San Diego – Tijuana Earthquake Planning Scenario Workshop

EERI San Diego Chapter

Technical Discipline 1: Geologic Hazards and Geotechnical Engineering

Prof. Tom Rockwell (SDSU), Jerry Treiman (CGS), Luis Mendoza (CICESE)

Jorge Meneses, PhD, PE, GE

Group Delta Consultants, Inc.

Jim Gingery, Kleinfelder

Overview

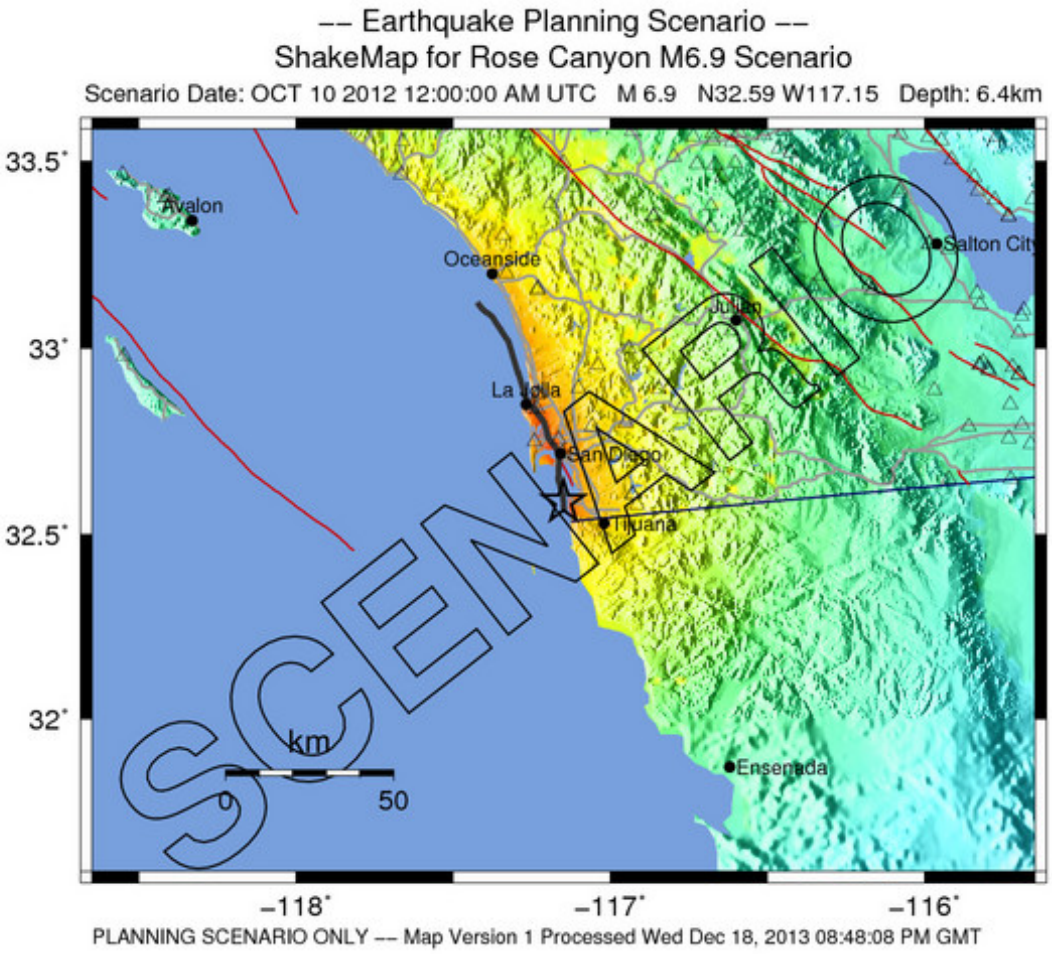
- Scenario earthquake
- Ground motions
- Geologic hazards
  - Surface fault rupture
  - Liquefaction and lateral spreading
  - Slope instability
  - Tsunami and seiche

Scenario Earthquake

- Rose Canyon fault
  - Rupture extent and magnitude
  - Rupture propagation direction
- Can/should a scenario be used that has similar ground motions for both Tijuana and San Diego?
- Other faults?
- A specific scenario will be presented by Prof. Tom Rockwell

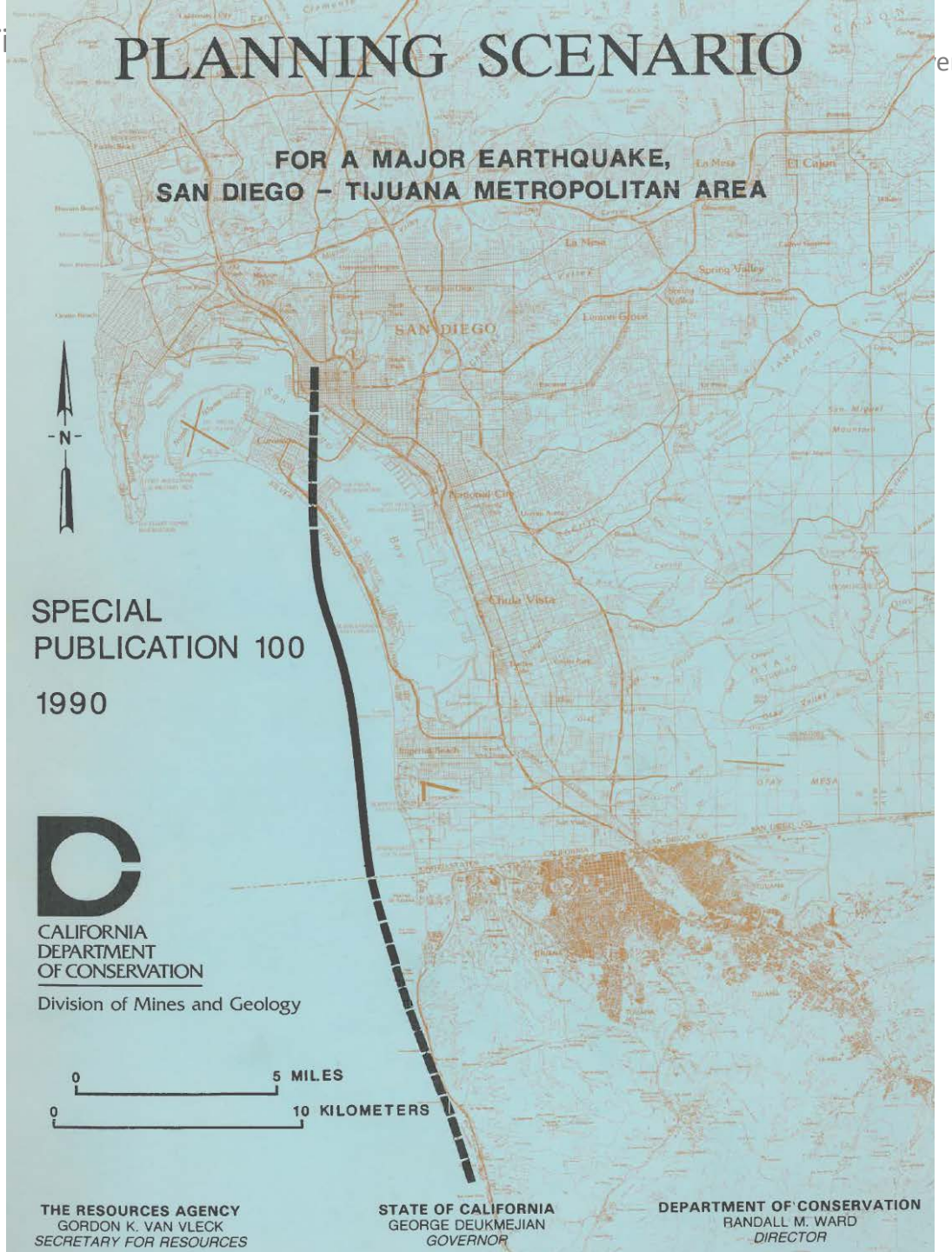
Ground Motions

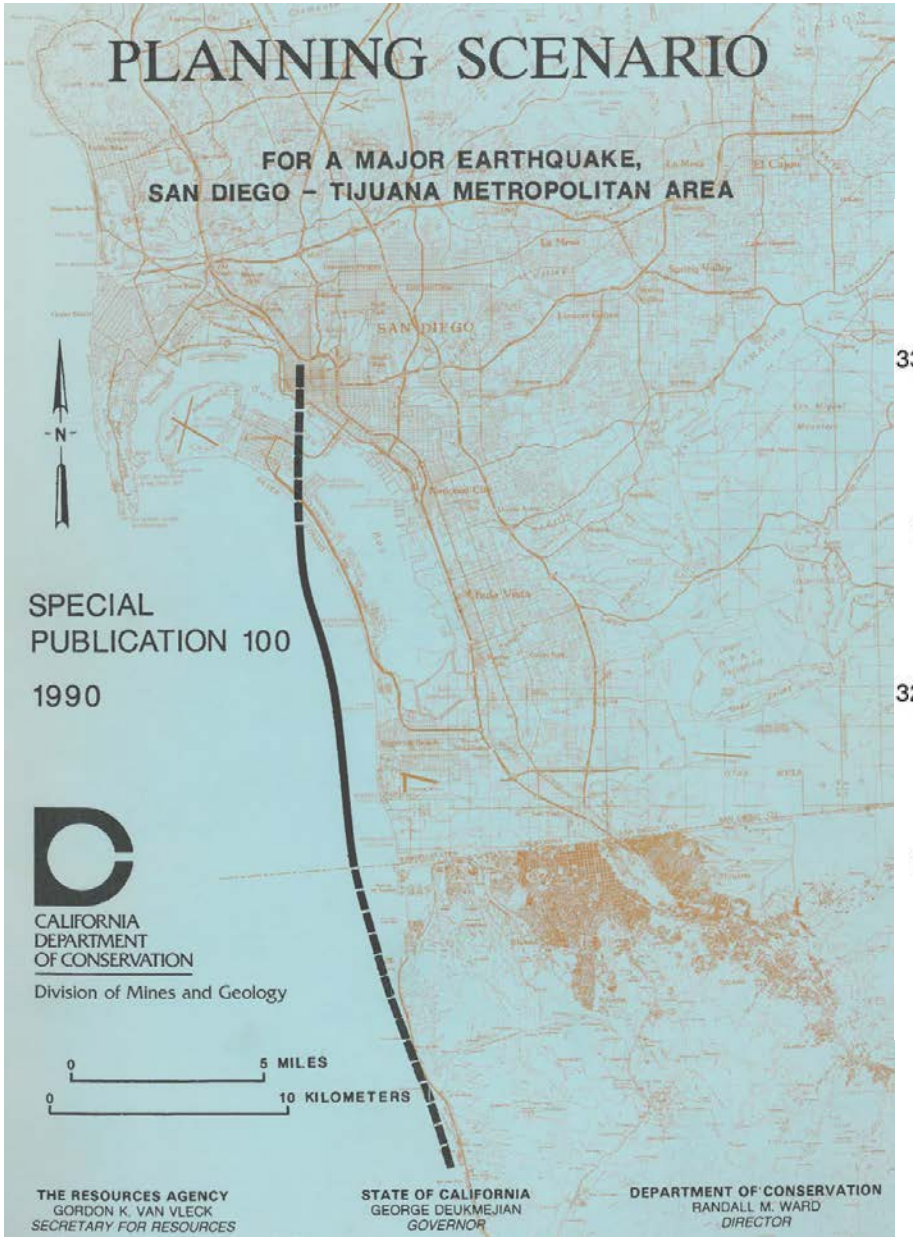
- USGS has generated shake maps in 2001 and 2012 (shown)
- Which ground motion intensity measures are required?

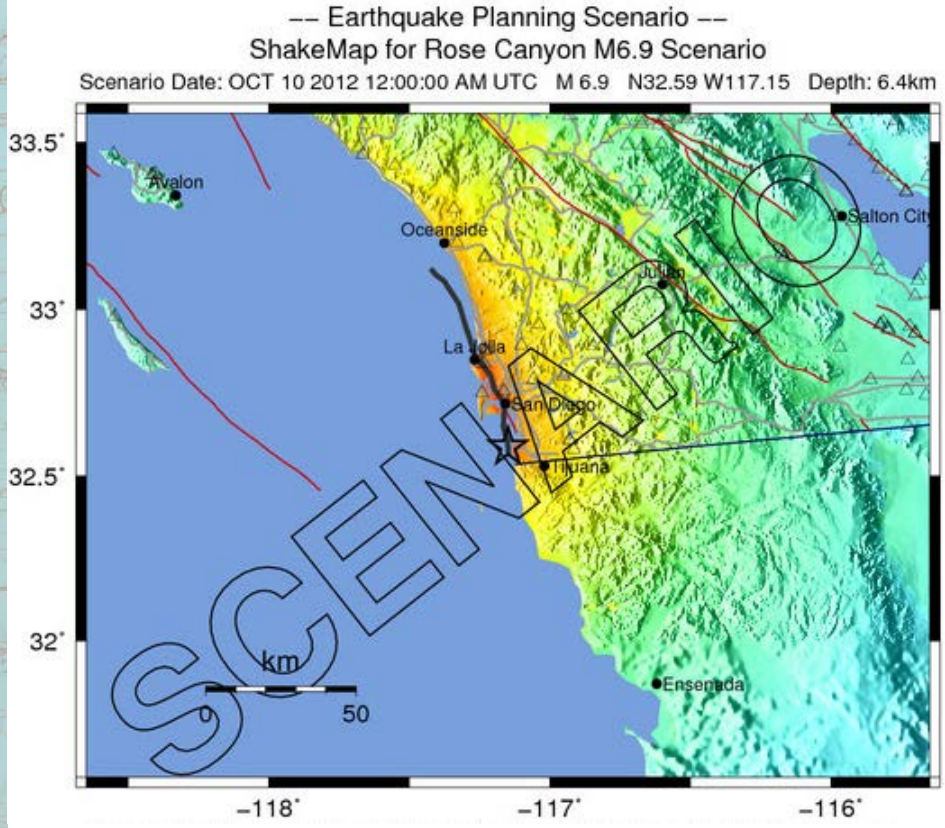


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<0.1*	*0.5*	*2.4*	*6.7*	*13*	24	44	83	>156
PEAK VEL.(cm/s)	<0.07	0.4	1.9	5.8	*11*	*22*	*43*	*83*	*>160*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Wald, et al.; 1999


PLANNING SCENARIO
FOR A MAJOR EARTHQUAKE,
SAN DIEGO – TIJUANA METROPOLITAN AREA
SAN DIEGO
Chula Vista
-N-
SPECIAL
PUBLICATION 100
1990
CALIFORNIA
DEPARTMENT
OF CONSERVATION
Division of Mines and Geology
0 5 MILES
0 10 KILOMETERS
THE RESOURCES AGENCY
GORDON K. VAN VLECK
SECRETARY FOR RESOURCES
STATE OF CALIFORNIA
GEORGE DEUKMEJIAN
GOVERNOR
DEPARTMENT OF CONSERVATION
RANDALL M. WARD
DIRECTOR


PLANNING SCENARIO
FOR A MAJOR EARTHQUAKE,
SAN DIEGO – TIJUANA METROPOLITAN AREA
SAN DIEGO
N
SPECIAL
PUBLICATION 100
1990
CALIFORNIA
DEPARTMENT
OF CONSERVATION
Division of Mines and Geology
0 5 MILES
0 10 KILOMETERS
THE RESOURCES AGENCY
GORDON K. VAN VLECK
SECRETARY FOR RESOURCES
STATE OF CALIFORNIA
GEORGE DEUKMEJIAN
GOVERNOR
DEPARTMENT OF CONSERVATION
RANDALL M. WARD
DIRECTOR


-- Earthquake Planning Scenario --
ShakeMap for Rose Canyon M6.9 Scenario
Scenario Date: OCT 10 2012 12:00:00 AM UTC M 6.9 N32.59 W117.15 Depth: 6.4km
33.5°
33°
32.5°
32°
Avalon
Oceanside
Julian
Salton City
La Jolla
San Diego
Tijuana
Ensenada
SCENARIO
km
0
50
-118°
-117°
-116°

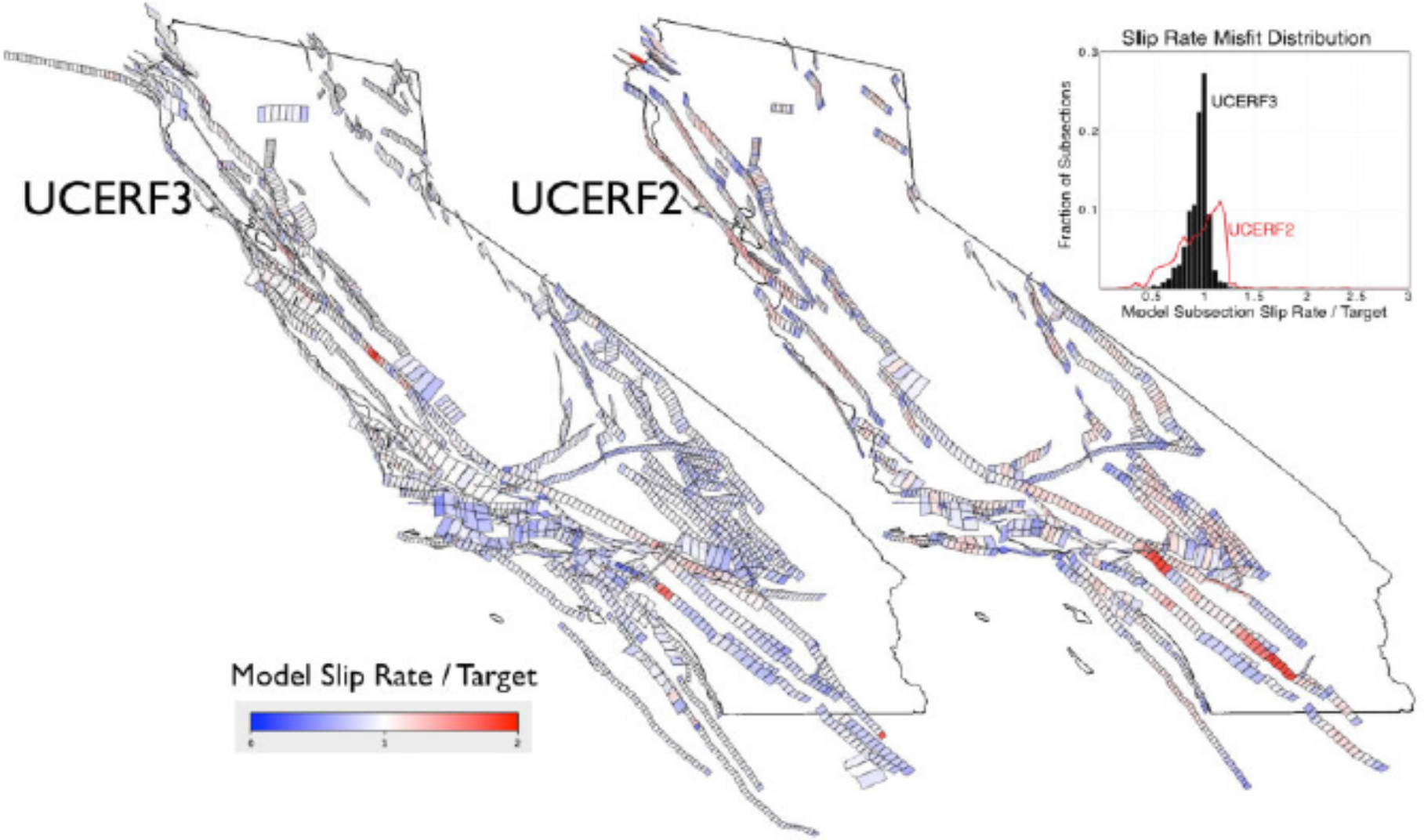
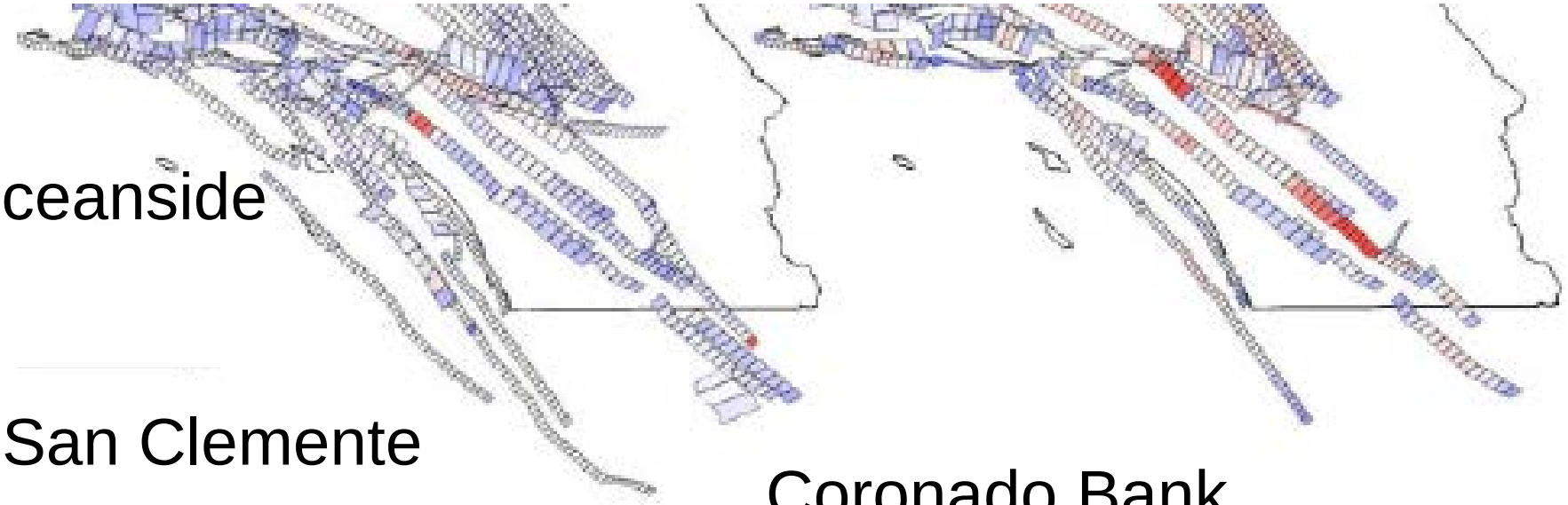


Figure 19. Maps showing average subsection slip rate misfits for both UCERF3 (Fault Model 3.1) and UCERF2 (Fault Model 2.1), shown as ratios of final implied slip rates divided by deformation model slip rates, and averaged over all logic tree branches. Equivalent plots for each deformation model (branch subsets) are given in appendix N (this report). The distribution of subsection slip rate misfits is shown for UCERF2 and UCERF2 at the upper right.

Faults in San Diego-Tijuana

Carlsbad

Thirty Mile Bank



Oceanside

San Clemente

Coronado Bank

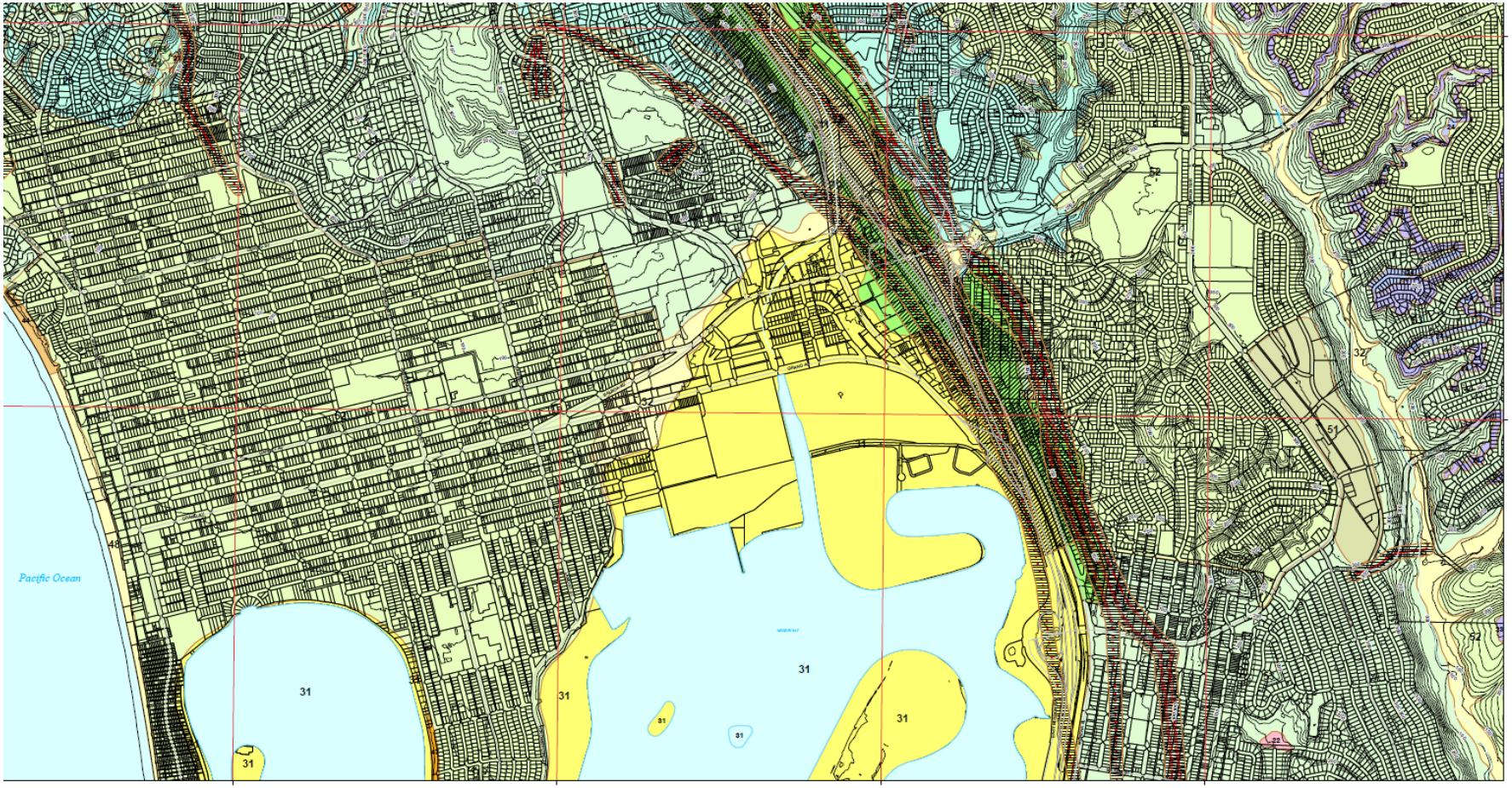
San Diego Trough

Geologic Hazards – Surface Rupture

- Tied to earthquake scenario
- Secondary fault displacements off the main trace?

Geologic Hazards – Liquefaction, lateral spreading, slope instability

- Qualitative maps available from City of San Diego



Geologic Hazards – Liquefaction, lateral spreading, slope instability

- City of San Diego (2008) Seismic Safety Element Maps provide qualitative risk potential
- To get quantitative estimates of deformation that can be used with fragility curves to estimate damage, must do more:
  - Extensive analyses (probably not practical given limited data and time available)
  - "Expert opinion" combined with some ground truthing through analyses. May also be used in combination with probabilistic methods to account for uncertainties

Discussion Topics

- Earthquake scenario
- Previous experience in other scenarios in dealing with these topics
- Methodologies for evaluating geologic hazards
- Working groups