

The Coastal Field Data Collection Program (CFDC)

Waves & Coastal Observations for the Corps and the Nation

Bill Birkemeier

Program Manager

William.Birkemeier@usace.army.mil

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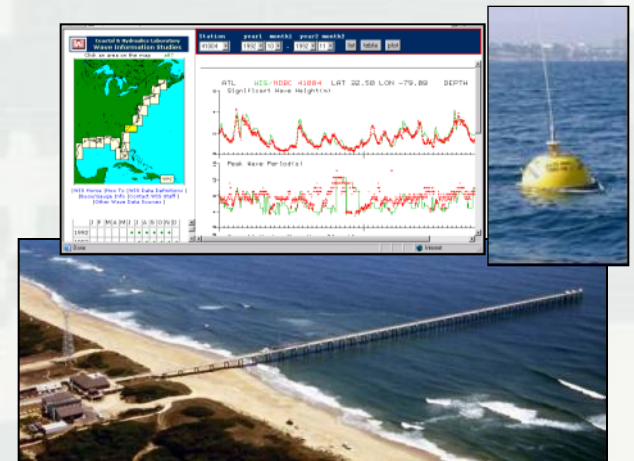


US Army Corps of Engineers
BUILDING STRONG®



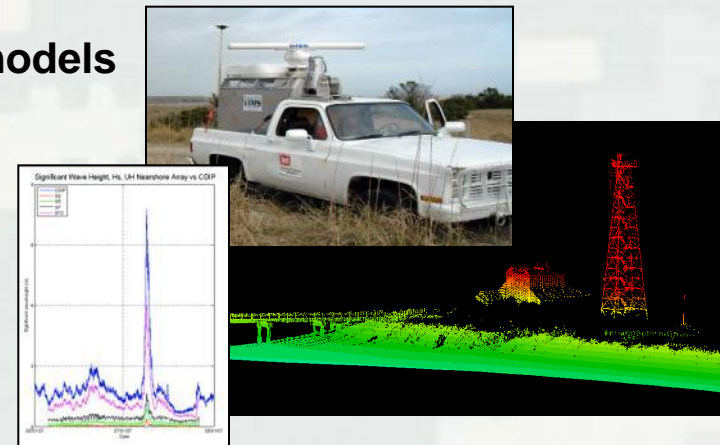
CFDC: Requirements

- **System approaches to Corps coastal projects require knowledge, through observations, of regional processes.**
 - ▶ Regional sediment management (RSM) studies require nationwide high-resolution directional wave observations
 - 5-10 deg uncertainty in wave direction can result in an error or even reversal, in predicted sediment transport
- **Uncertainty in climate and storm intensity/frequency, increases risk and costs**
- **Extreme conditions during storms are not reliably measured**
 - ▶ Gauges fail or are not well located
 - ▶ Data required in real-time for emergency operations, and later for diagnostic analysis and design
- **Coastal numerical models require calibration and verification data**
 - ▶ Advanced models require detailed observations
 - ▶ Project sponsors require models validated with local data
 - ▶ Tools for monitoring coastal processes and bathymetric responses are inadequate for resolving 3-D complexity
- **Corps projects have an increasing requirement for knowledge of data types not usually collected by us.**
 - ▶ turbidity, contaminants, fish abundance, etc



CFDC: Approach

- **Nationwide support of Corps' business lines through data collection, modeling activities, and partnerships:**
 - ▶ Navigation, Flood & Storm Damage Reduction, Recreation, Ecosystem Restoration, Environment – Stewardship, Emergency Management
- **Measure and model coastal waves nationwide, in collaboration with others, and independent of specific projects**
 - ▶ Supports system-wide and regional approaches
- **Participation in the multi-agency, multi-partner, Integrated Ocean Observing System (IOOS)**
 - ▶ Access to broader range of coastal and estuary variables
- **Collection of comprehensive, process/response datasets for calibration and testing of numerical models**
 - ▶ East & west coasts, islands
 - ▶ Investigate/measure nearshore complex environments in advance of next-generation modeling
- **Test, develop, deploy new measurements instruments & techniques**



The Field Research Facility, Duck NC

a coastal observatory established in 1977

Activities

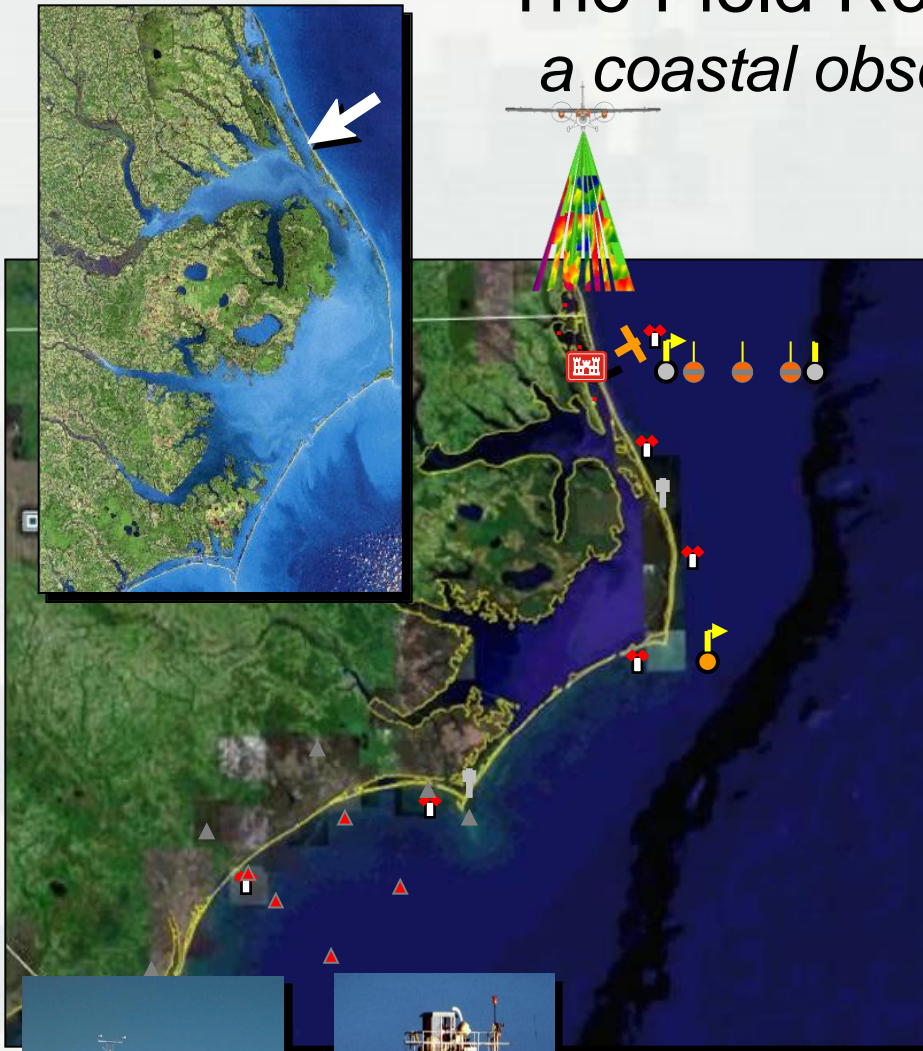
- Collect & distribute long-term data
- Research coastal & estuarine dynamics, climate change
- Testbed for model evaluation
- Leverage Corps R&D funding

Partnerships

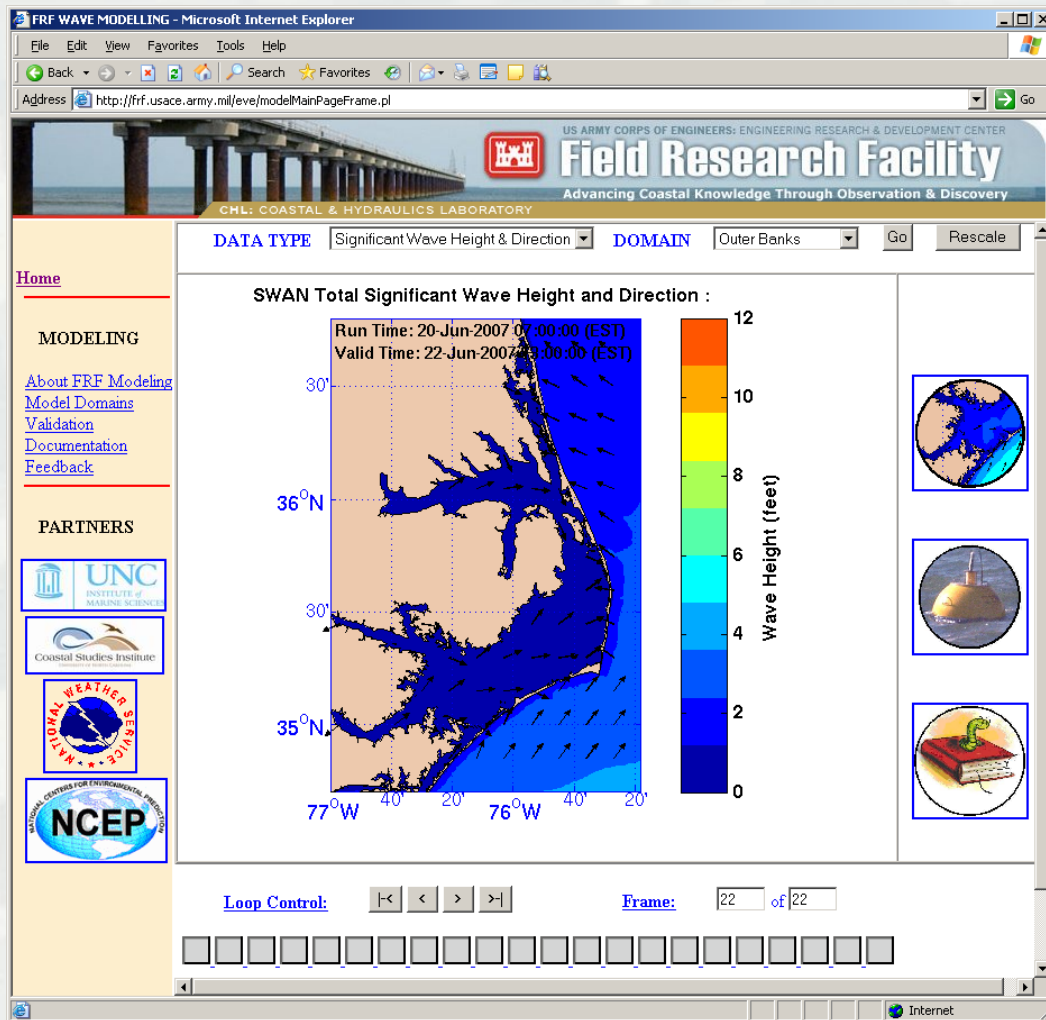
- NOAA has existing facilities
- USGS, ONR, NSF, NRL, Universities

24/7 Observations

- Waves
- Currents
- Water level & sea level rise
- Local meteorology
- Nearshore morphology
- Water characteristics



FRF Instrumented Model Testbed: SWAN Model Evaluation

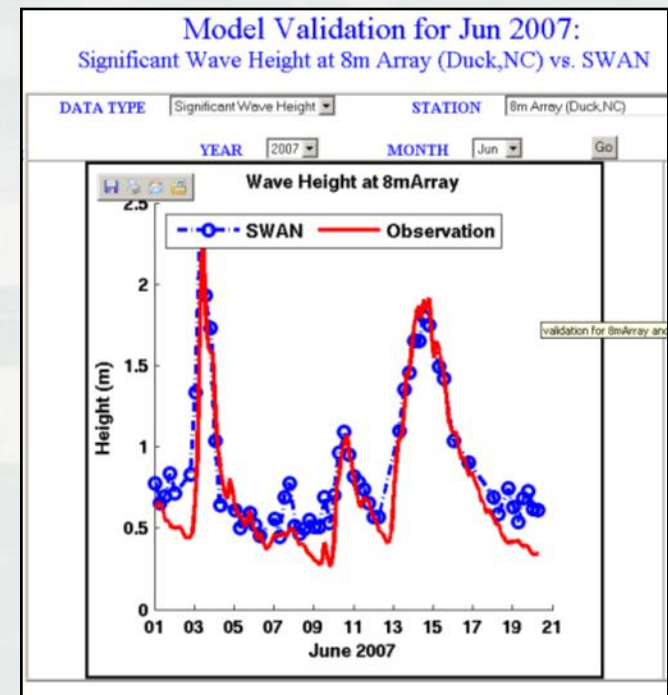


• Models need:

- Development & verification data
- Test & Evaluation Metrics
- Boundary conditions

• Testbed

- real-time performance metrics
- Operational nowcast



Wave Information Study (WIS)

Generation of Long-Term Wave Hindcast Estimates for all U.S. Coastal Waters

Modeling Effort

- ▶ Based on wind fields
- ▶ Wave model development
- ▶ Validated with measurements
- ▶ 20+ years of data

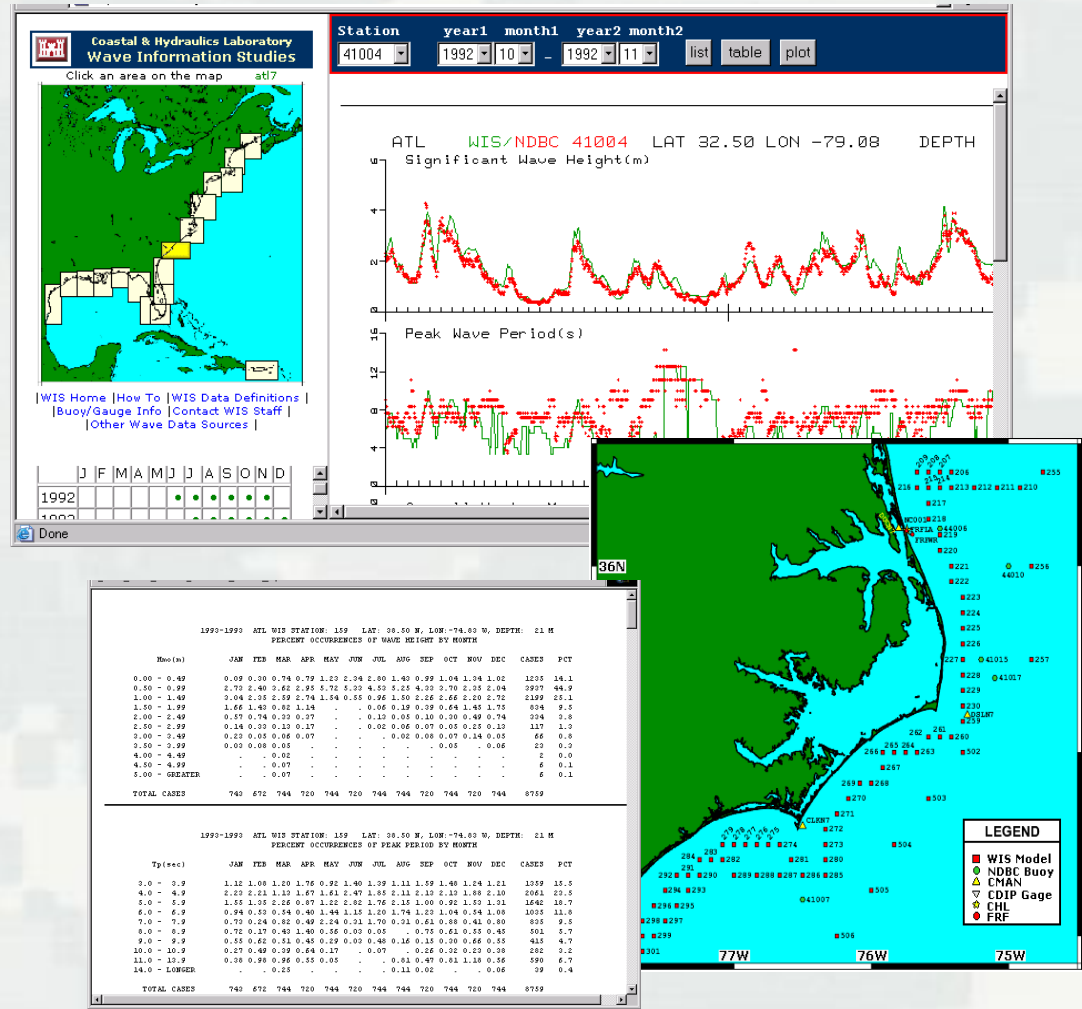
Widely used by Districts for project design

Used by coastal engineering community and the public

Useful for Wind & Wave energy production estimates

Online access to data & products

- ▶ Averages 13,000 hits/month



Field Wave Gauging

- Only National Program to collect shallow water waves
 - ▶ Supports *Coastal Data Information Program* (CDIP)
 - Operated by Scripps, co-funded with others
 - ▶ Support to *National Data Buoy Center* (NDBC)
 - add directional capabilities to existing buoys
- Motivation
 - ▶ Acquire data sets
 - ▶ Quantify wave energy & water levels
 - ▶ Provide sufficient temporal & spatial coverage
 - ▶ Establish wave/water level climatology for US
 - ▶ Provide input and validation for USACE models



Coastal Data Information Program

A sustained wave observing system

The screenshot shows the NDBC website for Station 46223 in Dana Point, CA. The page includes a navigation menu on the left with links for Station ID Search, Station List, Observations, Station Status, Ship Observations, About NDBC, Publications, and Contact Us. The main content area displays the station name, coordinates (33.46 N 117.77 W), and a list of observations including Wave Height (3.0 ft), Dominant Wave Period (13 sec), and Water Temperature (68.0 °F). A table of previous observations is also shown.

MM DD	TIME (PDT)	WDIR	WSPD	GST	WYHT	DPD	APD	MWD	PRES	PTDY	ATMP	WTMP	DEWP
			kts	kts	ft	sec	sec	in	in		°F	°F	°F
10 14	11:54 am	-	-	-	2.6	10	-	-	-	-	-	68.2	-
10 14	11:24 am	-	-	-	3.0	14	-	-	-	-	-	68.2	-
10 14	10:54 am	-	-	-	2.6	14	-	-	-	-	-	68.2	-
10 14	10:24 am	-	-	-	2.6	12	-	-	-	-	-	68.2	-

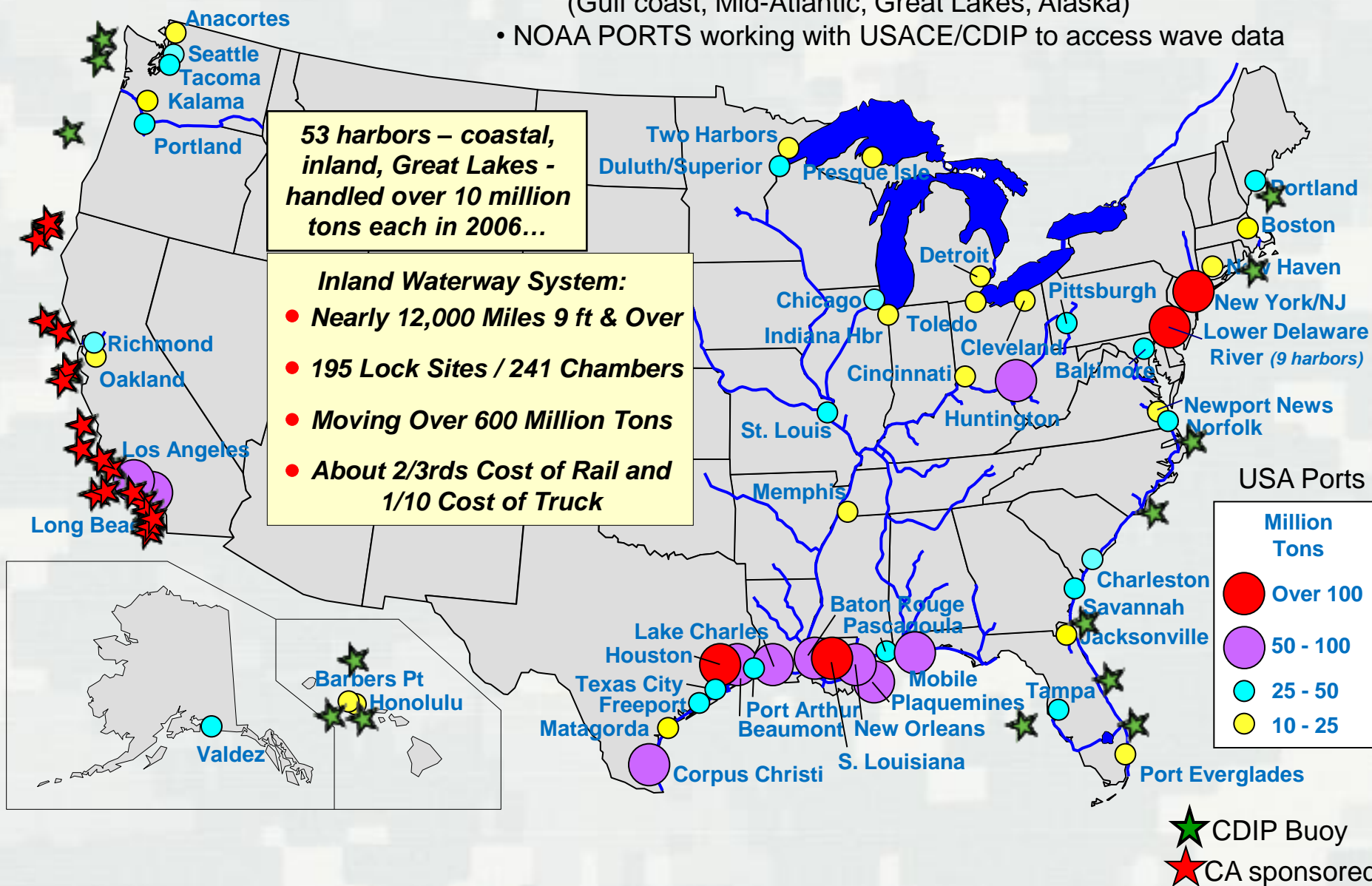
- Corps' and Cal Boating sponsored
- Since late 1970's
- Wave observations & forecasts
- Wide selection of data products
- Operated by Scripps Institution of Oceanography



<http://cdip.ucsd.edu>

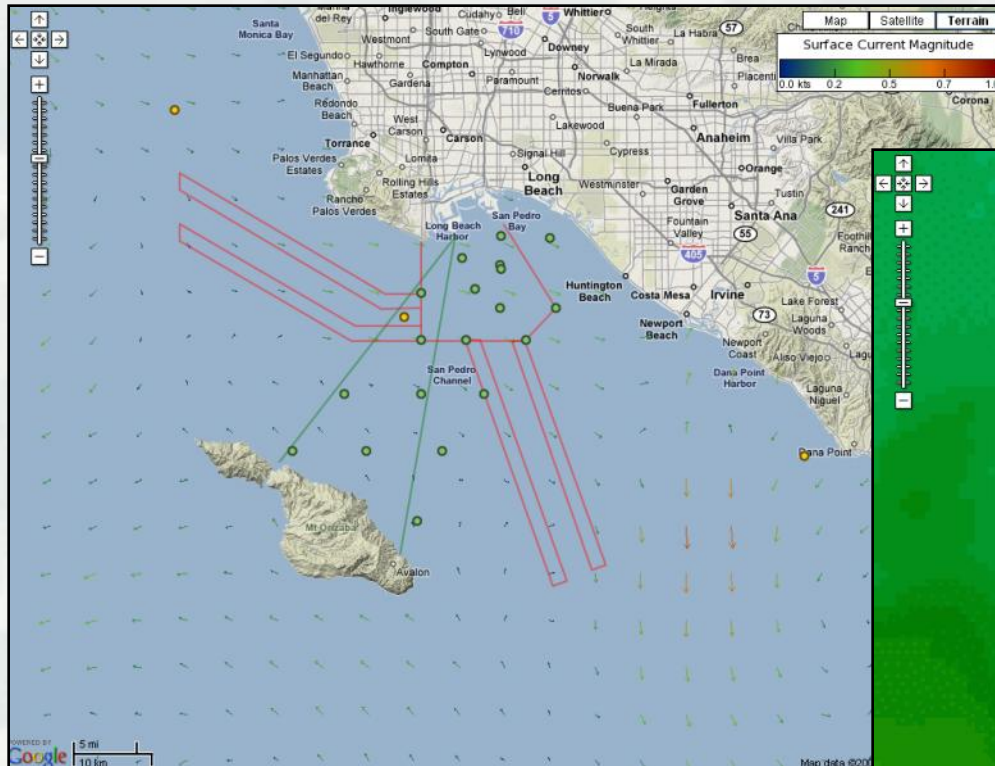
USA Ports and CDIP locations

- CDIP stations overlap ports, with some notable gaps (Gulf coast, Mid-Atlantic, Great Lakes, Alaska)
- NOAA PORTS working with USACE/CDIP to access wave data

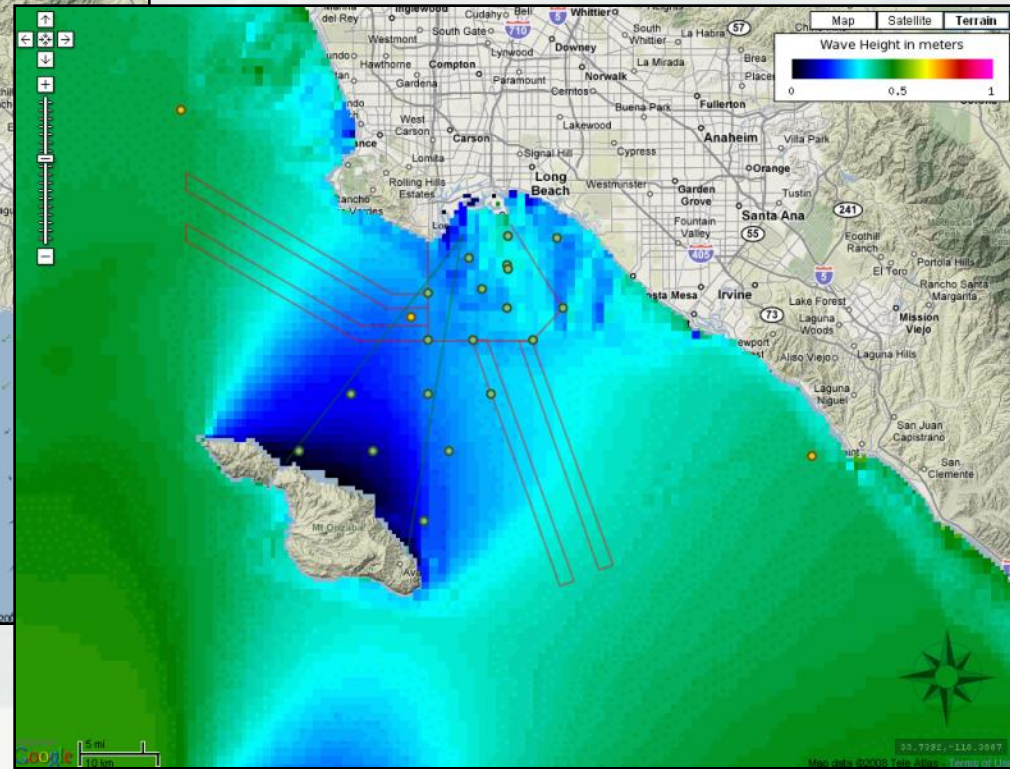


Waves and Currents in the San Pedro Channel

CDIP providing wave observations, Nowcasts and forecasts.

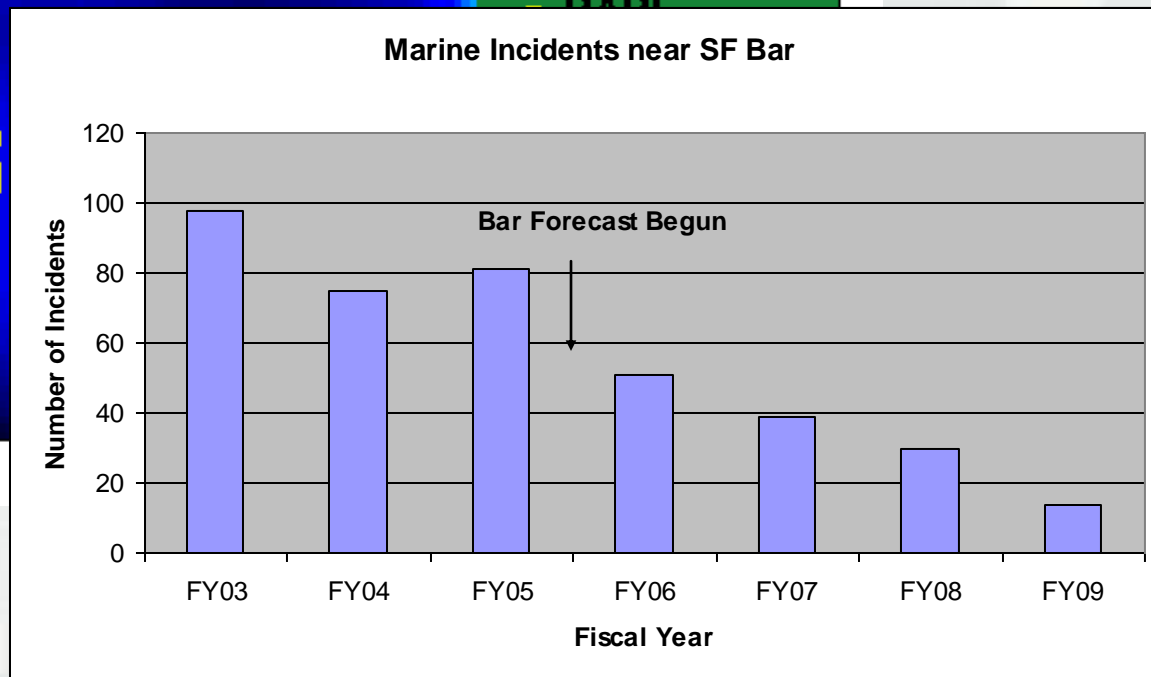
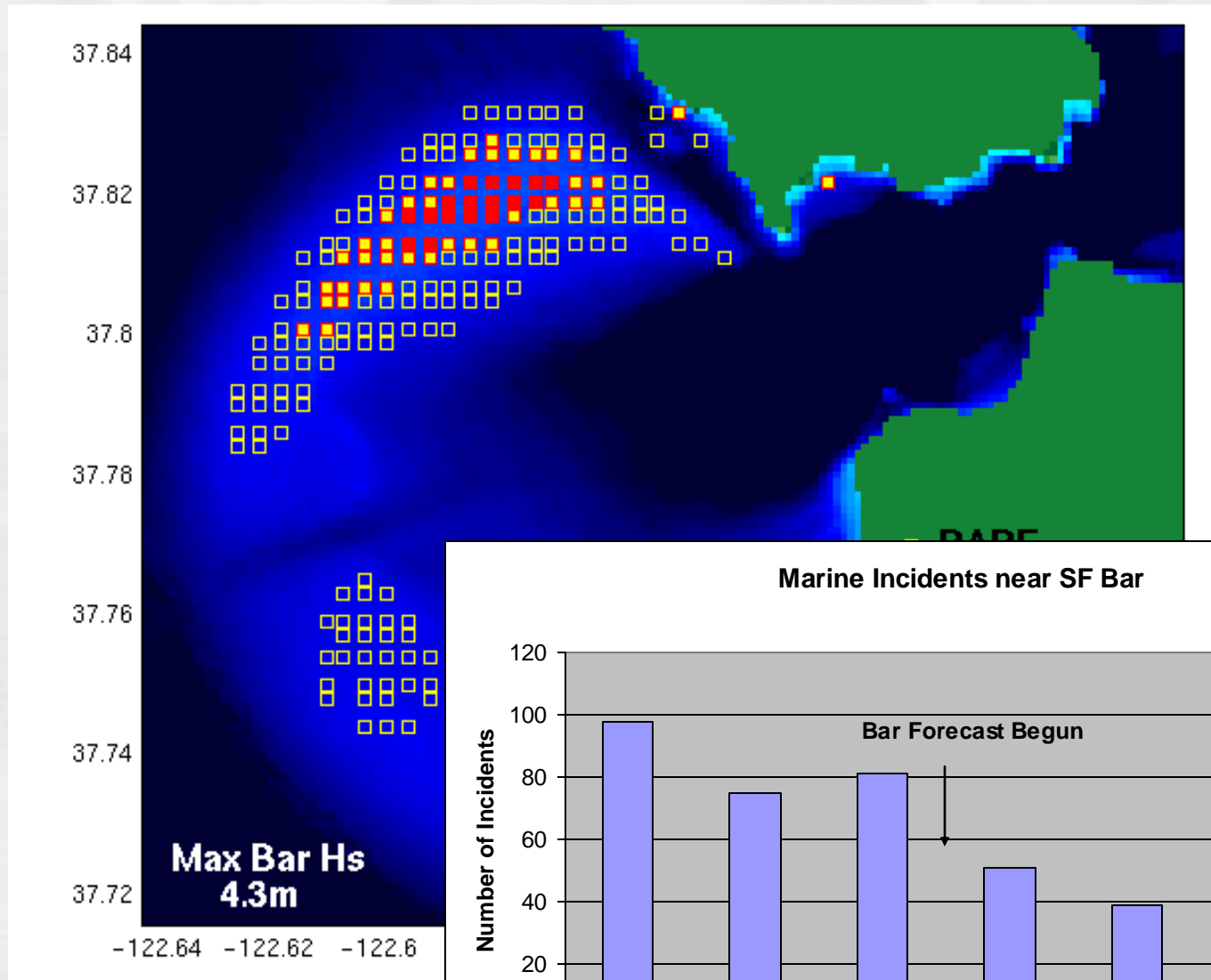


SCCOOS providing currents



<http://sccoos.ucsd.edu/themes/harbors>

Navigation Safety at the San Francisco Bar – a new application



National IOOS Wave Observation Plan

- **An integrated plan for wave measurements in the US**
 - ▶ Corps in partnership with NOAA/NDBC & NOAA IOOS
- **Addresses:**
 - ▶ Spatial / temporal coverage
 - ▶ Accuracy requirements of wave observations
- **Wave Observing System Design**
 - ▶ Four Subnets: Offshore / Outer / Inner / Coastal
 - ▶ Identifies gaps/upgrades
 - ▶ USACE responsible for Coastal & Inner Shelf
- **Technology development, training activities**
- **Testing and evaluation of existing & new technologies**
 - ▶ Wave instrument training/testbed at FRF and West Coast
- **Long-term, sustainable measurement program**





National IOOS Wave Observation Plan

296 sites, 181 exist, 128 upgrades



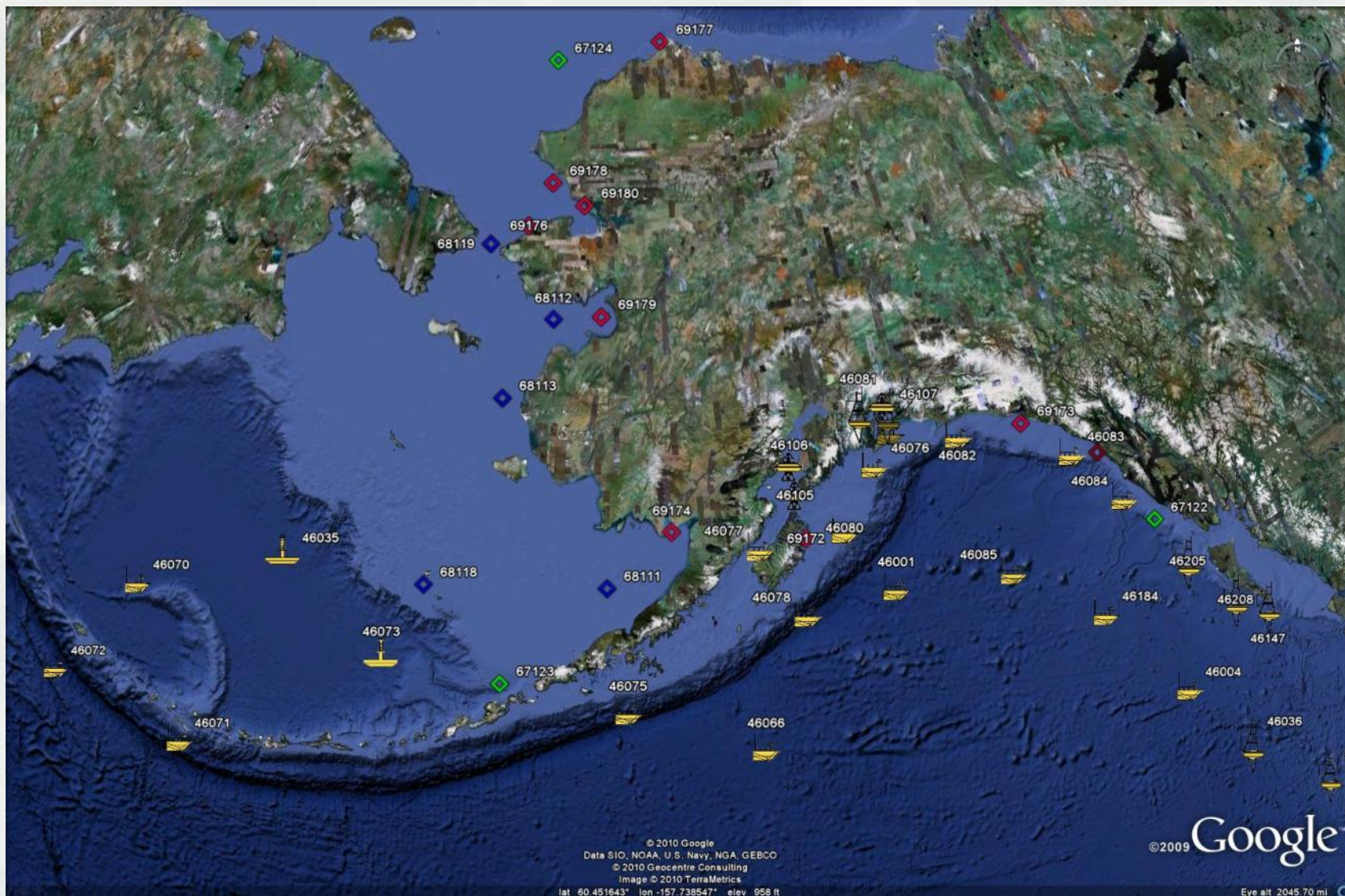
© 2009 Tele Atlas
© 2009 LeadDog Consulting
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2009 Europa Technologies

lat 43.344251° lon -108.160082° elev 5386 ft

©2009 Google™

Eye alt 5307.27 mi

Alaska



IOOS is making a difference on Data Access

NDBC - Standard Data Format (SDF) - Map of IOOS® Observations via NDBC SOS Server - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://sdf.ndbc.noaa.gov/

weather.gov

National Oceanic and Atmospheric Administration's
National Data Buoy Center
Center of Excellence in Marine Technology

Home News Organization Search NDBC Web Site Search

Observations
IOOS® DIF Station List
Sensor Observation Service
Web Coverage Service
Web Map Service

Program Info
About NDBC
Met/Ocean
Moored Buoy
C-MAN
TAO
DART
VOS
CSP
IOOS® DAC

SOS Software/Documentation
FAQ
Contact Us
Links

USA.gov
Government Made Easy

IOOS
INTEGRATED OCEAN OBSERVING SYSTEM

Standard Data Format (SDF) - Map of IOOS® Observations via NDBC SOS Server

Map Satellite Hybrid Terrain

Station 46001
GULF OF AK, 88NM South of Kodiak, AK
NA
56.3N 148.02W
Observations: currents, sea_water_temperature, waves, winds
2008-01-21T06:00:00Z / now

Select a data type:
☐ All Stations
☐ Ocean Currents
☐ Salinity
☐ Water Level
☐ Water Temperature
☒ Waves
☐ Winds

Start Date (yyyy-mm-dd):
2010-08-05

Stop Date (yyyy-mm-dd):
2010-08-06

Output Format: --
Get Data

Some stations depicted are not operated by the National Data Buoy Center.

164 stations displayed.

View NDBC SOS Availability Growth

500 mi
1000 km

North Pacific Ocean

Map data ©2010 AND, Europa Technologies, Geocentre Consulting, INEGI, MapLink - Terms of Use

Done

New Pacific Storminess/Climate Impact Initiative, FY12

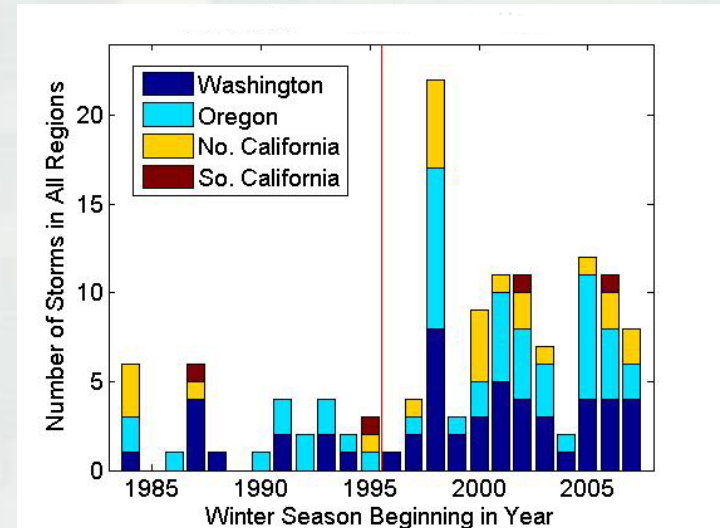


Hawaii

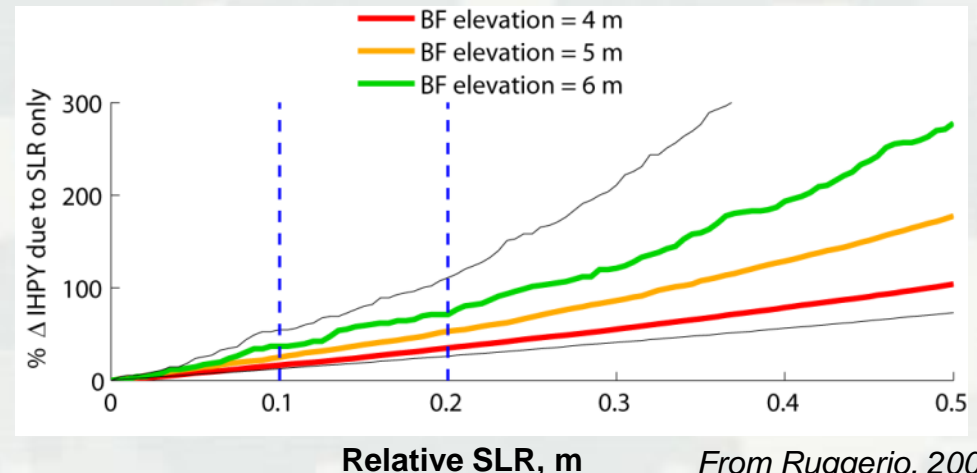


Southern California

Pacific Storms with $H_s \geq 6\text{m}$



Relative increase in number of hours wave runup reaches dune/cliff toe



From Ruggerio, 2008

a Corps' contribution to IOOS

- Wave Observations
 - ▶ Coastal Data Information Program (CDIP)
 - With Scripps
 - An IOOS component before there was an IOOS
 - ▶ NDBC directional sensors
 - ▶ NDBC serving all data
- Wave Hindcasts
 - ▶ 20+ years of 3-hourly hindcasted wave data
 - ▶ Nationwide & online
- New Pacific Climate Impact Initiative
 - ▶ Observations, Models & Products
 - ▶ In partnership with NOAA, USGS, others

