# Proposed Scenario Earthquake Rose Canyon Fault in San Diego

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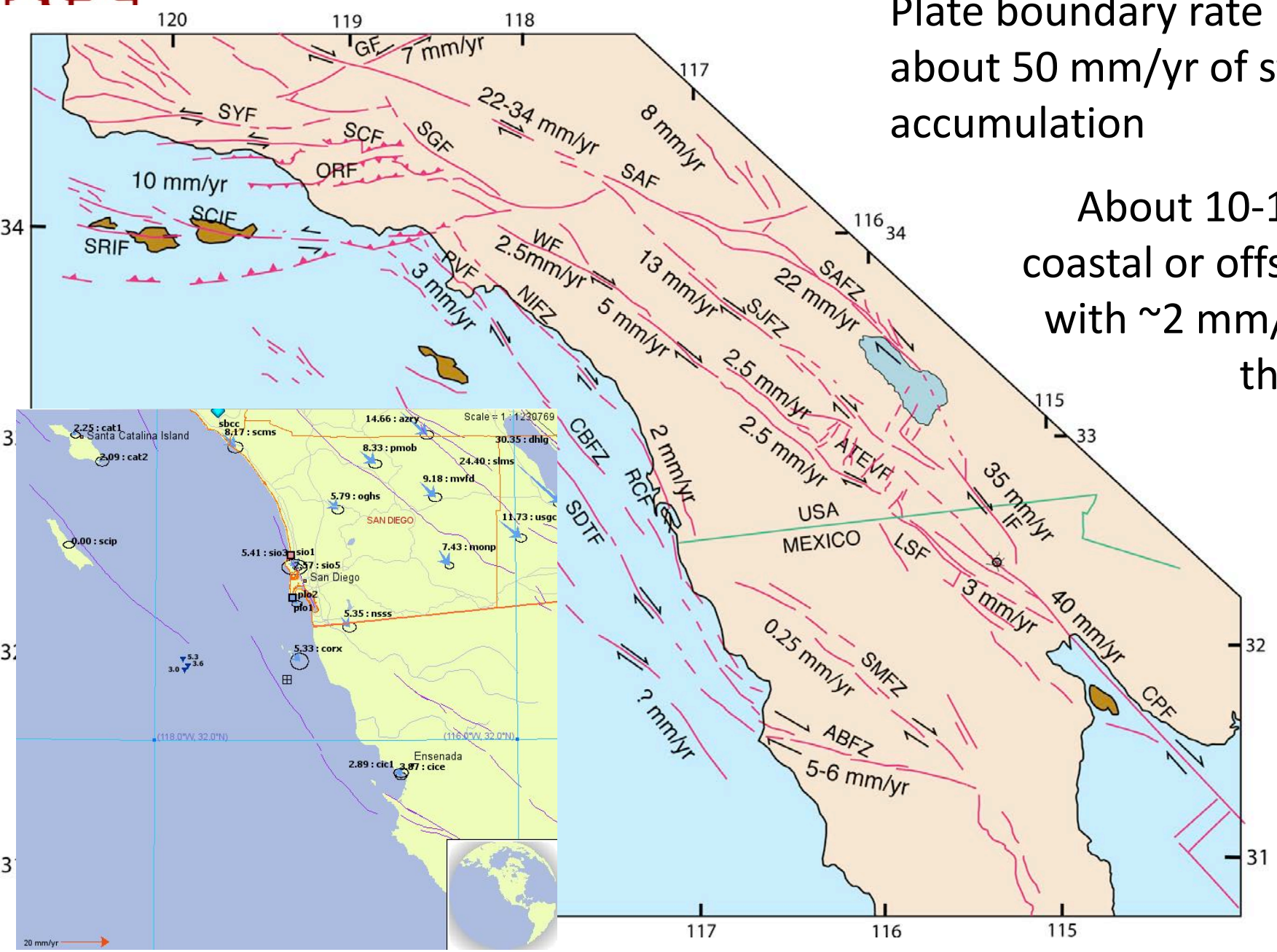
# Overview

- Brief summary of what we know about the slip rate on the Rose Canyon fault.
- Estimation of the likely rupture length for RCF earthquakes.
- Estimation of expected magnitude for the Rose Canyon fault based on scaling relationships.
- Estimation of expected magnitude based on our knowledge of the faults past behavior, slip rate and the general characteristics of the fault's structure.

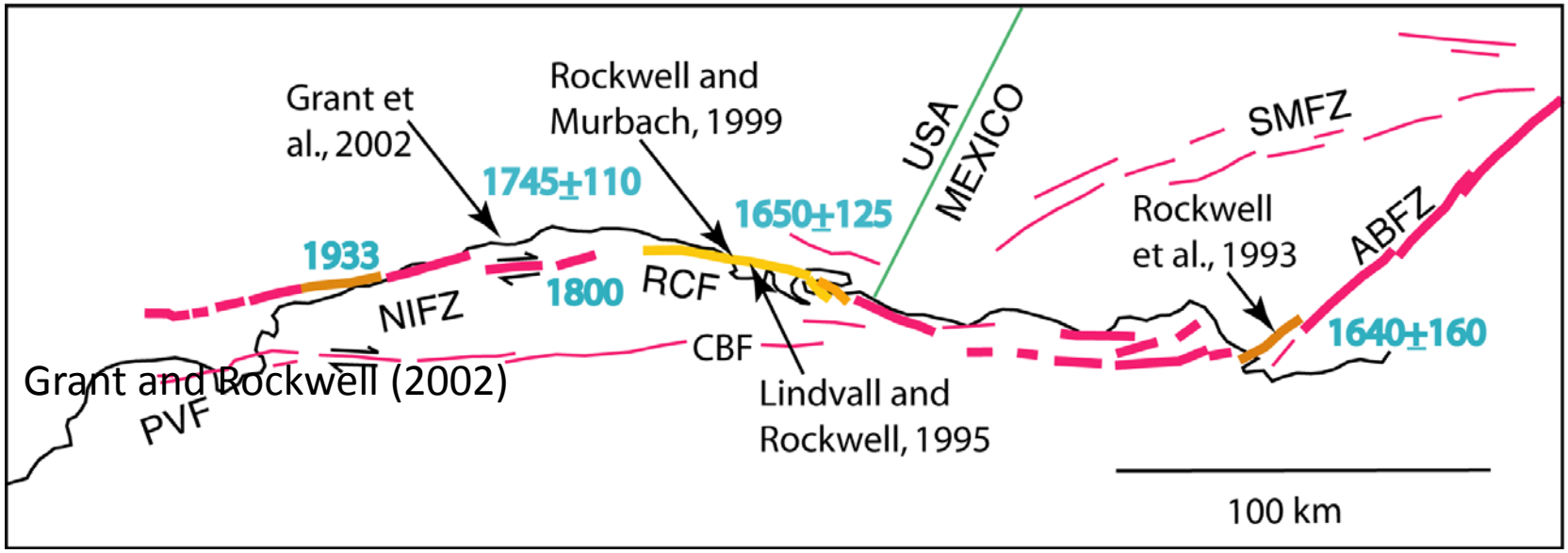
Plate boundary rate is about 50 mm/yr of strain accumulation

About 10-15% is coastal or offshore, with ~2 mm/yr on the RCF



There are several ways to determine the likely magnitudes of future earthquakes

1) Surface rupture length vs magnitude
2) Estimate magnitude from area-scaling relationships
3) Calculation of expected moment from rupture length, depth of seismicity, and expected displacement
3) Calculation of expected displacement from slip rate and average recurrence interval, and then use average displacement versus magnitude relationships
4) Other methods




For the Rose Canyon fault, large step-overs at San Diego Bay, a step-over and change in strike near Oceanside, and the timing of the most recent rupture on various elements of the Coastal fault system suggest that large RCF earthquakes may rupture about 40 km of fault

A 40 km rupture, with seismicity to 16 km depth (Magistrale, 1993) suggests a potential rupture area of about 640 square km

Using the Leonard (2010) relationship between rupture area and magnitude

$$M = 4 + \log A$$

yields an estimated magnitude of Mw6.8

Using Hanks and Bakun (2002) for earthquakes >537 square km

$$M = 4/3 \log A + 3.07$$

yields an estimated magnitude of Mw6.8* *preferred for larger magnitudes

Using the Wells and Coppersmith regression of surface rupture length versus magnitude

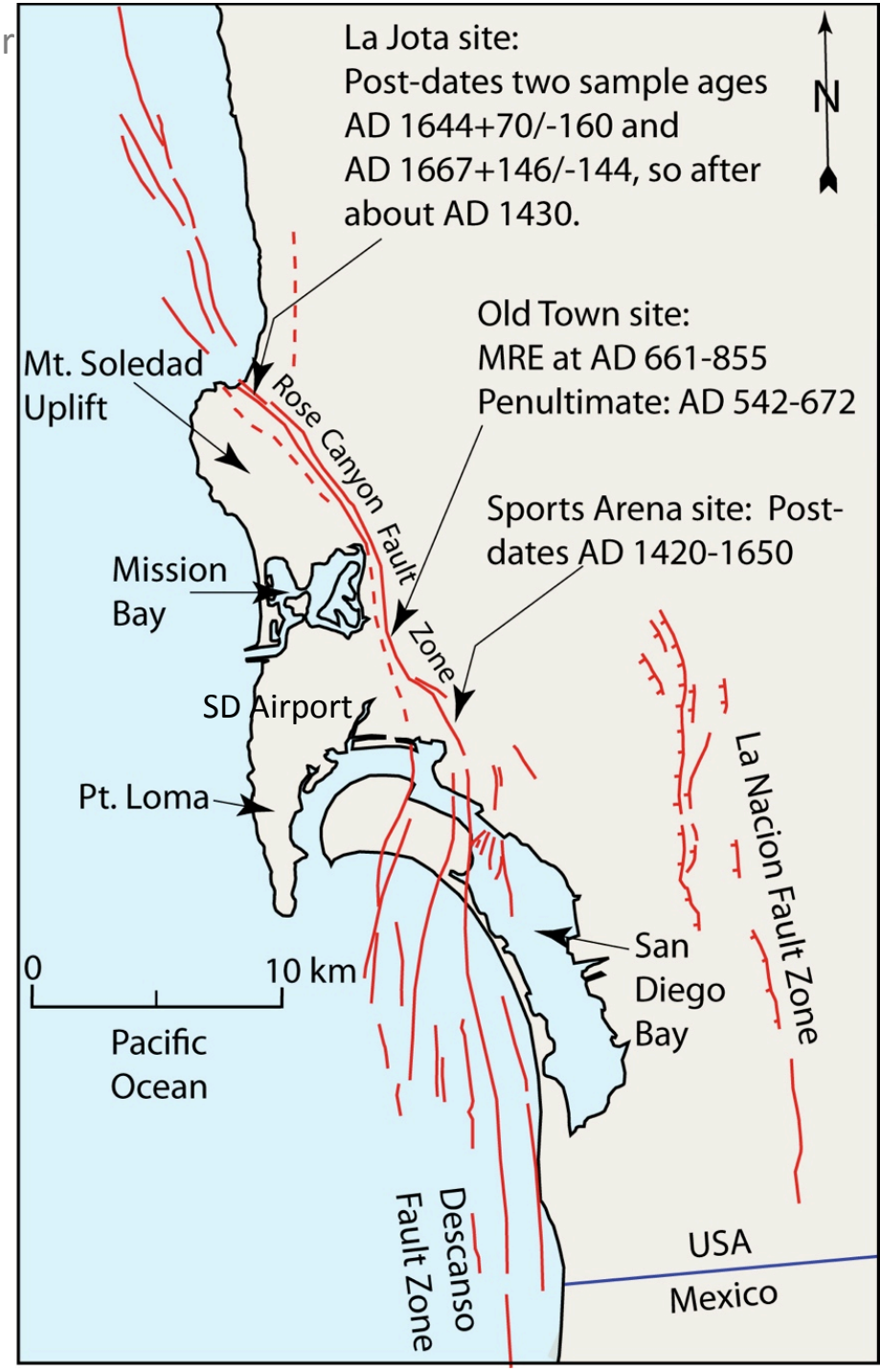
$$M = 4.38 + 1.49 \log RL$$

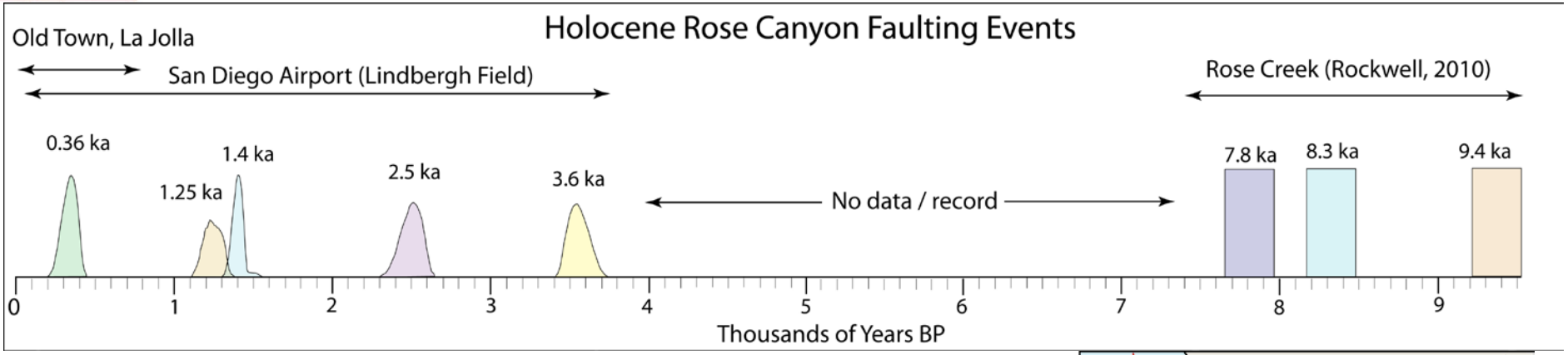
yields an estimate magnitude of Mw6.8

Timing of the most recent surface rupture dated In La Jolla and downtown San Diego

Early Holocene earthquakes dated in Rose Creek (Rockwell et al., 1991, Lindvall and Rockwell, 1995)

New data on paleo earthquakes from Old Town (Rockwell et al., 2013), and at the San Diego airport redevelopment (Kleinfelder studies), and other studies





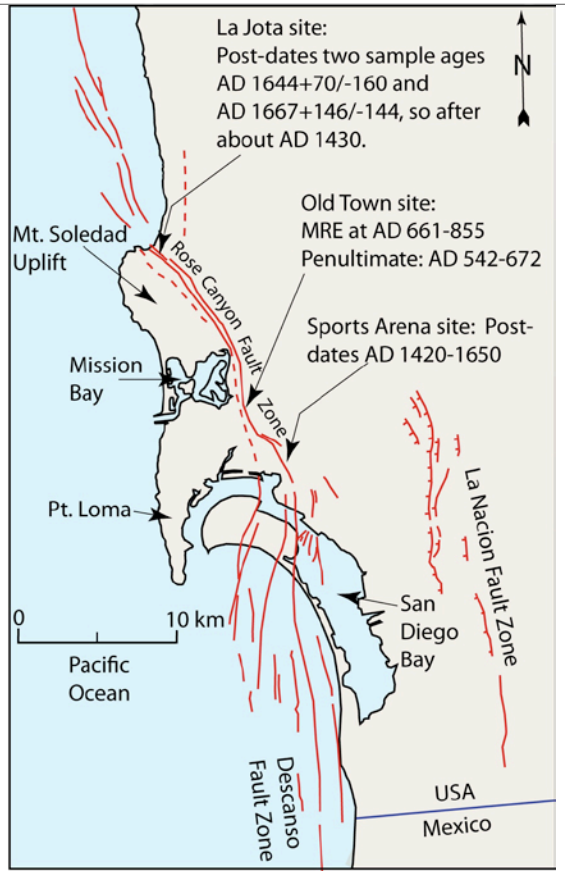

New data suggests recurrence interval of ~1000 ka, on average, although it could be shorter (record is likely incomplete)

At 2 mm/yr, this suggests events could be in the 2 m of slip per earthquake

Using 2 m of displacement with a rupture area of 640 square kms yields a seismic moment of ~4 x 10E26 dyne-cm (Mo = μAs)

Using Mw = 2/3 logMo - 10.7 yields a magnitude of Mw6.9

Using average displacement of 2 m and the Wells & Coppersmith (1994) relationship (M = 6.93 + 0.82 x log (AD)) Yields a moment magnitude of Mw7.2



# Summary of Magnitude Estimates

Emperical scaling relations suggest Mw6.8-7.2

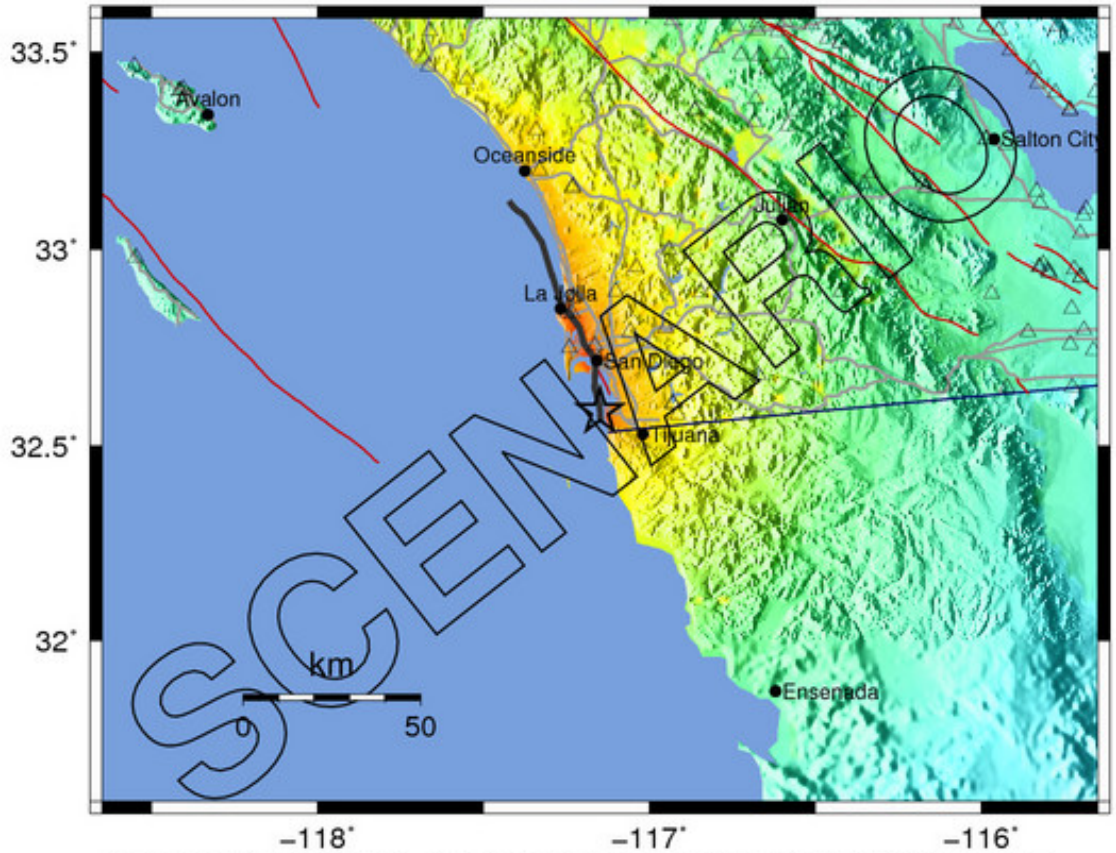
Moment estimates based on average displacement suggest Mw6.9

## Mean magnitude is ~ Mw6.9

-- 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




PLANNING SCENARIO ONLY -- Map Version 1 Processed Wed Dec 18, 2013 08:48:08 PM GMT

| 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