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High Holocene coastal uplift gives insight into the seismic behavior at the Arica Bend (Peru-Chile subduction zone)

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The Peru-Chile subduction zone offshore of the Arica Bend (18.3° S) is characterized by a seaward-concave geometry, which represents a very uncommon tectonic setting. Several published estimates of plate coupling suggest that the locking degree in the curved segment may be significantly lower than to the north and south of it, however, the lack of historical slip events hinders a full understanding of the seismic behavior in this particular portion of plate interface. We have mapped a terrace located at 35 m a.s.l. ca. 3 km onshore from the mouth of the Lluta river, which debouches immediately to the north of Arica. The sedimentology of the terrace has been described and three wood fragments embedded therein have been collected for radiocarbon dating. In addition, we compared the long stream profile of the Lluta river with its modeled steady-state profile, aiming to detect any possible tectonic perturbation along the trunk stream. Results show that the dated terrace consists of a thin storm deposit embedded within fluvial delta conglomerates, which have been most likely deposited near sea-level at ∼10 ka. We thus infer that the coast of the Arica Bend, although characterized by long-term quiescence, has undergone remarkable uplift (∼5 mm/y) throughout the Holocene. The vertical displacement has been inferred at roughly 175 km from the trench, which corresponds to the landward termination of the locked zone. Considering this structural position and the long-term absence of coseismic events in this trench segment, we propose that the inferred uplift signal might be related to interseismic flexural buckling, which does not result in permanent crustal deformation. Contrariwise, in the adjacent coastal regions north and south of the Arica Bend, repeated seismic cycles have resulted in long-term permanent crustal deformation, as observable in the uplifted Coastal Cordillera.