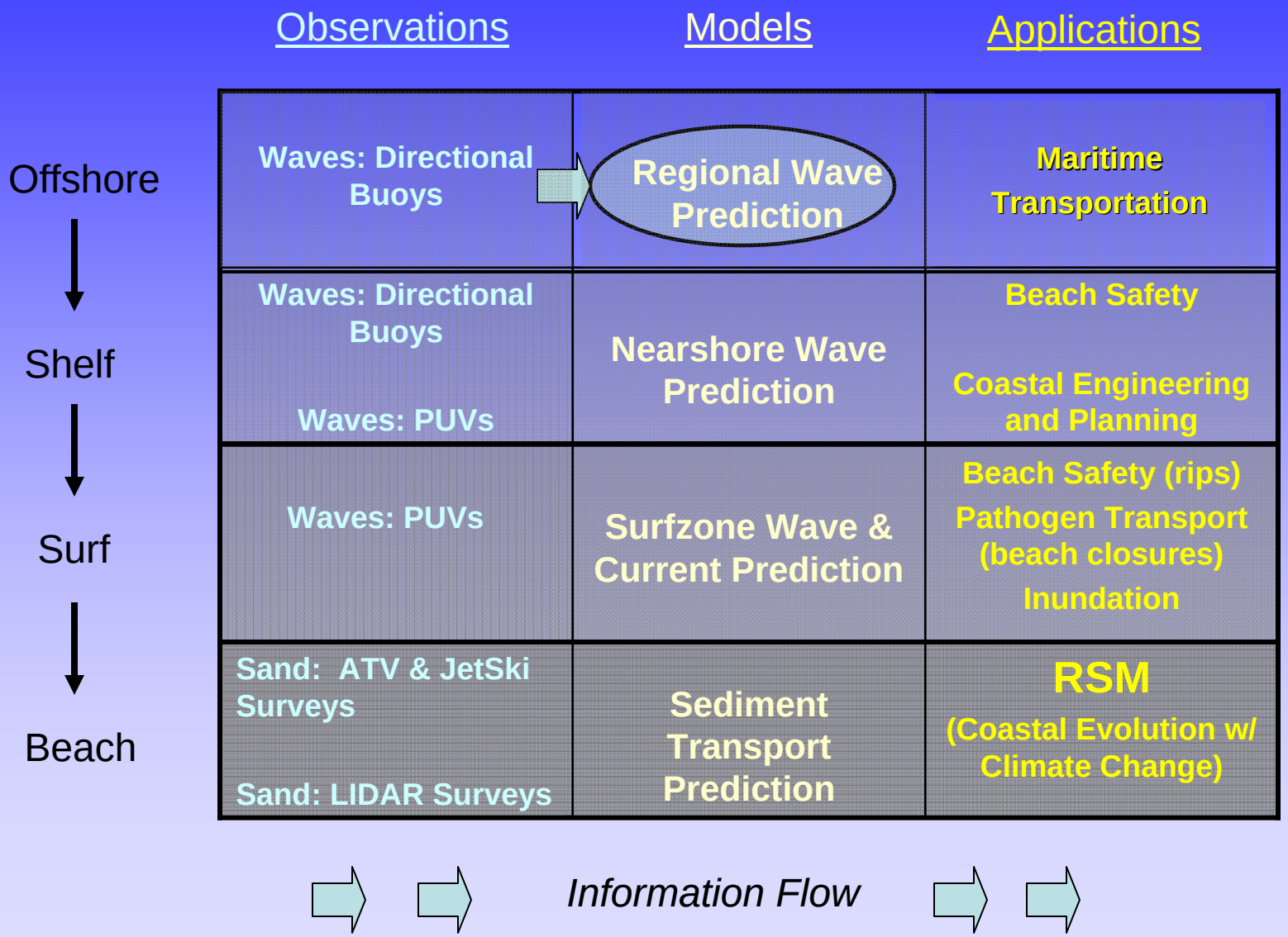
CDIP Wave Buoys

(includes stations owned by Military and IOOS partners)



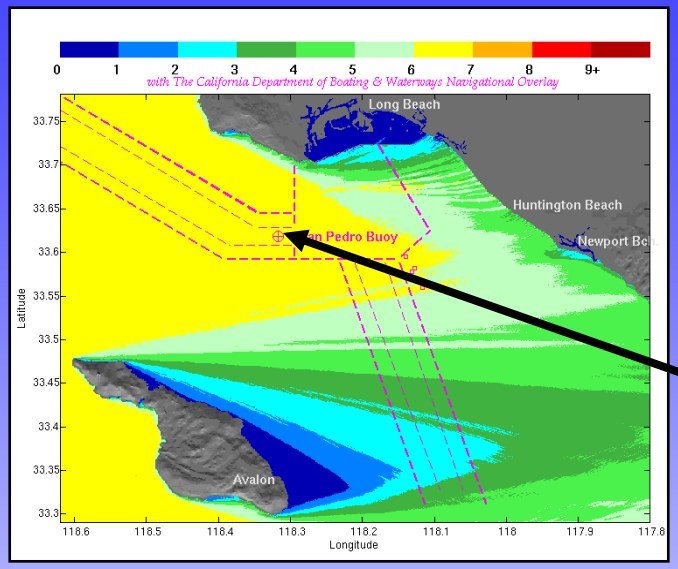
http://cdip.ucsd.edu

Systems Approach to CDIP Waves & Beaches



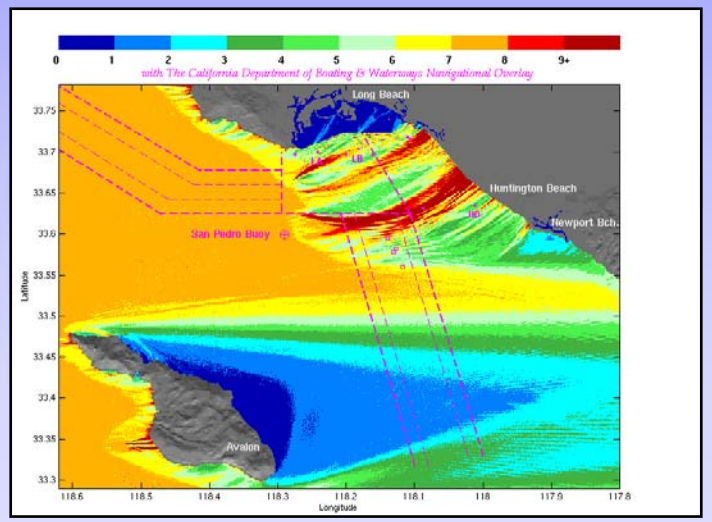
j1

Regional Wave Model Predictions

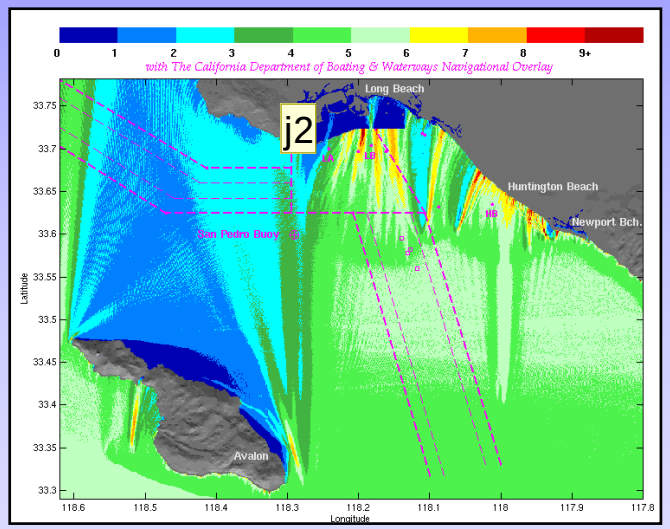


Leverage existing infrastructure for Wave products

San Pedro Wave Buoy



West Swell



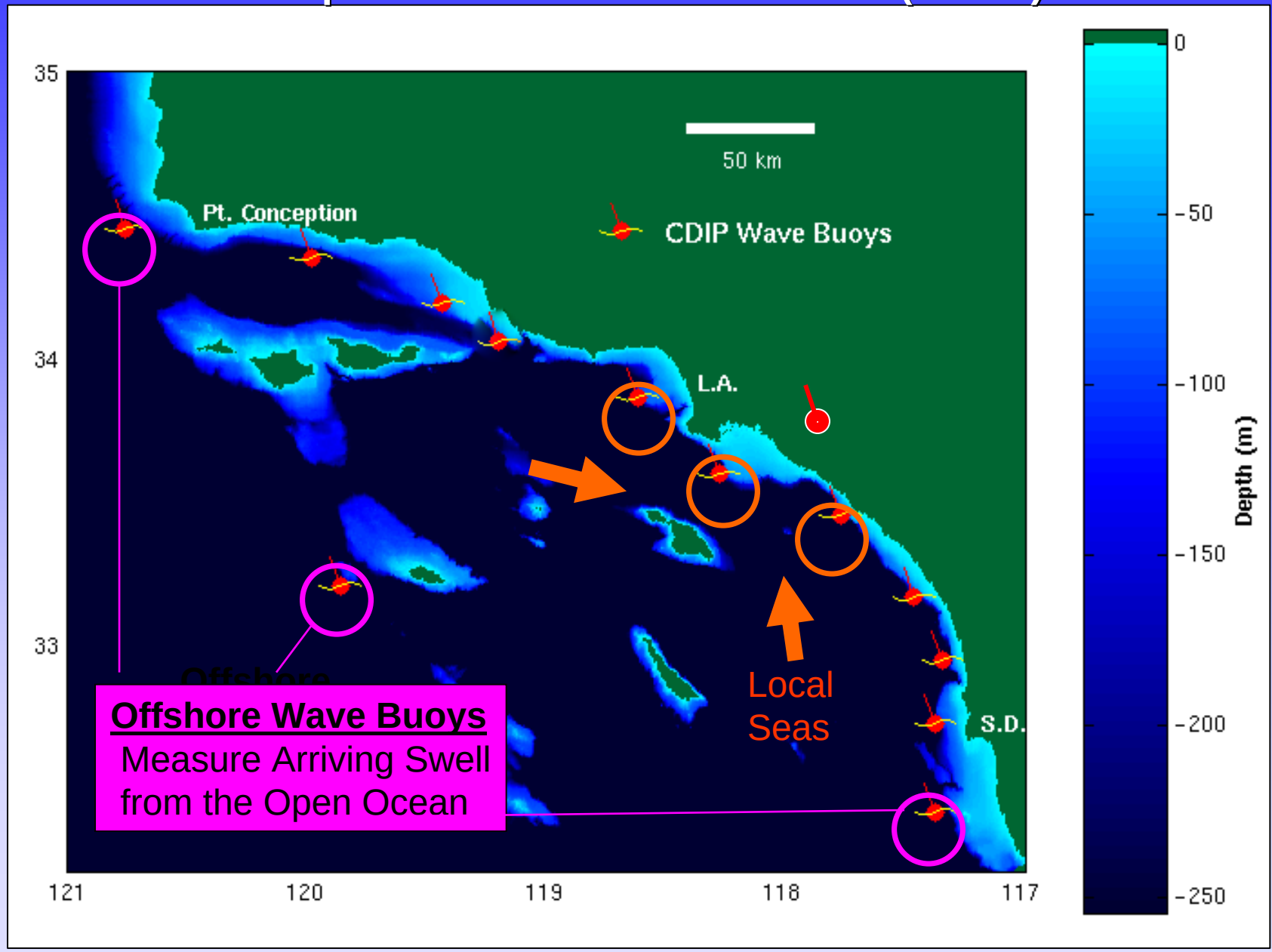
South Swell

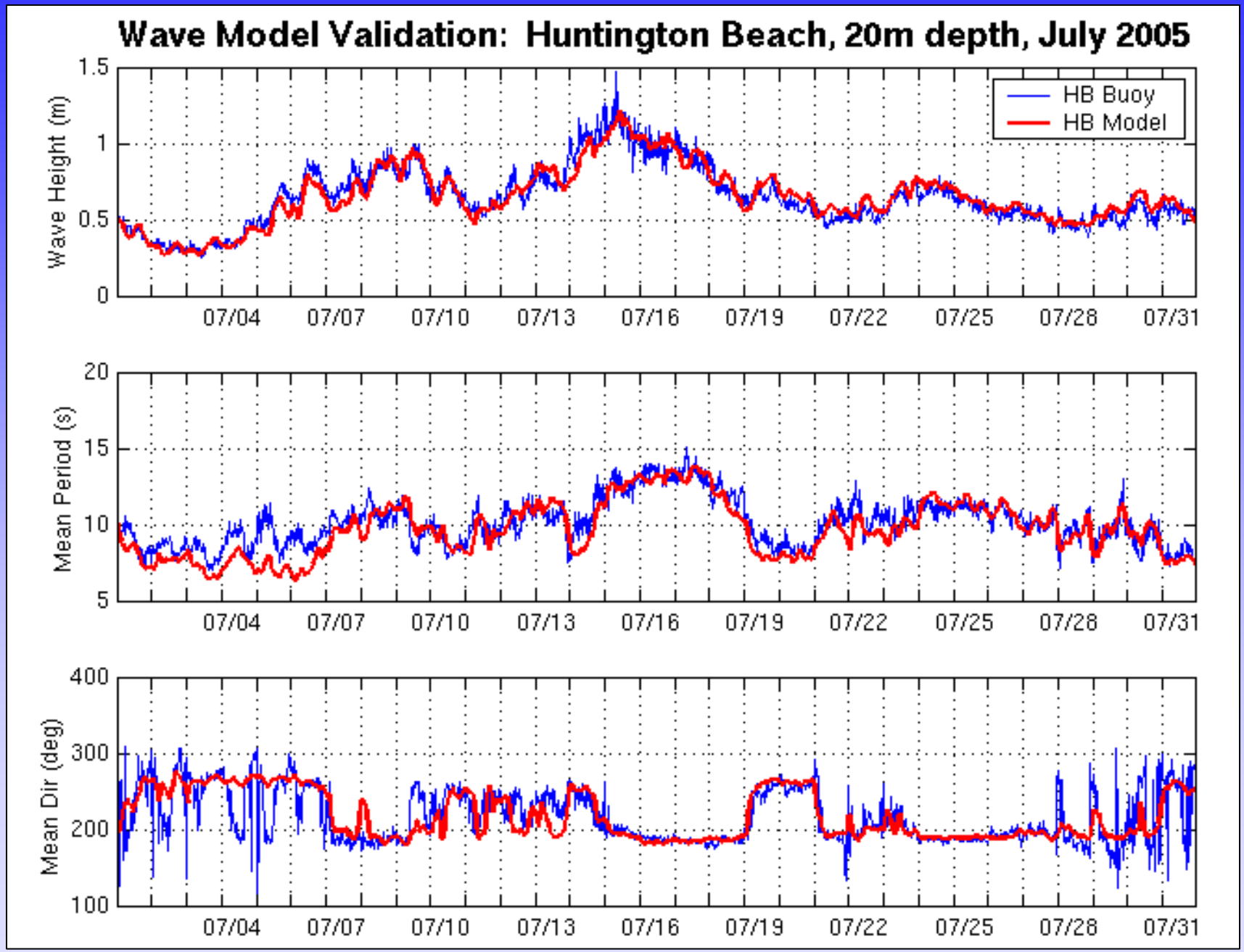
Slide 6

j1 Jan 31, 2000 1257 West Swell
jot, 7/27/2008

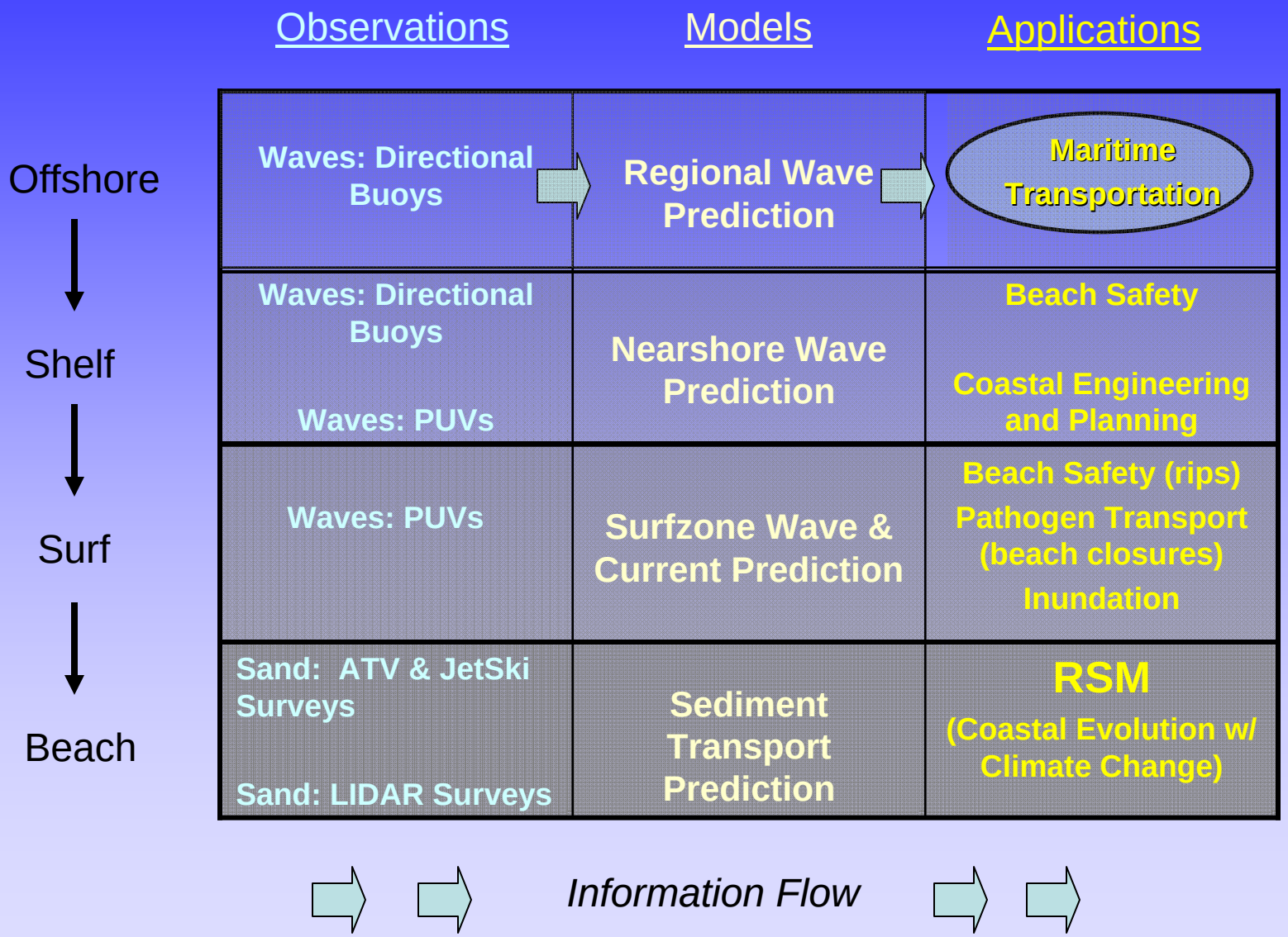
j2 9 May 2003 0645 PST
jot, 7/27/2008

"Buoy Network" Spectral Refraction Model – Provides both Sea and Swell Output = Model Prediction Points (MOPS)

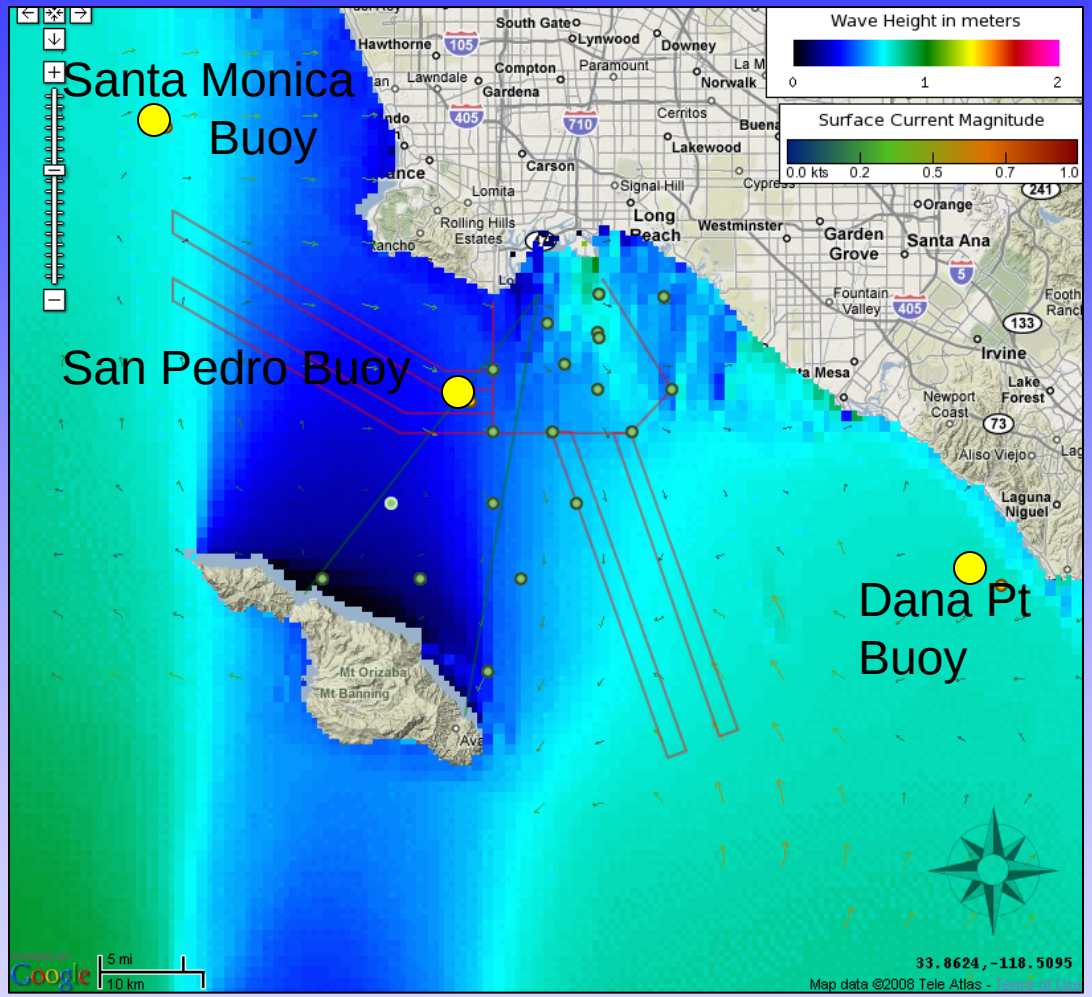



Wave Model Validation: Huntington Beach, 20m depth, July 2005
Wave Height (m)
1.5
1
0.5
0
HB Buoy
HB Model
07/04
07/07
07/10
07/13
07/16
07/19
07/22
07/25
07/28
07/31
Mean Period (s)
20
15
10
5
Mean Dir (deg)
400
300
200
100

Systems Approach to CDIP Waves & Beaches



Maritime Transportation – Ports of LA/LB



CDIP - wave observations, nowcasts and forecasts.

Southern California Coastal Observing System (SCCOOS) - HF Radar surface currents

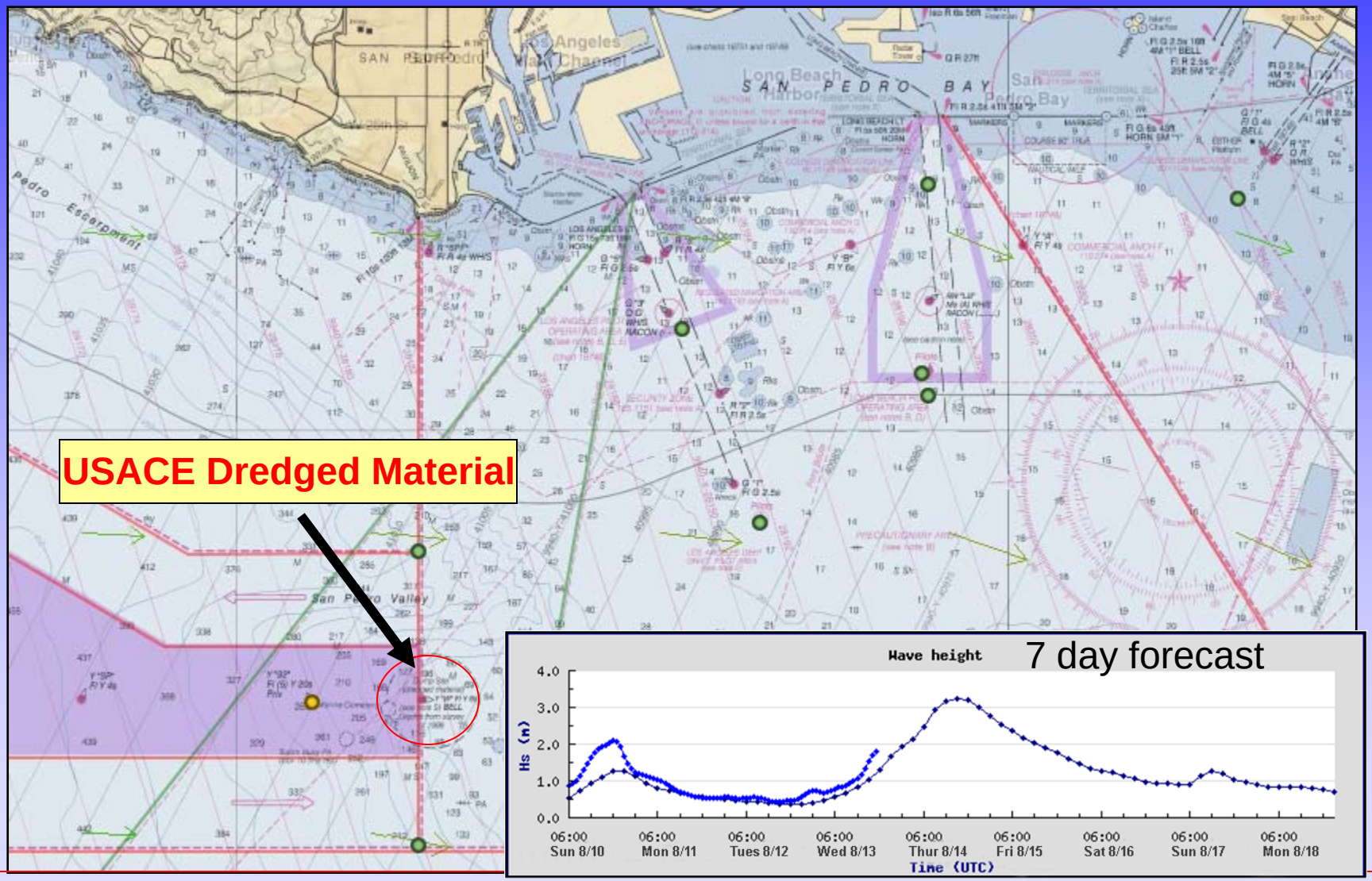
USACE - LAD
Catalina Express
Fishing Community
Los Angeles Bar Pilots
Long Beach Bar Pilots
NOAA - Navigation
San Pedro Marine Exchange
Sause Brothers
US Coast Guard

http://www.sccoos.org/data/harbors/lalb/fullscreen.php

NOAA IOOS INTEGRATED OCEAN OBSERVING SYSTEM

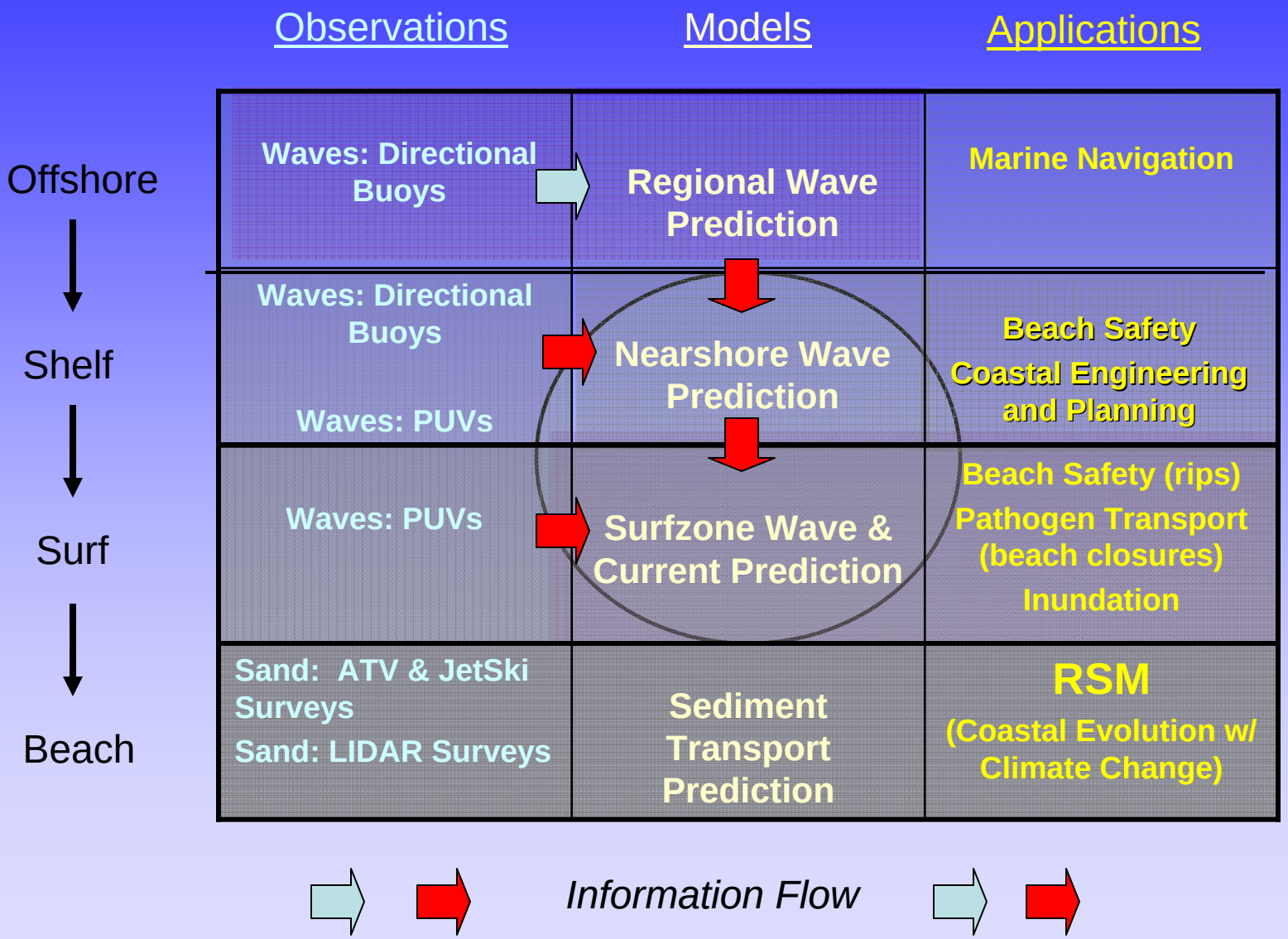
Coastal Conservancy

Geo-referenced NOAA charts to Google San Pedro Channel

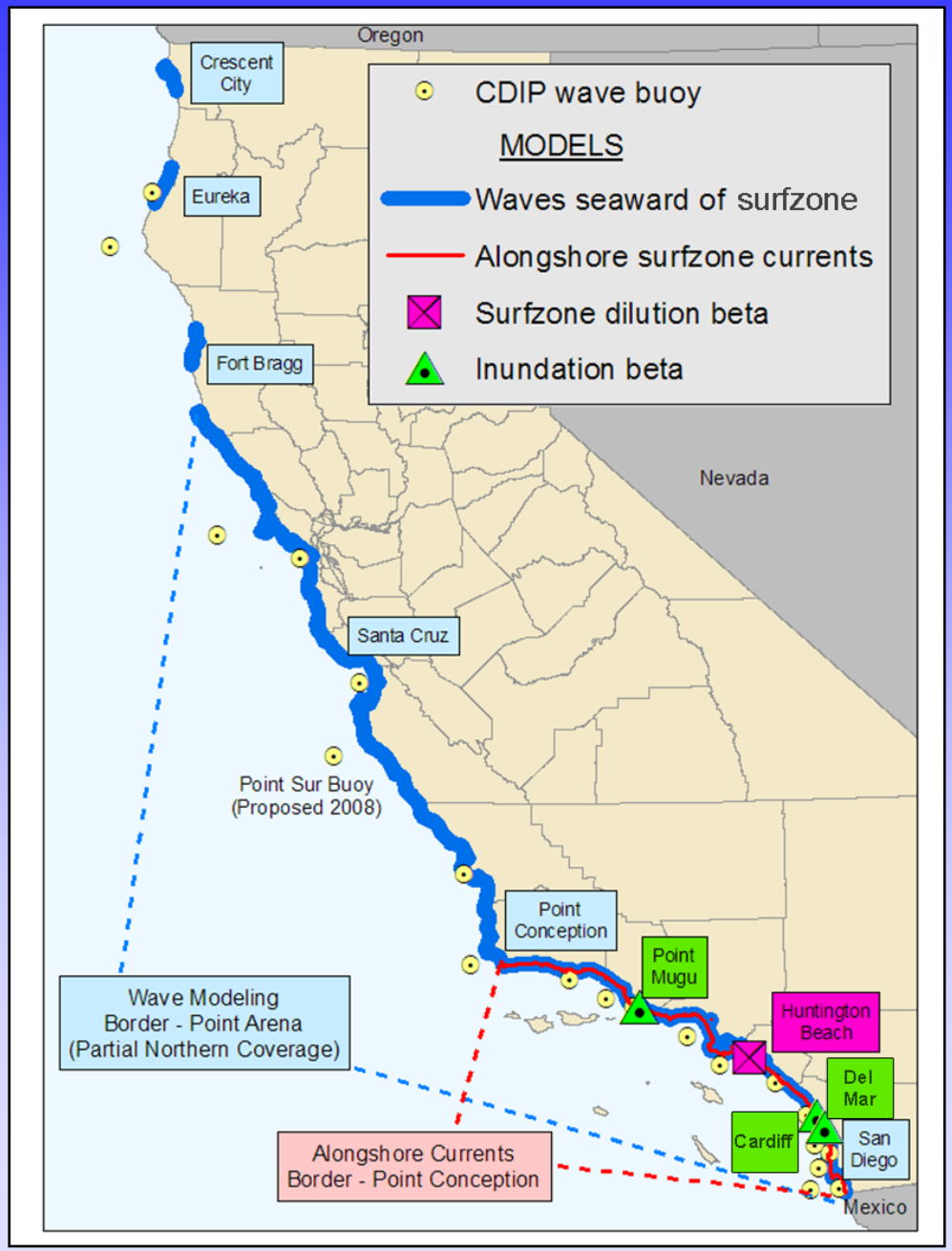


Capability to send automated notification when thresholds are exceeded!

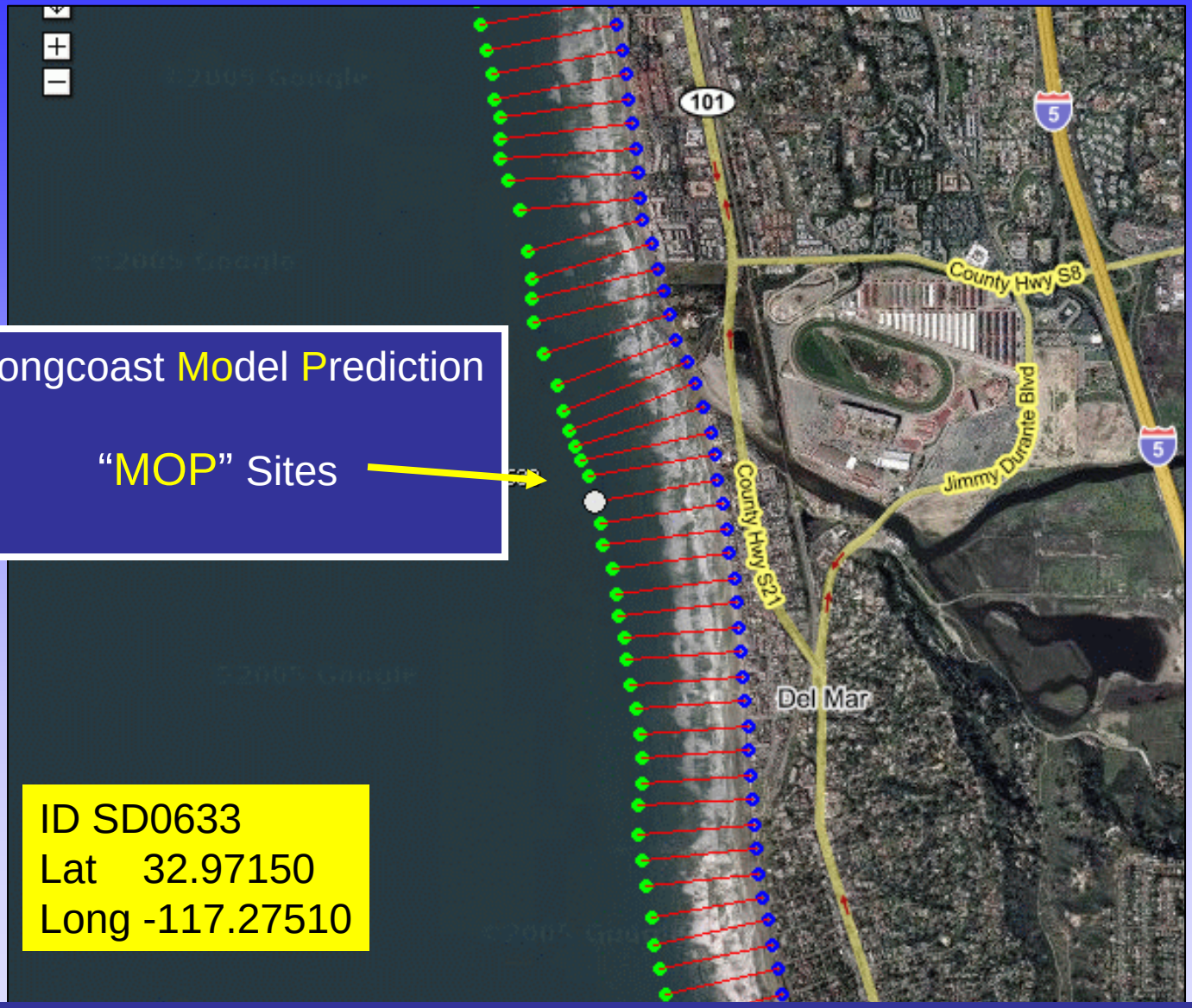
CDIP Waves & Beaches : The "Buoy Network Wave Model"



Models - Beach Safety and Coastal Engineering



NEARSHORE WAVE PREDICTIONS



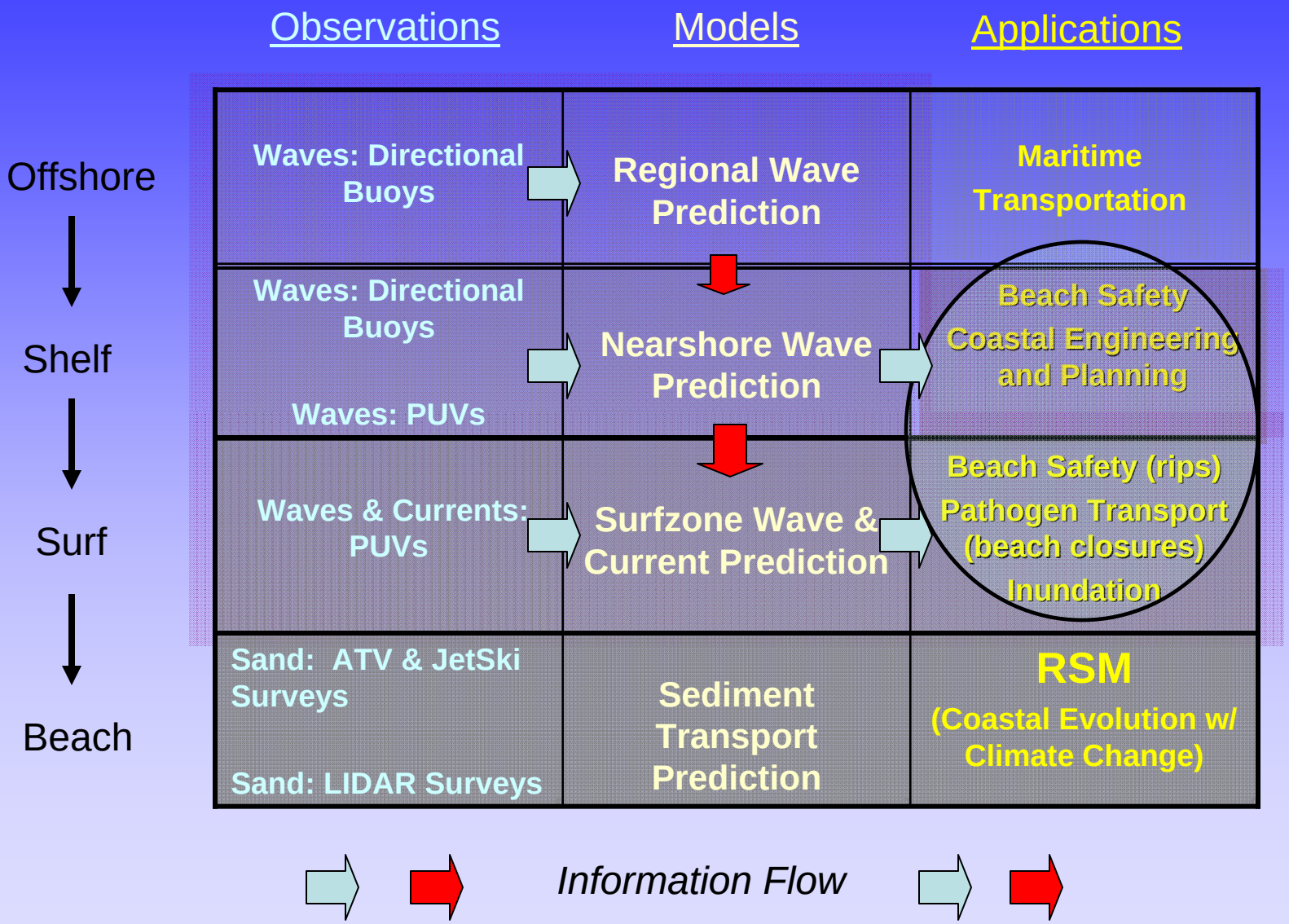
Alongcoast Model Prediction

"MOP" Sites

ID SD0633
Lat 32.97150
Long -117.27510

MOPs – South of Pt. Conception: 10m water depth, 100m alongshore spacing
North of Pt Conception : 15m water depth, 200m alongshore spacing

CDIP Waves & Beaches



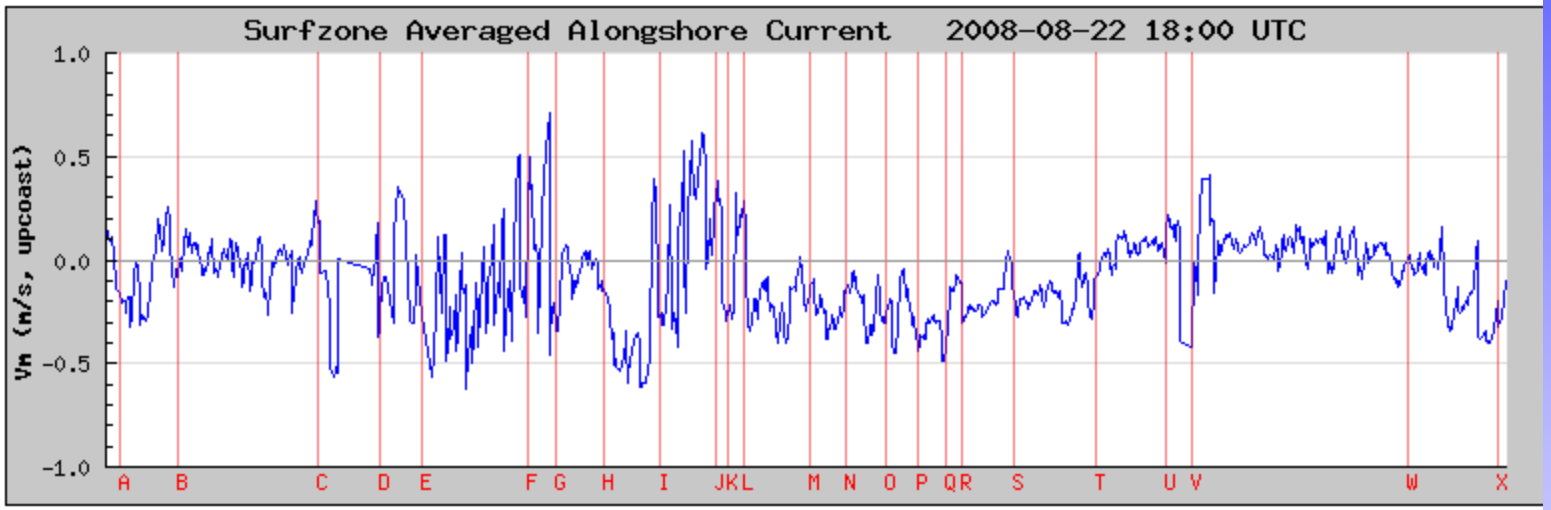
BEACH SAFETY – RIPS

MOP- Alongshore Currents

Used by Lifeguards and NWS in Santa Monica

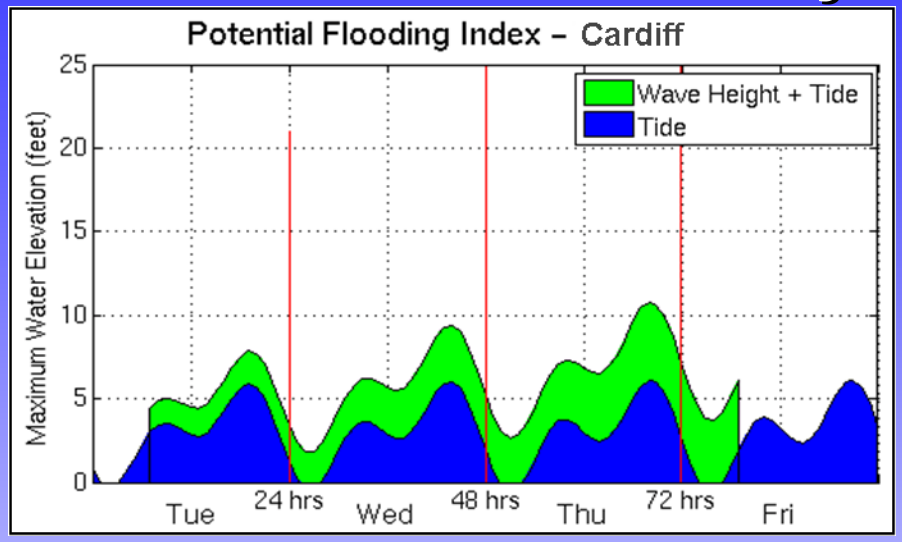
San Diego County Alongcoast Wave Conditions

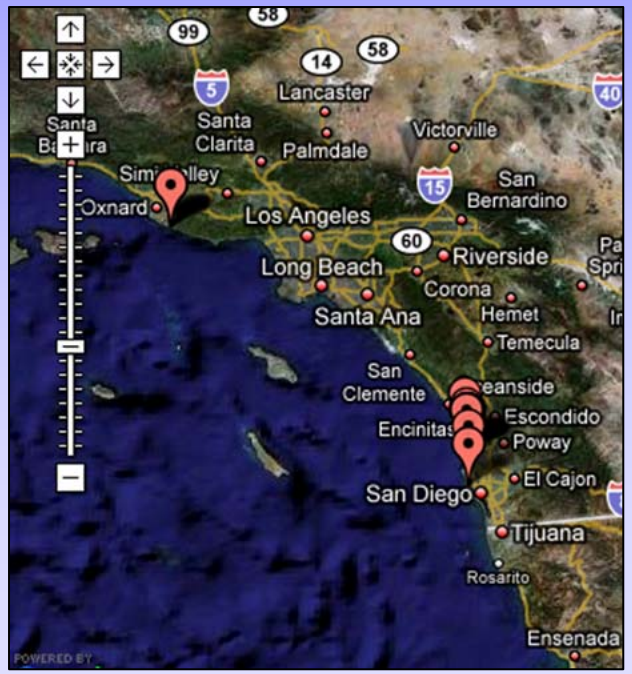
Parameter to plot: Hs Tp Dp Ta Sxy Sxx Dm Vm Hb Click plot to zoom



A : Border Field State Park (D0013)
B : Imperial Beach Pier (D0053)
C : Coronado Beach (D0179)
D : San Diego Harbor Entrance (D0232)
E : Point Loma, Southern Tip (D0250)
F : Sunset Cliffs (D0333)
G : Mission Bay Channel Entrance (D0361)
H : Crystal Pier, Pacific Beach (D0405)
I : Windansea Beach (D0453)
J : La Jolla Shores Beach (D0502)
K : Scripps Pier, La Jolla (D0513)
L : Blacks Beach (D0528)
M : Torrey Pines Beach (D0587)
N : 15th Street, Del Mar (D0618)
O : Fletcher Cove, Solana Beach (D0655)
P : Cardiff Reef (D0683)
Q : Swamis, Encinitas (D0709)
R : Moonlight Beach (D0722)
S : Batiquitos Lagoon (D0768)
T : Tamarack, Carlsbad (D0843)
U : Oceanside Pier (D0906)
V : Oceanside Harbor Entrance (D0929)
W : San Onofre State Beach (D1124)
X : Trestles (D1206)

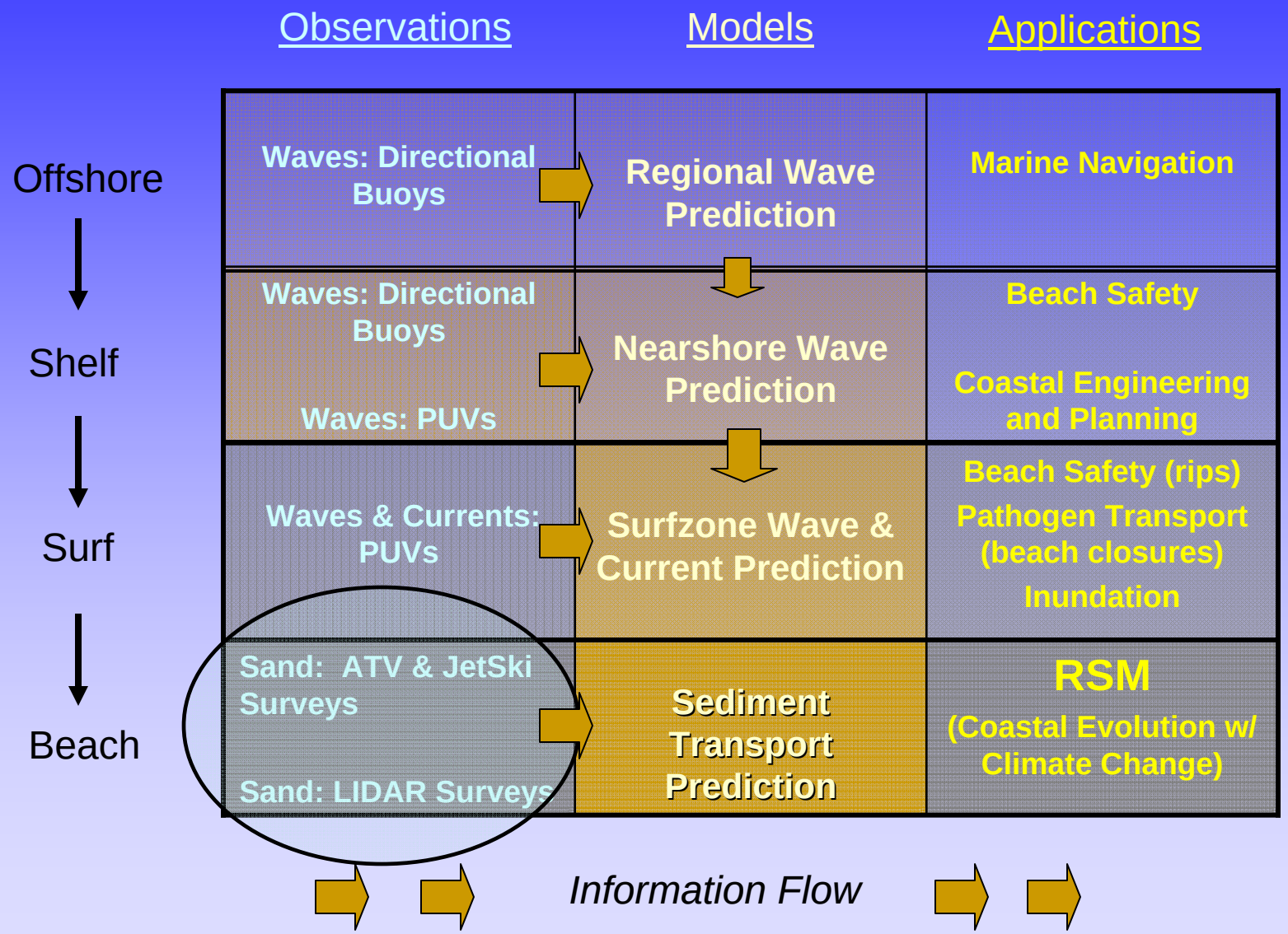
Beach Safety, Wave Inundation Predictions
3-day forecasts



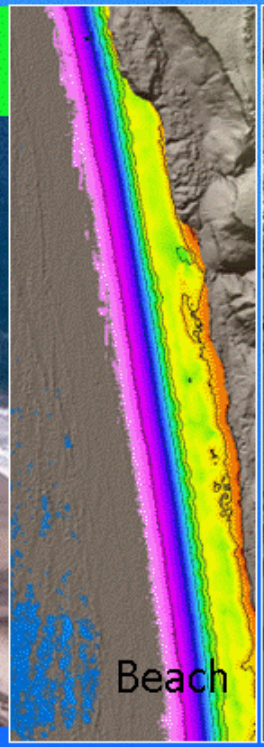


ID	Date	Latitude	Longitude	MOP ID	Hs	Dp	Tp	Observer	Region
1	2008-01-06 07:30:00	32.85058	-117.261977	D0502	0.69	277	8.33	Bob Guza	La Jolla
2	2008-01-06 08:00:00	32.75989	-117.256365	D0361	2.79	269	18.18	Bob Guza	Mission Bay
3	2007-12-05 06:15:00	32.75749	-117.254864	D0361	4.61	270	18.18	Bob Guza	Mission Bay
4	2008-01-06 07:00:00	32.93730	-117.261934	D0587	1.79	265	11.76	Bob Guza	Torrey Pines
5	2008-02-05 07:30:00	32.93238	-117.260878	D0587	1.30	264	11.76	Bob Guza	Torrey Pines

CDIP Waves & Beaches : Modeling Framework



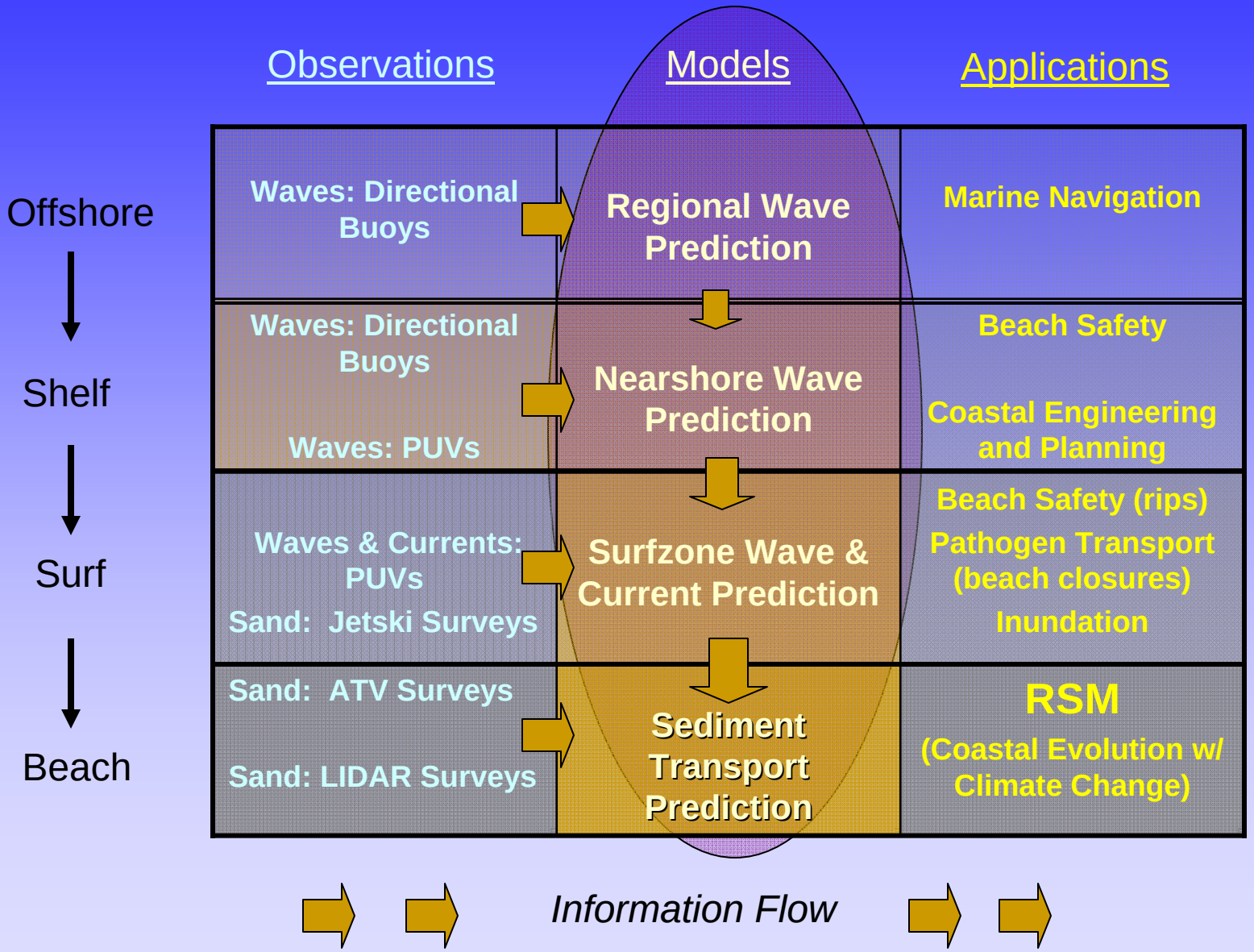
CA Beach Monitoring & Prediction



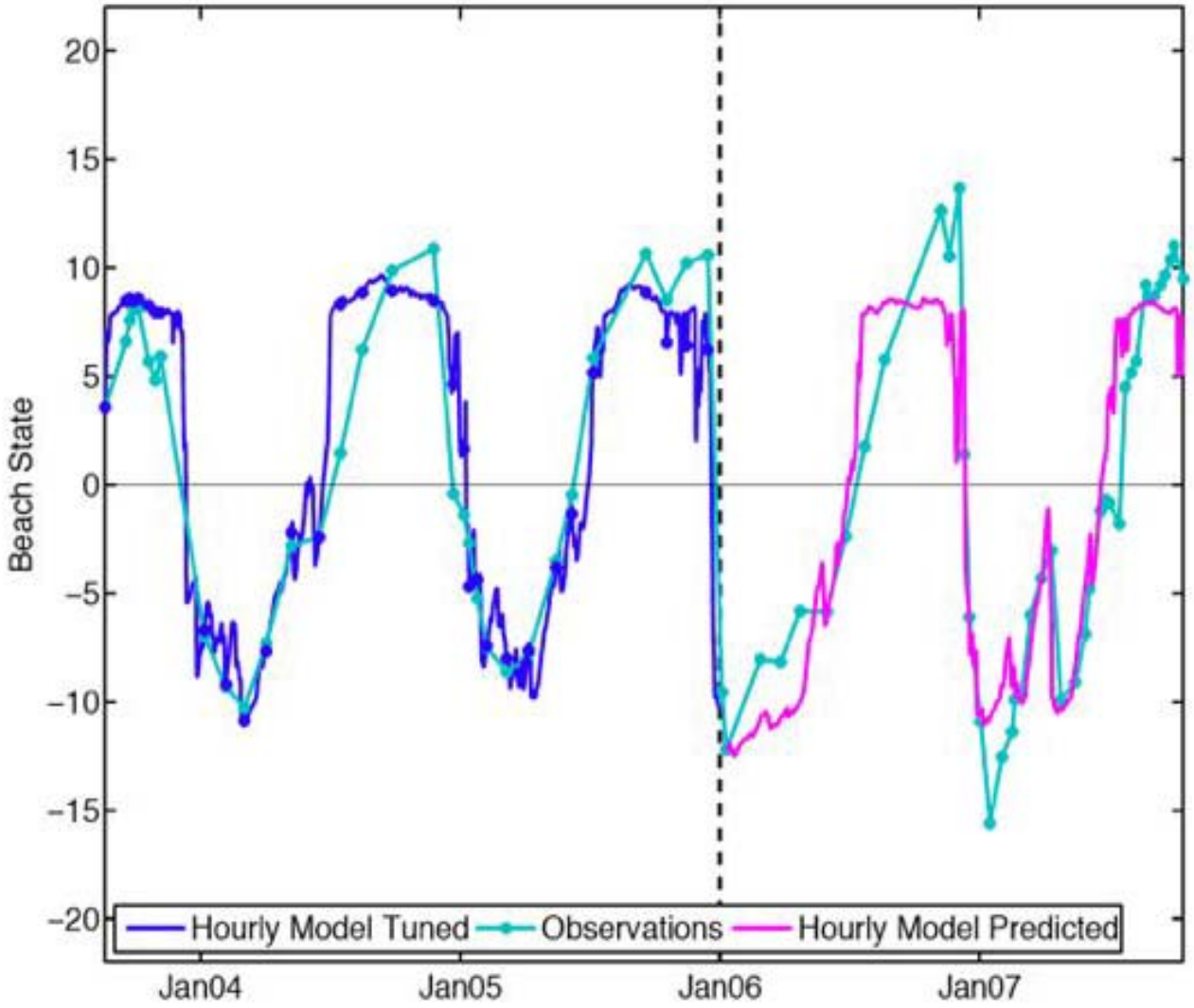
Coastal Engineering

- USACE LAD Projects
- In-Situ Surveys
- LIDAR Surveys
- Wave Buoys

CDIP Waves & Beaches : Modeling Framework

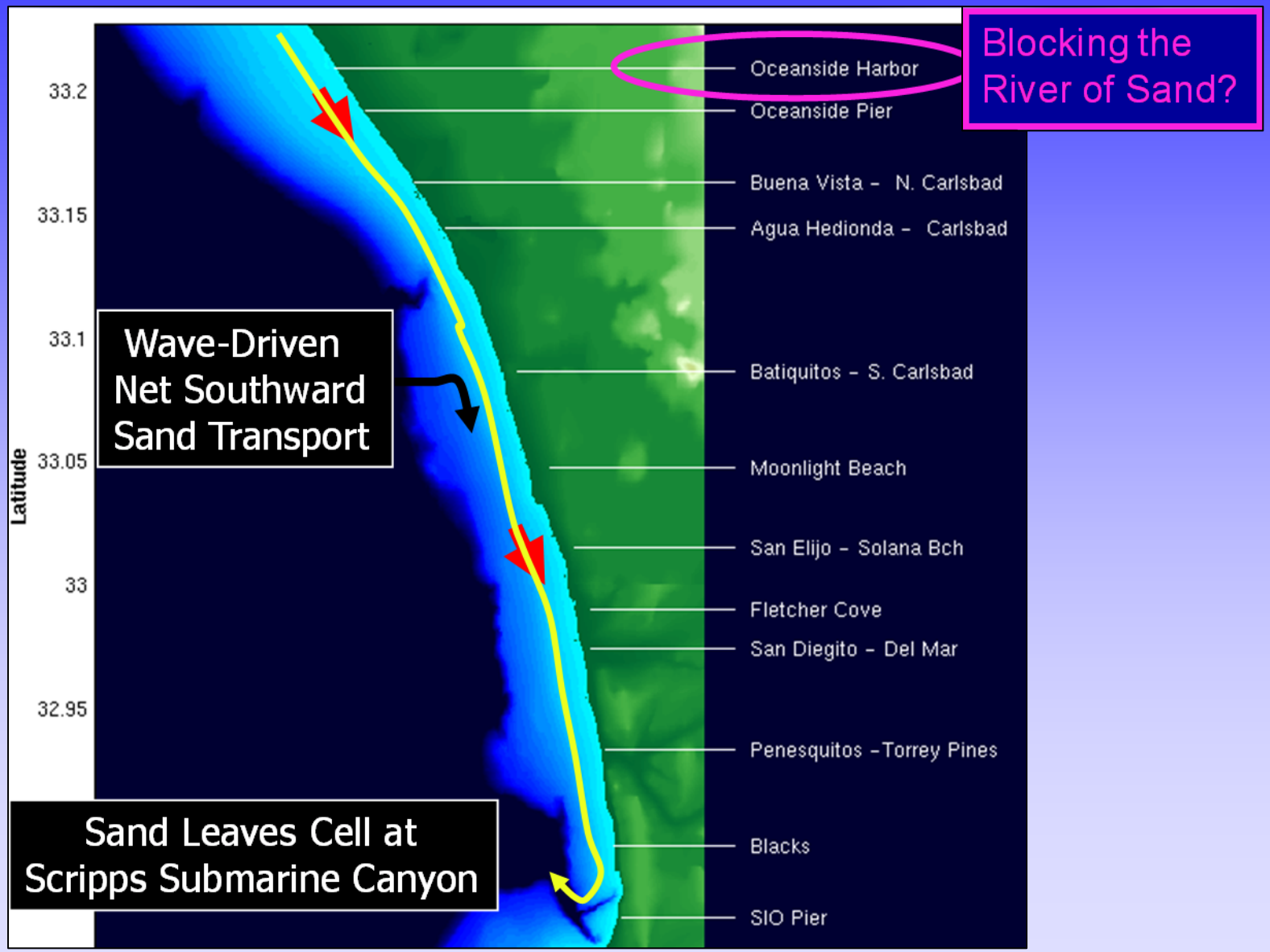


Train beach-wave response model with 2+ yrs of observations, predict next 2 yrs : Preliminary result for Torrey Pines

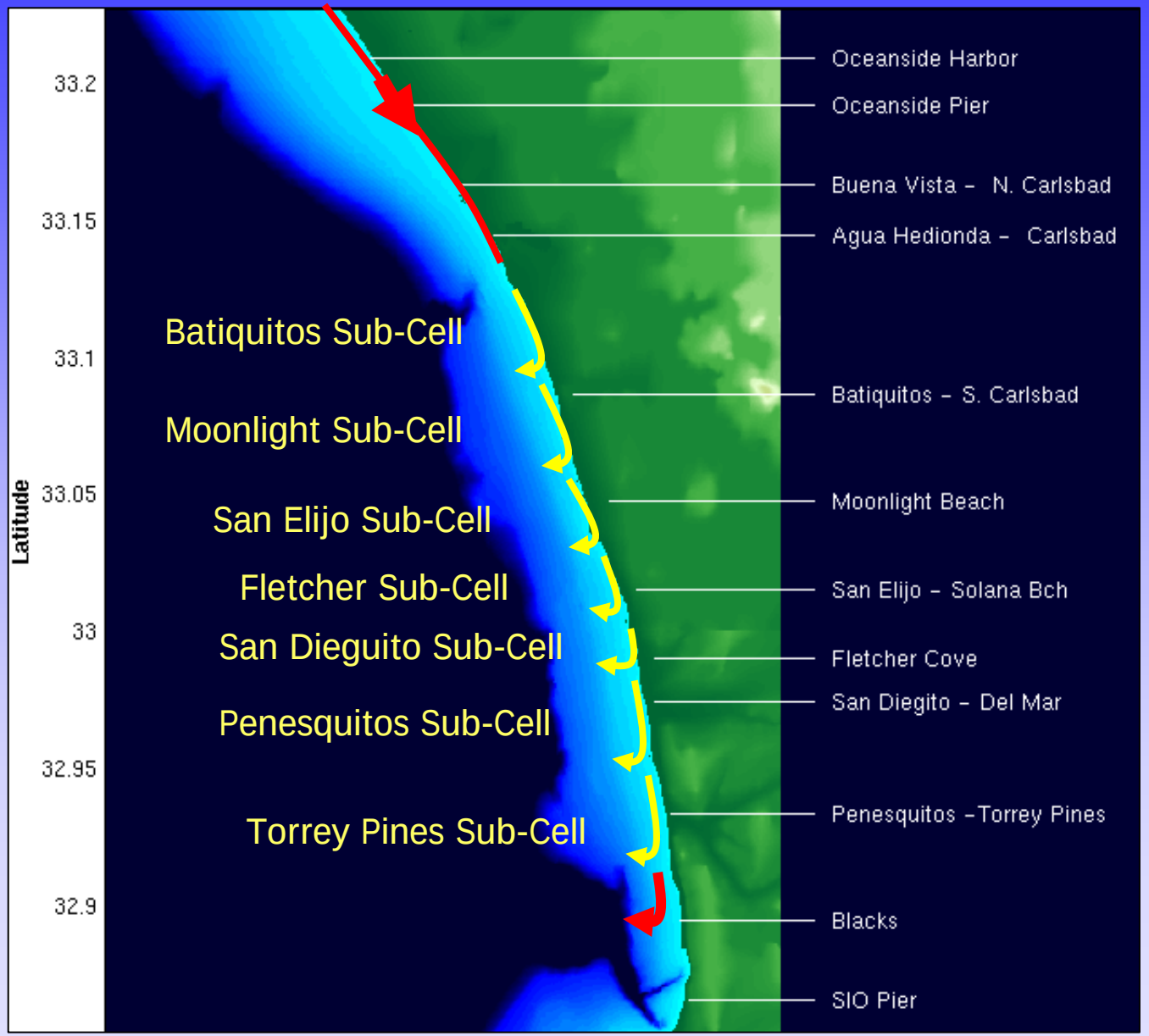


Data Adaptive Model

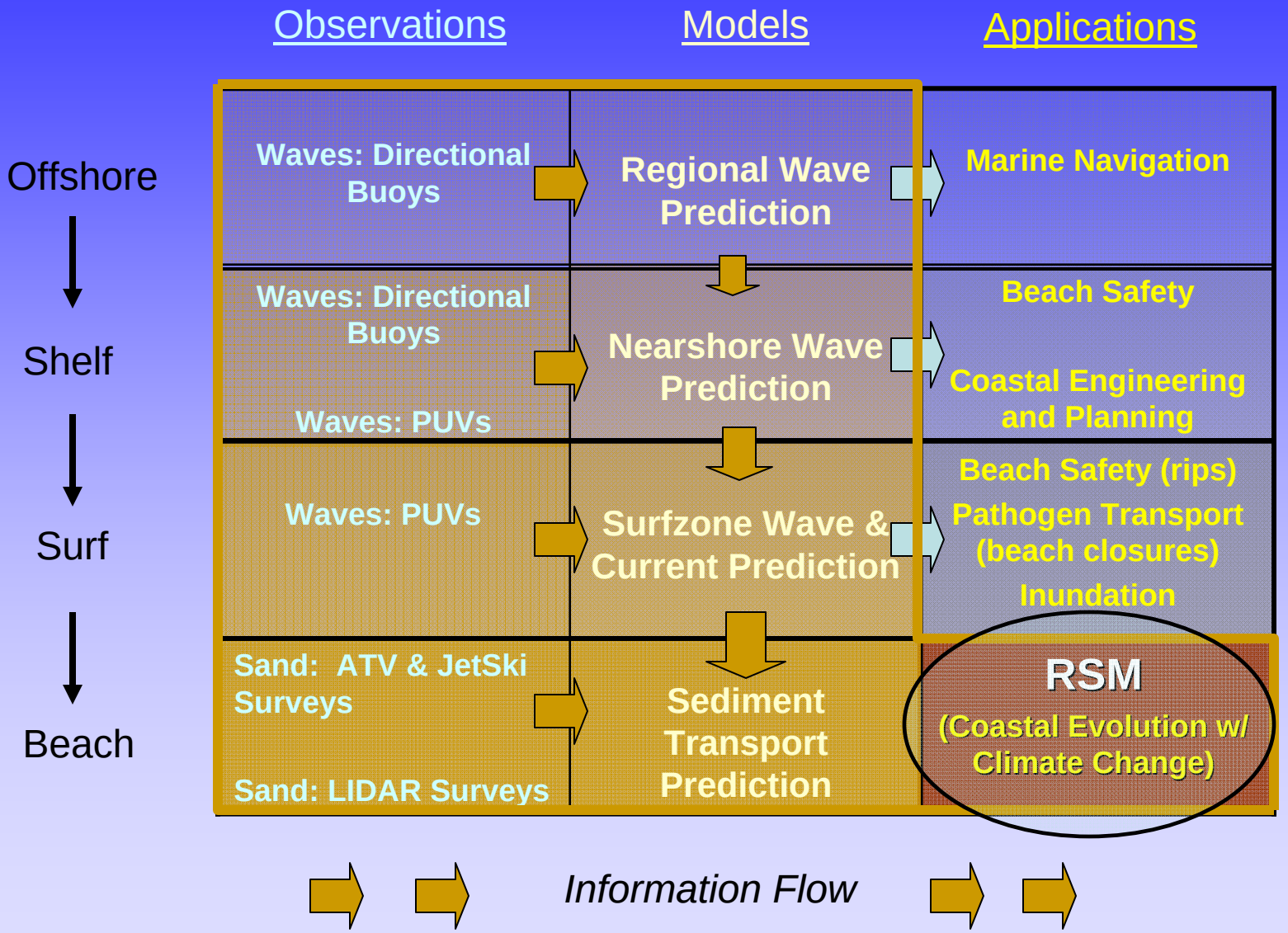
Oceanside Littoral Cell: The “River of Sand”



Wave-driven Lagoon Sub-Cells

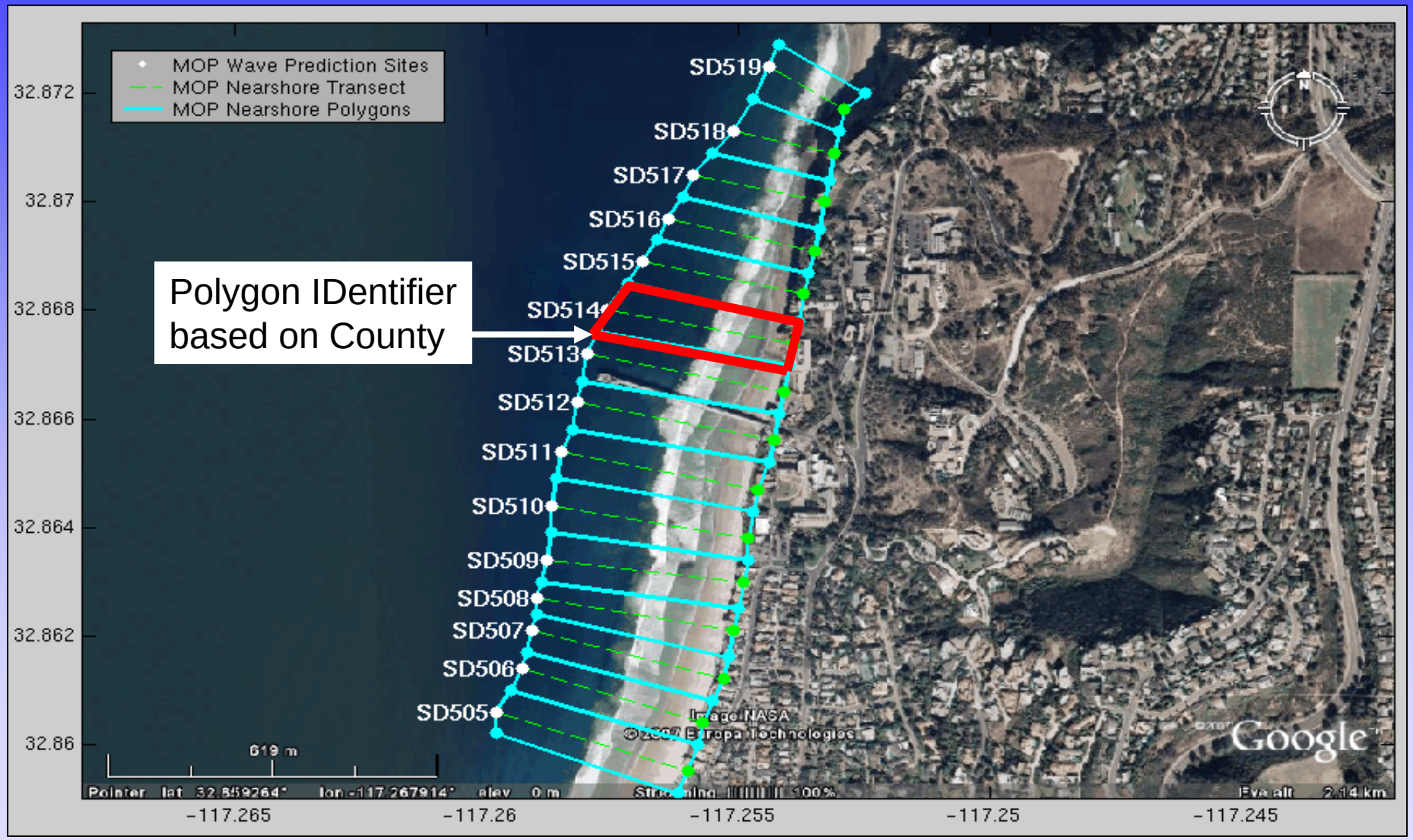


RSM – At Last!

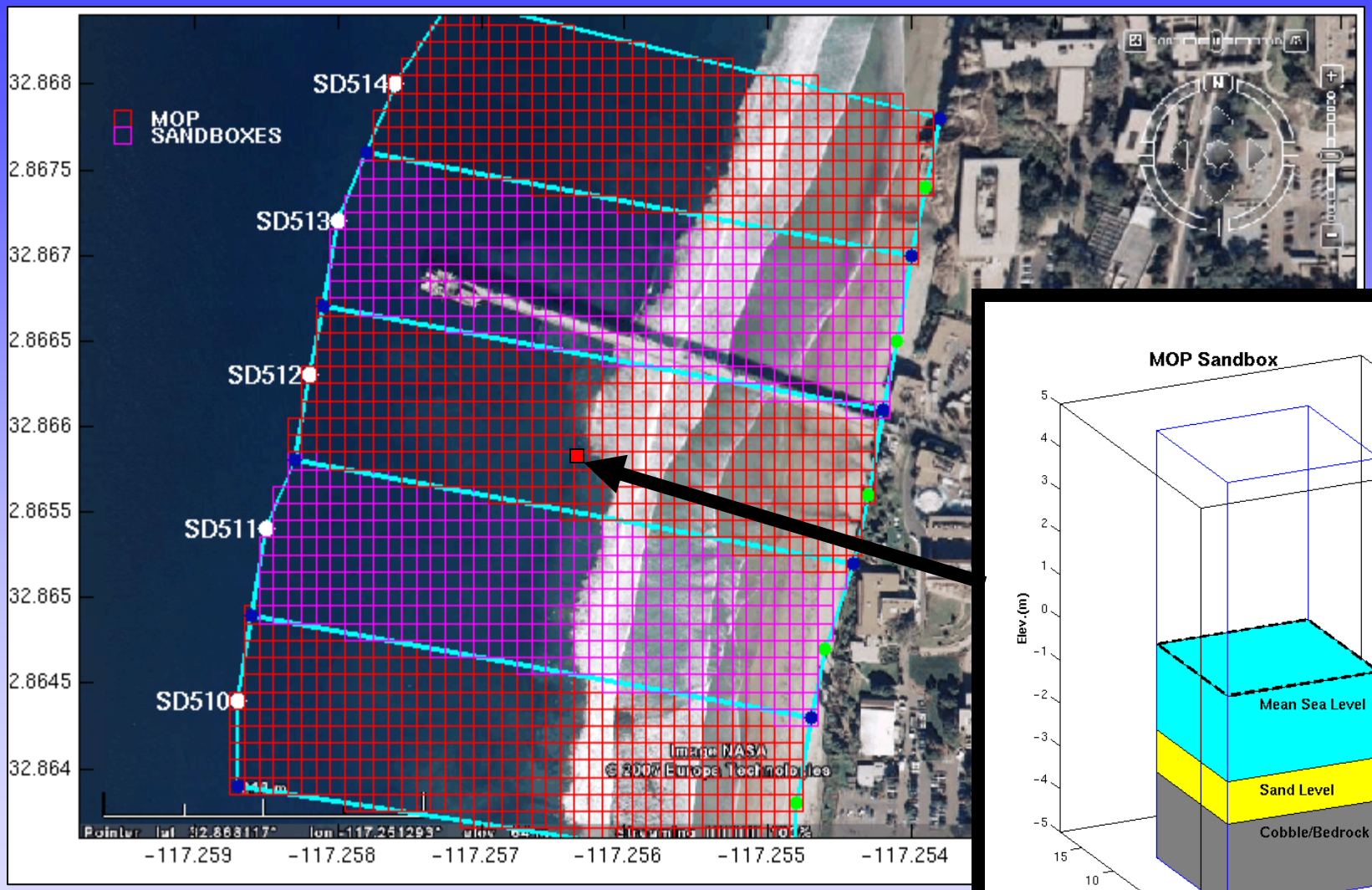

Observations
Models
Applications
Offshore
Shelf
Surf
Beach
Waves: Directional Buoys
Regional Wave Prediction
Marine Navigation
Waves: Directional Buoys
Waves: PUVs
Nearshore Wave Prediction
Beach Safety
Coastal Engineering and Planning
Waves: PUVs
Surfzone Wave & Current Prediction
Beach Safety (rips)
Pathogen Transport (beach closures)
Inundation
Sand: ATV & JetSki Surveys
Sand: LIDAR Surveys
Sediment Transport Prediction
RSM
(Coastal Evolution w/ Climate Change)
Information Flow

REGIONAL SEDIMENT MANAGEMENT

Each MOP Transect is bounded by a MOP Nearshore Site and a MOP Backbeach Site

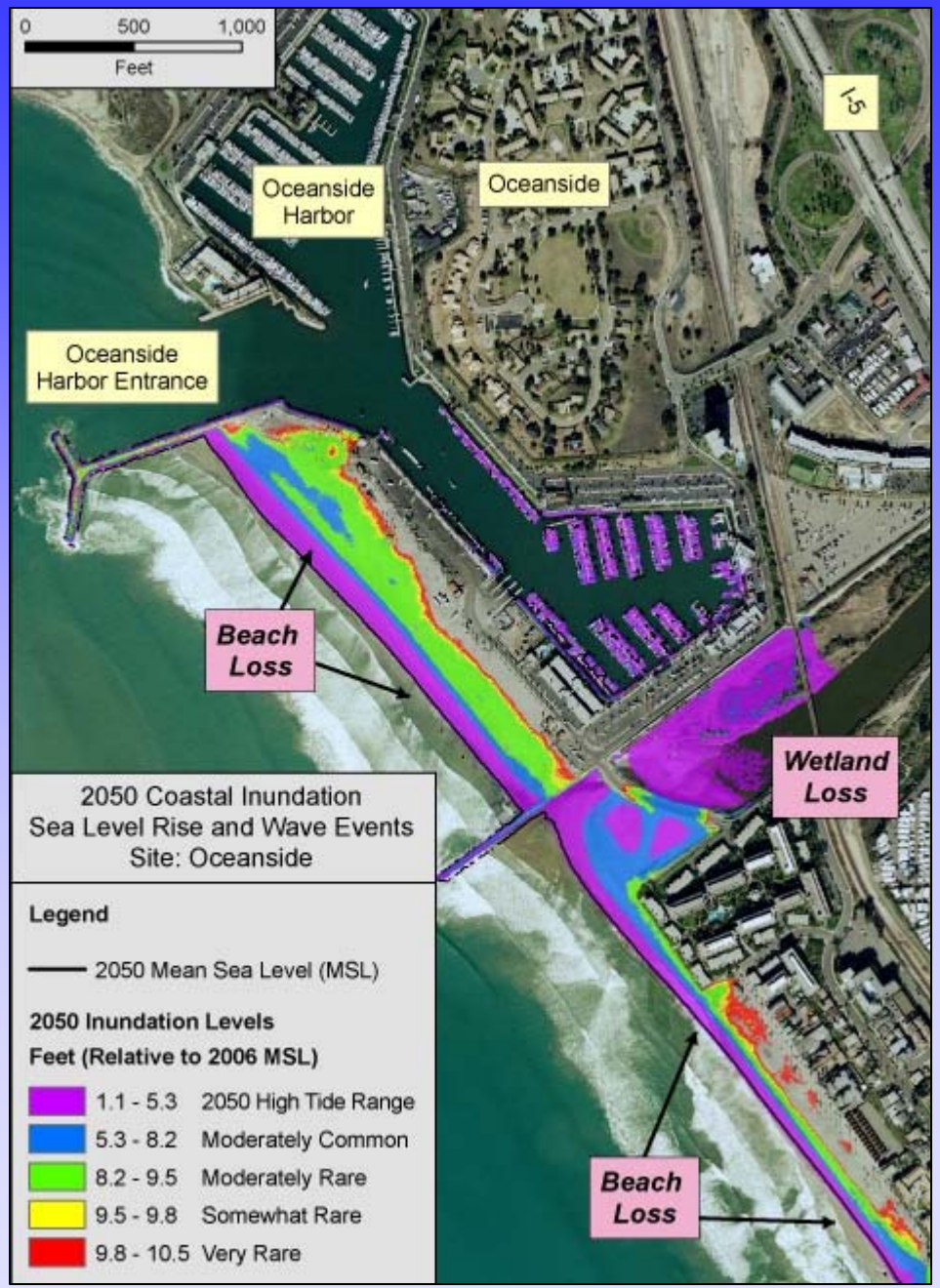


Future Goal
Provide Quantifiable measurements of sand transport



Each MOP Polygon contains a set of MOP Sandboxes.

Sea Level Rise Prediction for 2050 – Oceanside Harbor



- Wave Watch III forecast to 2050 (offshore)
- CDIP waves inside SoCal bight
- Tides
- 0.4 run-up coefficient
- LIDAR Surveys

COASTAL EVOLUTION W/ CLIMATE CHANGE

Tri-State Governors Agreement

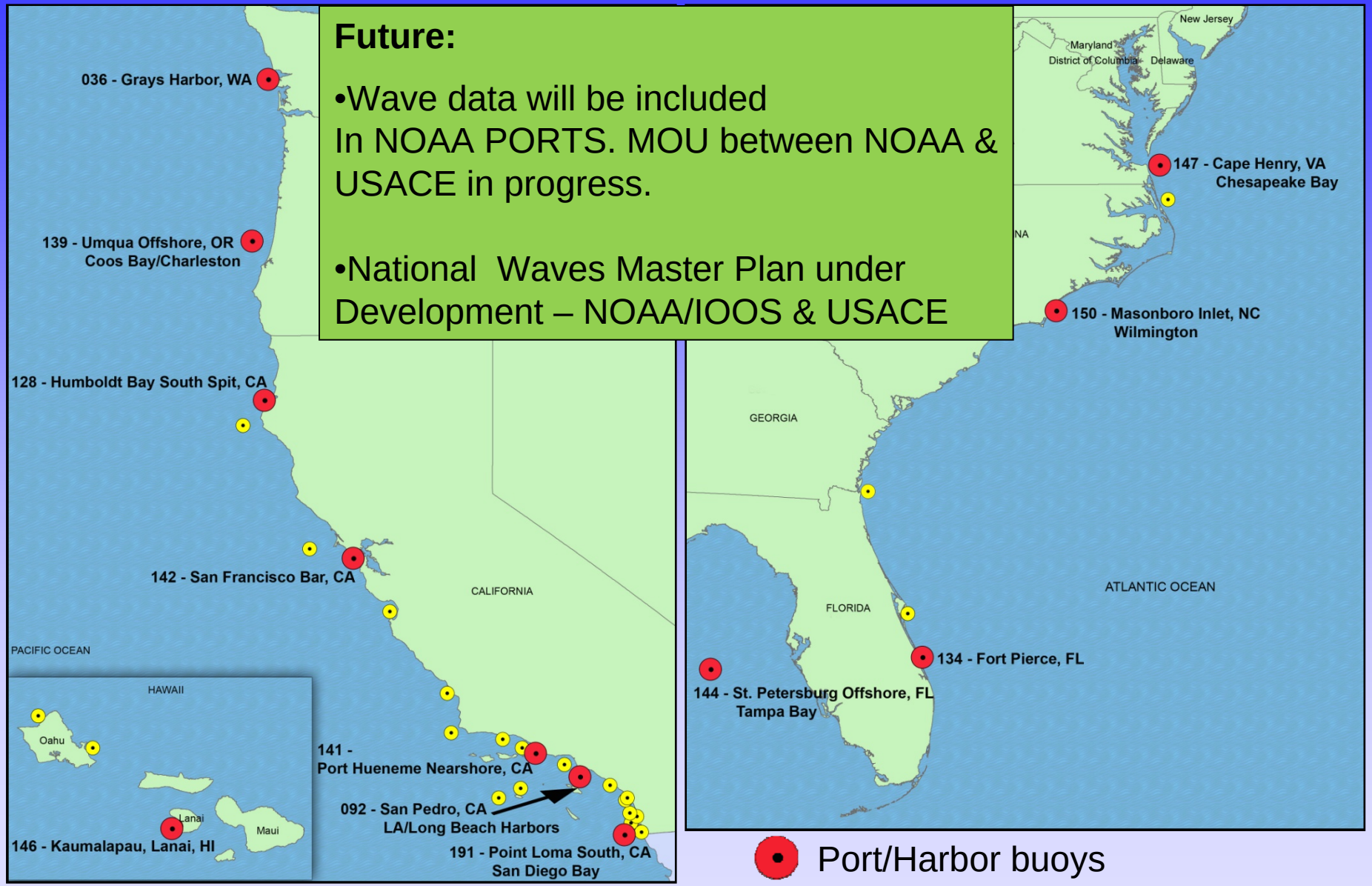
"*Sediment management has implications for the coastal economy…* Changes to sediment availability impact beaches, tourism, marina infrastructure, and vessel traffic. Erosion affects critical existing coastal structures, such as jetties."

(West Coast Governors' Agreement on Coastal Health, May 2008)

Port/Harbor buoys

Other CDIP wave buoys

CDIP Wave Buoys Near Ports and Harbors



CONCLUSION

CDIP'S SYSTEM APPROACH to ***"Monitor and predict nearshore waves and shoreline change"*** *CAN BE APPLIED TO THE ENTIRE COASTAL US.*

Regional assets and unique conditions and challenges must be taken into account.