SEIZE/ SF	Imaging the Seismogenic Zone with Geodesy and Seismology: Two Land Ocean Transects Across Costa Rica and the Middle America Trench	
	Dixon, Univ. of Miami; Schwartz; Dorman	
	8/15/1999 – 7/31/2002	OCE 99-05469

One important aspect of the Margins/SEIZE initiative has been the study of the up-dip limit of the seismogenic zone, and factors influencing its location (e.g., thermal state, nature of subducting sediment).

One way to investigate this limit is to look at the distribution of small and medium interseismic earthquakes ("microearthquakes") on the seismogenic plate boundary, which can be well-imaged by joint offshore (OBS) – onshore (IRIS/PASSCAL) seismic observations.

We compared the distribution of such earthquakes with the distribution of locked and creeping patches of the seismogenic plate boundary in Central America, as inferred from inversion of dense, high precision GPS observations in the Nicoya peninsula of northern Costa Rica (Fig. 1a).

The data show that interseismic microearthquakes do not define the up-dip limit of the seismogenic zone at this location. Rather, these earthquakes tend to occur on sections of the plate boundary that are inferred to be creeping based on the geodetic observations. However, the up-dip limit of the rupture areas of past large earthquakes does appear to agree with the up-dip limit of the geodetically inferred locked zone (Fig. 1b).

In other subduction zones, where the geometry for land-based geodetic observations may be less favorable compared to northern Costa Rica, estimates of the up-dip seismogenic limit based solely on interseismic microearthquakes should be treated with caution.

Our observations of locked and slipping patches in the Costa Rica seismogenic zone based on dense geodetic observations suggest that inferences of "partial coupling" at other subduction zones might be better represented by alternating locked and creeping sections.

Comparison of seismic and geodetic data in northern Costa Rica is helping us to better understand the nature and location of strain accumulation and release throughout the seismic cycle; although longer term observations are required (different parts of the earthquake cycle may exhibit different patterns of strain accumulation). The possibility that coupling patterns may change throughout the seismic cycle needs to be considered.

Figures and Captions

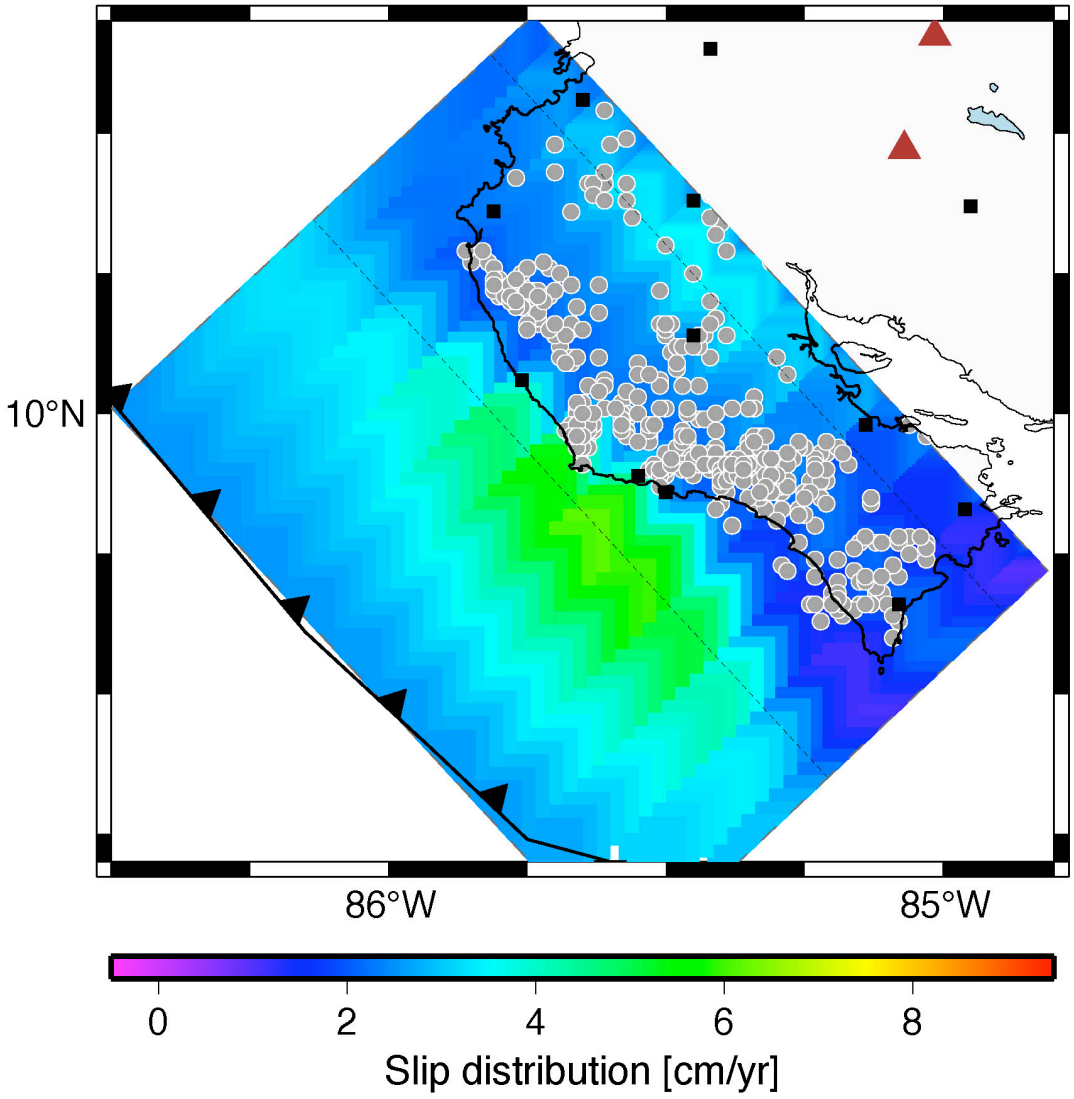

Figure 1a: Comparison of well-located interseimsic small earthquakes in northern Costa Rica recorded by an OBS (offshore) – PASSCAL (on-shore) network during 1999-2000 compared to patches of locked slip from inversion of GPS data acquired during 1994-2000. Interseismic earthquakes reach an up-dip limit about 50 km from the trench; maximum locked slip (~ 6 cm/yr) is centered about 35 km from the trench.

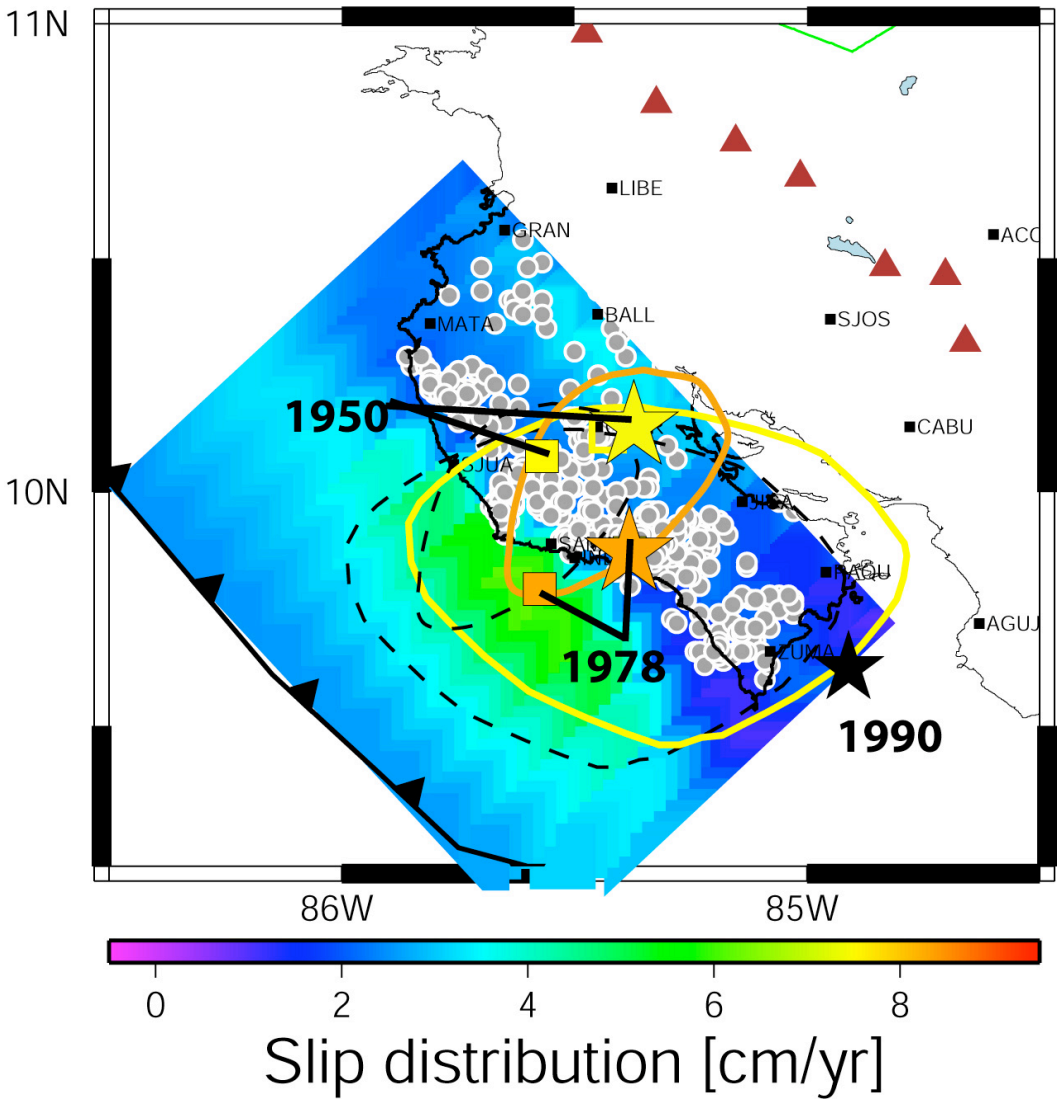

Figure 1b: Rupture areas of past large earthquakes versus size of locked slip patches from inversion of geodetic data. Stars show relocated positions relative to the 1990 event. Note that the up-dip limit of the rupture areas of past large earthquakes corresponds approximately to the up-dip limit of the geodetically determined locked zone.

Publications and Presentations

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Norabuena, E., T.H. Dixon, S.Y. Schwartz, H. DeShon, M. Protti, L. Dorman, E. R. Flueh, P. Lundgren, A. Newman, F. Pollitz, D. Sampson, Geodetic and seismic constraints on some seismogenic zone processes in Costa Rica, *J. Geophys. Res.* (submitted)