The Relative Effects of Wave Climatology and Tidal Currents on Beach Processes Adjacent to a Major Tidal Inlet, Ocean Beach, San Francisco, California

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Project Goal

Determine the cause of the erosional hot spot in the southern portion of Ocean Beach

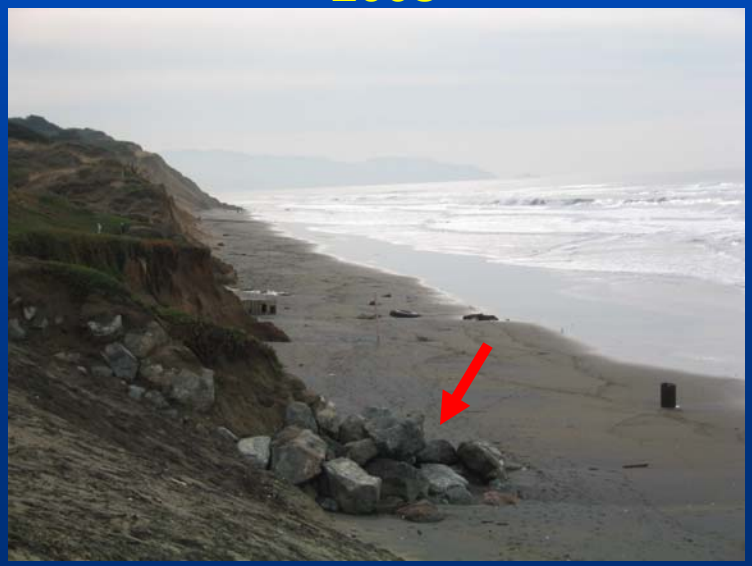
Ocean Beach Erosion- near Sloat

1979

1987

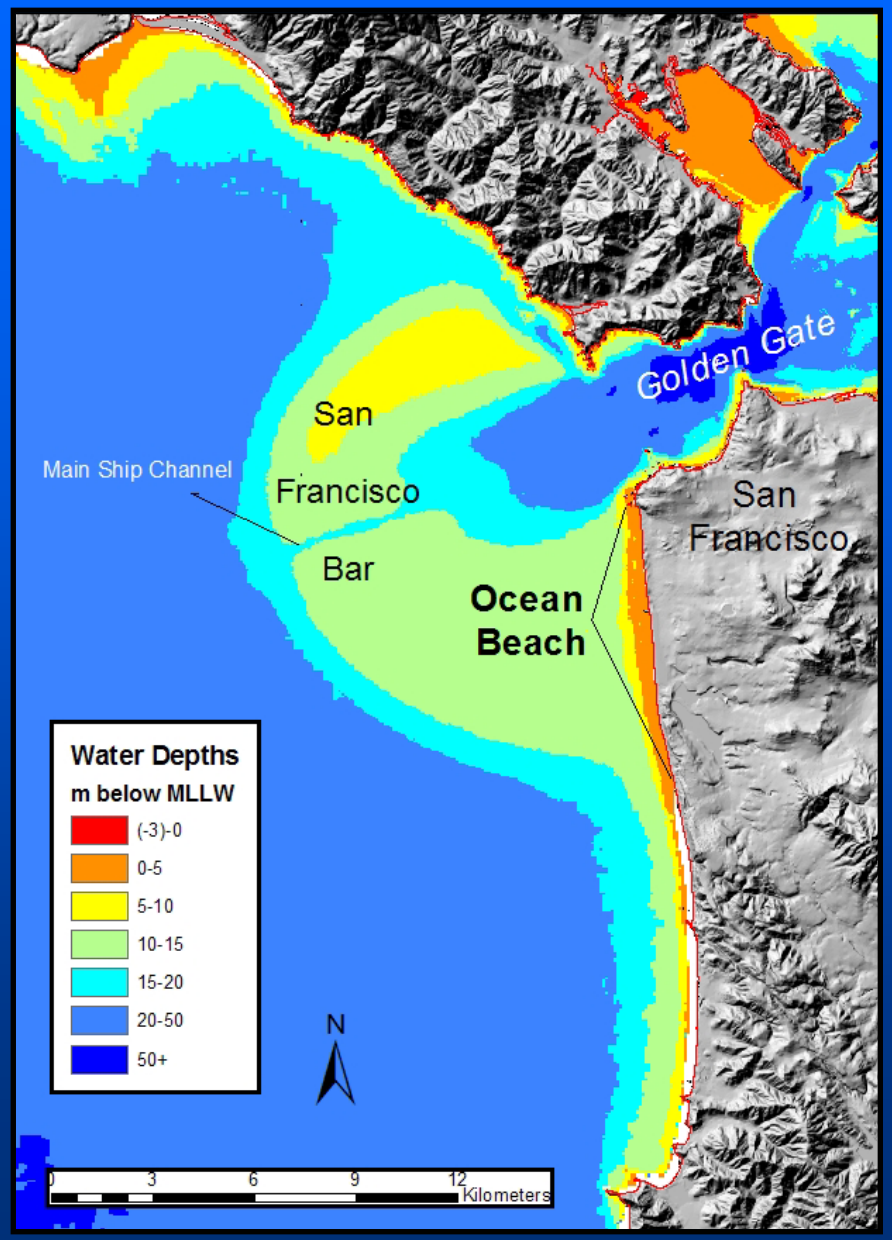
1998

2003



Ocean Beach

Study Area



- Hypothesis #2: The systemic sediment starved due to extensive damming coupled with a significant decrease in delta discharge

offshore wave statistics-
Pt. Reyes
Directional Buoy
(Dec 1996-Nov 2004)

max Hs (m)	6.7-8.4
avg Hs (m)	2.5
avg deg (daily)	296.5
avg Hs (s)	10.8

- Hypothesis #1: The ebb tidal delta has shrunk in extent due to altering wave refraction/focusing patterns and sediment transport pathways.

maximum tidal currents (modeled)

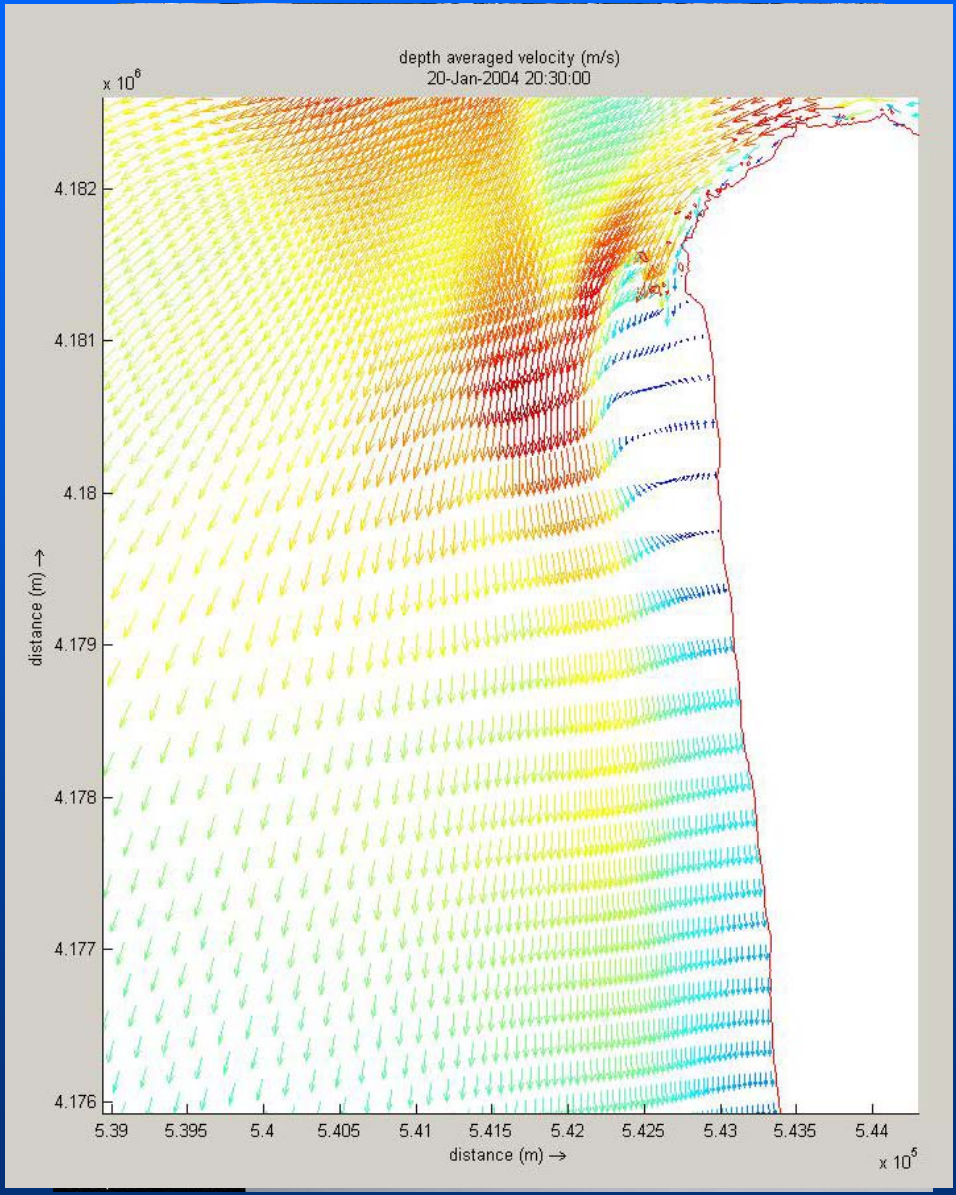
Golden Gate (m/s)	**2.5**
Point Lobos	**1.5**
Central Ocean Beach	**1.0**

Project Design

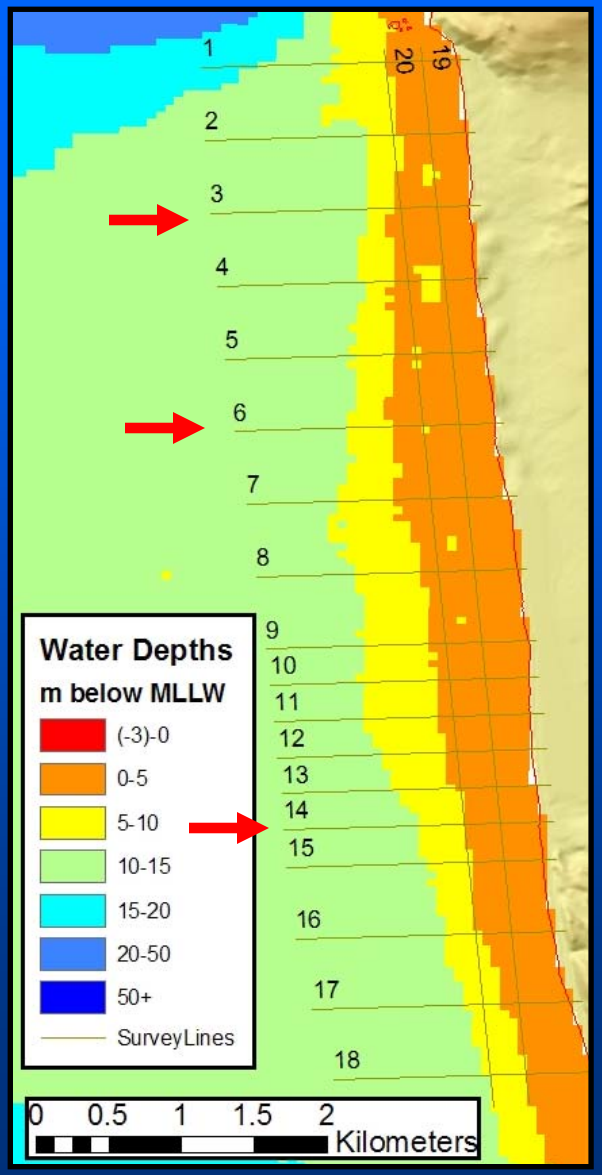
- Quantify the physical processes impacting Ocean Beach
- Develop a sediment transport model for the mouth of San Francisco Bay
- Model long-term coastal geomorphic change
- Evaluate sediment management options

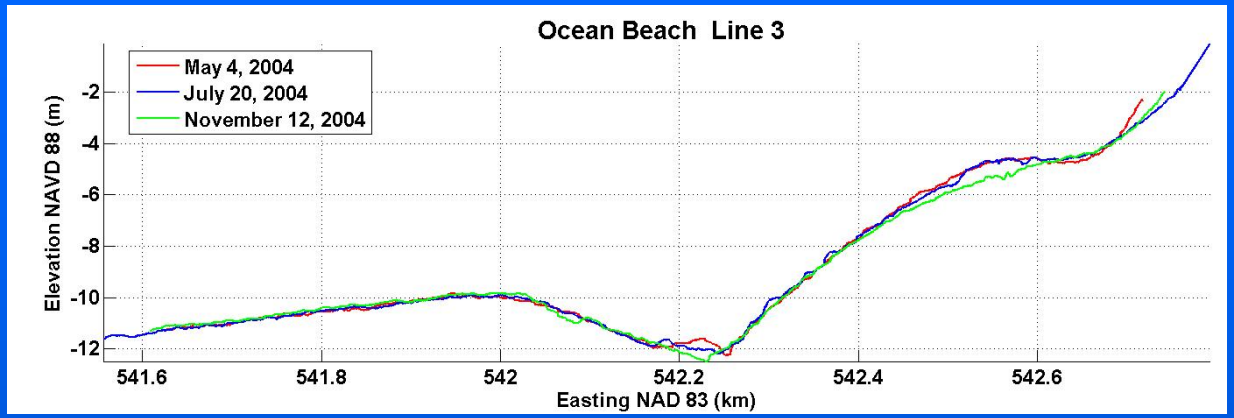
Methods

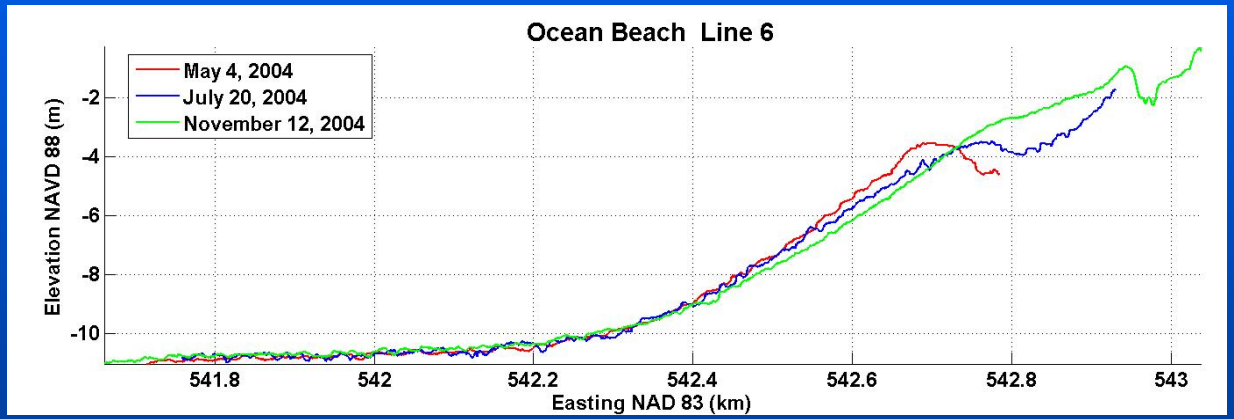
- All-terrain vehicle beach surveys
- Personal watercraft cross-shore surveys
- Bed sediment camera surveys
- Multibeam/ sidescan survey- Kvitek, CSUMB Sea Floor Mapping Lab
- Web cam image analysis
- Numerical modeling

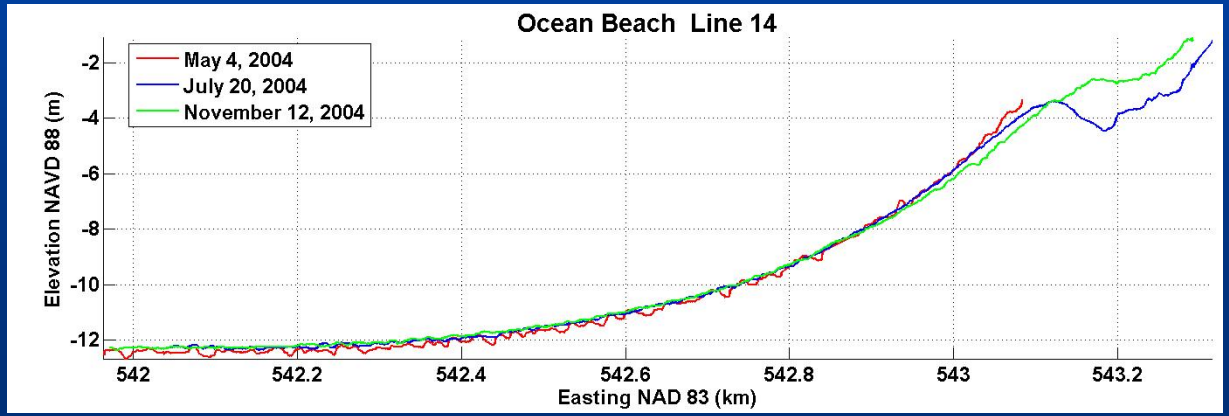


Nearshore Bathymetry

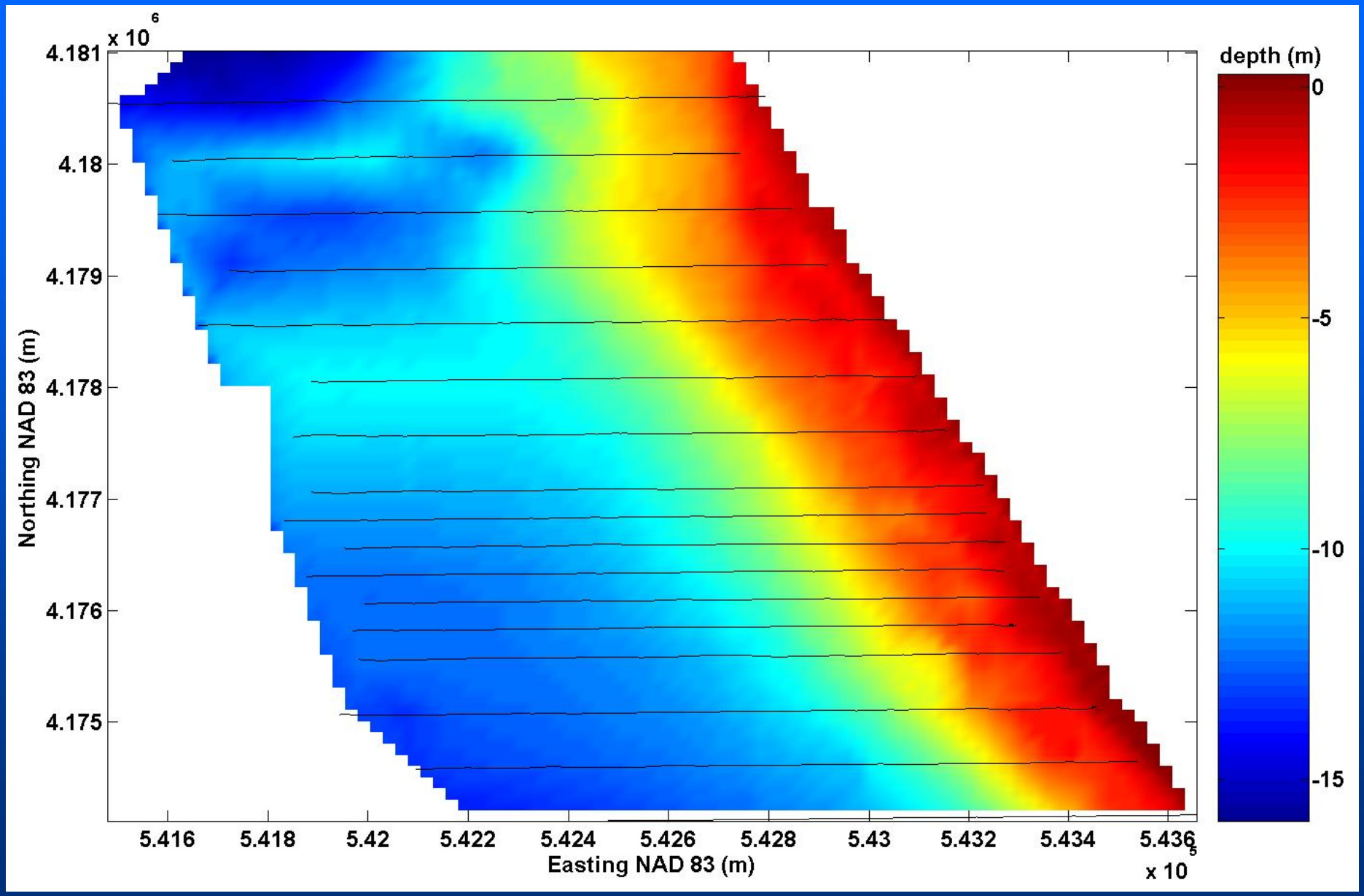




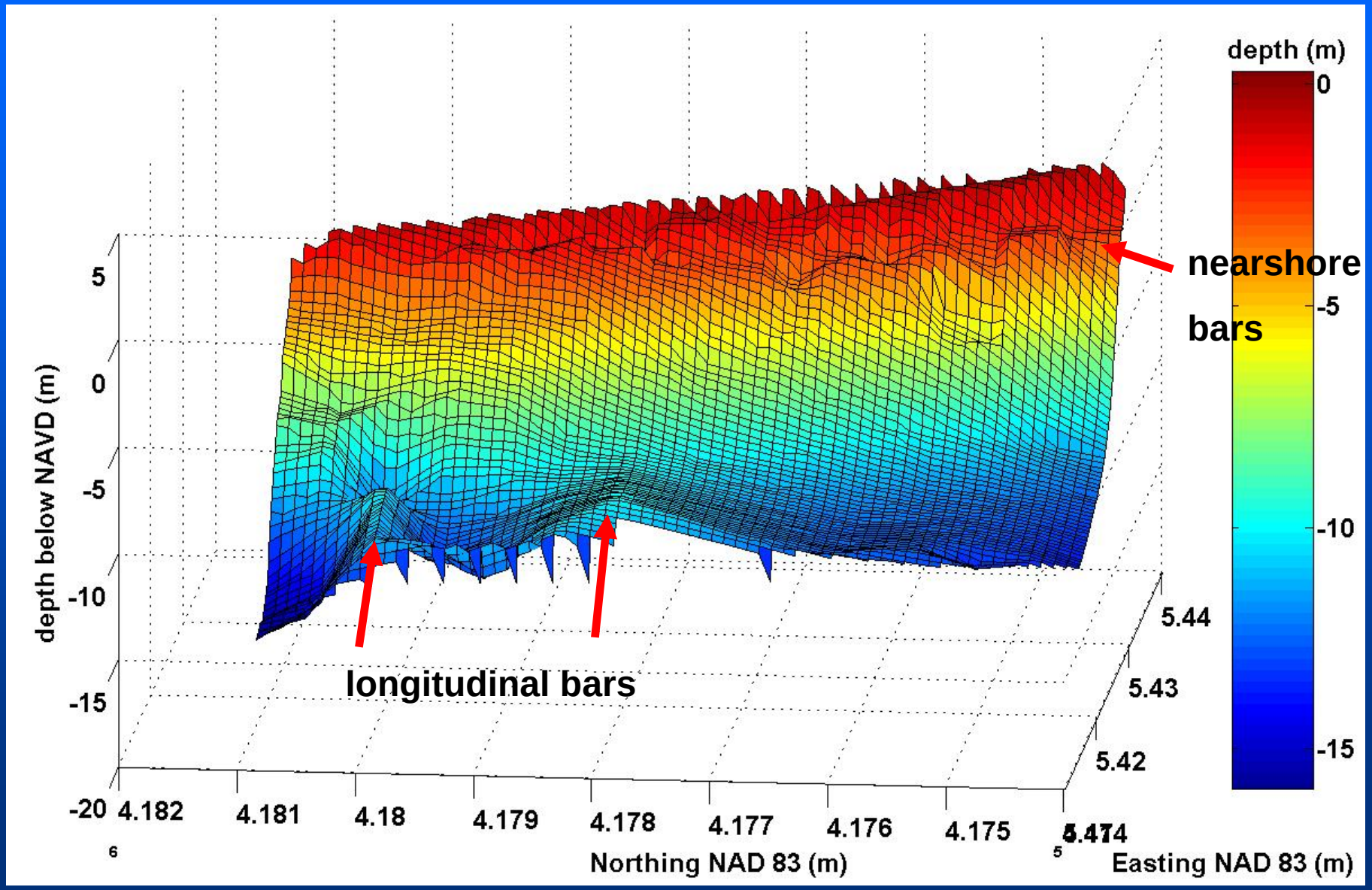




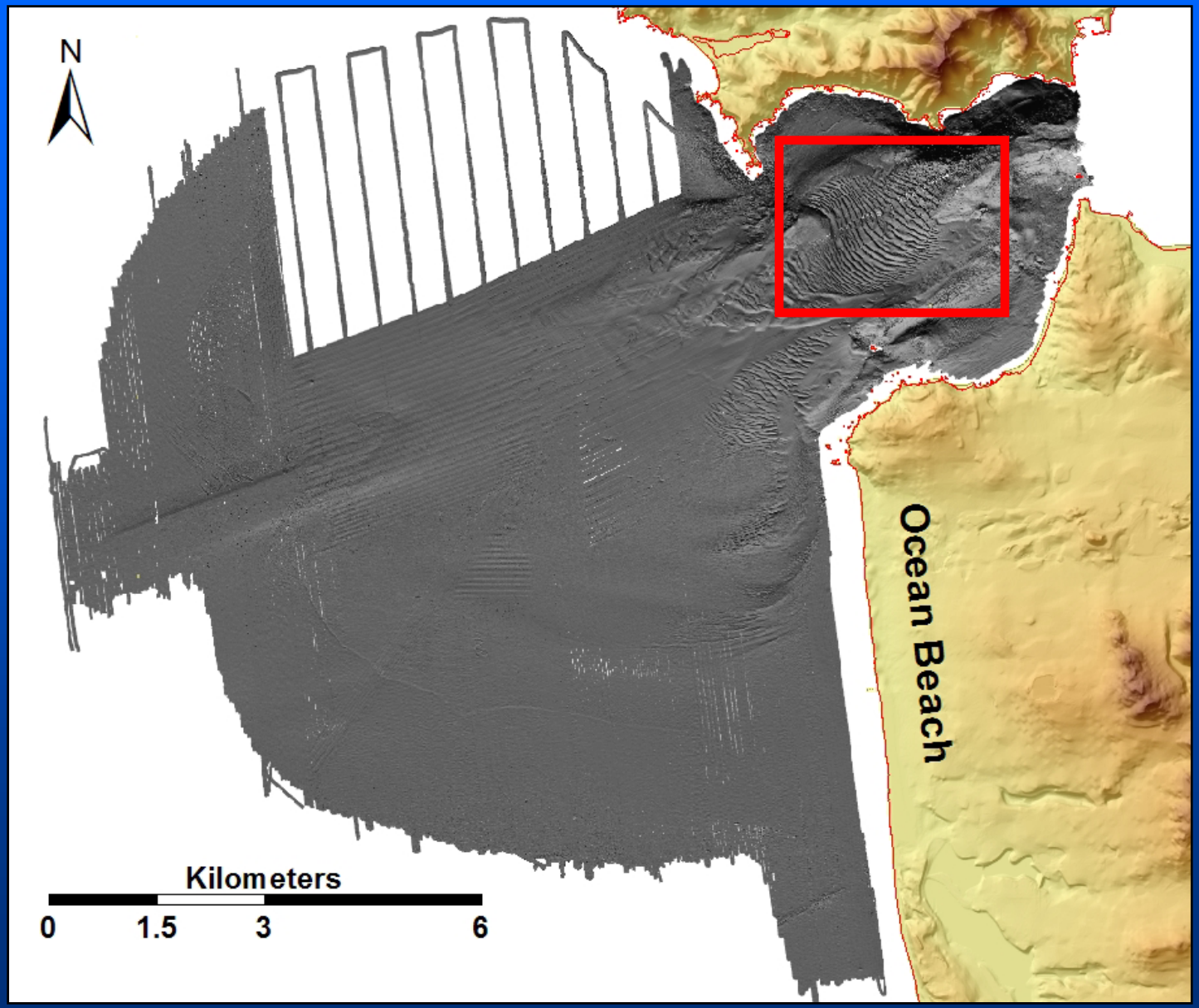
Nearshore Bathymetry Interpolated from Nov 2004 PWC Lines



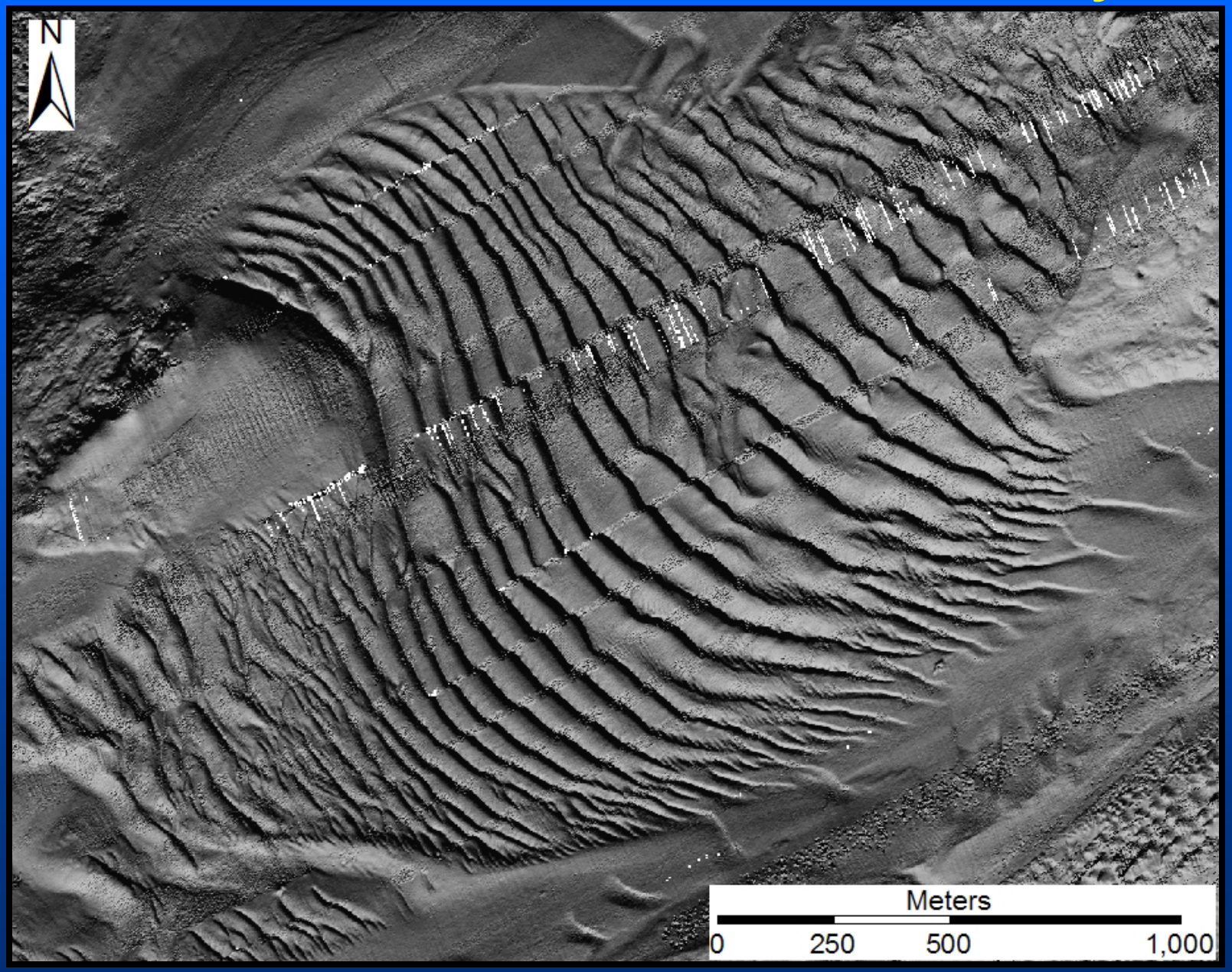
3D Nearshore Bathymetry



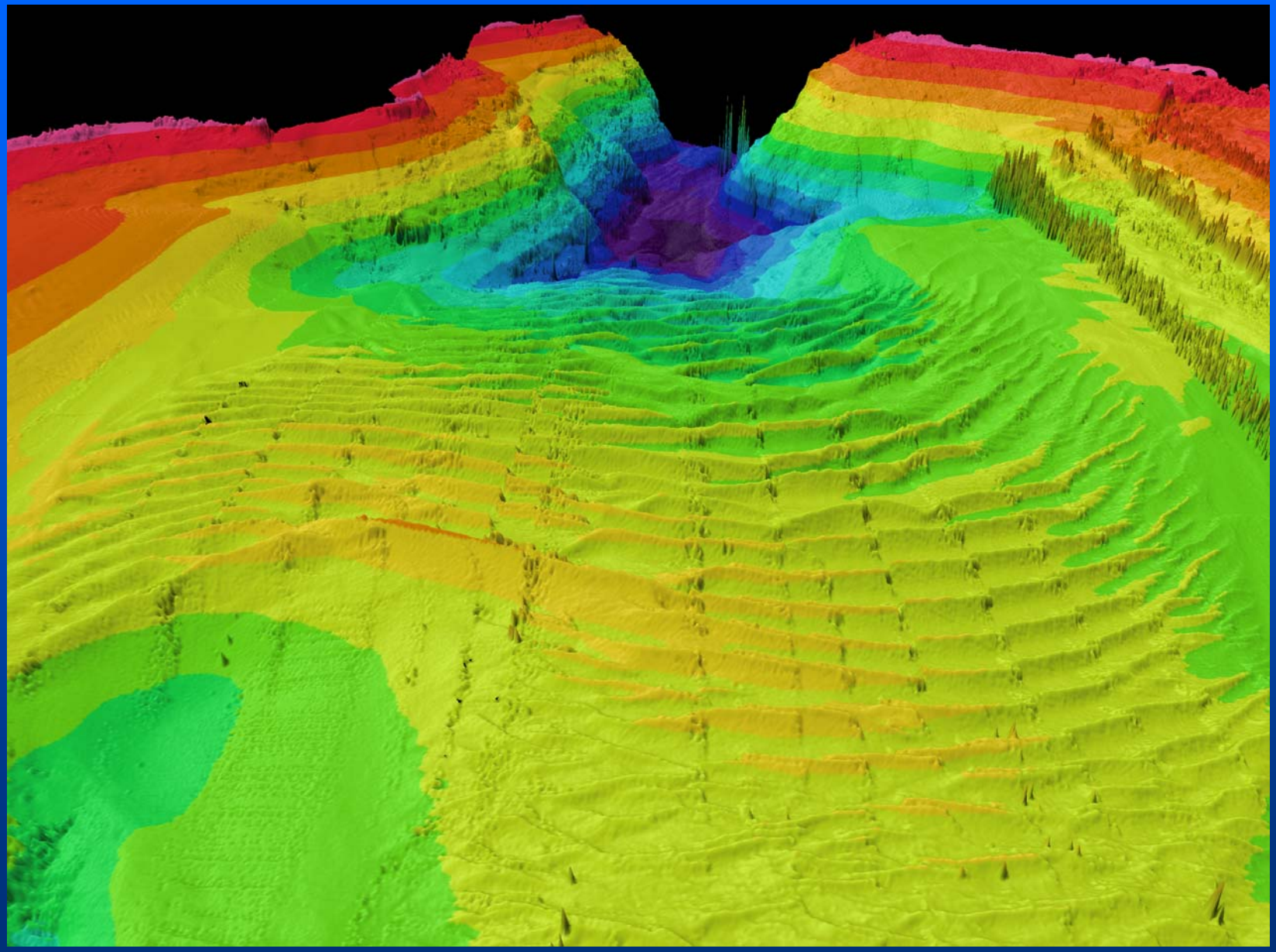
Multibeam Survey- October 2004



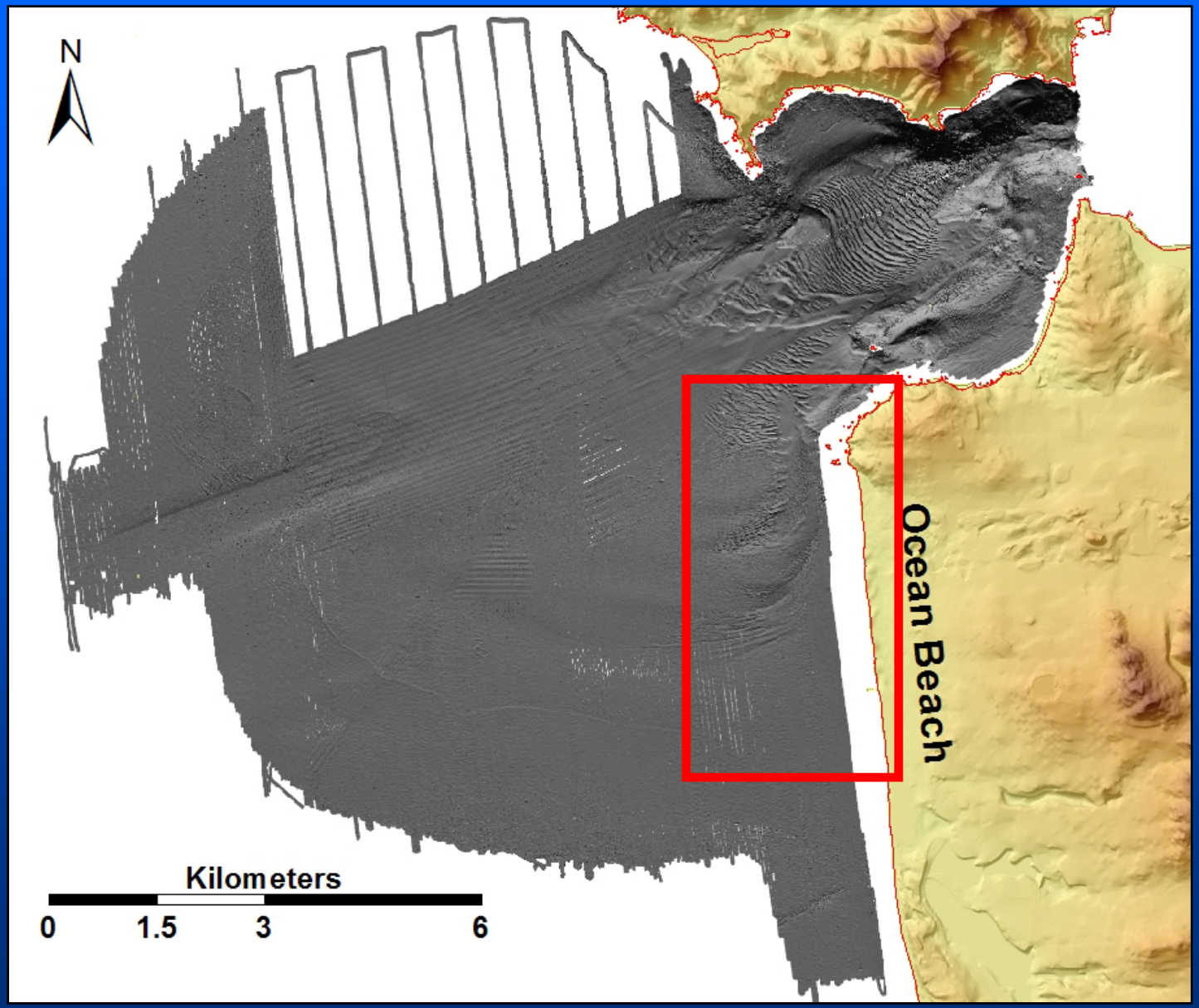
Bedforms at the mouth of SF Bay



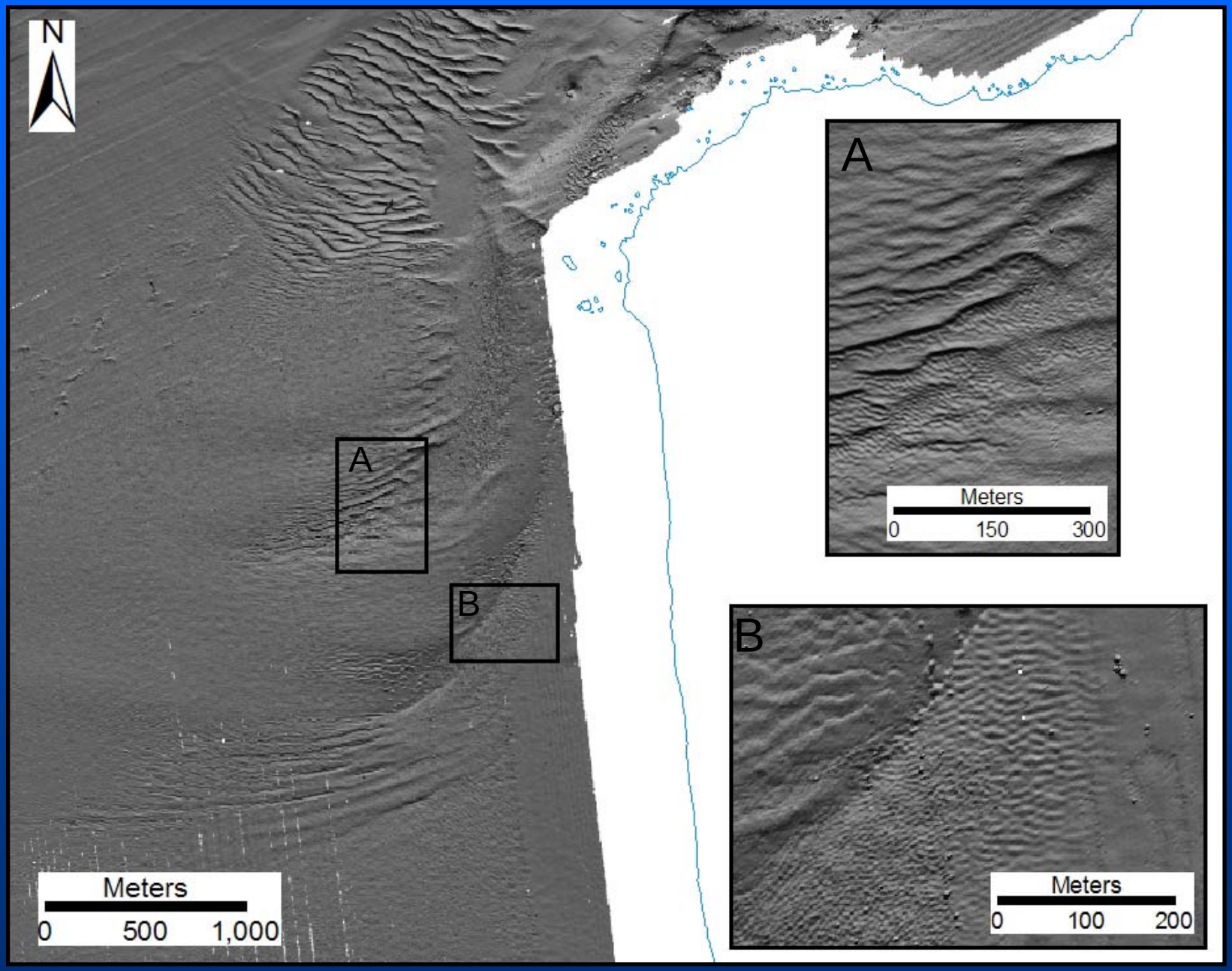
3-D Views-SF mouth



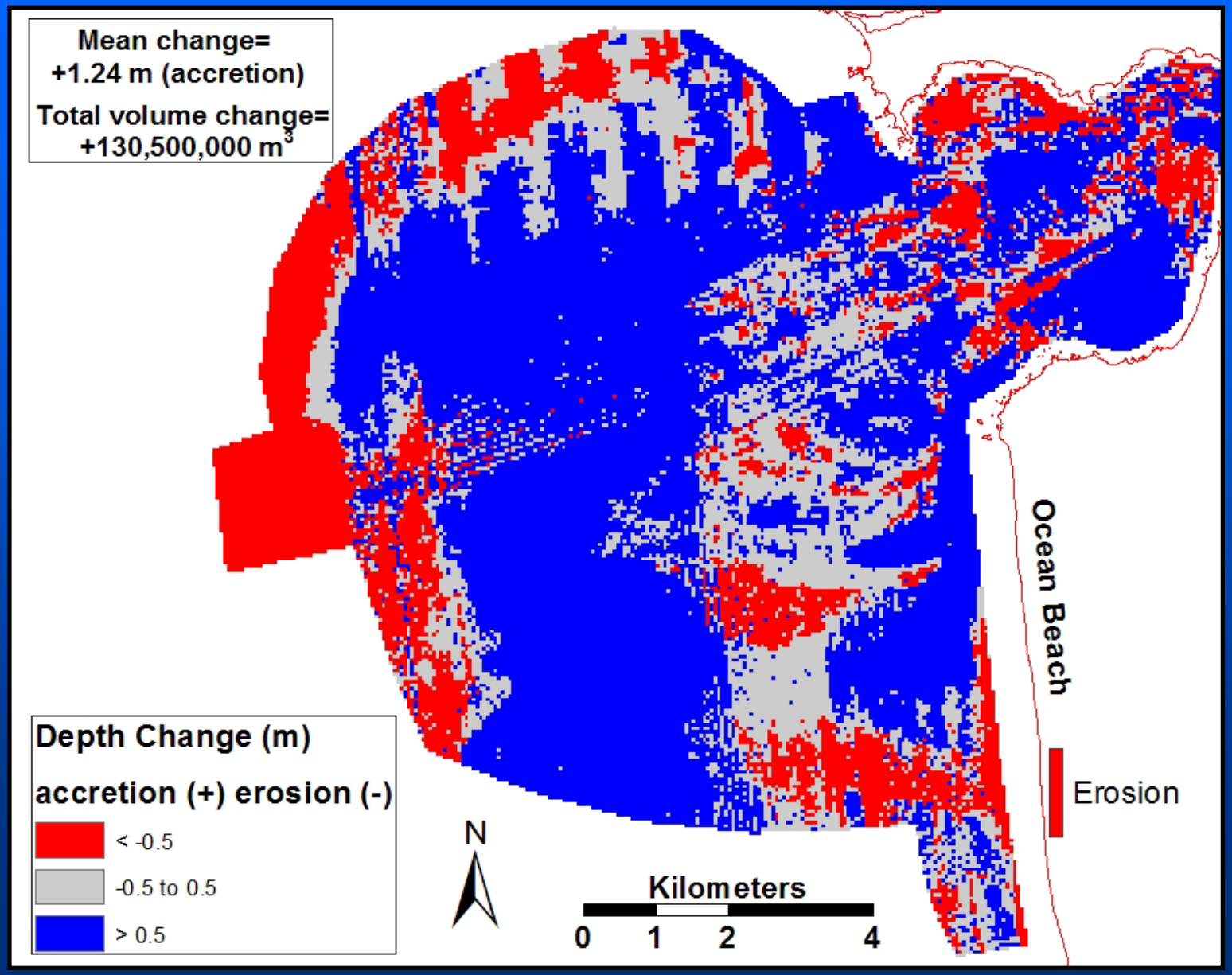
Multibeam Survey



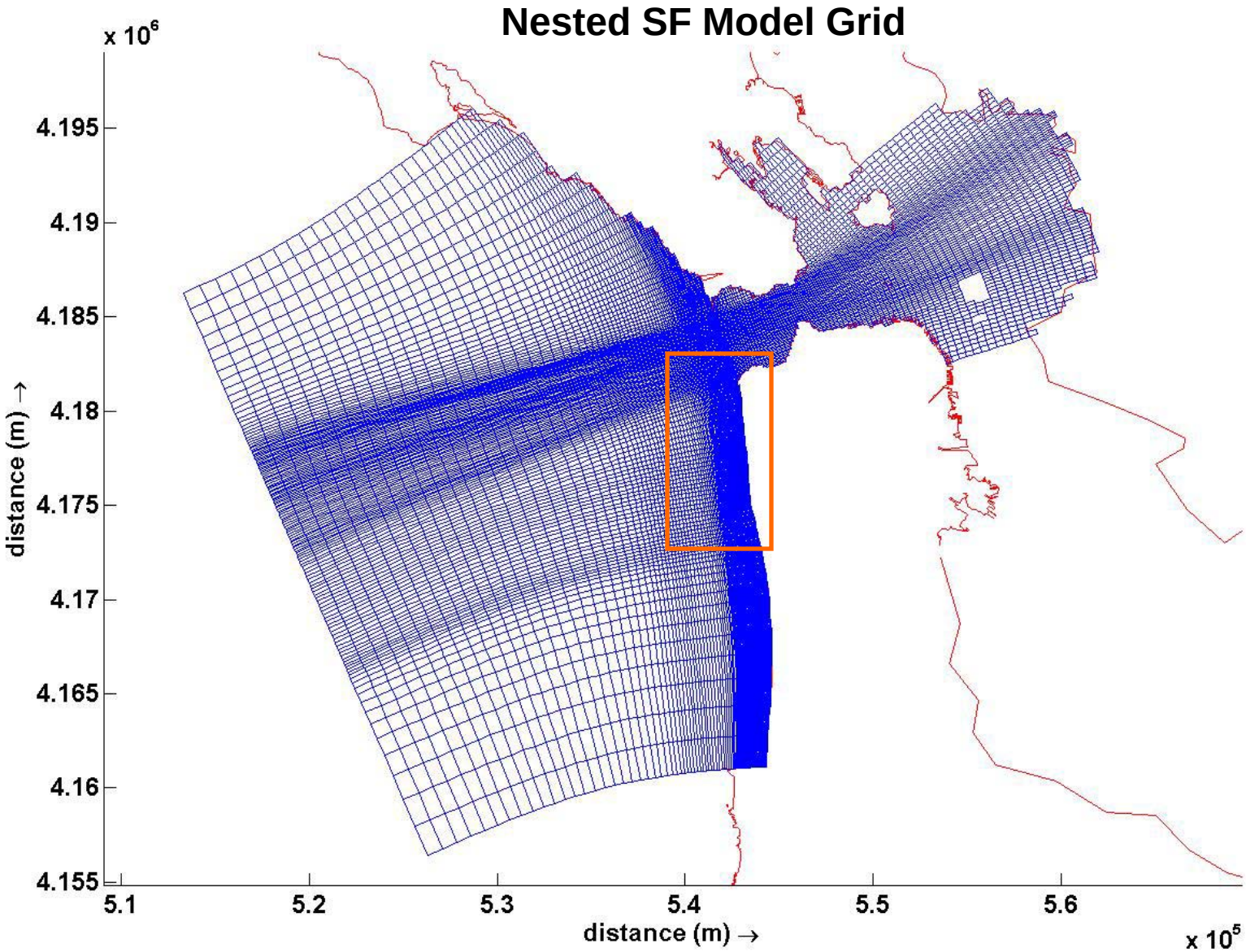
Bedforms offshore of Ocean Beach



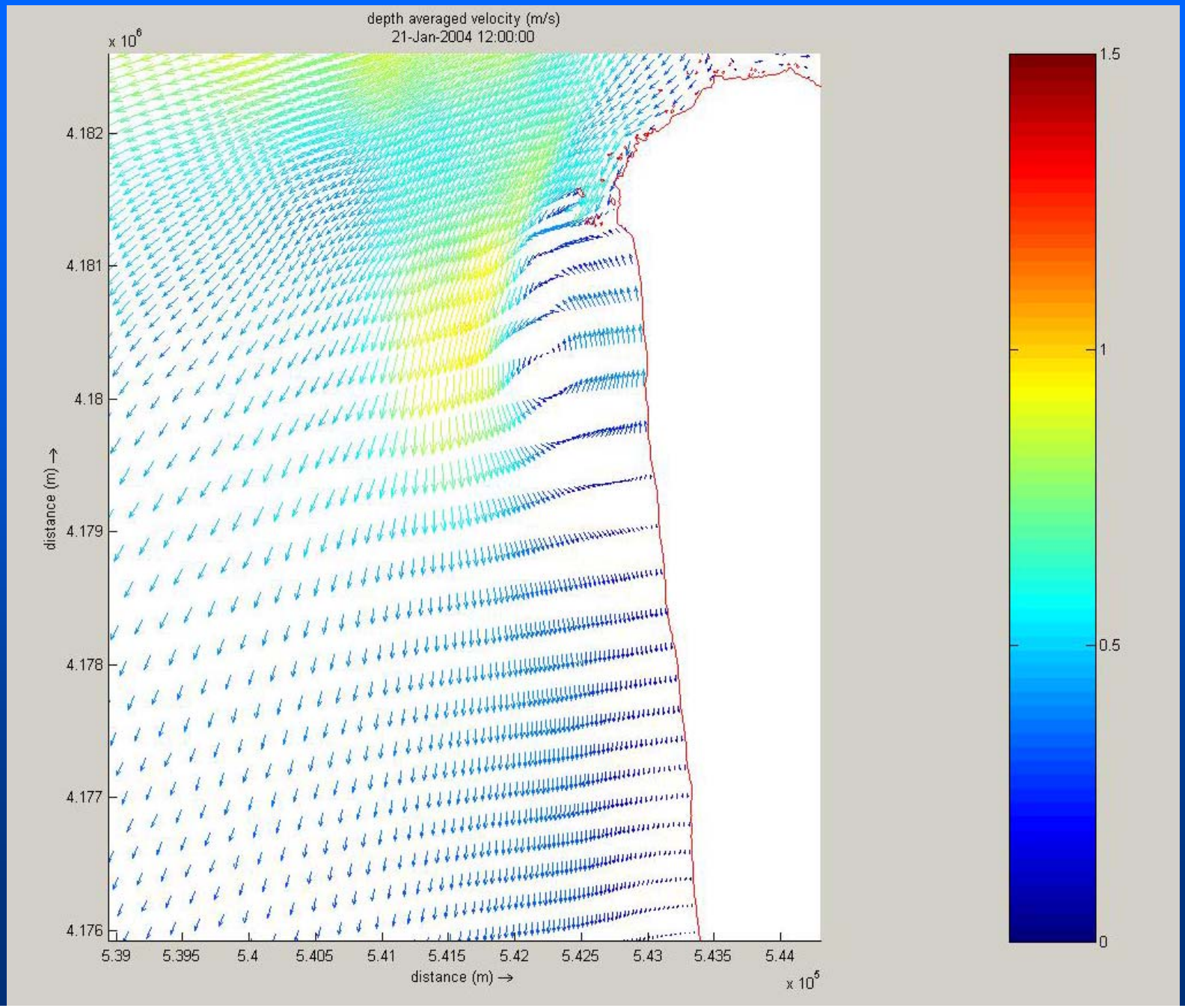
Comparison w/ 1956 Bathy



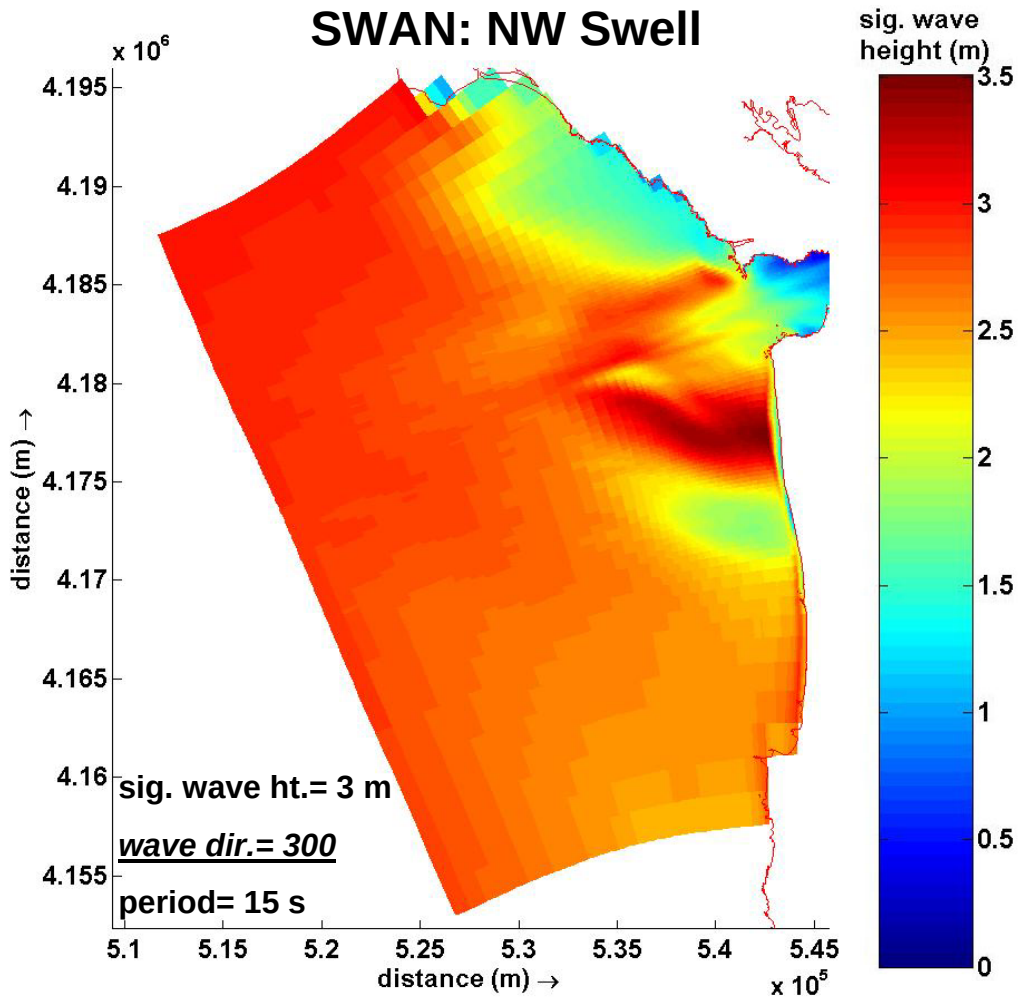
Numerical Modeling

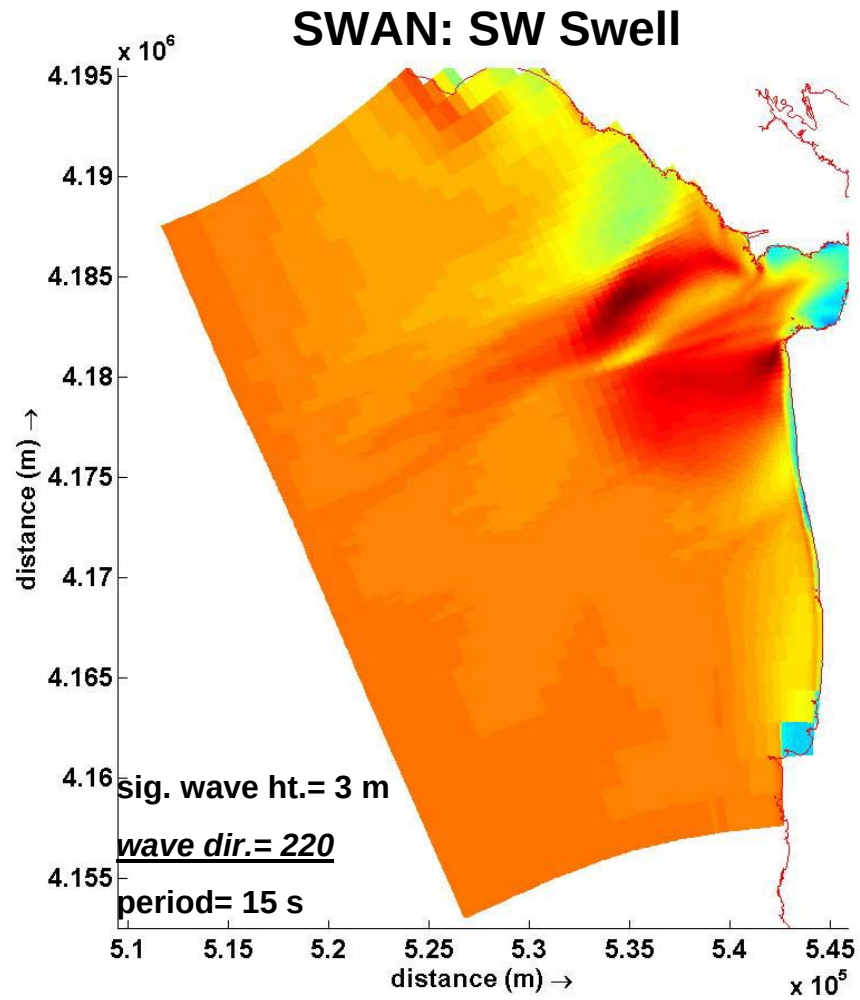


Ocean Beach Tidal Currents

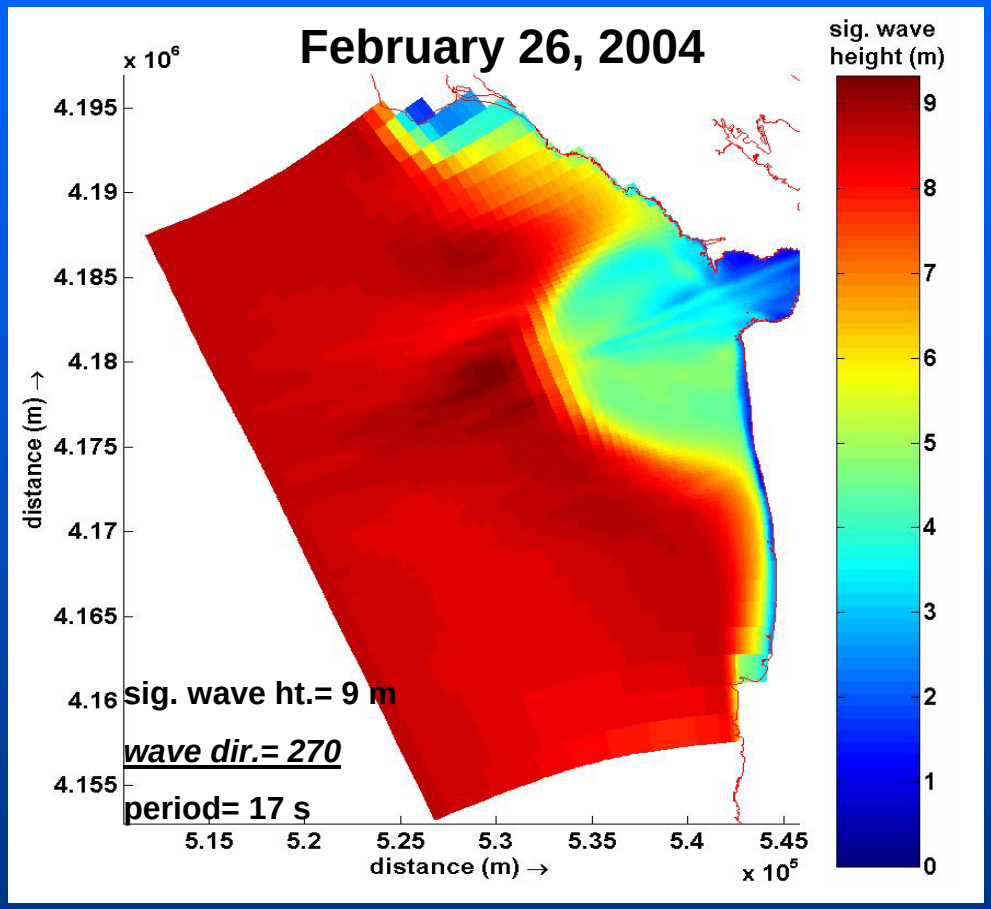


Wave Modeling





Extreme Events



Key Points

- Sediment abundant- supply not the issue
- Ebb tidal delta and nearshore morphology of Ocean Beach are strongly coupled- wave refraction, sediment transport, flow structure
- Bedforms on many scales and orientations attest to dynamic tidal inlet environment

Future Applications

- Sediment management and fate of dredge disposal
- Decadal-scale evolution of coastal morphology
- Web-based, near-real time coastal observing system
- Storm impact and risk assessment
- Bedform dynamics in high-energy wave and current environment

Acknowledgements

- United States Army Corps of Engineers, San Francisco District
- National Park Service
- San Francisco Department of Public Works
- USGS Mendenhall Post-doctoral Fellowship Program
- USGS CMG Coastal Evolution Modeling Project

Ocean Beach
November 15, 2004