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Crustal deformation in northern Peru Andes derived from GPS measurements

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The fast subduction of the Nazca plate beneath the South American continent results typically in two main processes, including elastic stress accumulation along the plate interface that produces moderate to large earthquakes, and permanent deformation of the overriding plate. The northern Peru 600 km-long subduction segment (Lat. 3ºS to 9ºS), nonetheless show a different behavior; no large earthquake (M>=8) has been reported nor recorded in this area since the XVI century (when historical records started) (Dorbath, et al., 1990; Nishenko, 1991), suggesting that this portion may either be aseismically slipping or accumulating enough stress to produce a giant earthquake. This segment in contrast is characterized by hosting moderate-size tsunami-earthquakes (<=7.6), like the ones occurred in 1960 offshore Piura and in 1996 offshore Chimbote (Pelayo and Weins, 1990, Ihmle et al., 1998). Geodetic studies of interseismic deformation carried out during the last ten years at the scale of the northern Andes and the whole Peruvian subduction zone show this area accommodates the convergence predominantly through steady aseismic slip (Villegas-Lanza et al., 2016), although some isolated moderate-size areas may accumulate strain released through tsunami-earthquakes and mixed seismic and aseismic processes (Villegas-Lanza et al., 2015). On the other hand, the GPS velocity field shows that the inland crustal deformation in northern Peru is consistent with a southeastward motion of a sliver at a rate of 4-5 mm/yr extending from southern Ecuador to the Bolivian Altiplano. This sliver named as the Inca or Peruvian sliver has been proposed to laterally extend initially from the trench in the west to the Subandean fault systems and secondly to the Marañon valley that defines the limit between Western and Eastern Andean cordilleras (Nocquet et al., 2014; Villegas-Lanza et al., 2016), however, few GPS observations measured for that studies do not allowed to determine a more plausible limit. Here we present a new GPS velocity field including new campaign GPS sites and observations measured and collected during the past four years in the northern Peruvian Andes subduction zone, extending from the coast towards the Subandean ranges. Our results consist first on an evaluation of the consistency of the sliver motion, second on the assessment of the remaining interseismic crustal deformation due to the coupling at the plate interface, and third an evaluation of the internal deformationof the Peruvian forearc sliver and its possible eastward limit.

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