The Coastal Field Data Collection Program (CFDC)

Waves & Coastal Observations for the Corps and the Nation

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10 August 2010
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:
- 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

http://frf.usace.army.mil/eve/modeling/modelMainPageFrame.pl
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

[Website Link]
http://frf.usace.army.mil/cgi-bin/wis/atl/atl_main.html
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

- 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

53 harbors – coastal, inland, Great Lakes - handled over 10 million tons each in 2006...

Inland Waterway System:
- Nearly 12,000 Miles 9 ft & Over
- 195 Lock Sites / 241 Chambers
- Moving Over 600 Million Tons
- About 2/3rds Cost of Rail and 1/10 Cost of Truck
Waves and Currents in the San Pedro Channel

SCCOOS providing currents

CDIP providing wave observations, Nowcasts and forecasts.

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

INTEGRATED OCEAN OBSERVING SYSTEM

NOAA IOOS
Navigation Safety at the San Francisco Bar – a new application

Marine Incidents near SF Bar

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Max Bar Hs 4.3m

Bar Forecast Begun
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
  - Identities 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
National IOOS Wave Observation Plan: Alaska
IOOS is making a difference on Data Access
New Pacific Storminess/Climate Impact Initiative, FY12

Pacific Storms with $H_s \geq 6m$

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

From Ruggerio, 2008

Hawaii

Southern California
Coastal Field Data Collection Program

*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