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The 2001-2002 aseismic slow slip event and an interplate coupling in the Oaxaca subduction zone, Mexico

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A GPS (Global Positioning System) network has been established in the Mexican state of Oaxaca with the aim to understand the subduction-related seismotectonic regime in the area. Permanent GPS stations have been operating since 2000. Data from campaign GPS sites have been acquired every year for the period between 2001 and 2004. The observed average displacements corresponding to the epochs of 2001-2002 and 2002-2003 differ significantly from the crustal displacements for the apparent interslip steady state phase, the epoch of 2003-2004. Continuous GPS stations in Guerrero (the neighboring state to the NW of Oaxaca) recorded a large slow slip event (SSE, or silent earthquake) in 2001-2002 and a smaller SSE in 2002-2003. At least two continuous stations of the Oaxaca GPS network registered a propagation of 2001-2002 slow slip event from Guerrero to Oaxaca. The anomalous displacements observed on the campaign GPS sites in Oaxaca may be attributed to the effect of the 2001-2002 slow slip event. The average 2001-2002 and 2002-2003 epoch displacements are the sum of the interslip steady state and the slow aseismic slip displacements. The latter can be modeled by a displacement pulse propagating along the Guerrero-Oaxaca coast. The model helps to identify the undisturbed interslip epochs at each GPS site which can be used to estimate the interplate coupling in the Oaxaca subduction zone. Simple dislocation models show that the coupled interface in the Western and Central Oaxaca extends from $\sim$55 km to 210 km from the trench, along with the coupling decreasing down dip from $\kappa \approx 1$ to 0.7. For the Southern Oaxaca the coupled zone,

with $\kappa \approx$ 0.6-0.7, is less then 60 km, located from 40 km to $\sim$100 km from the trench. This drastic difference in the average coupling extension from the Central to Southern Oaxaca subduction zone is obviously related with a change in the plate interface geometry.