INTERSEISMIC UPLIFT IN THE GUERRERO SEISMIC GAP, MEXICO, FROM LEVELING OBSERVATIONS

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A study of the vertical surface deformation (uplift) along profiles perpendicular to the coast provides important data for understanding the long-term interseismic process of elastic strain accumulation. Four leveling lines were installed in the states of Guerrero and Michoacán to measure interseismic uplift at the "Guerrero seismic gap". These profiles are 10-15 km long and have the following locations: (i) south of Acapulco, (ii) in the middle of the seismic gap (Atoyac), (iii) in the northern part of the gap (Barra de Potosí), and (iv) near Playa Azul (the central part of the rupture zone of the 1981 and 1985 Michoacán earthquakes). Up to date, several, subsequent, one-year period, high-accuracy leveling surveys have been carried out on these profiles. The vertical uplift rate across the Guerrero coastal region was determined through the changes in repeated leveling surveys. The relative rate of coastal uplift is 7-10 mm/yr measured on baselines ~15 km-long at the!

Barra de Potosí, Atayac and Acapulco profiles. An important finding shows that the tilt on the Atoyac line is opposite (tilting off land) to the one observed on the other lines (inland tilt). These results are compared with the uplift rate distribution calculated from elastic dislocation models for different subduction, thrust fault angles and various widths and locations of the locked zone. A model with a thrust fault angle of 12° and a completely locked zone of ~40-45 km width starting at ~55 km from the trench axis gives a good fit to the data in the Acapulco and Barra de Potosí lines. Nevertheless, the observed uplift rate on the Atoyac profile is in contradiction with a reasonable location of the "interseismically coupled" zone. The latter observation could be explained by the occurrence of mostly aseismic slip in the gap or even by an unusual, extremely slow rupture. The GPS data collected in 1996 and 1998 in Guerrero should provide a more definitive conclusion to these hypotheses.

POSTSEISMIC MOTION FOLLOWING THE 9 OCTOBER 1995 GREAT JALISCO EARTHQUAKE: WHAT MODELING FOUR YEARS OF GPS OBSERVATIONS CAN TELL US ABOUT FAULT SLIP ALONG A SUBDUCTION INTERFACE

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On 9 October 1995, a magnitude 8 earthquake ruptured the Rivera-North American subduction interface just offshore of the state of Jalisco. This earthquake, combined with a pre-existing GPS network, and four years of observations, have provided a unique and unparalleled opportunity to analyze the behavior of a subduction interface during the individual phases (coseismic, postseismic, and early interseismic) of a seismic cycle.

We have inverted four years of observed surface displacements in order to map both the distribution and magnitude of slip occurring on the subduction interface. Each epoch represents a snapshot of fault slip evolution. Our model results show coseismic fault slip of up to five meters occurring in two main rupture patches which we interpret as a smeared view of the main rupture and its northwestern migration. Models of subsequent postseismic epochs suggest that the slip decreases in both areal extent and magnitude while the locus of slip shifts slightly downdip in relation to the coseismic rupture. The downdip extent of slip is limited by the maximum depth of the seismogenic zone. We do not observe modeled slip deeper than perhaps 40 km and interpret this depth as the downdip limit of interplate coupling. Models of the first two postseismic epochs show a decrease in magnitude of fault slip, while those of the third year also show a reduction in areal extent of the slip. Our inversion results are well supported by an analysis of the decay rate for the horizontal components of displacement. These data are well fit by a logarithmic trend suggesting that the mechanism is continued slip along the subduction interface and not viscoelastic relaxation of the asthenosphere.

In 1998 we began to observe a subtle shift in the horizontal displacement direction, thus signalling a return to interseismic conditions. That is, the southwesterly directed coseismic motion of the coastal sites began shifting to the northeast in the interseismic direction. Sites further inboard and thus reflecting fault motion further downdip continued to move in the coseismic direction until 1999. This gradual change in direction, beginning with coastal sites and progressing inboard suggests that the subduction zone is now in the process of locking and that the plate boundary is returning to a state of strain accumulation. We suggest that the locking has begun in the upper portions of the fault interface and is gradually migrating downdip.

A POSSIBLE STRESS INTERACTION BETWEEN LARGE THRUST AND NORMAL FAULTING EARTHQUAKES IN THE MEXICAN SUBDUCTION ZONE

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A large, nearly-vertical, normal faulting earthquake (Mw=7.1) took place in 1997 in the subducting Cocos plate just beneath the ruptured fault zone of the 1985 Michoacan, Mexico, earthquake (Mw=8.1). We investigate if there is any possible stress interaction between the two large events, through a 3D analysis of coseismic stress change due to the first event, together with some qualitative considerations on its postseismic change, and from the dynamic rupture process of the second event. The calculated maximum coseismic increase in the vertical shear stress and in the Coulomb failure stress in the subducting plate at depths below 30 km beneath the high stress-drop zones of the 1985 earthquake was found to be of the order of 0.4-0.8 MPa. The 1997 earthquake took place in this zone of maximum stress increase. The dynamic rupture pattern of the 1997 event appears consistent with the pattern of stress increase due to the 1985 event. Possible postseismic stress changes due to
the subduction process or to the loading of the overriding continental lithosphere, and from aseismic slip if it actually existed, would all enhance the coseismic stress change and hence the chance of occurrence of a normal faulting earthquake in the subducting plate. All the above evidence suggests that the 1997 nearly-vertical, normal faulting earthquake occurred under stress transfer from the 1985 large thrust event to the interior of the subducting Cocos plate.

**SGEOD-04**

MINI-RED DE MEDIDORES DE DEFORMACIÓN SUPERFICIALES EN LA ZONA SUR DE LA FALLA IMPERIAL (BAJA CALIFORNIA, MEXICO) PARTE II

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Con el objetivo de establecer cualitativamente algunos de los procesos de deformación en la zona del Valle de Mexicali, se han continuado con las mediciones con la mini-red de medidores de deformación en el área. Además, durante el año de 1999 se instalaron dos hidrófonos dentro del Campo Geotérmico de Cerro Prieto en los pozos fríos PZ2 y PZ12, con la meta de mejorar la precisión de la localización de los eventos sísmicos locales.

En este trabajo se muestran dos años de mediciones de extensión vertical y horizontal en la Falla Imperial y cambios de inclinación. En este periodo se observó un sismo de magnitud $Md = 5.1$ con mecanismo focal normal el 1º de junio 1999 el cual se registró en los aparatos de la red.

Las deformaciones inducidas por este evento tienen amplitud pequeña comparado con algunos eventos de creep registrados anteriormente. La dirección de deformación es similar a la tendencia observada desde 1998.

**SGEOD-05**

PRELIMINARY RESULTS OF THE INTERSEISMIC SURFACE DEFORMATION IN THE GUERRERO GAP, USING GPS

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In 1992 we established a network of 21 GPS sites in the Guerrero Gap region. We subsequently re-measured some of the sites in 1996. In 1998 eleven sites were added along the coast and also perpendicular to the coast from Acapulco to Chilpancingo. We are in the process of analyzing all of the Guerrero GPS data in a consistent reference frame. We processed these data with the JPL software, GIPSY/OASIS.

At this time we have preliminary results from six stations along the coast, Acapulco, four to the northwest and one to the southeast of Acapulco. The northwest sites all show significant motion with respect to Acapulco, in the direction of relative plate motion between the North American and Cocos plates. The magnitude of the motion increases with distance from Acapulco.

To the south, we see motion in the opposite direction, suggesting that there is a change in how the crust is responding to strain accumulation.

With these few sites, it would be much too speculative to say something more without doing some modeling, however these results are consistent with other results obtained from a study done in the region using leveling data and which will be presented in this same session by Kostoglodov.