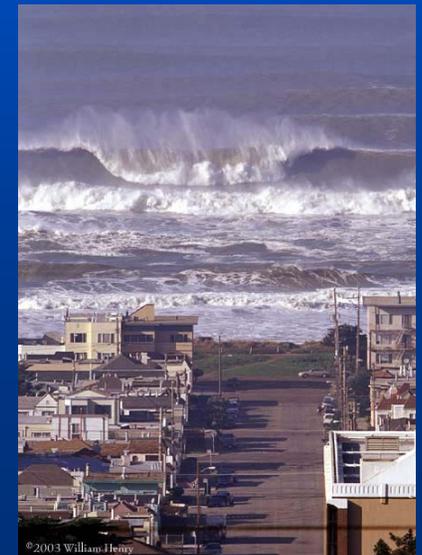


Integrating field research, modeling and remote sensing to quantify morphodynamics in a high-energy coastal setting, Ocean Beach, San Francisco, California

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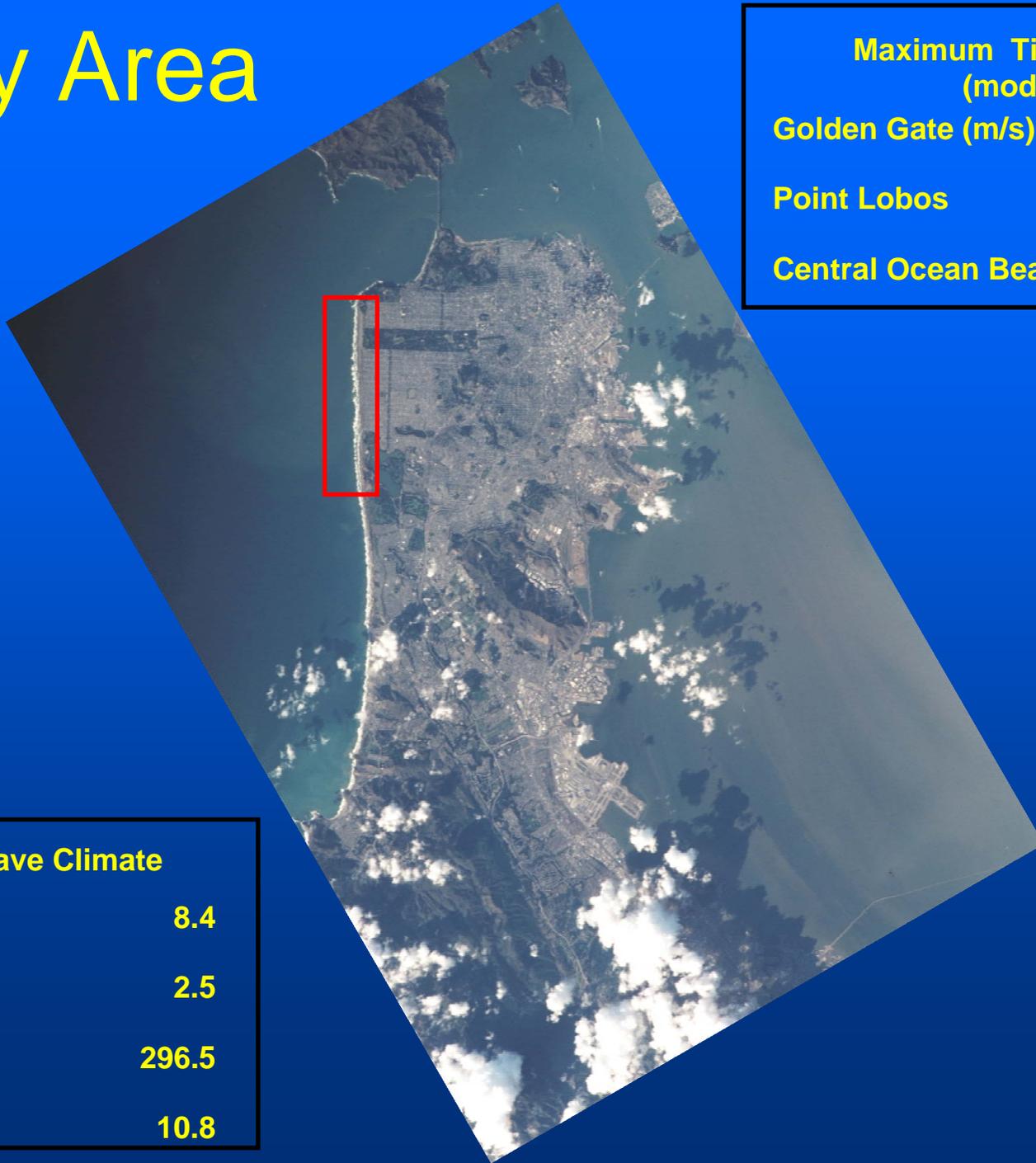
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Project Goal

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

Study Area



Maximum Tidal Currents (modeled)

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

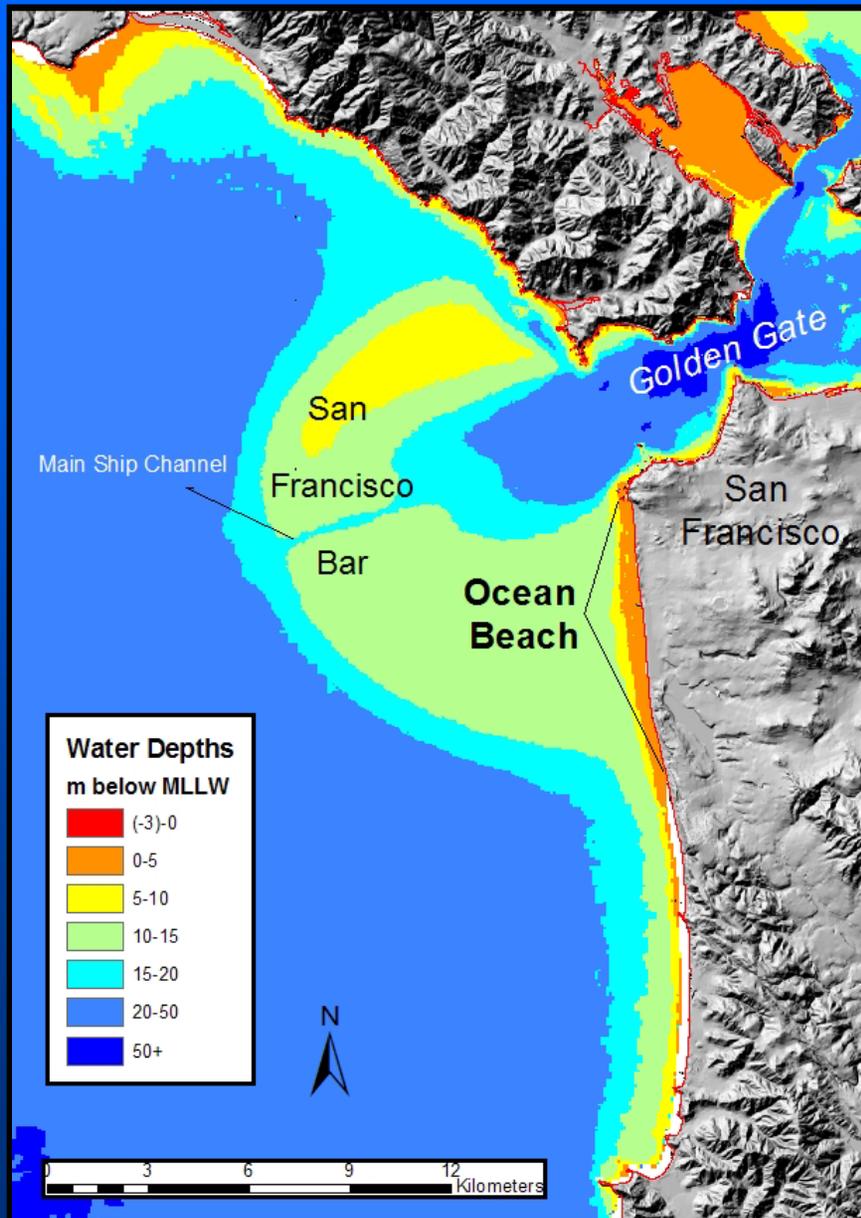
Offshore Wave Climate

max Hs (m)	8.4
avg Hs (m)	2.5
avg deg (naut)	296.5
avg Tp (s)	10.8

Ocean Beach



Study Area



- Hypothesis #1: The ebb tidal delta has shrunk in extent due to a reduced tidal prism—thereby altering wave refraction/focusing patterns and sediment transport pathways.
- Hypothesis #2: The system is sediment starved due to extensive damming coupled with a significant decrease in delta discharge.

Project Design

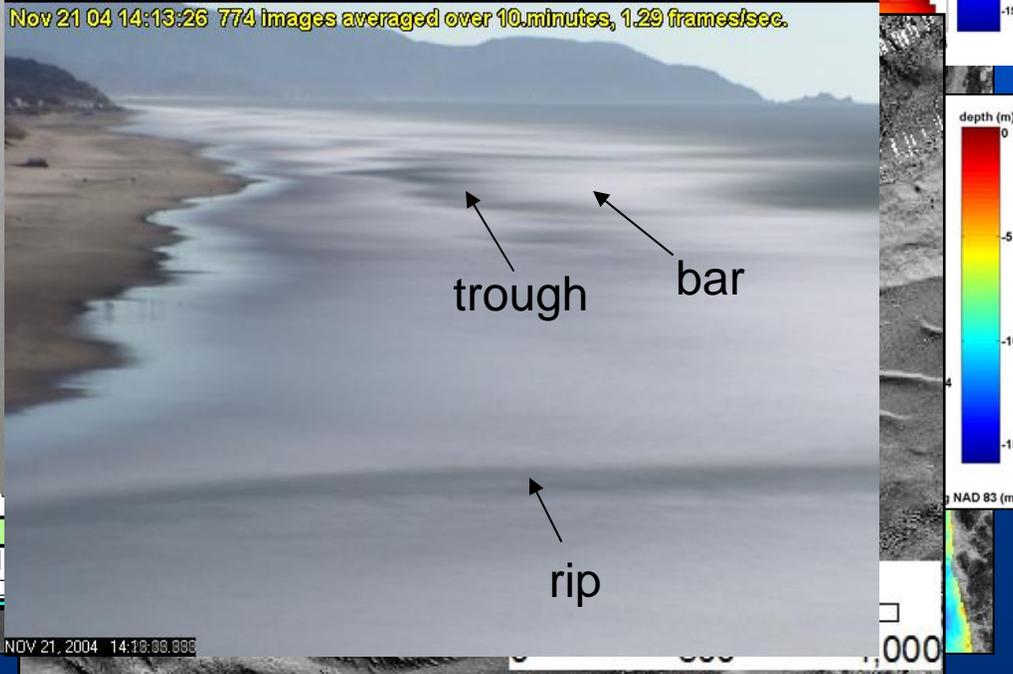
- Quantify the physical processes impacting Ocean Beach
- Develop a sediment transport model for the mouth of San Francisco Bay
- Model long-term coastal geomorphic change
- Evaluate sediment management options

Field Support

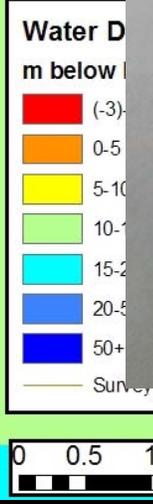
- All-terrain vehicle beach surveys



Nov 21 04 14:13:26 774 images averaged over 10 minutes, 1.29 frames/sec.



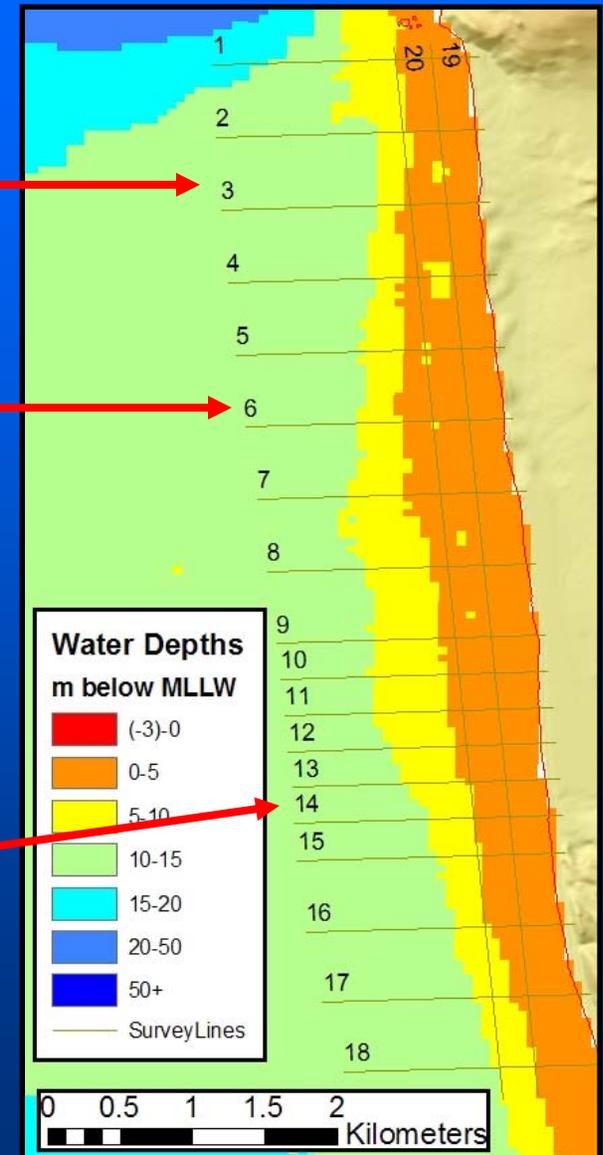
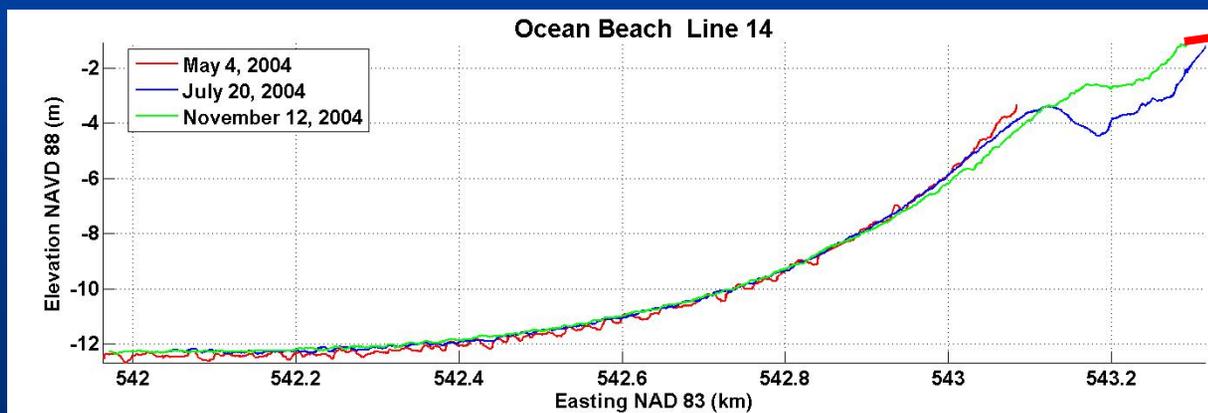
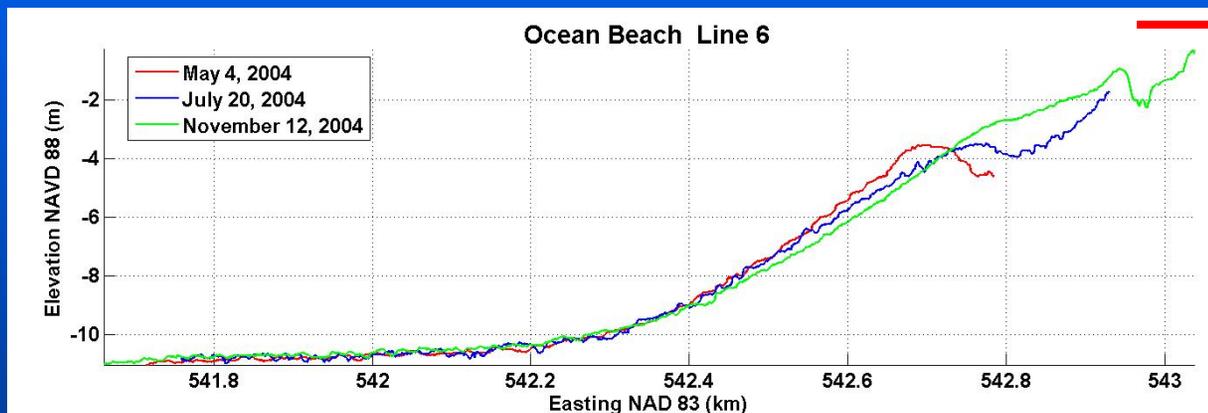
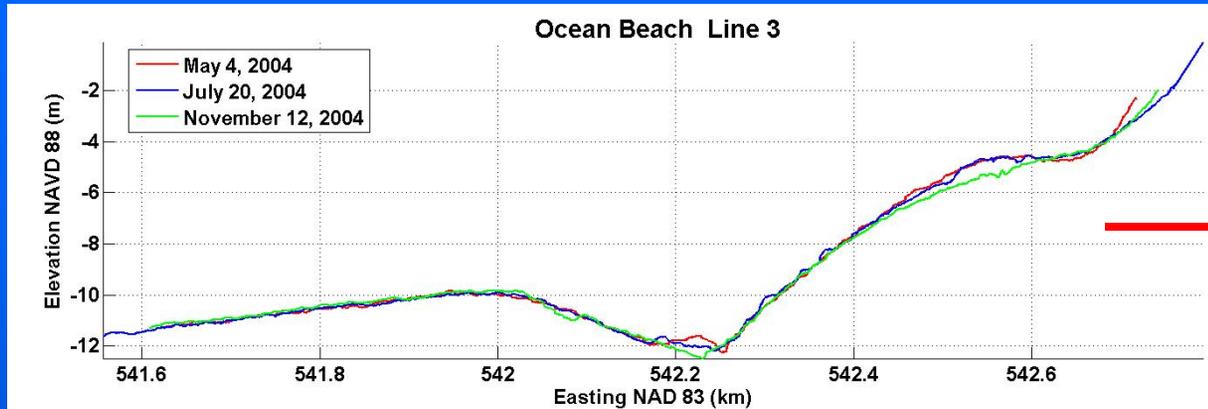
analysis



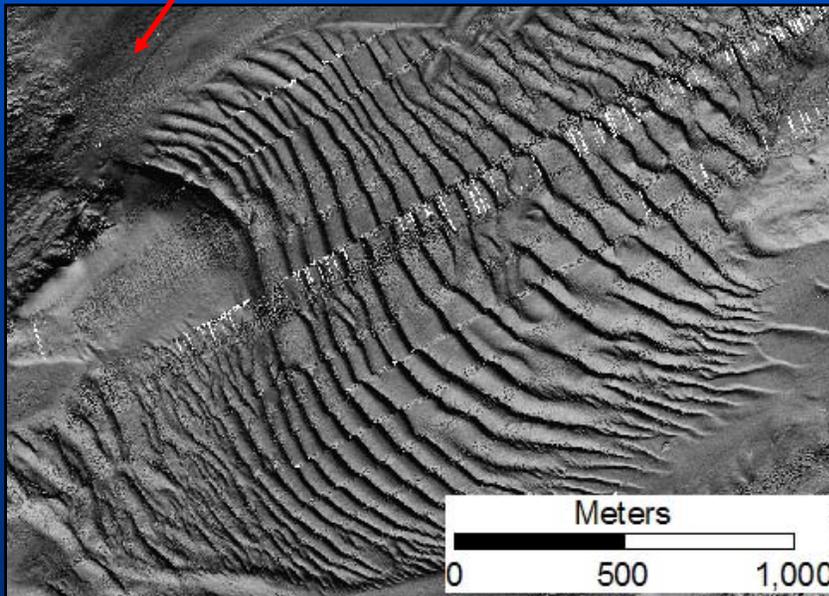
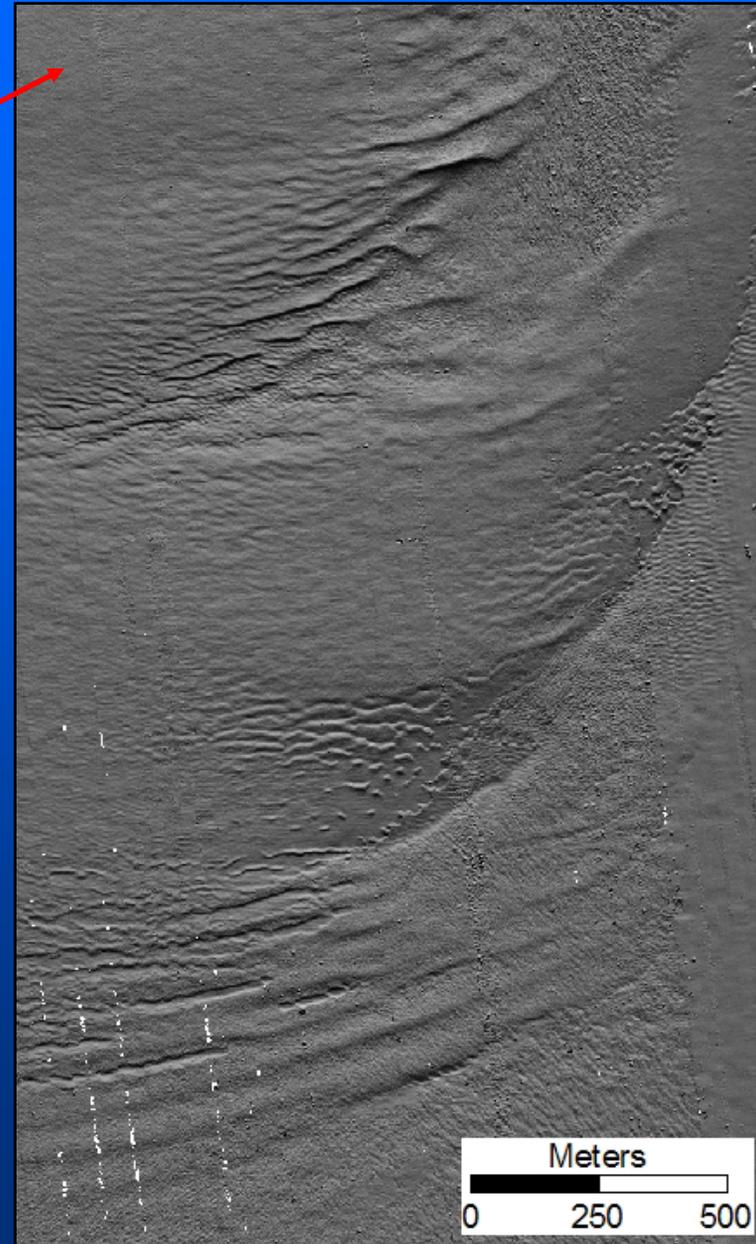
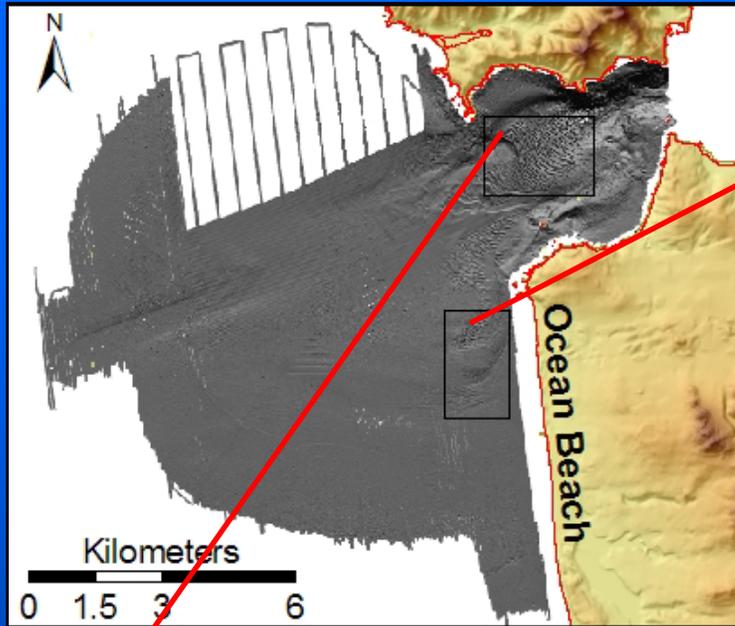
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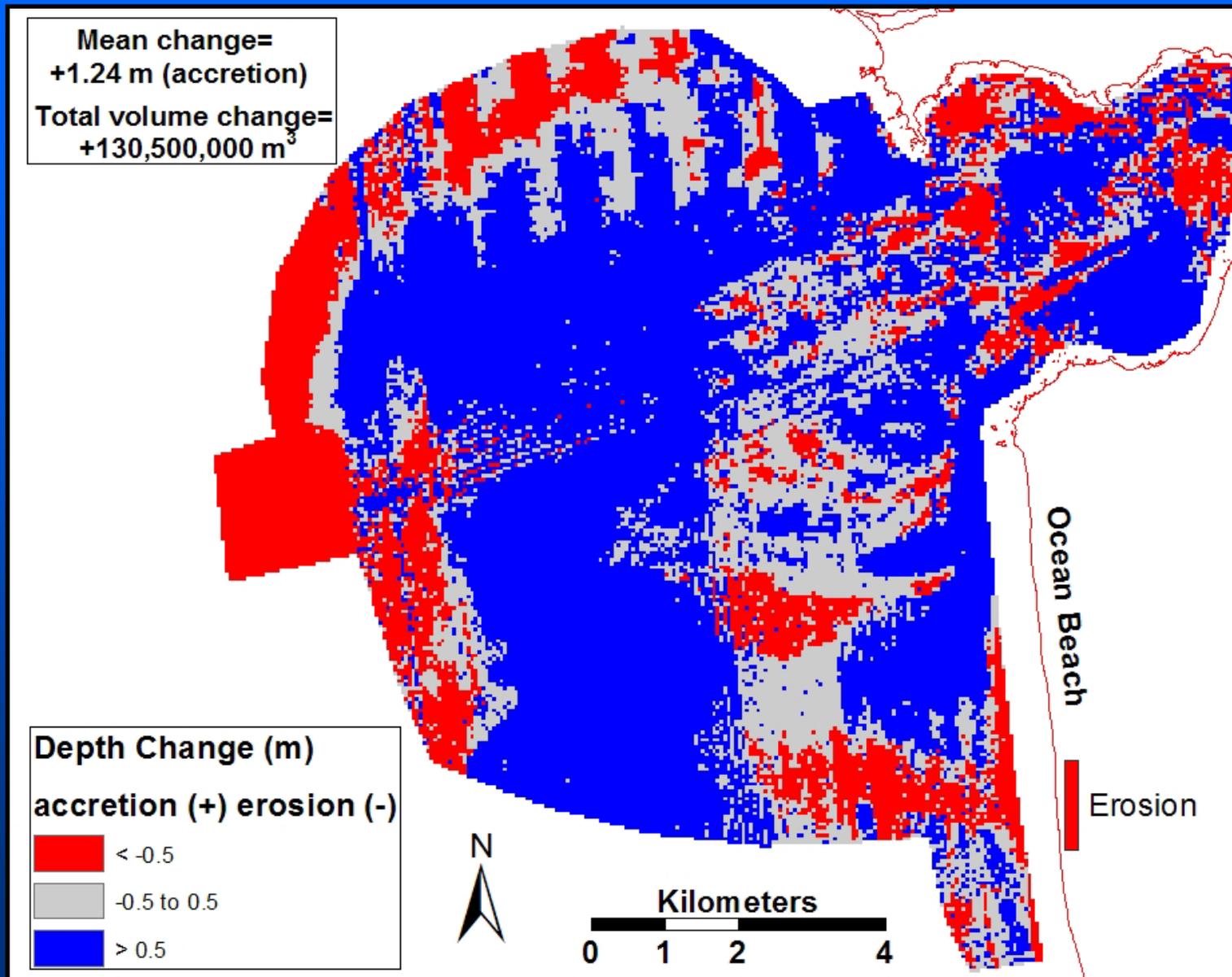
Nearshore Bathymetry



Multibeam Survey- October 2004

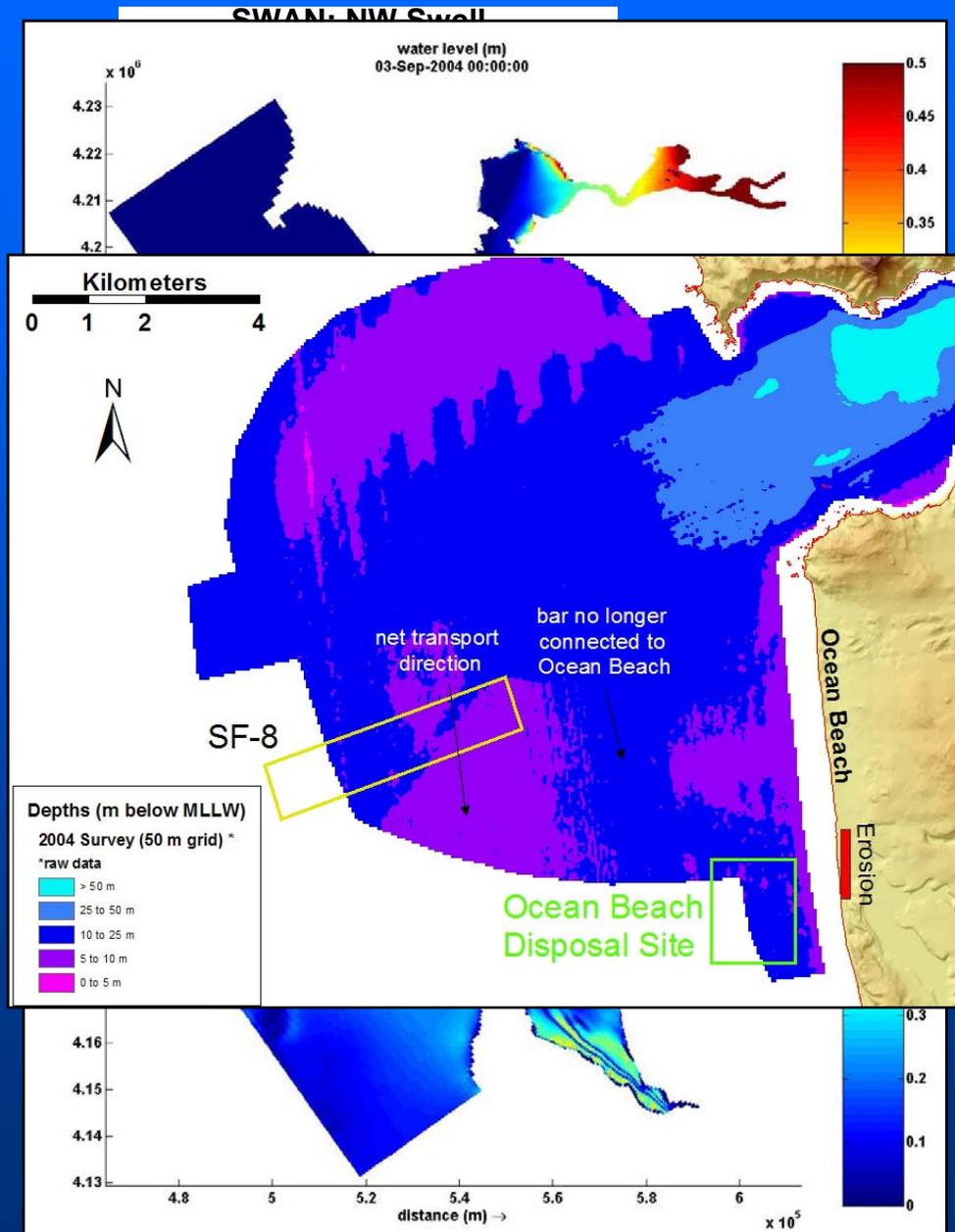


Comparison w/ 1956 Bathy

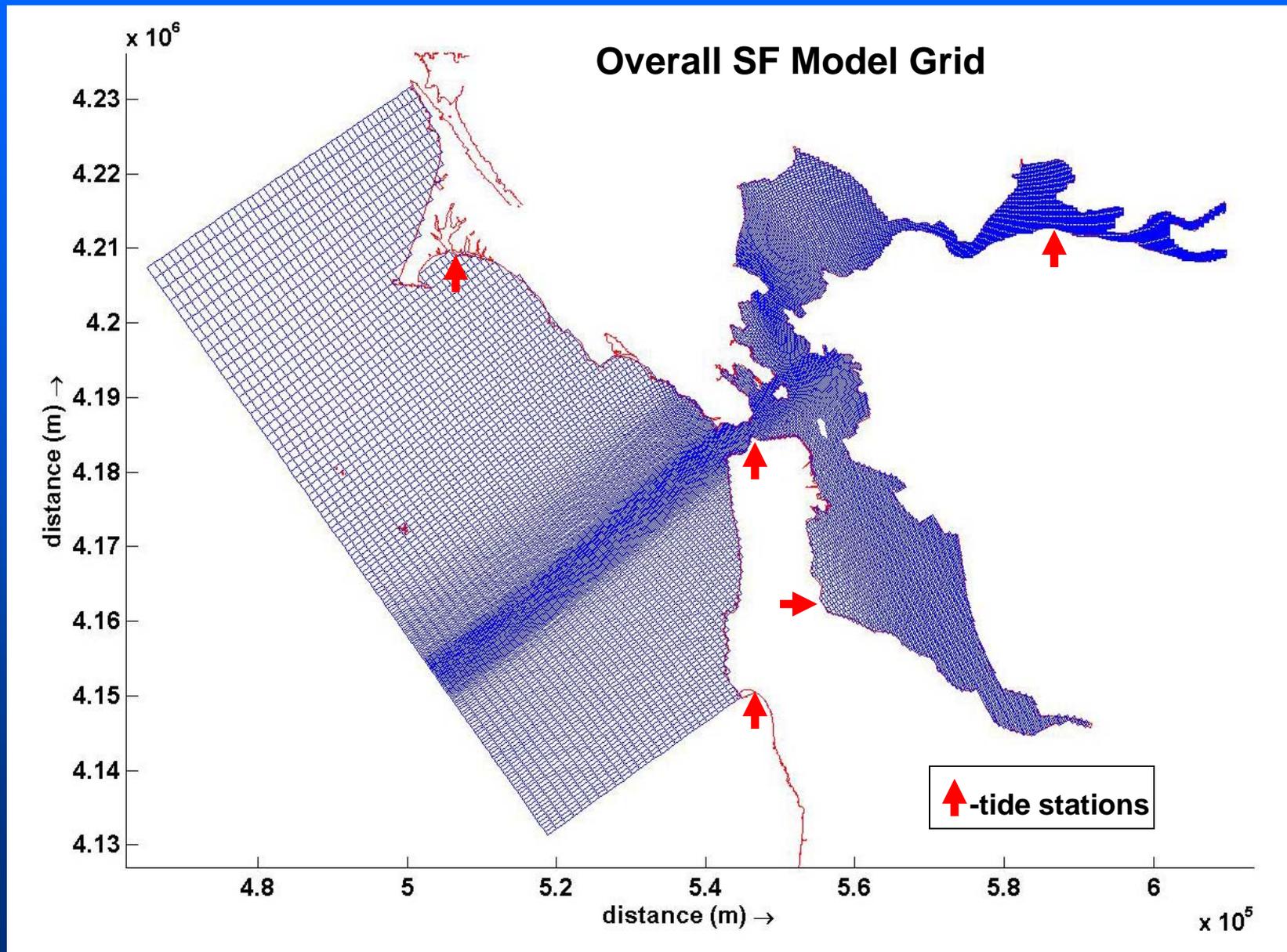


Role of Modeling

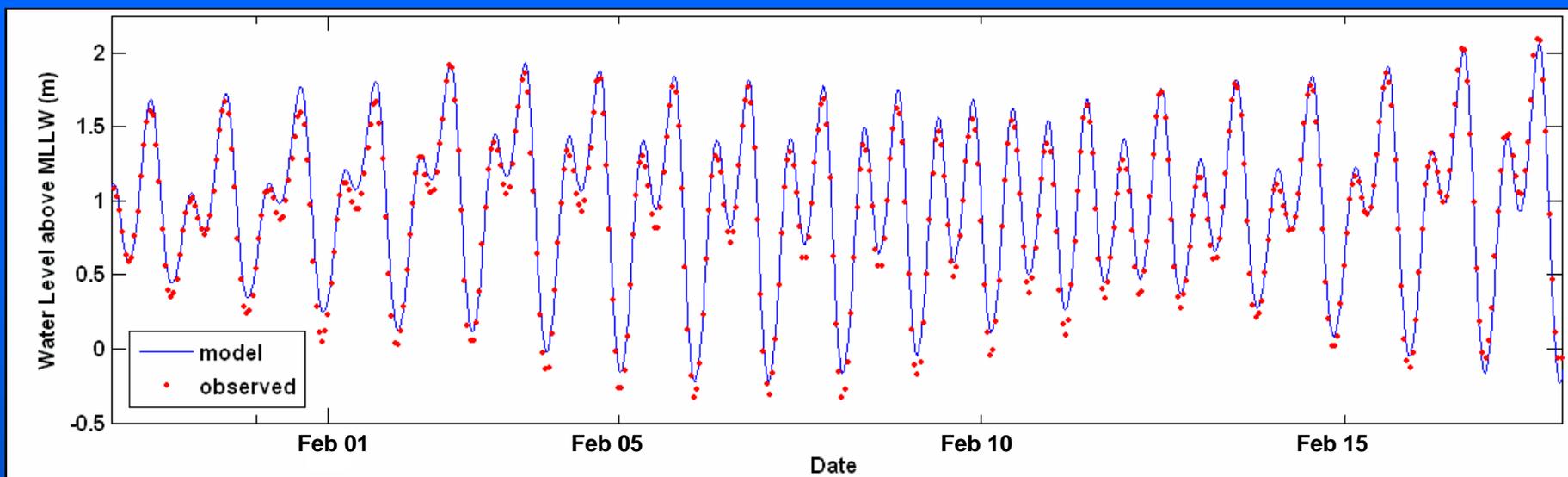
- Analyze wave refraction, tidal current and sedimentation patterns due to evolving bathymetry, bay development, sediment supply and wave climate
- Test coastal response to variations in delta discharge, winds, wave direction, storms, etc.
- Evaluate sediment management options
- Predict long-term coastal geomorphic change



Numerical Modeling

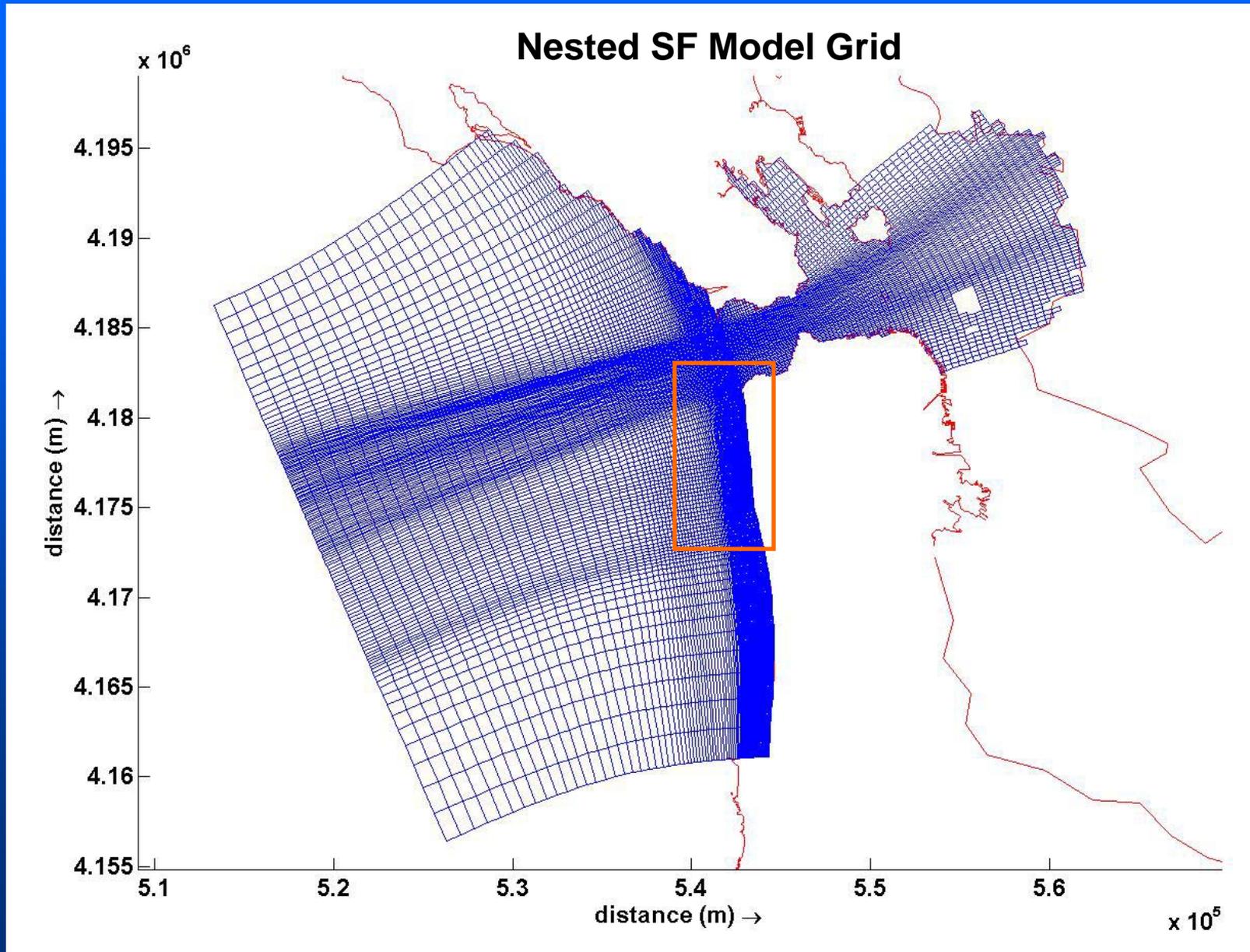


Water Level Validation

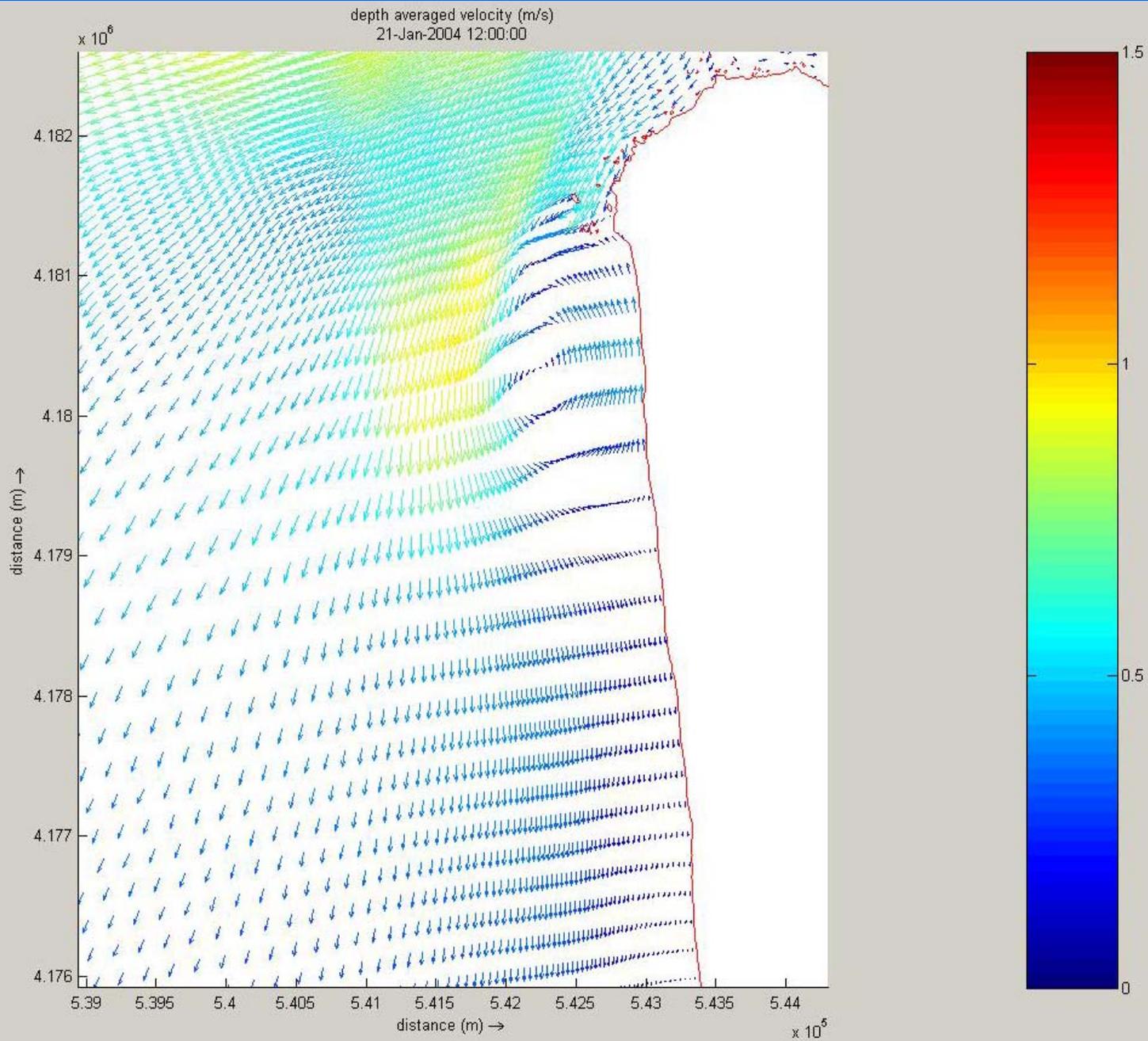


tidal constituents	observed amplitude (m)	modeled amplitude (m)	amplitude error	observed phase (deg)	modeled phase (deg)	phase error
Q1	0.038	0.038	0.994	193.831	193.197	-0.634
O1	0.225	0.224	0.997	207.458	207.690	0.231
P1	0.118	0.118	0.998	228.906	229.278	0.372
K1	0.375	0.374	0.998	225.706	226.078	0.372
N2	0.115	0.115	0.997	172.881	172.858	-0.023
M2	0.565	0.564	0.999	207.140	207.297	0.157
S2	0.161	0.161	0.998	217.015	216.885	-0.130
K2	0.047	0.047	0.998	225.515	225.385	-0.130

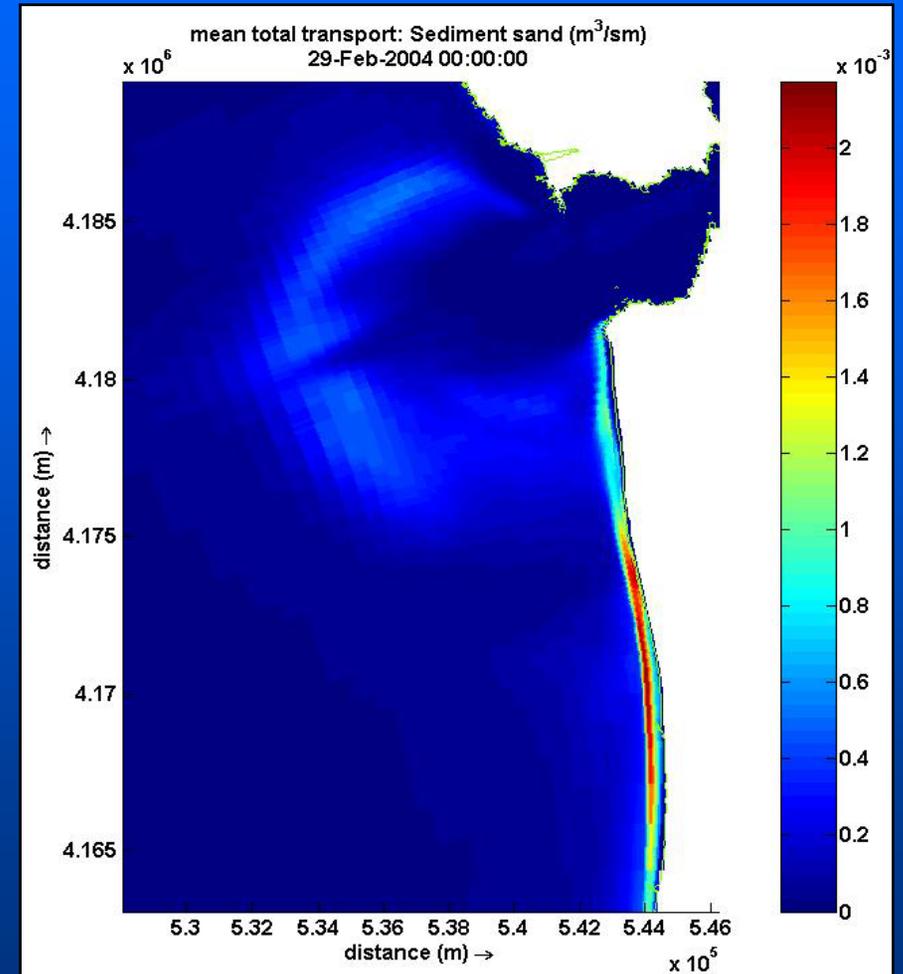
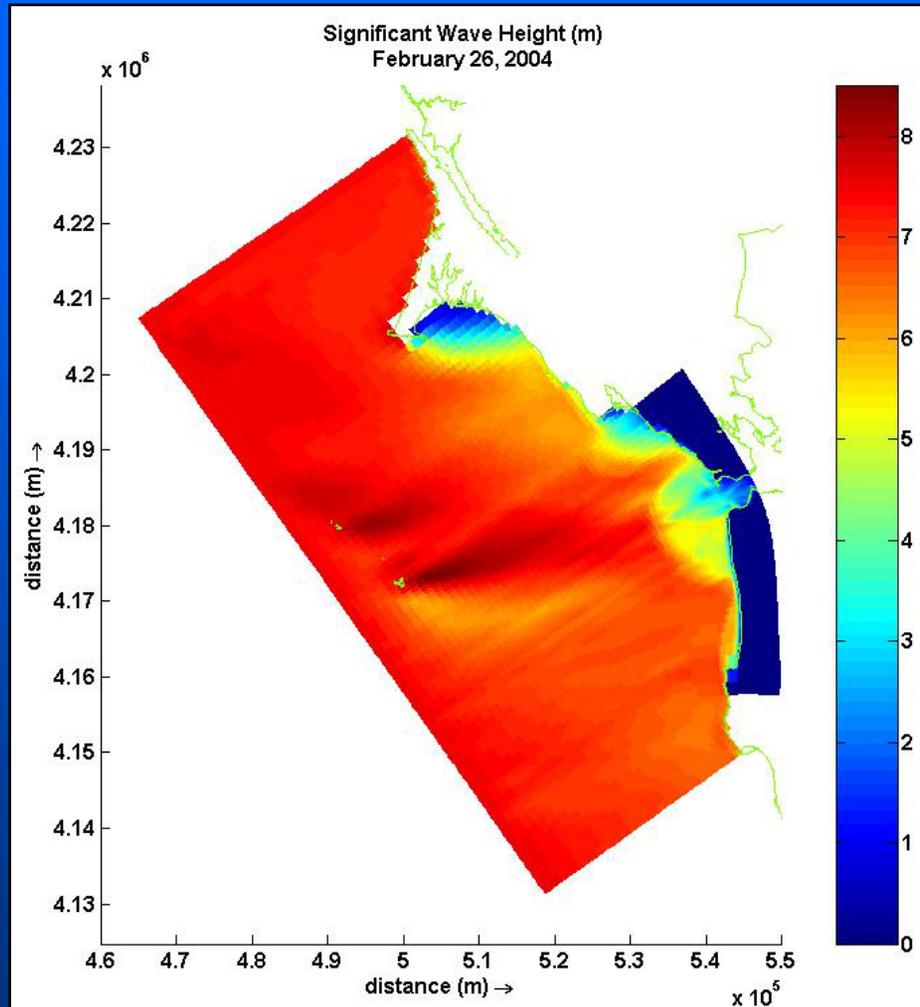
Numerical Modeling



Ocean Beach Tidal Currents

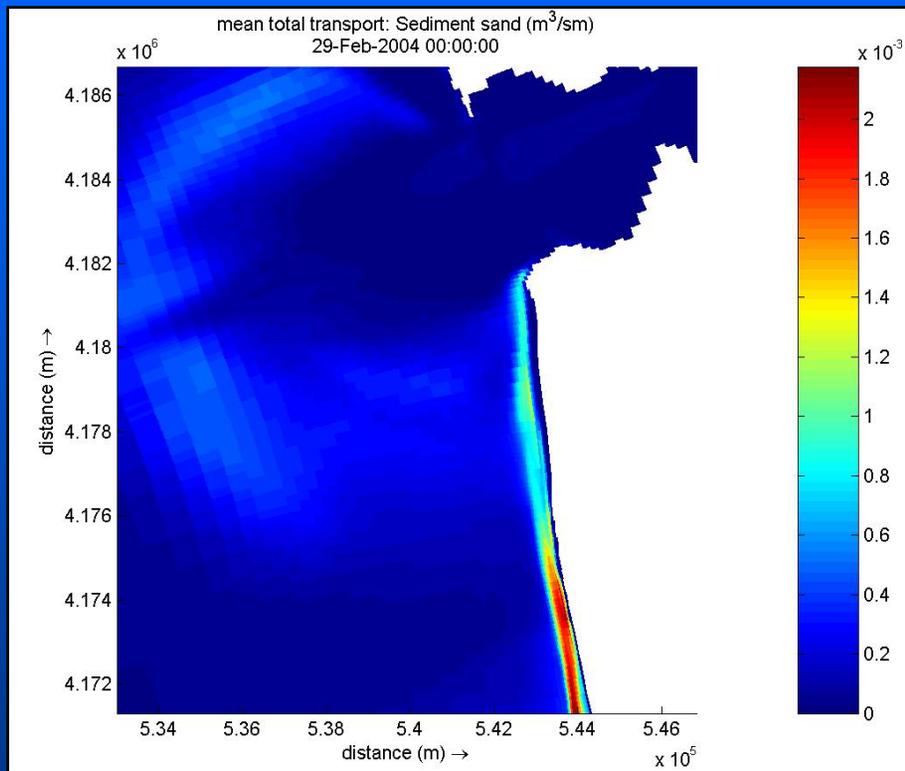


Modeling Extreme Events

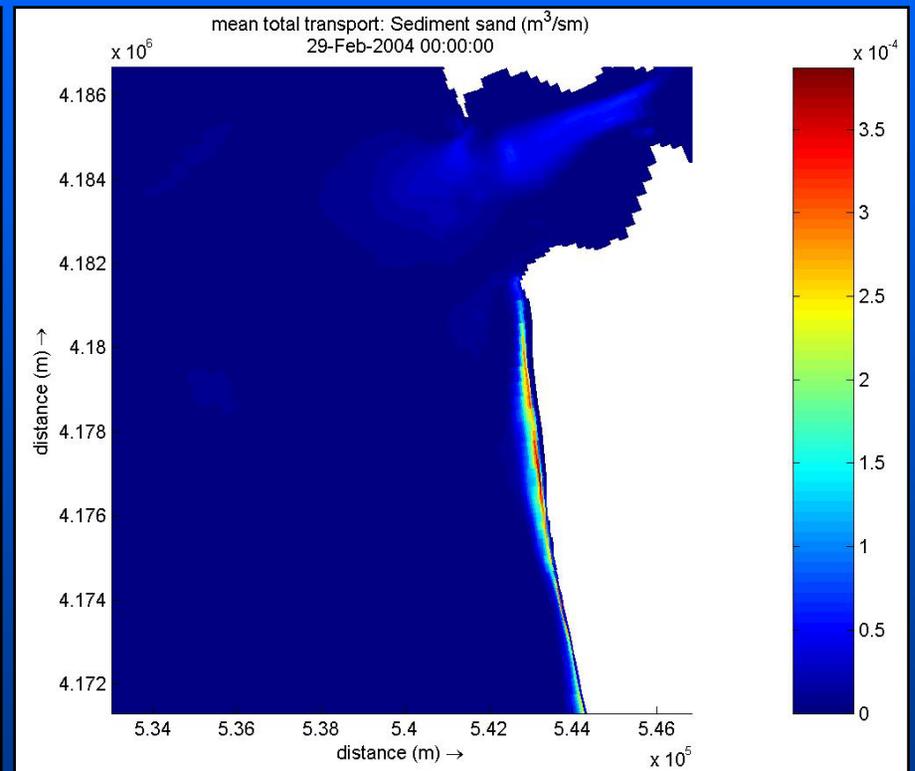


Modeling Extreme Events

Storm Sediment Transport

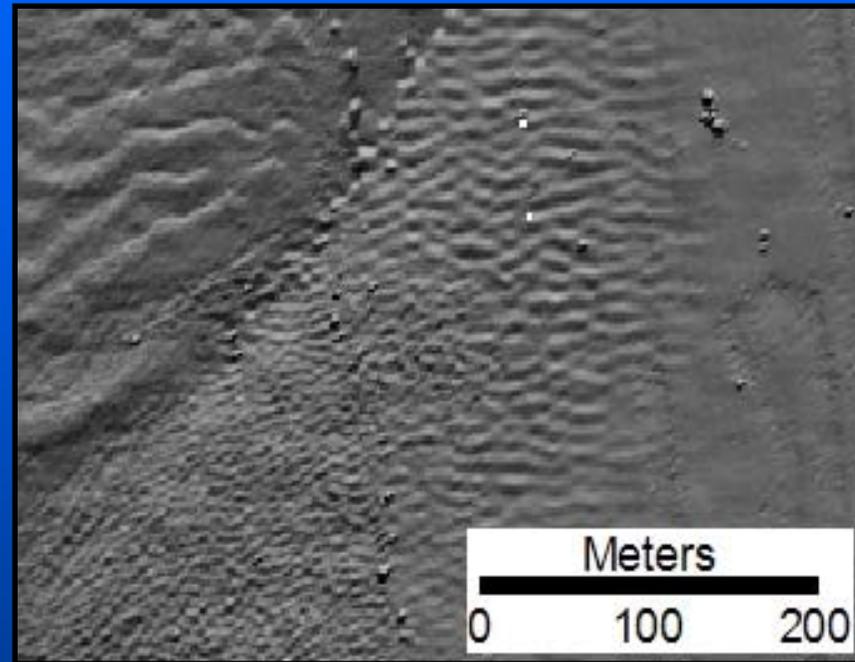


Typical Sediment Transport



Key Findings

- 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 Directions

- Modeling of new dredge disposal
- Model validation with open coast in situ measurements in key locations
- Web-based, near-real time coastal observing system
- Storm impact and risk assessment
- Bedform dynamics in high-energy wave and current environment



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