

San Francisco District, Sediment Transport Model Development and Application for Ocean Beach and San Francisco Bight, CA

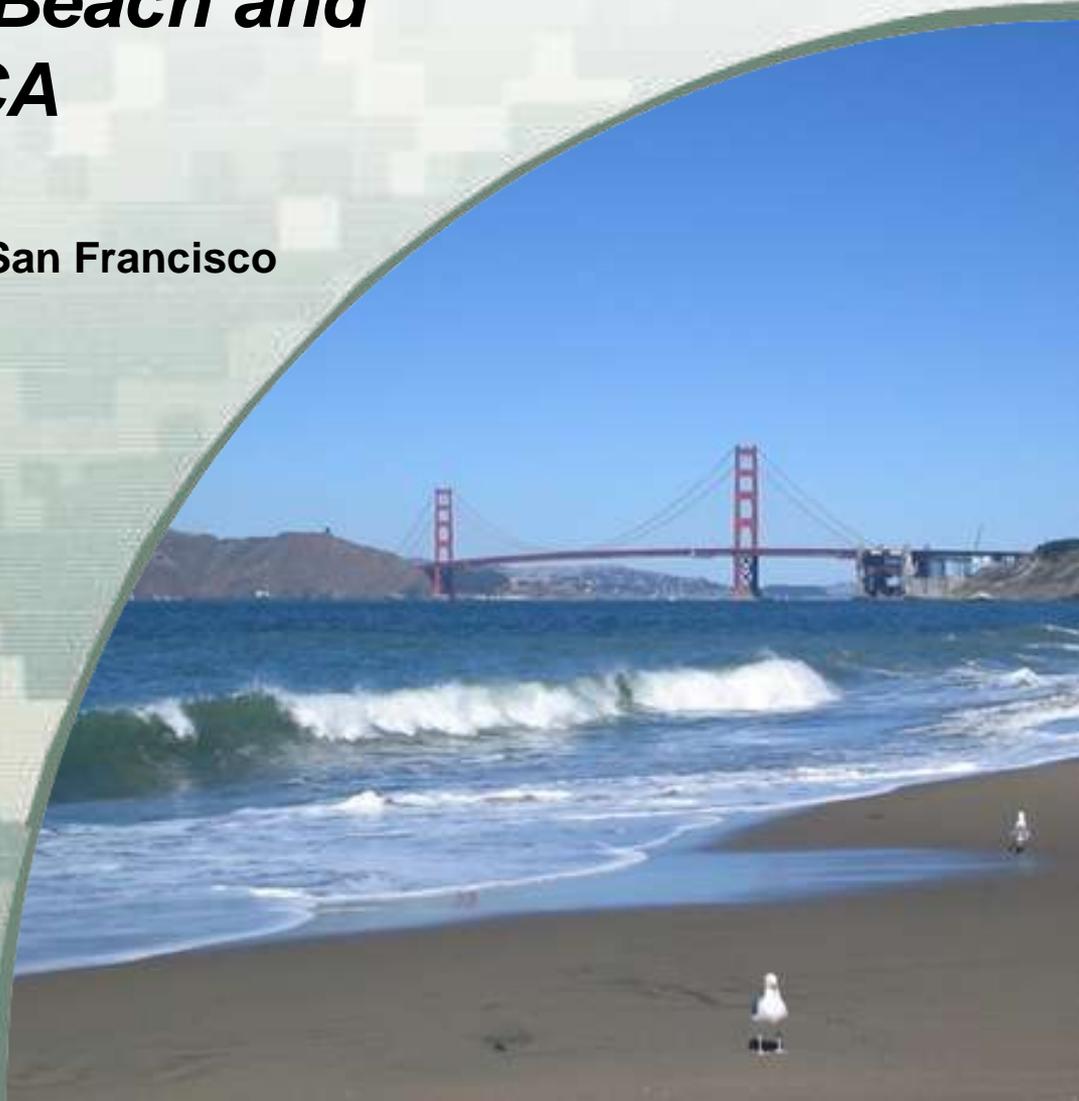
Frank Wu, Lisa Andes, USACE District San Francisco

Lihwa Lin, Honghai Li, ERDC

BLUF: Develop an operational
sediment transport model in a high
energy environment

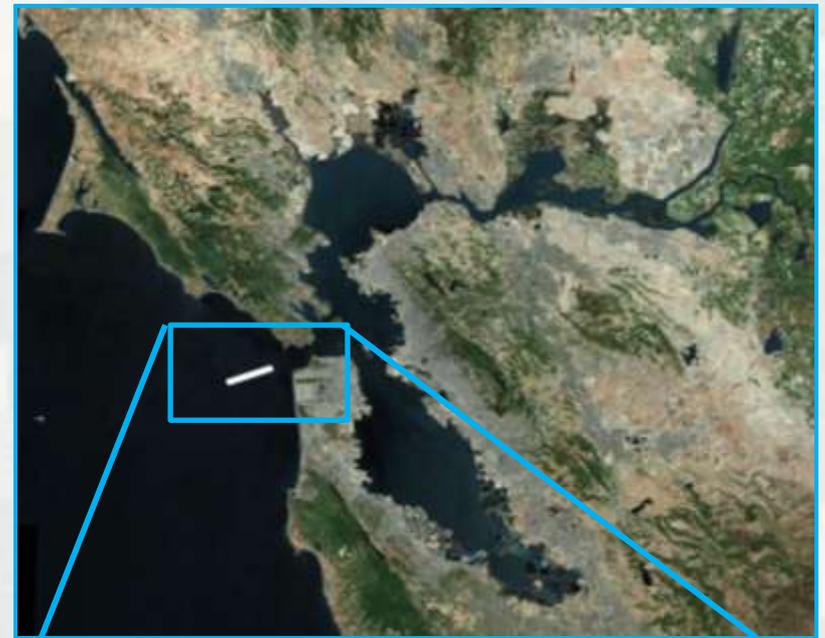


US Army Corps
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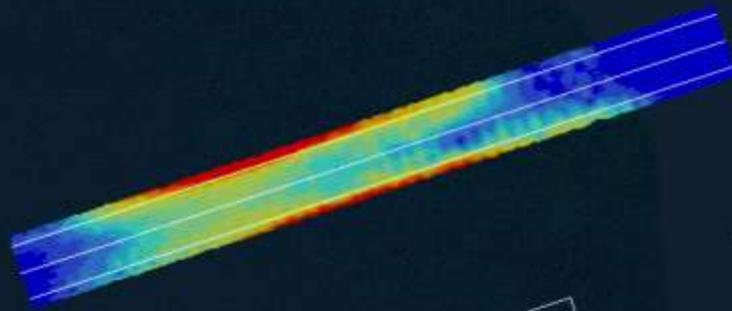
Description/Challenge:

- SF Main Ship Channel is the gateway to all of the Ports of Richmond, Oakland, Redwood City, West Sacramento, Stockton, etc.
- Channel length ~26,000 ft
- Channel width ~2000 ft
- Maintained depth 55 ft, MLLW
- Dredged by Essayons
- Dredging has occurred since ~1931
- Maximum Dredge Volume = 1.43 mcy (1975)
- Mean Dredge Volume = 0.51 mcy
- General decline in dredge volumes since 1975



Description\Challenge:

Predominately fine grained sand
(~0.18 mm)

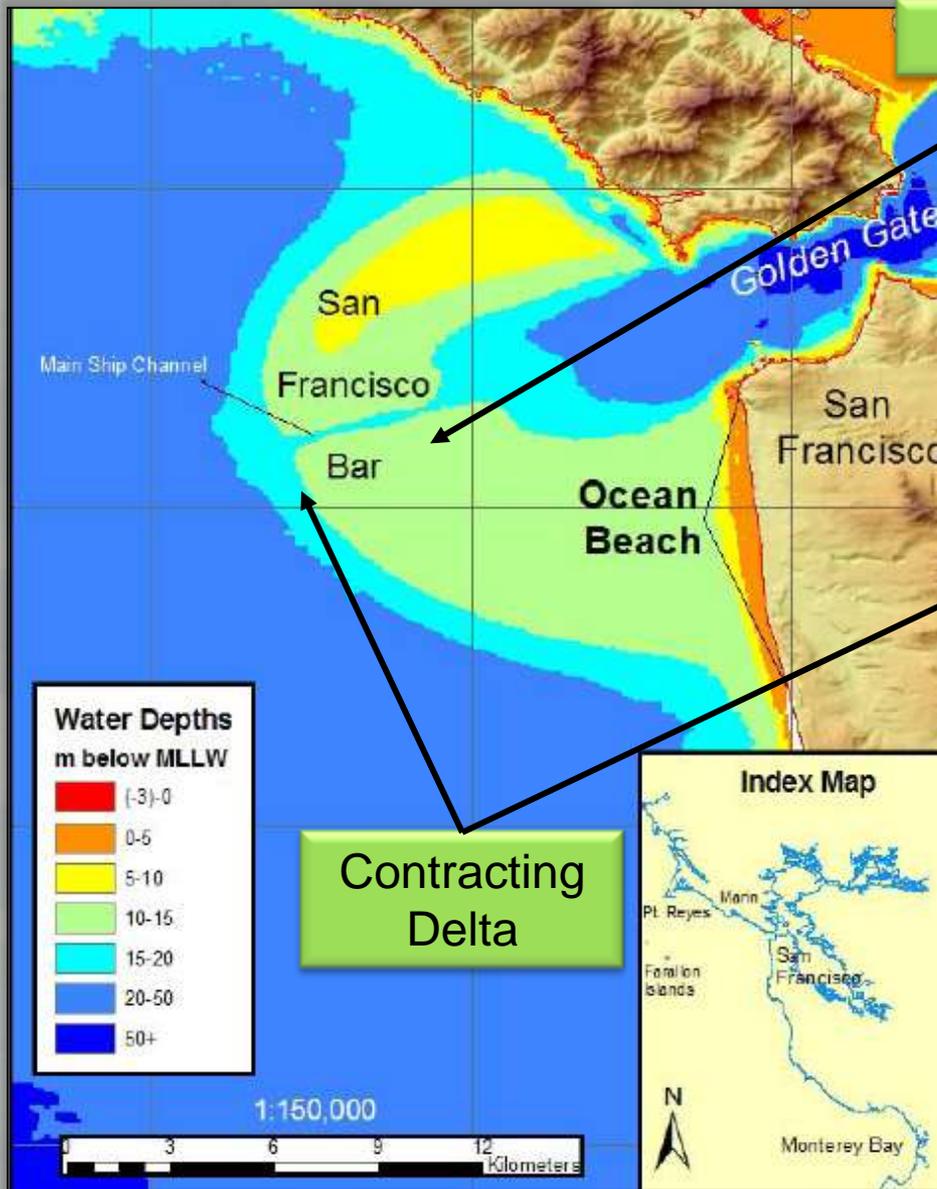


SF-8
1975 – Present

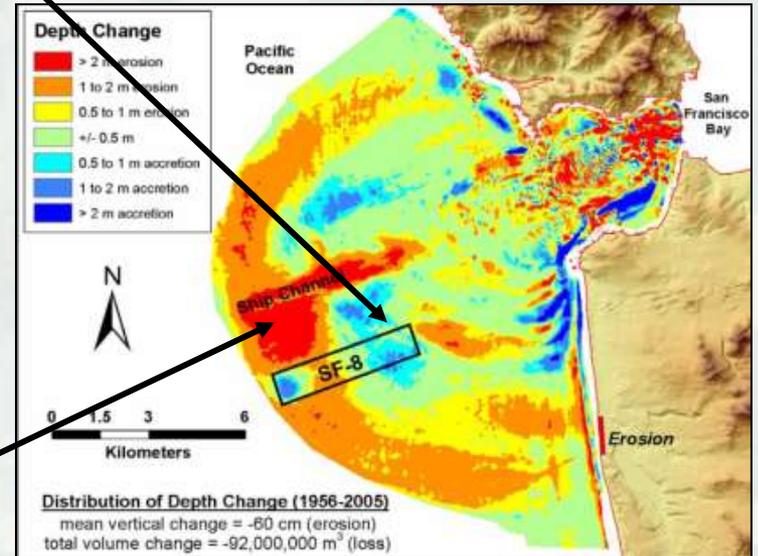
SF-17
2005 – Present
74-99% of Dredged Material

• Ocean Beach Nourishment Project (Section 204) – Planning Phase

Description\Challenge



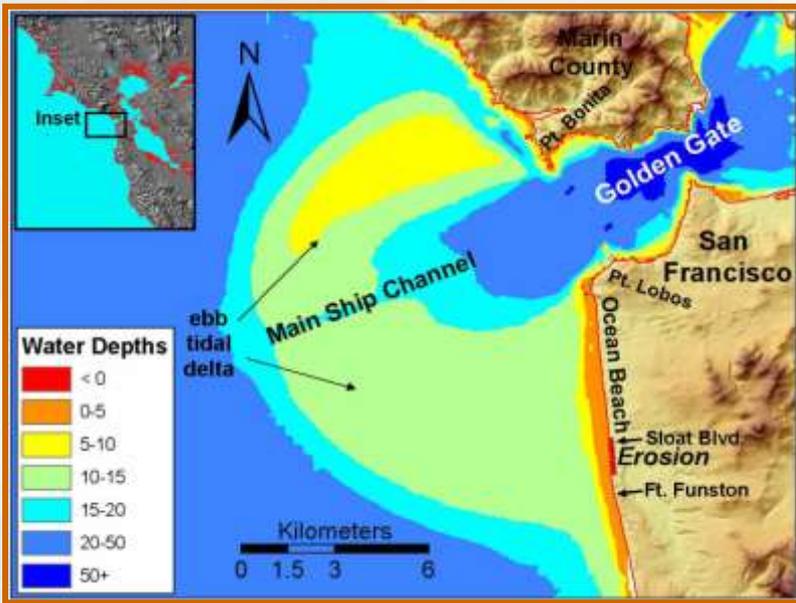
Shoaling



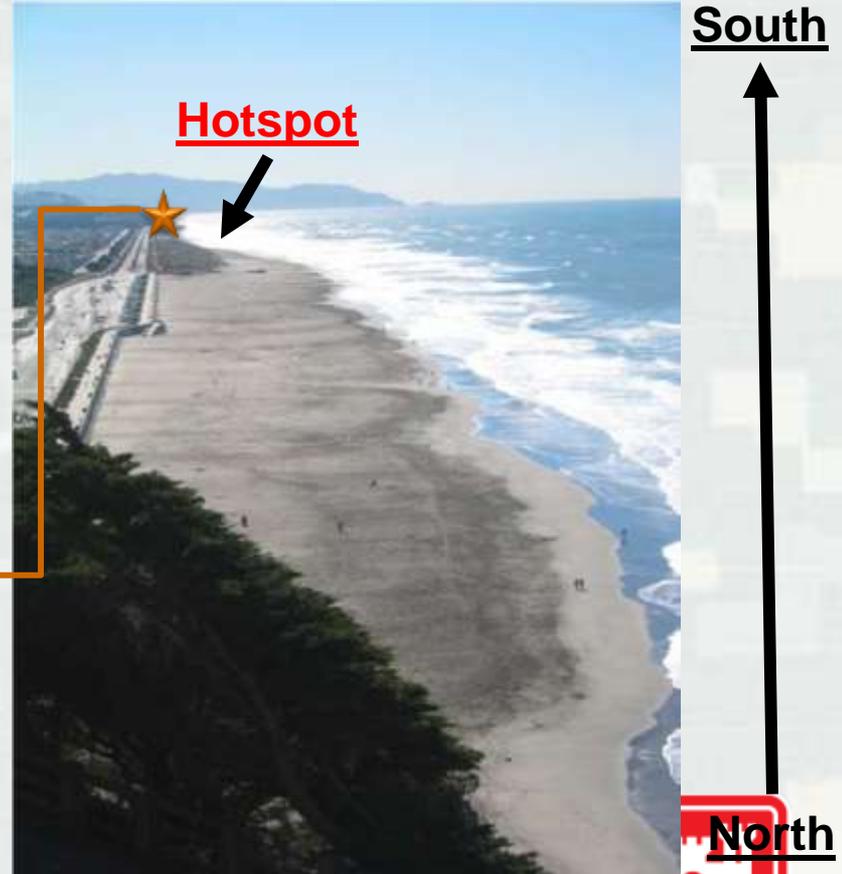
~120 mcy of sediment reduction of ebb tidal delta
 ~23.5 mcy of deposition at SF-8



Innovative solutions for a safer, better world

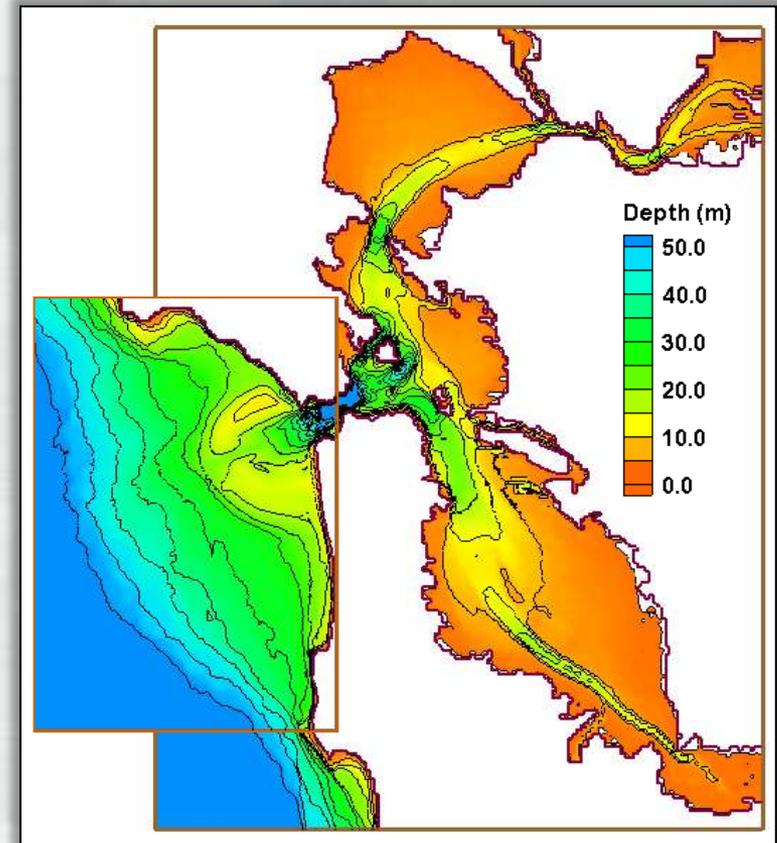


Erosion Hot Spot at "Ocean Beach"



Goals/Issues to Address:

1. Develop a fully calibrated sediment transport model that captures the unique coastal, estuarine and tidal processes that contribute to sediment transport in the Ocean Beach and the San Francisco Bight
2. Assist navigation O&M projects with beneficial use of dredged material for beach restoration and reducing dredging cycles
3. Calculate morphology change and sediment flux at Ocean Beach



District PDT Members

- Dr. Frank Wu, Regional Technical Specialist, Hydraulics, Hydrology and Coastal Engineering
- Lisa Andes, Hydraulics, Hydrology and Coastal Engineering

Leveraging/Collaborative Opportunities

funding, data, tools, models, etc
with Other Projects, Programs, Partners, etc

1. Work with State of California and City & County of San Francisco to reduce coastal erosion
2. Enhance cross-mission benefits (shore protection / O&M)
3. Have fully developed models for all inlets along the west coast to be used by USACE and local/regional agencies

Stakeholders and Partners

- Patrick Barnard, USGS, Data Collection
- Lihwa Lin, ERDC, Numerical Modeling
- Honghai Li, ERDC, Numerical Modeling
- Bay Conservation Development Commission (BCDC)

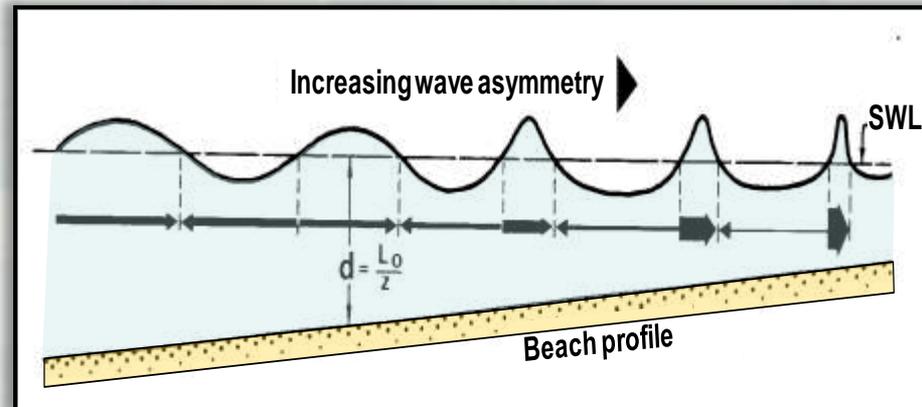
Milestones/Deliverables

1. Updated CMS model for offshore berm placement, **100% completed**
2. Model implementation of wave asymmetry and undertow processes, **100% completed**
3. ICCE presentation and paper (2012), **100% completed**
4. Tech-Note, **100% completed**
5. Final Report, **95% completed**
6. Technology transfer to SPN, **100% completed**



Models, Tools, Databases, etc Used

- CMS Wave and CMS Flow
- **Model Development:** wave asymmetry and undertow processes were included for cross-shore sediment transport calculations
- Nearshore data collection of waves, currents and water surface elevation



Modeling Approach

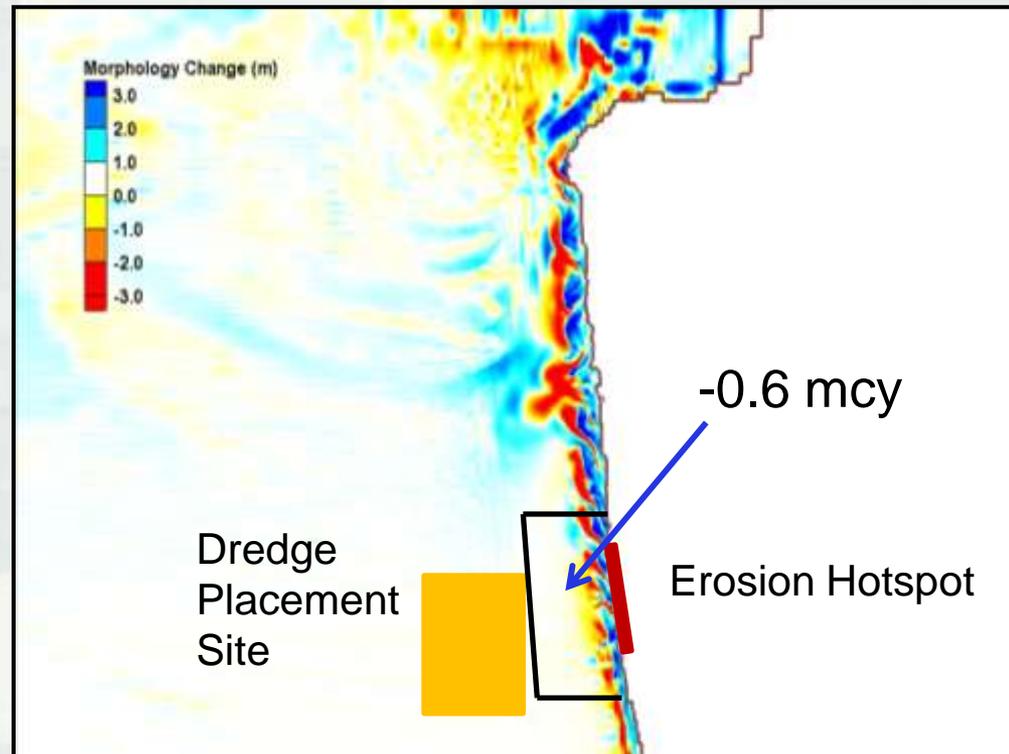
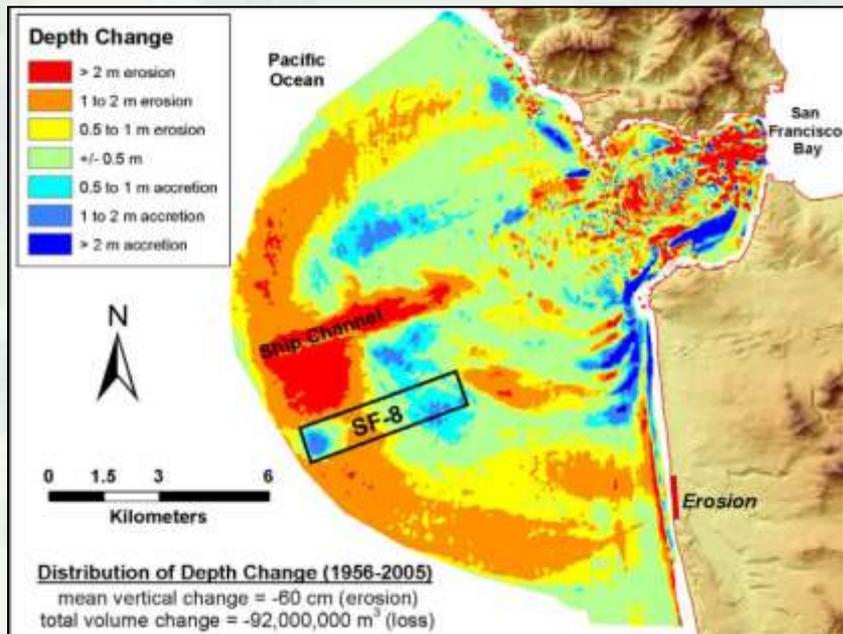
- Set-Up/Grid Generation
- Calibration/Validation
- Application of synthetic berm scenarios
- Application of beach nourishment



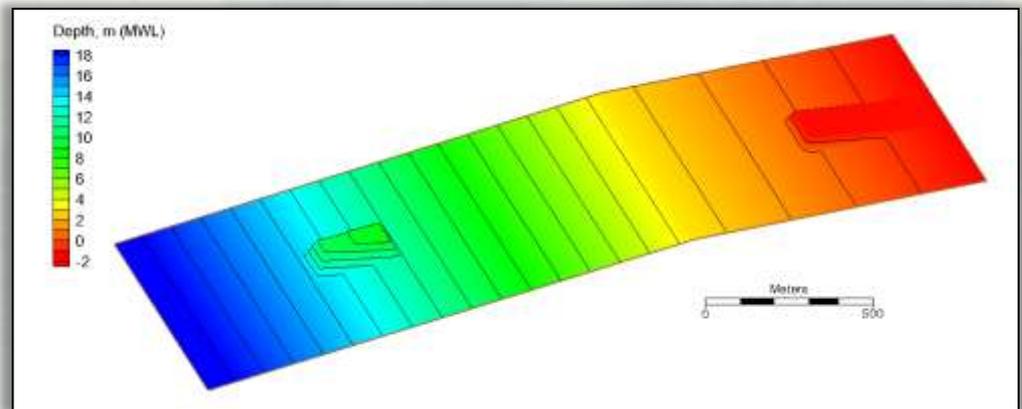
Preliminary Comparisons

Measured Data
~50 Year Change

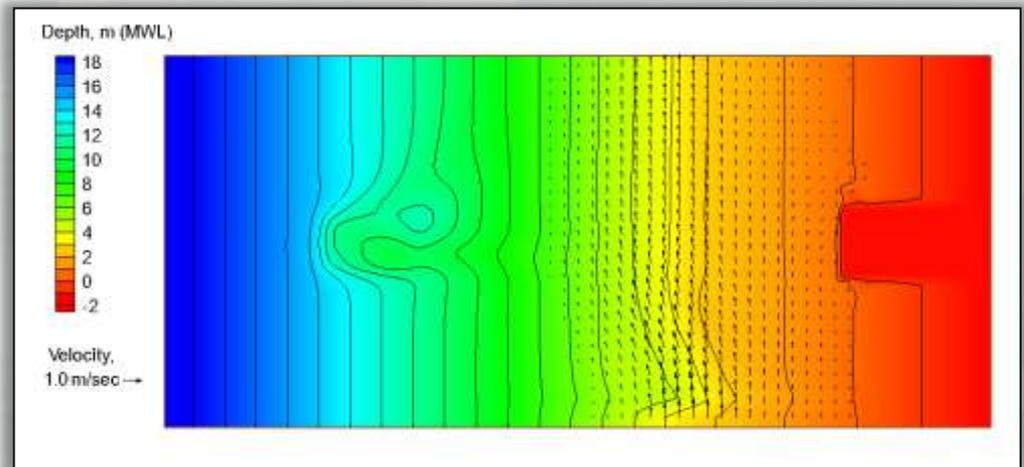
Model Results
~25 Day Change



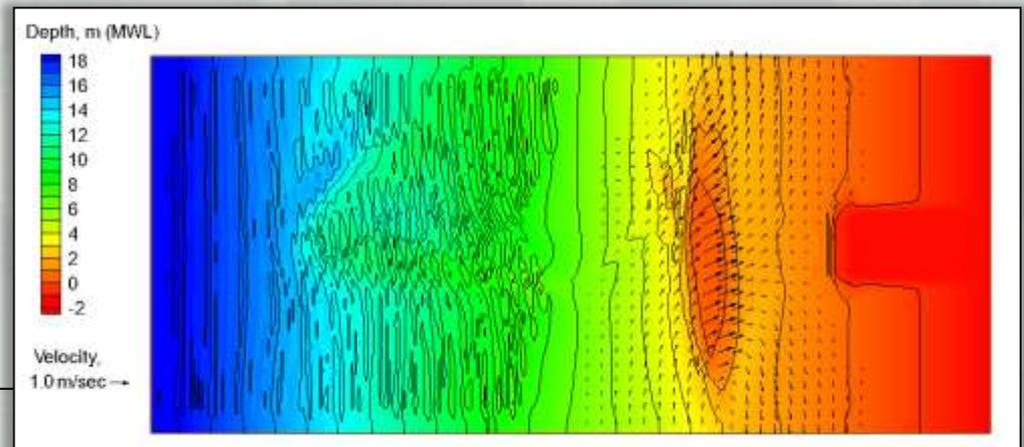
Initial Condition



10 Day Morphology Change
Without Wave Asymmetry and
Undertow



10 Day Morphology Change
With Wave Asymmetry and
Undertow



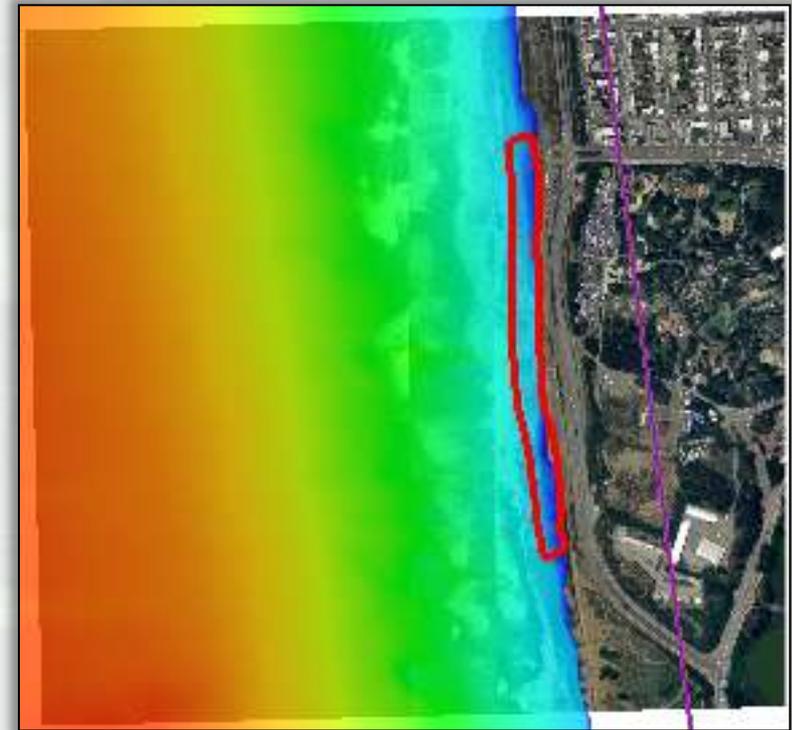
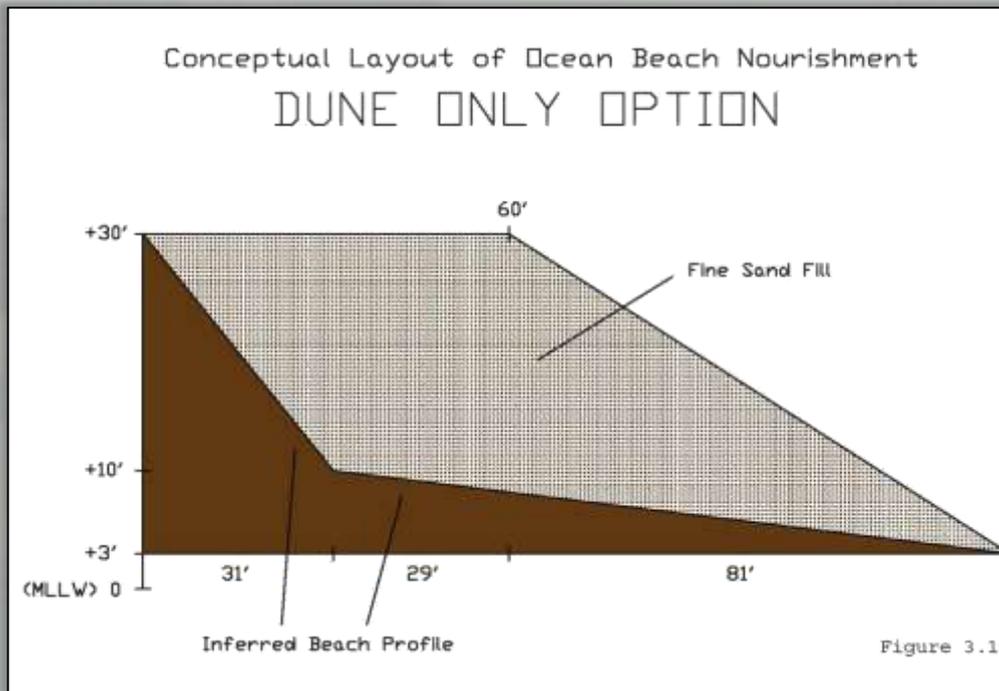
Opportunities to take action & Benefits to O&M, FRM, Environmental

Calculate sediment movement

- Improve efficiencies

- We have a tool for application:

1. Identify optimal locations for near-shore pilot study sites in the region and estimate potential performance
2. Estimate longevity of onshore nourishment projects



Accomplishments

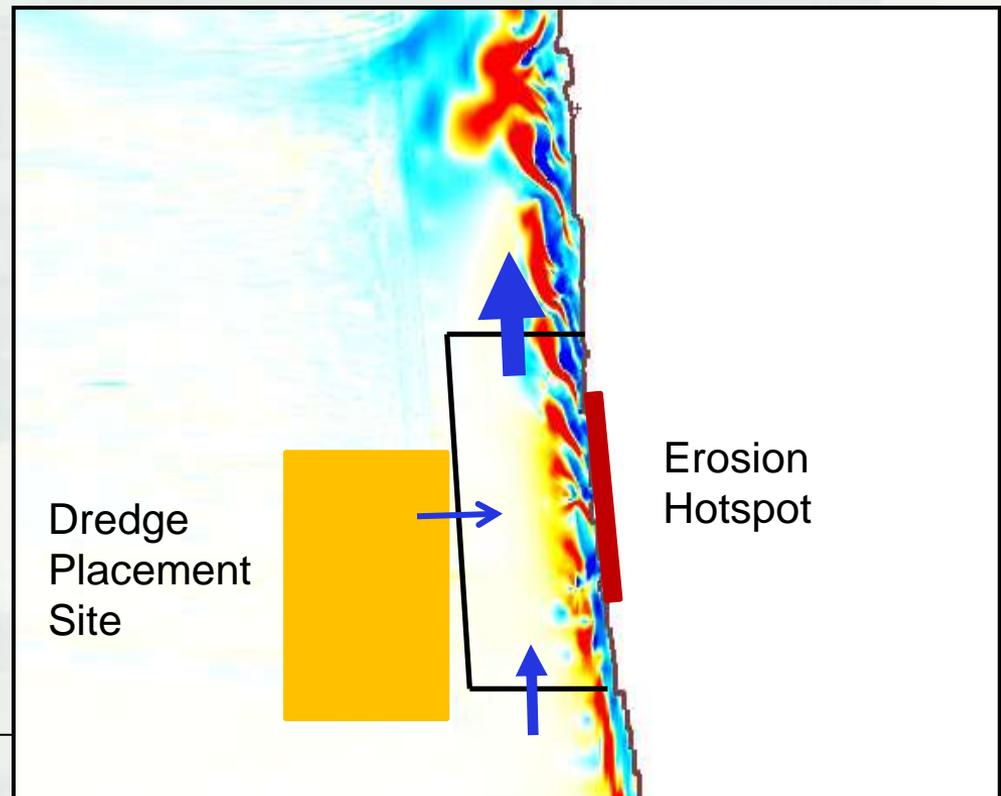
We have tool, a calibrated sediment transport model for application in high energy coastal environments

Lessons Learned

- Collaboration with USGS, BCDC and NOAA was really important
- Optimizing resources for overlapping projects
- Technology transfer at district level is very important
- Surf zone modeling is hard

Volume of Sediment Moved

- Beach Nourishment Proposed Volume = 300,000 cy
- Nearshore Placement At SF17 = 900,000 cy
- **Sediment Flux:**
 - In: 120,000 cy
 - Out: 750,000 cy



Acknowledgements

