The SAFRR Tsunami Scenario

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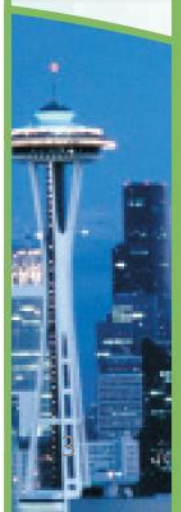
USGS, California Geological Survey,
Cal Office of Emergency Services, and NOAA

Science Application for Risk Reduction

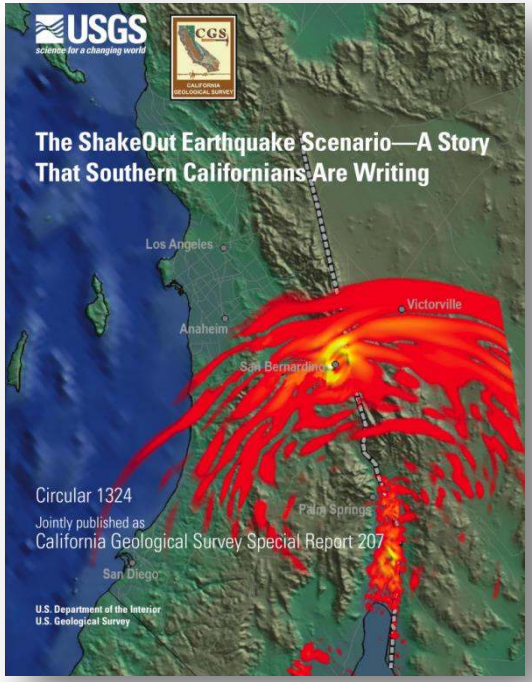
SAFRR's mission: innovate and apply hazard science for the safety, security, and economic well-being of the nation

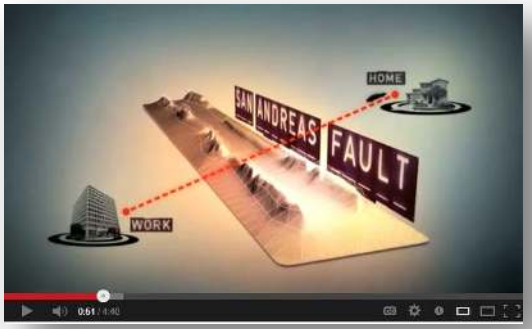
What is your science need?

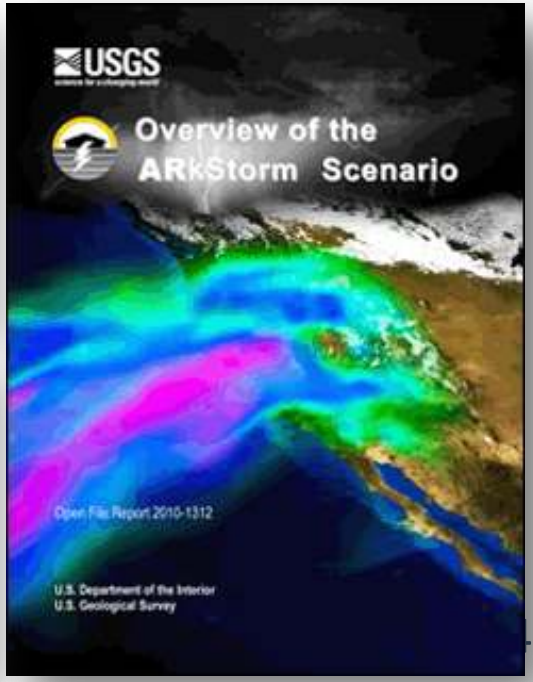


SAFRR scenarios

- A large but plausible event worth planning for
- Crafted with stakeholders
- Consensus among leading experts
- Information for planning & mitigation decisions







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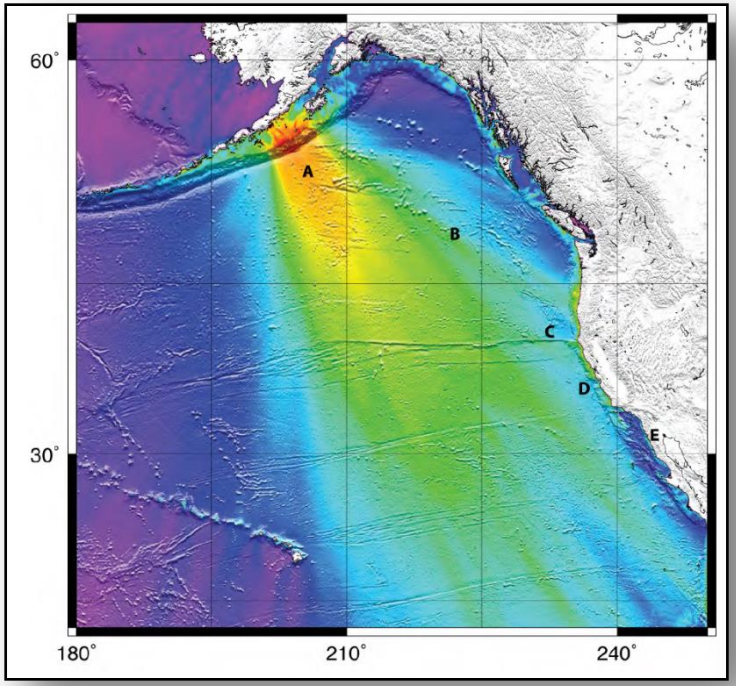
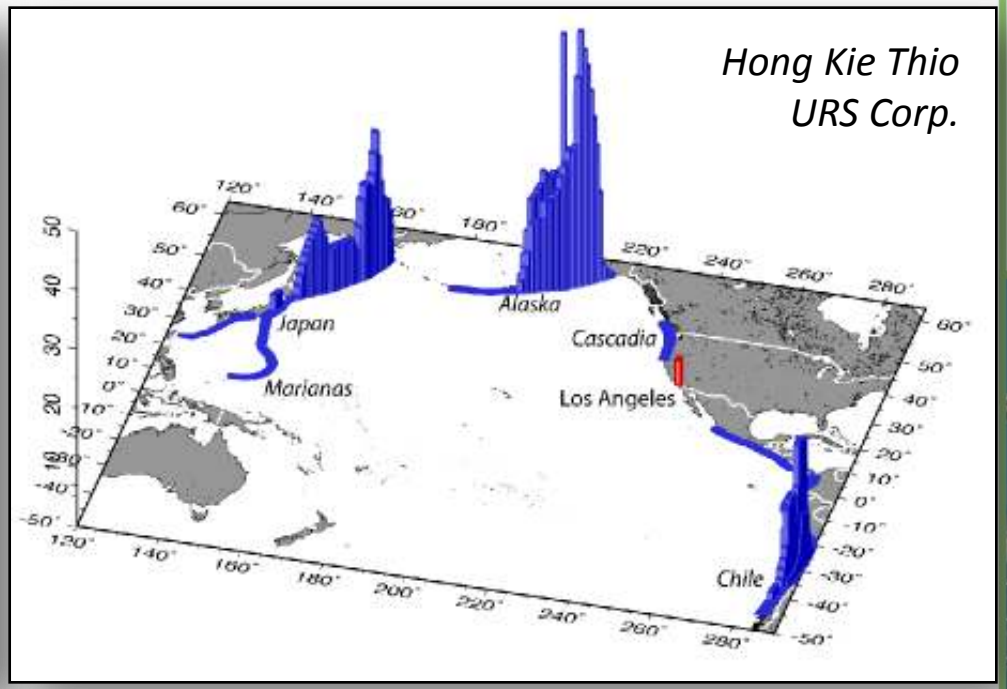
Mw 9.1 offshore of Alaska Peninsula

Like Tohoku rupture

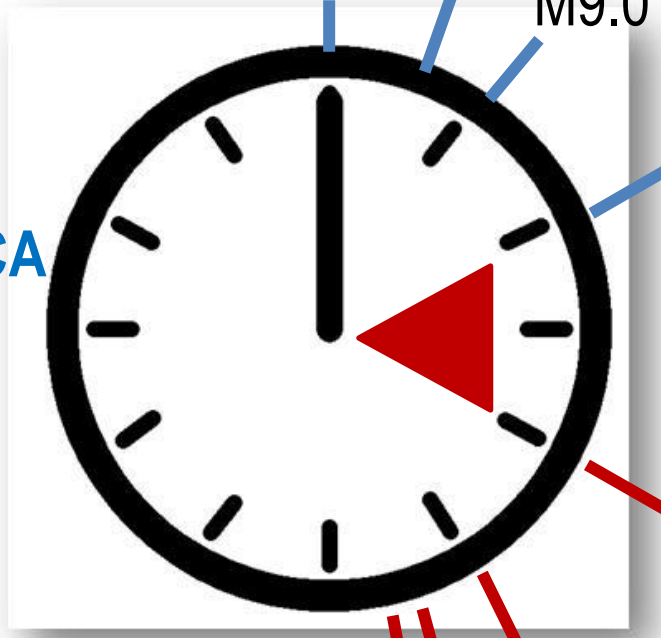
Between 1946 & 1964 sources

Biggest contribution to LA's tsunami hazard





NOAA tsunami messages



M8.6

11:54 AM Thu 27 Mar
M8.2, **Watch for CA**

M9.0

Warning for CA
6-21 hr duration
2-5 ft at buoys

12:00 PM Sat 29 March
(message 50):
Advisory cancelled for CA

8:02 PM Fri 28 March:
Advisory for CA

1st wave @ Crescent City
Durations 24 hr

Amplitude ests ↑

San Francisco

San Pedro

La Jolla

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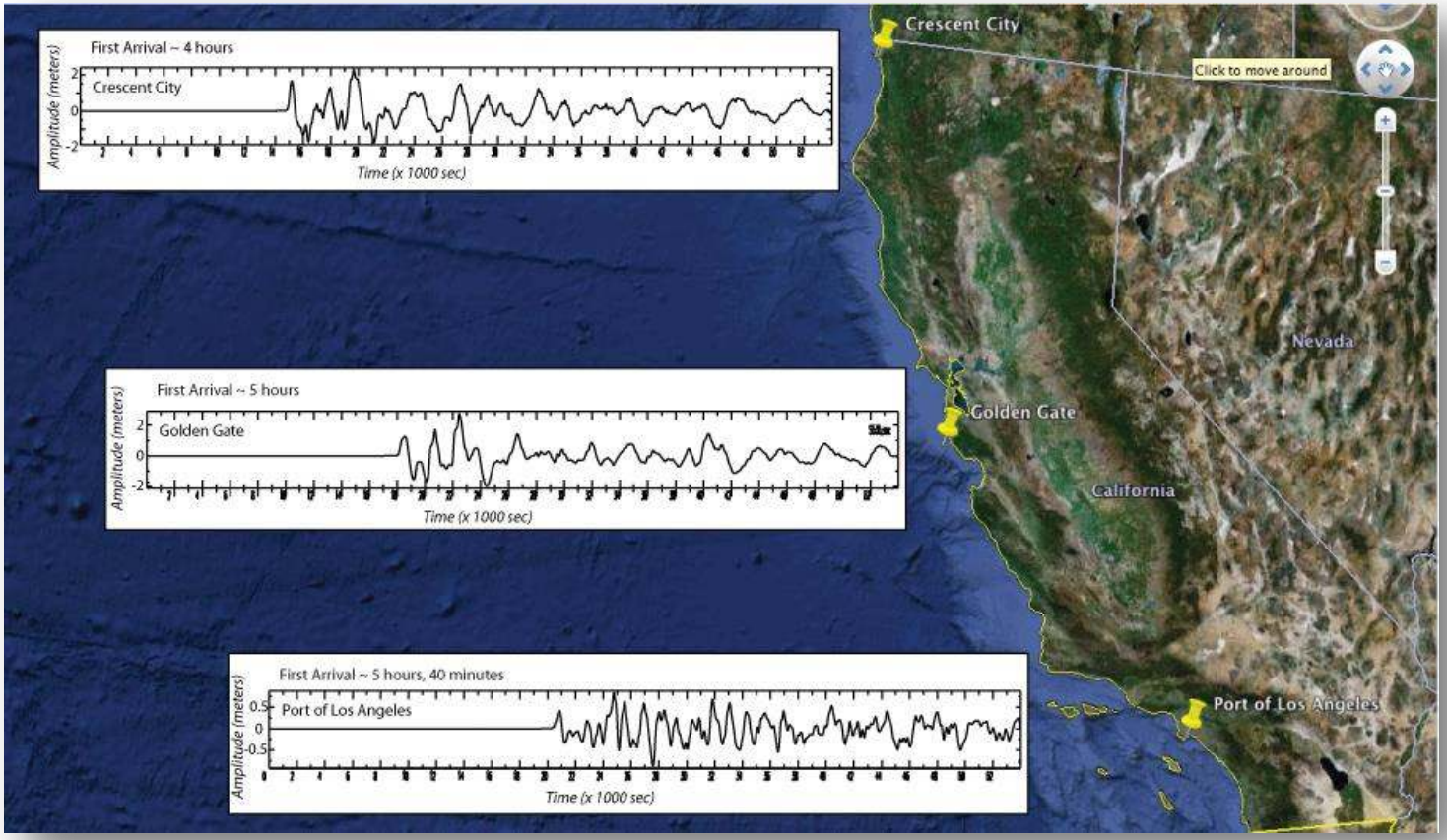
Hydraulic and hydrological modeling



Waves up to 5m (15 ft) above MHHW at shore

1st wave generally not the largest

Independent models agree well

Physical damages chapter

- Buildings, ports, marinas, roads, bridges, fire…
- Describe asset, history, scenario damage, recovery, & resilience opportunities
- Lean toward cautious (optimistically low)
- Draw lessons from past tsunamis & H. Sandy
- 32 peer reviewers
  - 2+ experts per topic
  - Professionals, scholars, stakeholder experts
  - Peer review was longer than the damage chapter

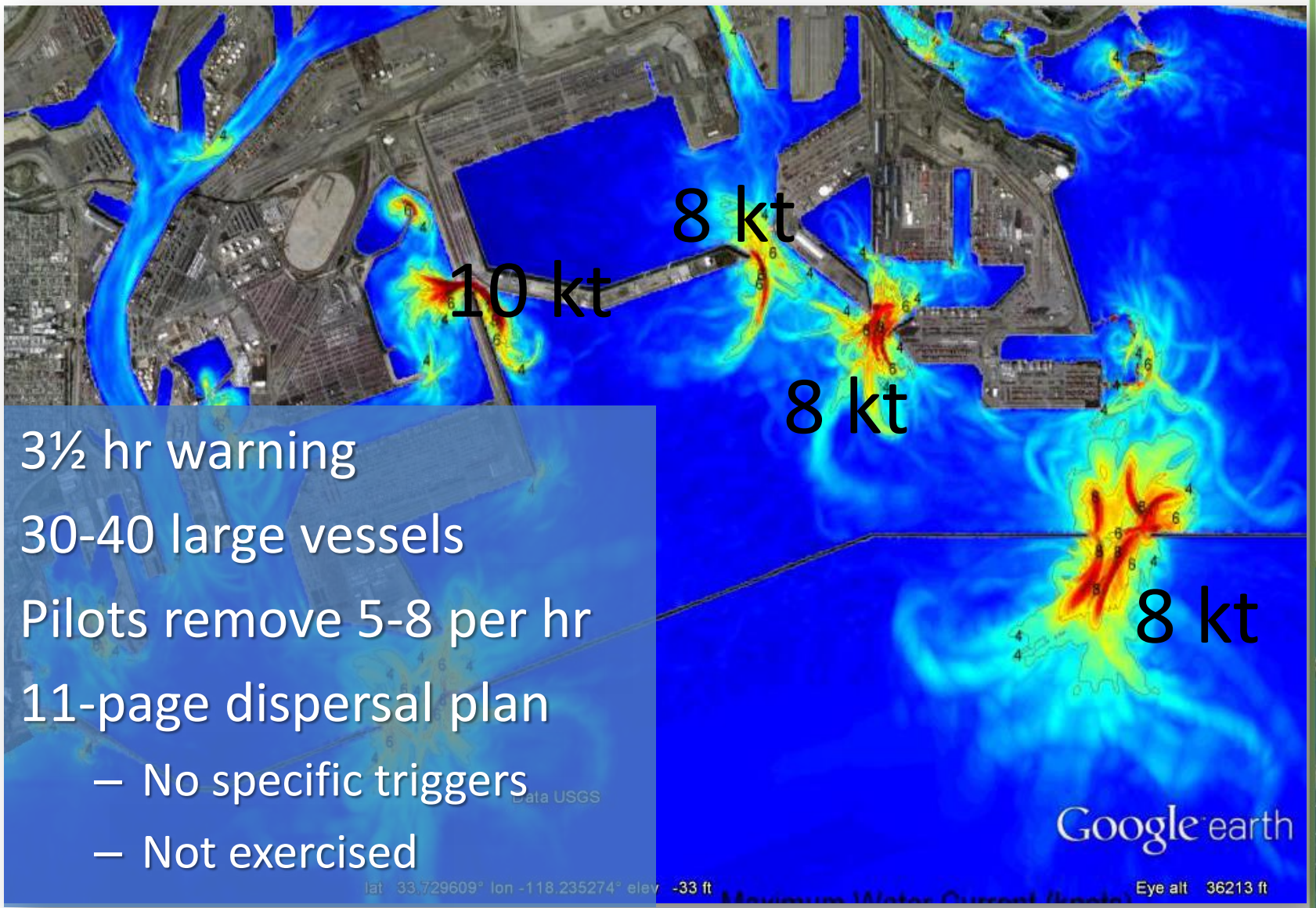
Marinas and harbors

- 15% of boats sunk
- 20% of boats damaged
- 40% of docks damaged
- 20% of docks destroyed
- $700 million damage plus
  - Sediment transport
  - Hazmat
  - Fires
  - Navigational hazards

"We don't think that a large tsunami would cause docks to float off the top of pilings, we KNOW that it will happen." -- Morro Bay Harbor Director

Ports of Los Angeles and Long Beach

Ports of Los Angeles and Long Beach



- 3½ hr warning
- 30-40 large vessels
- Pilots remove 5-8 per hr
- 11-page dispersal plan
  - No specific triggers
  - Not exercised

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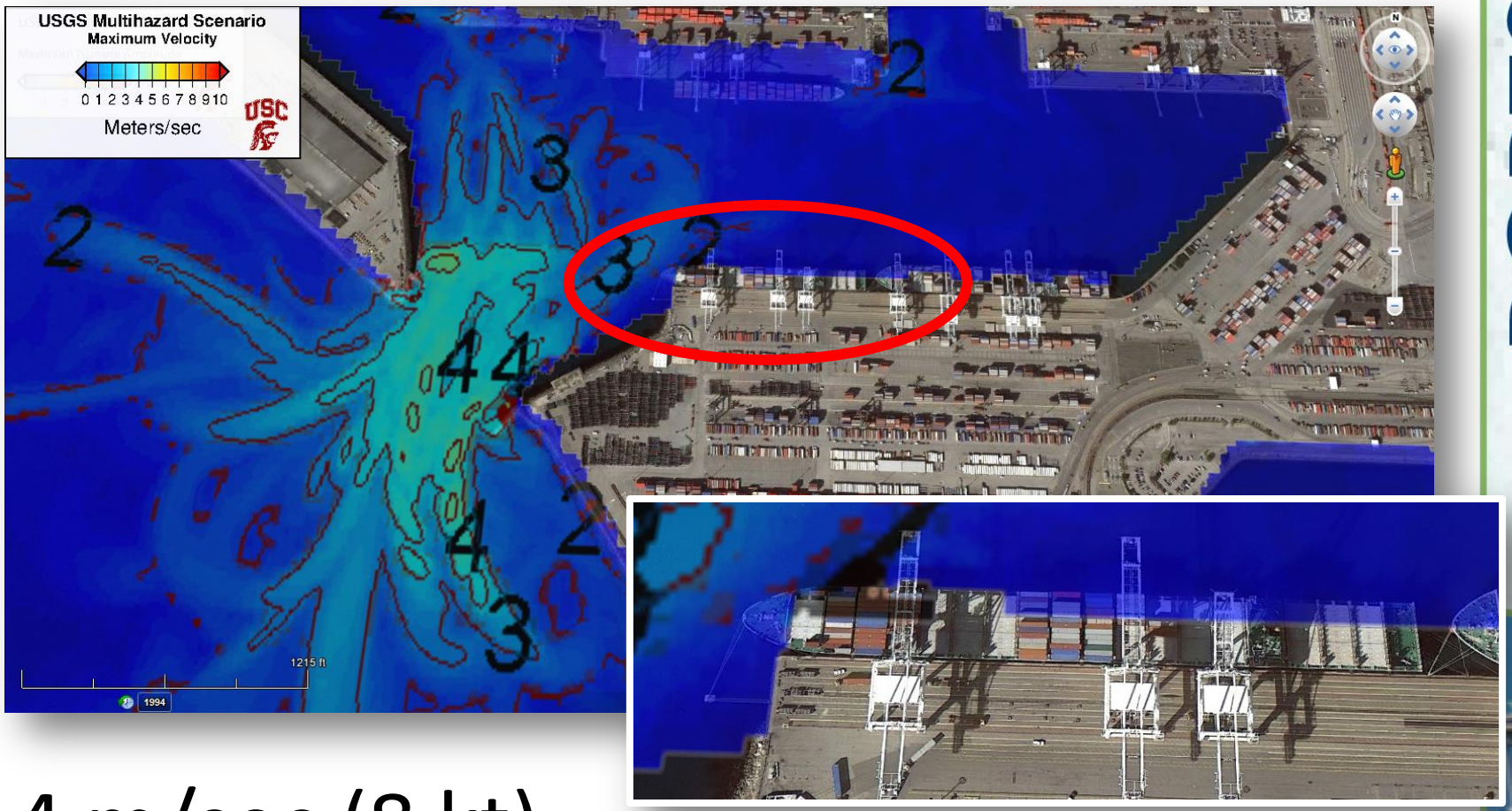
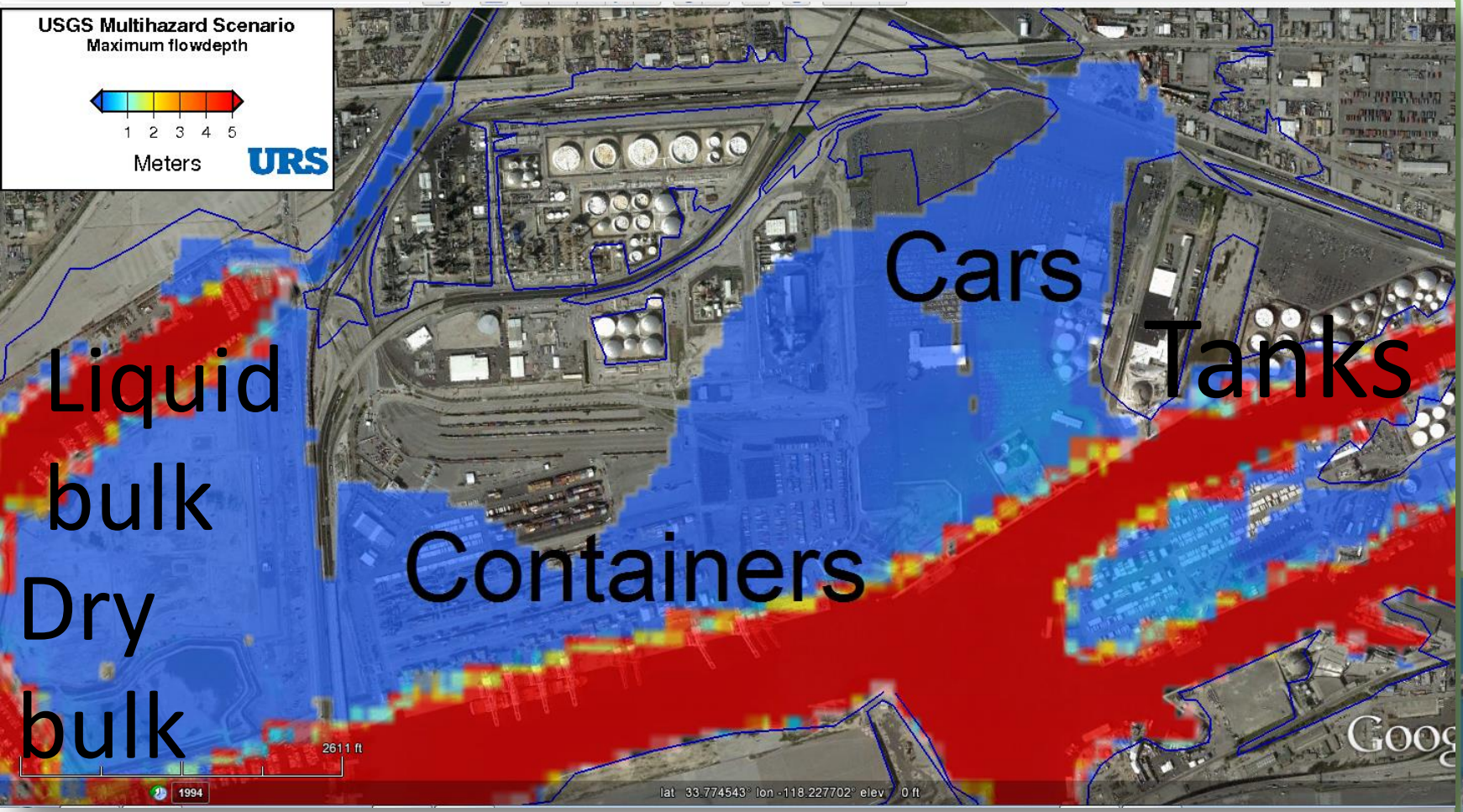
Ports of Los Angeles and Long Beach



4 m/sec (8 kt)

Guam: subs pulled from pier @ 2 kt

Ports of Los Angeles and Long Beach



Ports of Los Angeles and Long Beach

Moffatt & Nichol estimate: $100 M damage

- 2,650 cars
- 1,040 TEUs
- Moorings, warehouses, equipment…
- 2-3 days downtime

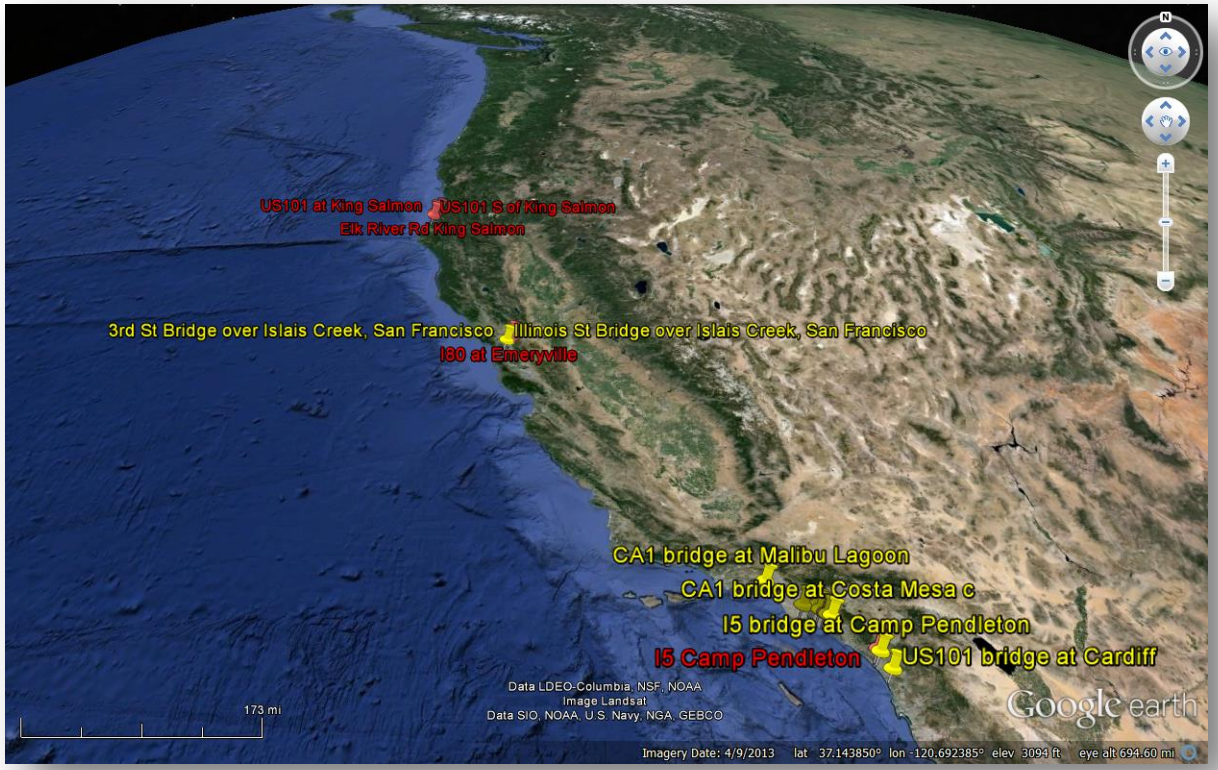
Likely damage to other ports

Port Elizabeth: PANYNJ “need to stay out of the habit of only reacting to the last event.”

Population vulnerability issues at the ports

Highways and bridges

- Estimates created & reviewed with Caltrans
- $100 million, mostly CA1, US101 road scour
- Oakland-Bay Bridge Toll Plaza



Coastal homes & businesses

Wetted

- 13 counties, 1840 census blocks, 103 million sf (≈70,000 dwellings), $31B value
- 40% of property in Cal OES max inund. zone

Repair cost

- Using HAZUS (not “in” HAZUS)
- $2.6B, mostly contents

Fuel + debris = fires

- 284 in Tohoku
- Here: 17 possible releases of flammable product
- Pipe breaks, fires likely
- POLA/LB: fire boats face strong currents

Economic bottom line: $5-10B

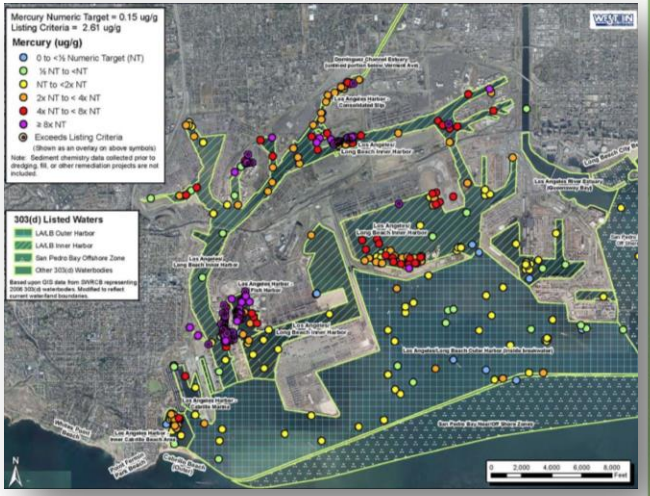
Assets	Repair cost $M	Business interruption ($M)	
		W/o resilience strategies	W/ resilience strategies
Ports of LA and LB	$100	$4,300	$100-$860
Fishing in Port of LA		$2	$0.3
Marinas and small craft	$700	$30	
Property damage	$2,600	$1,700	$320
Roads and bridges	$80		
Railroads	$2		
Agriculture	$4		
Total (rounded)	$3,500	$6,000	$420-$1,200

- Sediment, soil remediation, fires, other ports, and evacuation could add $1B+
- Reconstruction will bolster the economy

Potential environmental impacts

- Toxicants in debris
- Petroleum from refineries, terminals, & vessels
- Dry bulk (industrial borates…)
- Smoke, ash, debris from fires
- Contaminated sediments

Port of Sendai March 2011 (EPA)



Mercury in harbor sediments

Public policy

- Federal and state tsunami-management policy is less developed than for other hazards
- Risk awareness gaps (public & coastal sectors) may undermine disaster management in a big tsunami
- Some maritime policy priorities:
  - More detailed analyses to identify high-hazard areas & safer facility & passageways locations
  - Port dispersal planning, training & exercise
  - Review regulations to facilitate port recovery and reduce BI, e.g., dredging

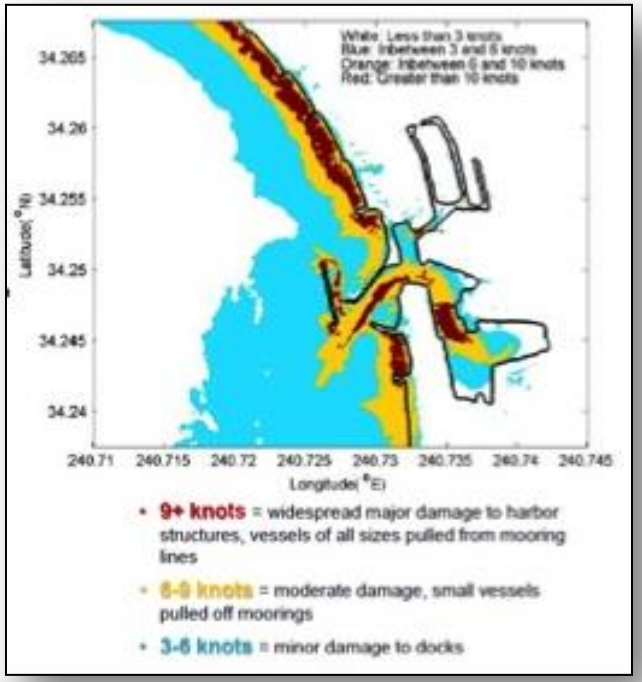
Cal OES Tsunami Program

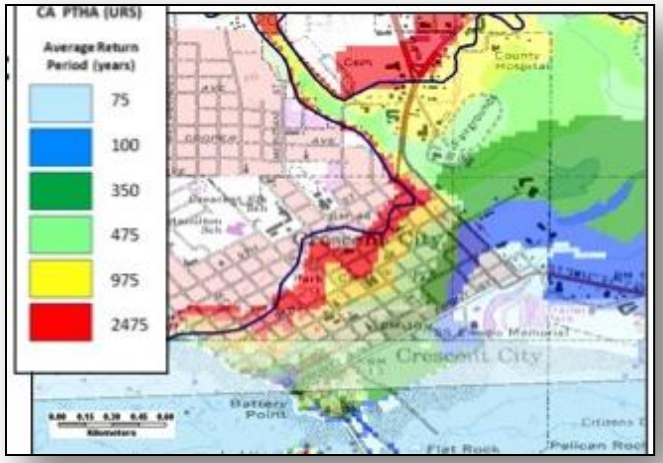
Inundation mapping

Emergency response plans

Maritime planning

Land-use planning





Stakeholder survey & interviews

4 agencies, 37 respondents:

- Found presenters well qualified, realistic scenario, well-thought-out findings
- Using SAFRR info to improve preparedness
- Understand tsunamis better, more able to plan
- Improved networking, better understand other organizations

Challenges

- Info overload, organizational confidentiality

Conclusions

- Realistic, worth planning for
- Much more severe than 2010 & 2011
- CA lucky with tides in past tsunamis
- Affects the entire CA coast: ports, marinas, communities, transit, tourism, …
- Causes fires, hazmat, ecological damage
- Resilience strategies can make a big difference
- What are your science needs?

Learn more

- CA county emergency managers
- Workshops next 2 weeks throughout CA
- Open file report September 2013
- http://www.usgs.gov/natural_hazards/safrr

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