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A Giant Kink in the Subducted Nazca Plate

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A 3D model of the subducting Nazca Plate has been constructed based on hypocenter locations and mantle tomography. A giant vertical kink in the subducted slab has been recognized beneath Bolivia. This is potentially the largest fold so far recognized in our planet, ∼550 km in length, and visible from ∼400-700 km depth. It has formed where the slab is pushing vertically through the mantle transition zone. The kink has resulted in at least one devastating earthquake with moment magnitude, Mw = 8.2, so its geodynamic origin is of general interest. In this contribution we demonstrate that we can restore the 3D model of the inferred geometry back to the planet surface without requiring rips and tears in the subducted lithosphere. By this means, we demonstrate that our 3D model is feasible, and show that the kink may be nothing more than a geometrical consequence of subduction in a spherical Earth. By the time it reaches ∼600km deep, the descending slab must be shortened horizontally by ∼10%, which is what is geometrically necessary to produce the giant kink. By floating the 3D geometry back to the planet surface, we can show that the kink geometry per se did not require the subducting slab to have ripped or torn. However, the question of how such a large scale instability might have amplified raises phenomenological issues of considerable significance.