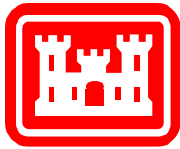


Coastal Sediment Transport Modeling Ocean Beach & San Francisco Bight, CA

Honghai Li and Lihwa Lin
Engineering Research and Development Center
U.S. Army Corps of Engineers

Frank Wu, Lisa Andes, and James Zoulas
San Francisco District
U.S. Army Corps of Engineers

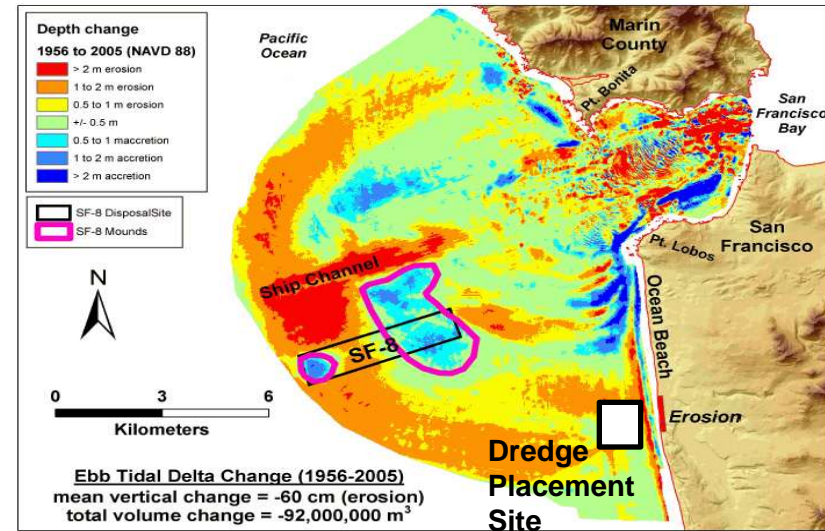
24th Annual
National Conference on
Beach Preservation Technology
10 February 2011

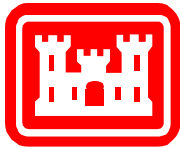


Objectives

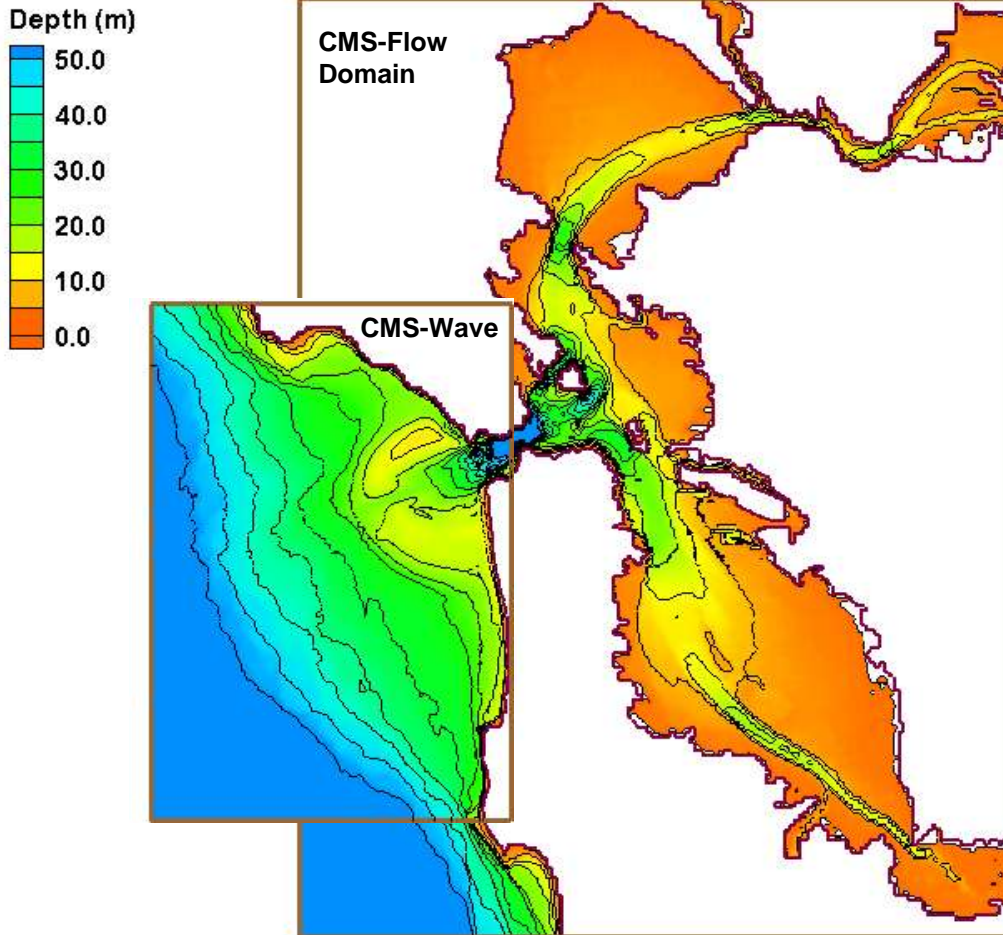


- Develop a hydrodynamic, waves, and sediment transport model for Ocean Beach & San Francisco Bight
- Evaluate morphology change and sediment flux nearshore Ocean Beach
- Technical transfer for the regional sediment management project applications





CMS Bathymetry and Domain



Current, Waves and
Sediment Transport

CMS Domain

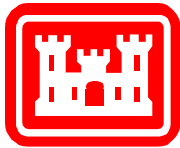
CMS-Flow: 60 x 80 km

CMS-Wave: 30 x 44 km

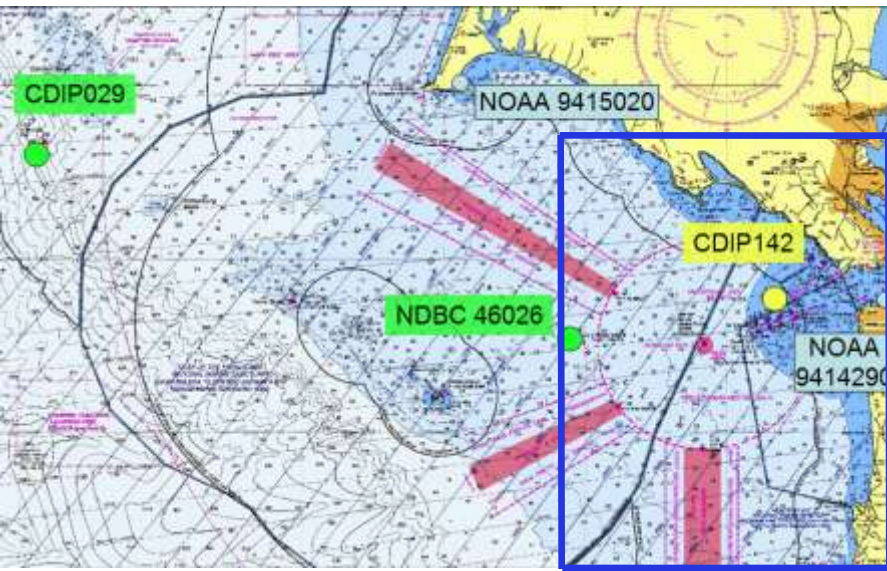
Cell Size: 20-400 m

Water Depth: 0-110 m

USGS and NOAA Data

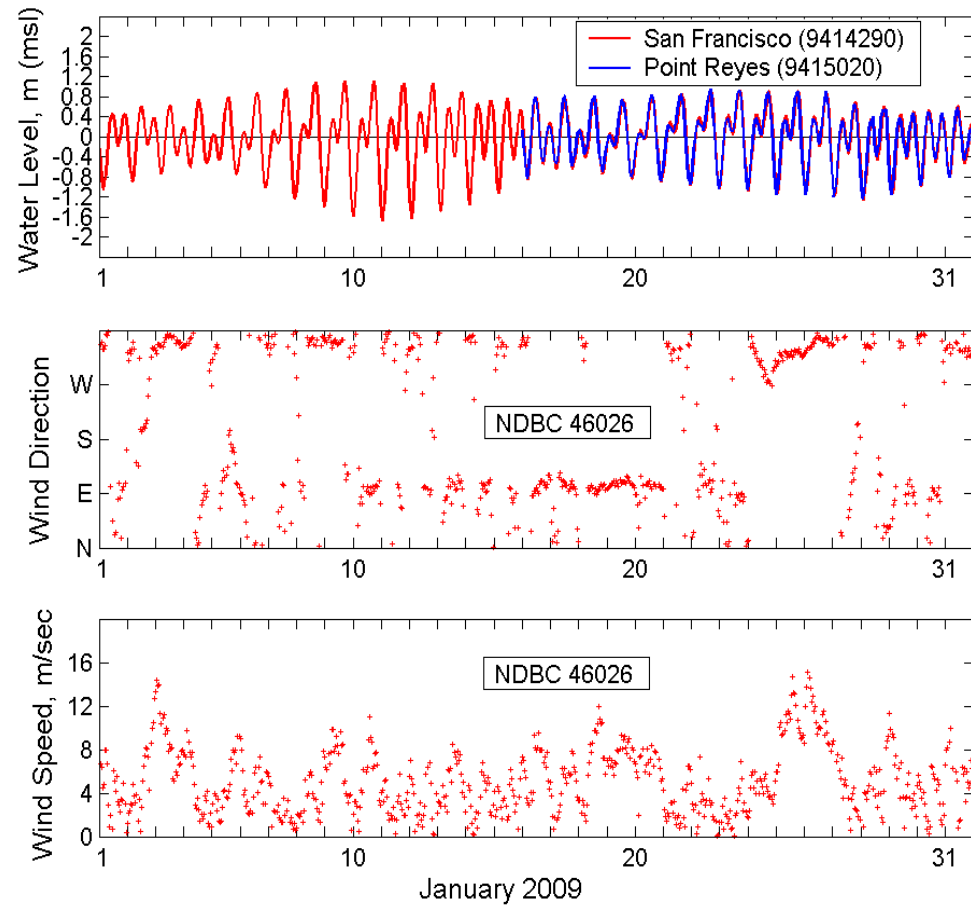


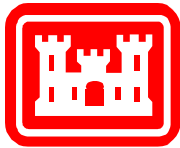
CMS-Wave Input (January 2009)



CMS-Wave Domain

Input Wind and Water Level



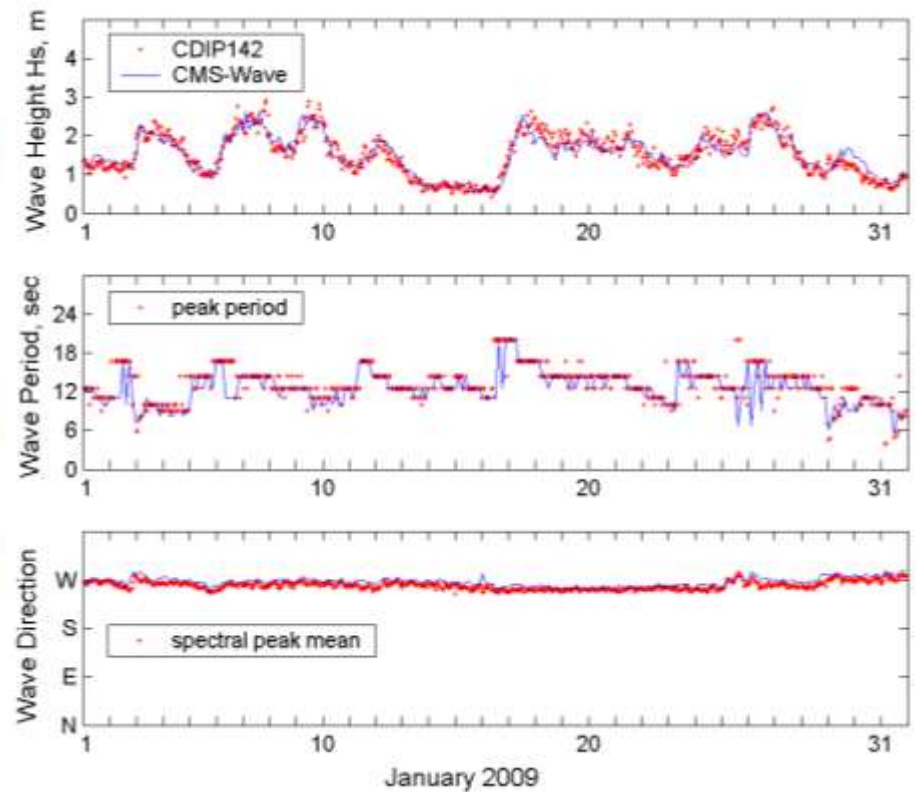
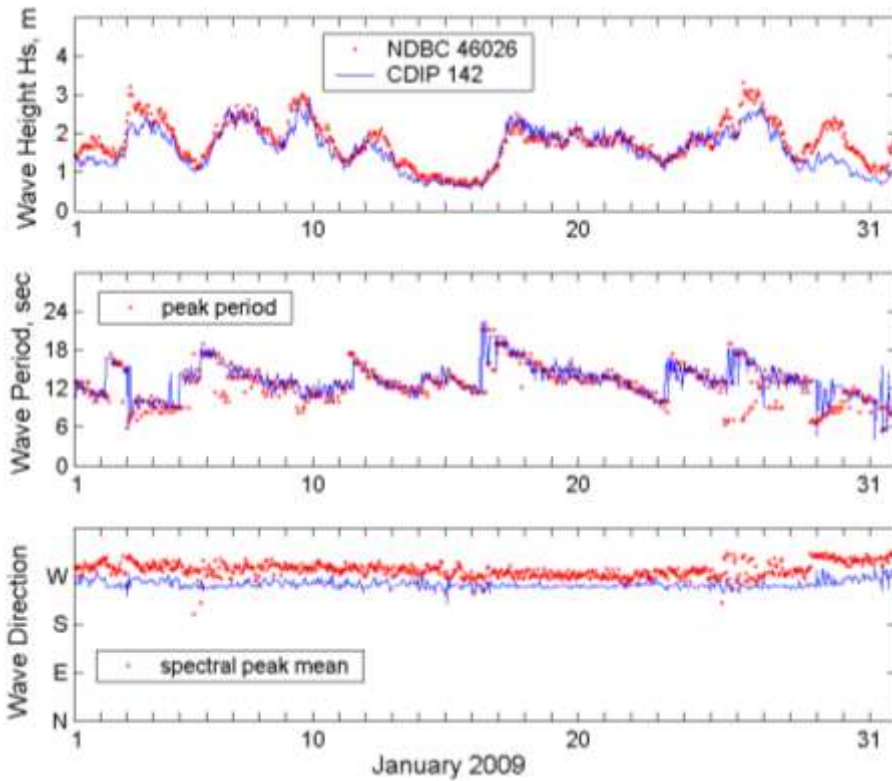


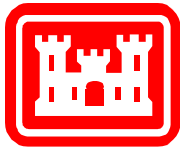
CMS-Wave Validation with Buoy Data



Buoy Wave Data

Calculated Wave and Data



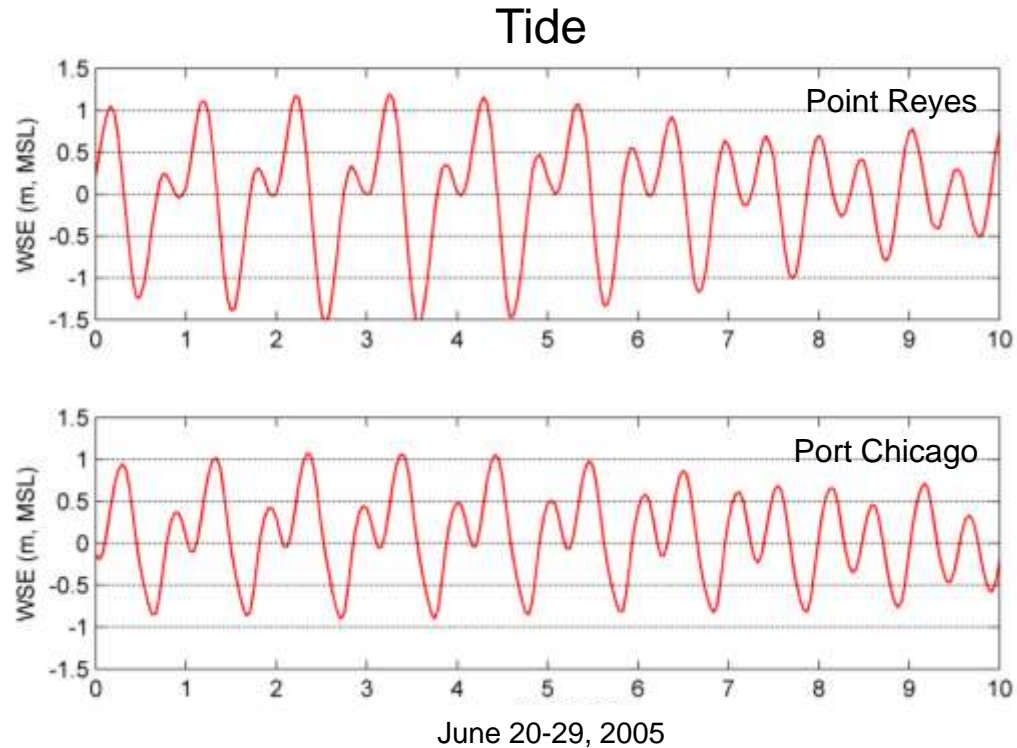


CMS-Flow Water Level Forcing



Water surface elevation (WSE)
at NOAA's Point Reyes
(9415020) and Port Chicago
(9415144) Gages

Drive CMS-Flow along the model
open boundaries



NOAA 9415020
(Pt Reyes)

NOAA 9415144
(Port Chicago)

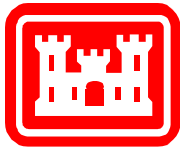
NOAA 46026

Mixed, predominately semi-diurnal tide
Mean tide range (MHW – MLW)

Point Reyes: 1.19 m

Port Chicago: 1.12 m

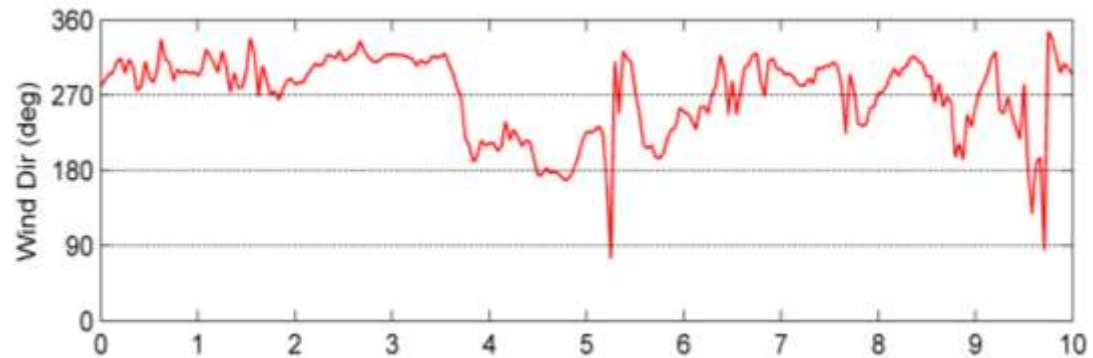
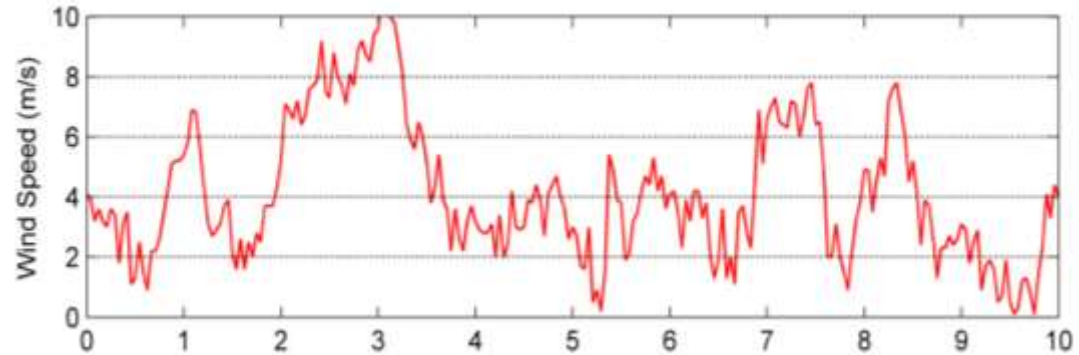
Calibration period: spring tide



CMS Wind Forcing



Wind at NOAA Buoy 46026



June 20-29, 2005

Surface boundary forcing for CMS-Flow

Mean Wind Speed:

4.12 m

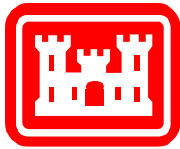
Mean Wind Direction:

270.6°

Direction Convention: 0° North

0°- 360° Clockwise

From which wind blowing



CMS-Flow Wave Forcing



Mean Significant Wave Height:

0.91 m

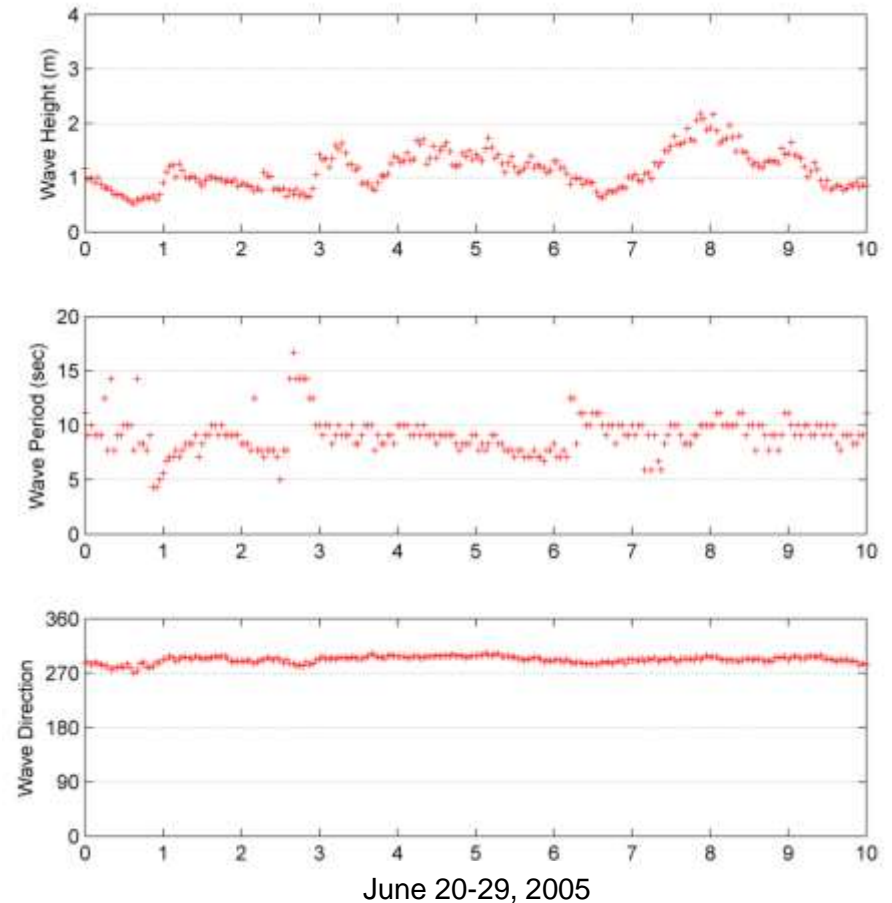
Mean Wave Period:

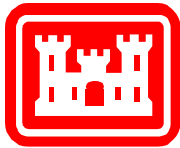
9.2 sec

Mean Direction:

289.1°

Wave Parameters (NOAA Buoy 46026)

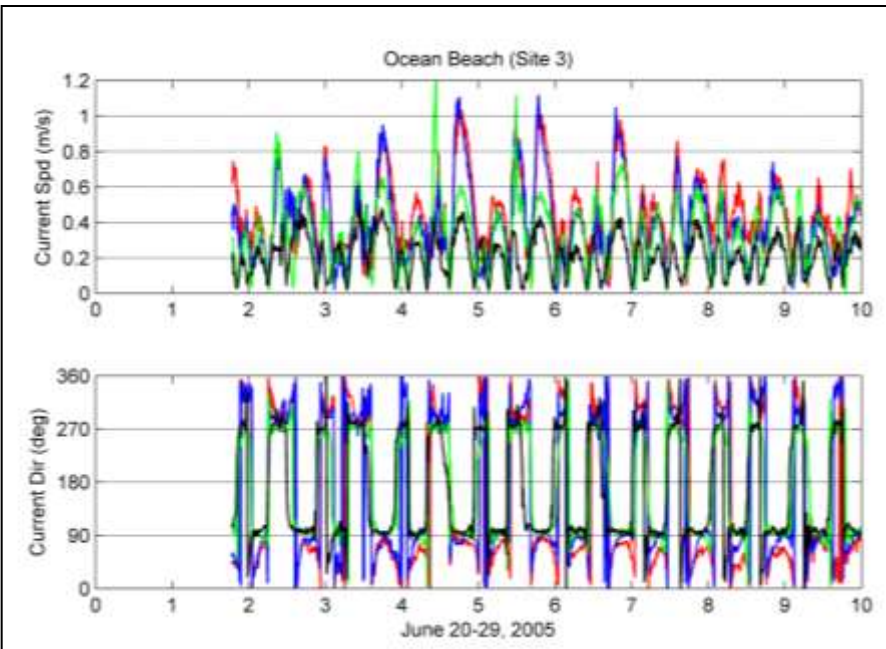




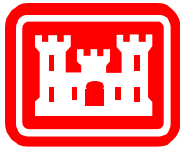
ADCP Measurements



ADCPs Deployed by USGS
Nearshore Ocean Beach
Current and Pressure Measured



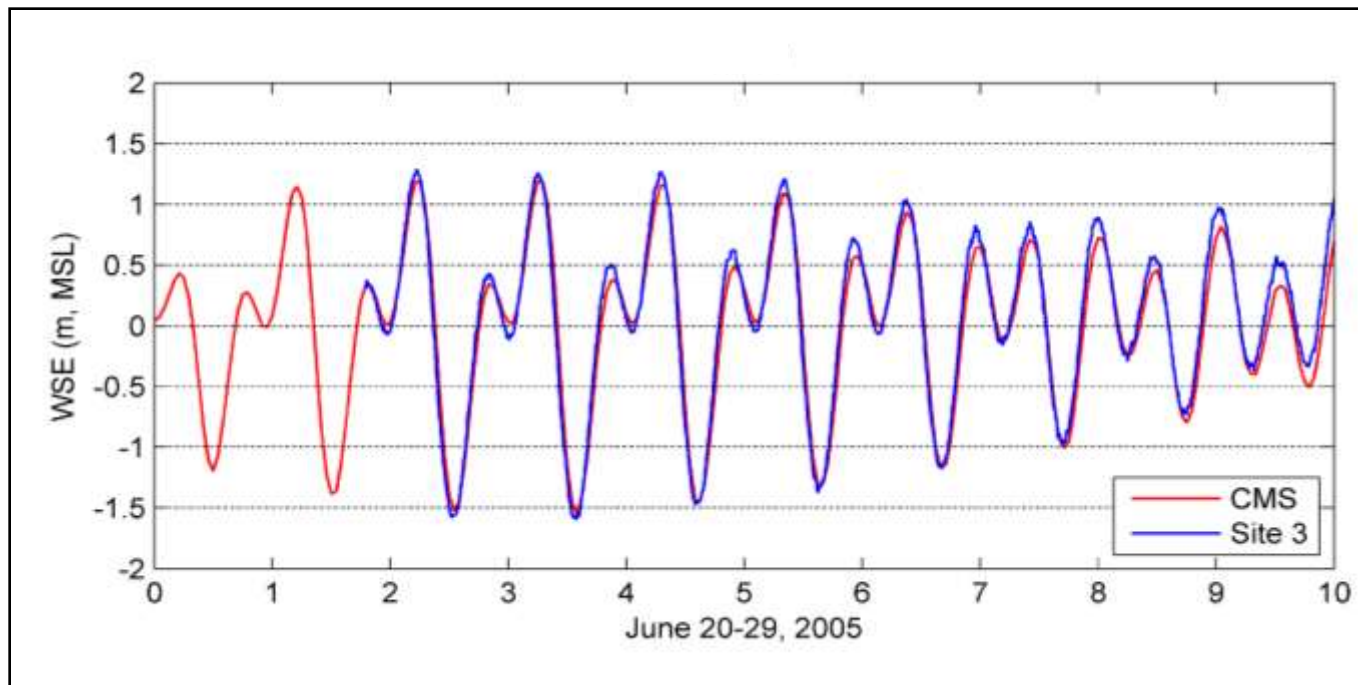
Site1: 7.5 m, 06/21/2005-06/26/2005
Site 2: 10.9 m, 06/21/2005-08/01/2005
Site 3: 14.1 m, 06/21/2005-07/30/2005

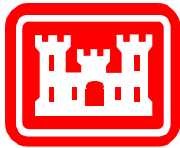


Calculated and Measured Water Levels



Ocean Beach (Site 3)

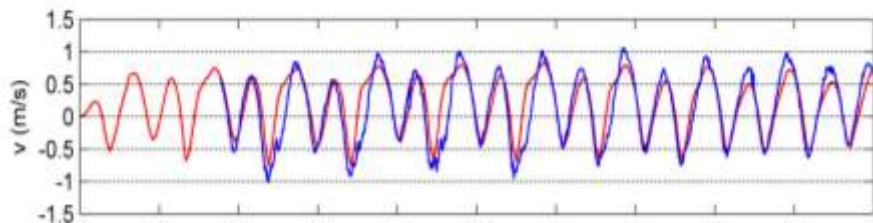
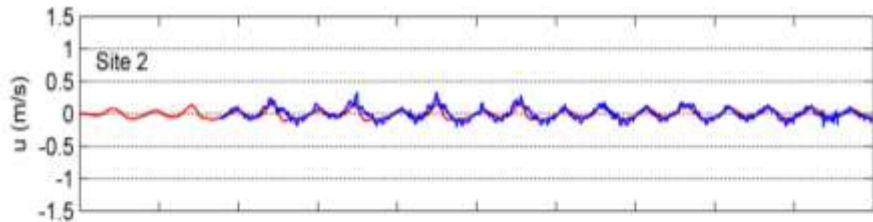
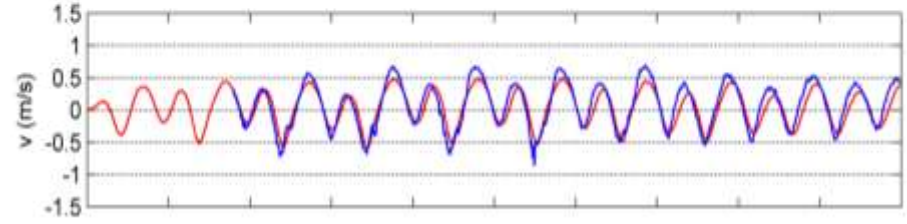
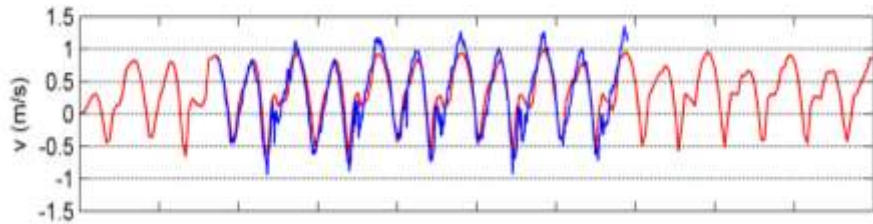
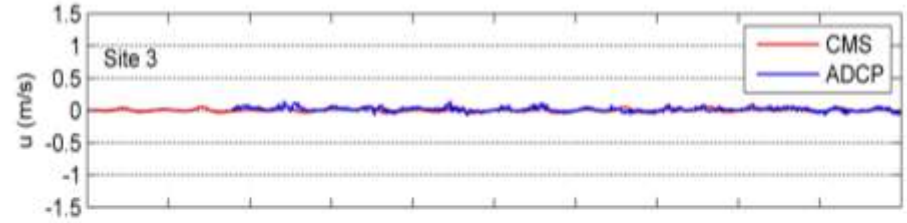
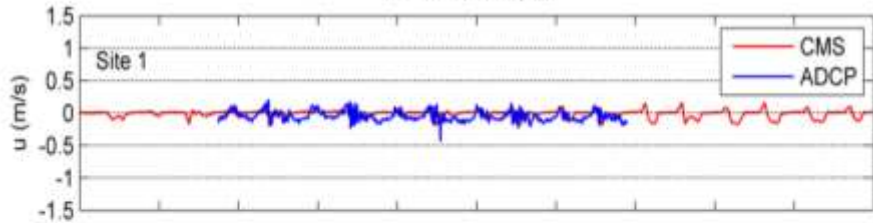




Calculated and Measured Currents

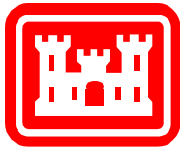


Ocean Beach, CA

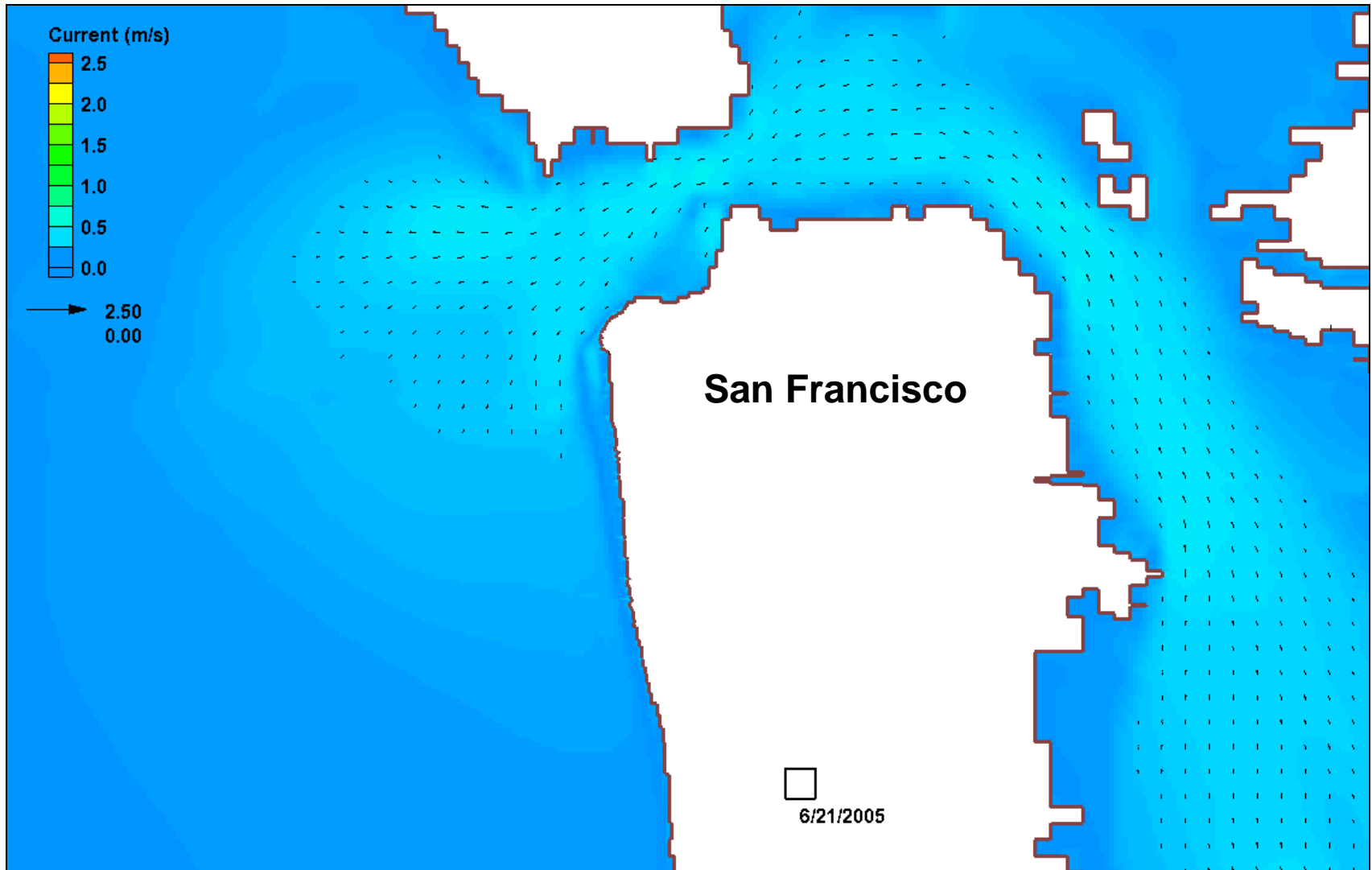


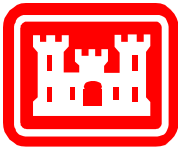
June 20-29, 2005





Calculated Surface Current (6/21-25/2005)



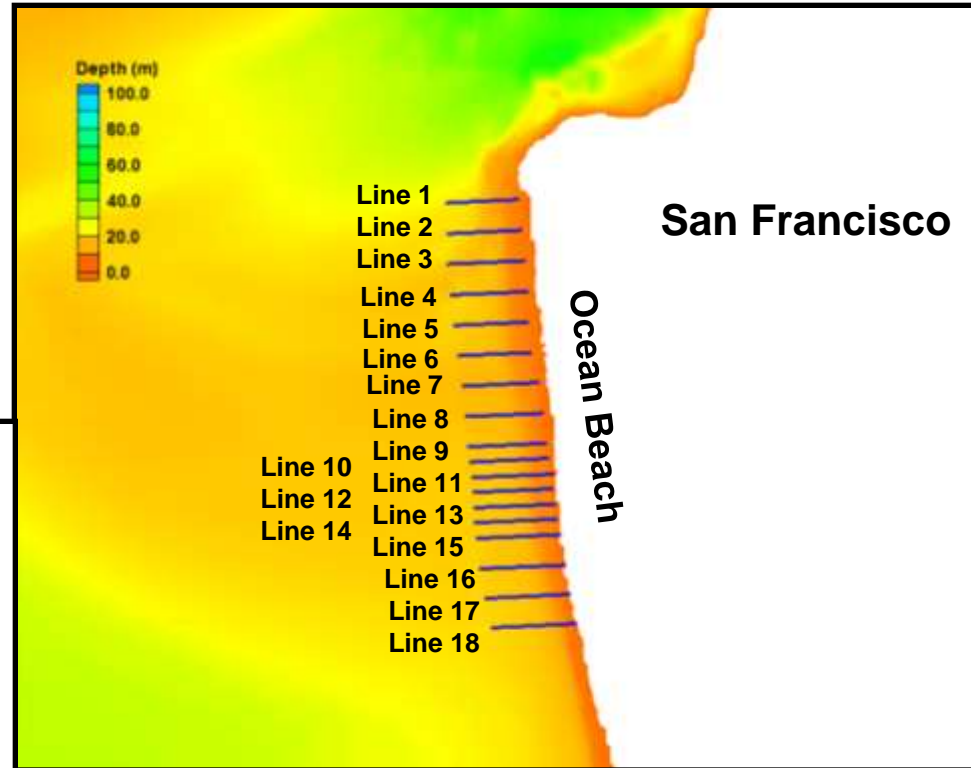


USGS Transects and Morphology Change

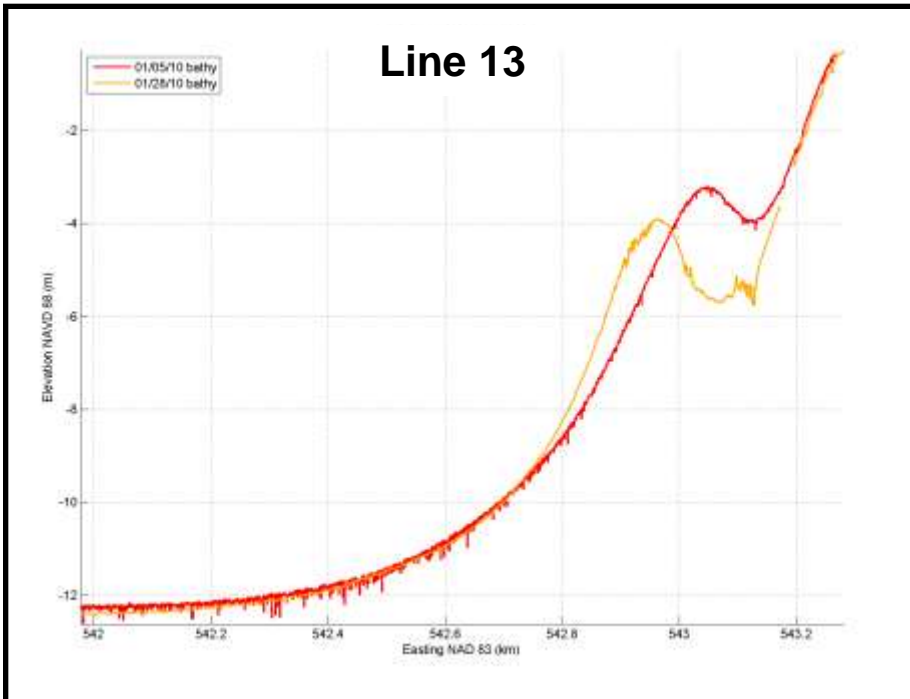


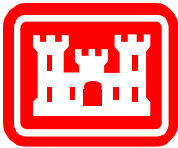
Bathymetry Measurements along 18 Transects

01/05/2010-01/28/2010



Berm Offshore movement





USGS Transects and Morphology Change



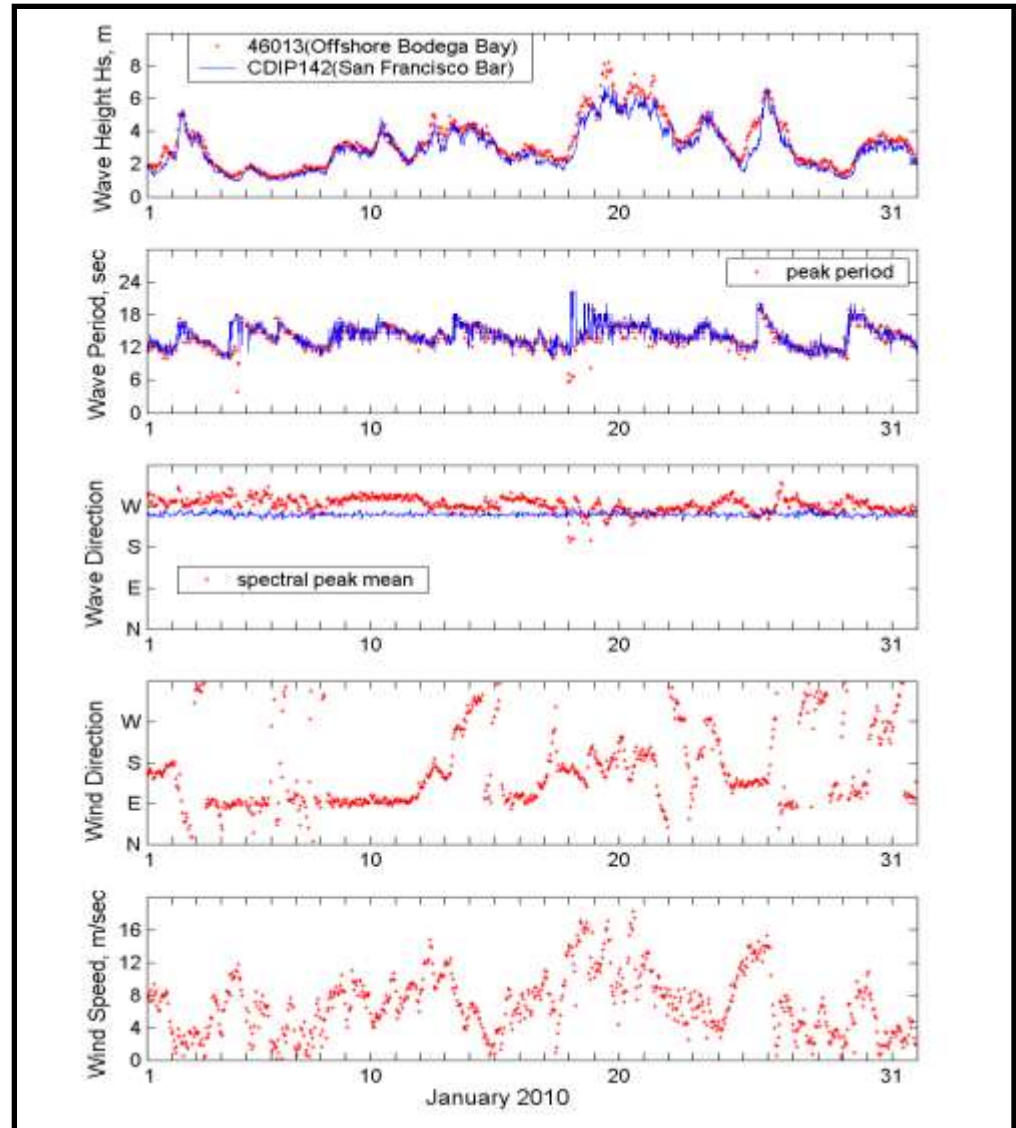
Winter Storm:

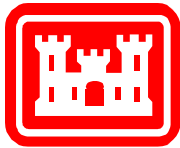
Maximum Wave Height

8 m

Maximum Wind Speed

> 20 m/s



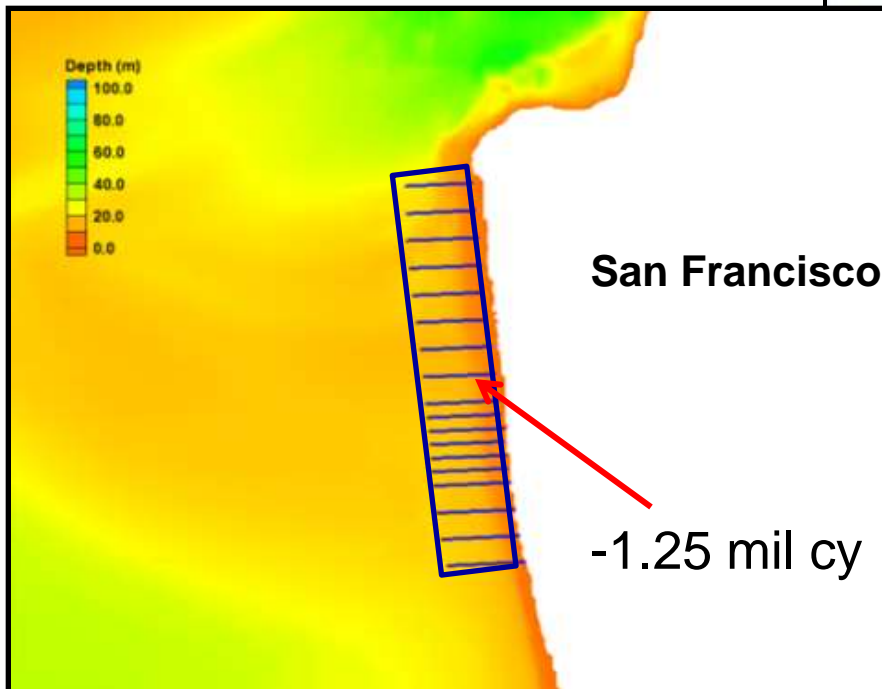
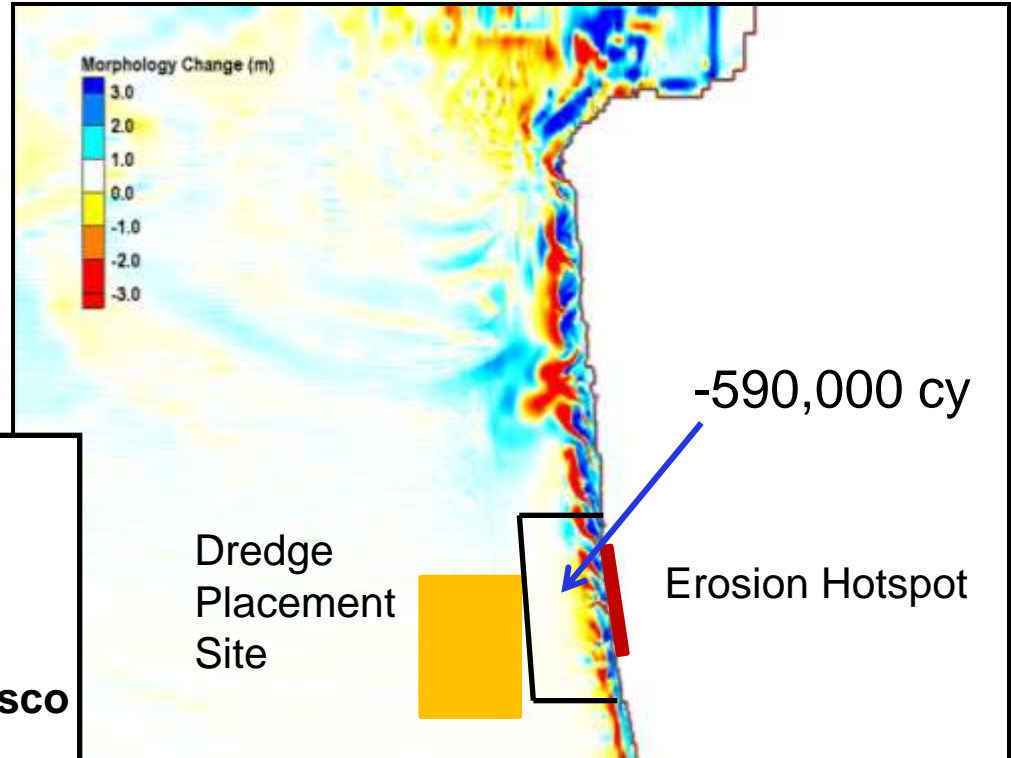


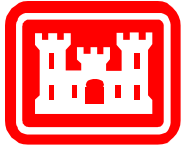
Morphology Change at Ocean Beach



Sediment Transport
(bedload + suspended load)

Bed Elevation Change after
25-day Simulation





Sediment Volume Control Box at Erosion Hotspot

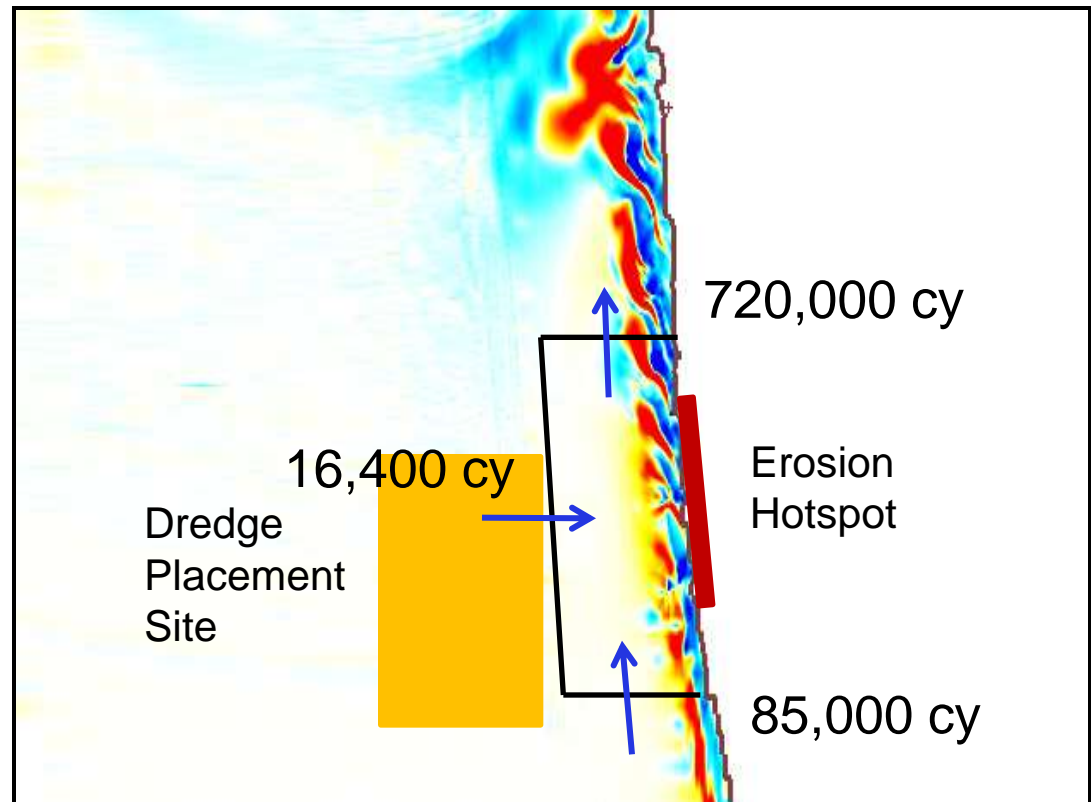


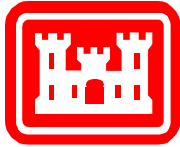
Sediment Flux

In: $16,400 + 85,000 = 101,400$ cy

Out: 720,000 cy

Erosion: 590,000 cy

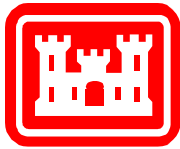




Summary



- CMS is developed for the Ocean Beach application.
- CMS-Wave and CMS-Flow results are calibrated against buoy data, WSE and current measurements at Ocean Beach.
- Preliminary CMS results show consistent patterns of morphology changes and sediment transport with observations.



Thank You!



Questions?