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Evidence of active detachment in the Taiwan arc-continent collision based on new crustal-scale geologic cross-sections

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The ongoing oblique arc-continent collision in Taiwan between the Eurasian continental margin and the Luzon island-arc of the Philippine Sea Plate provides a classic spatial view of the temporal evolution of an orogen from accretion to collision. We have constructed crustal-scale geologic cross sections through the Taiwan orogen at various latitudes, integrating local earthquake tomography and gravity data. Relocated earthquakes and a database of >1600 focal mechanisms of ML$\geq$4 events allow accurately constraining seismogenic faults to mid- and lower crustal depths. A salient feature of our analysis is the progressive steepening of the downgoing Eurasian lithosphere slab from subduction and accretionary-wedge tectonics south of Taiwan to a subvertical plate boundary under central and northern Taiwan. In central Taiwan the deep plate shortening is accomplished by folding of both the lower-plate Eurasian and upper-plate Philippine-Sea lithospheres without an active subduction zone. A restoration of the total thrust belt shortening along this transect places the inferred footwall cut-offs at about 70 km depth along the presently subvertical plate boundary. Yet substantial shortening is still transmitted into the external parts of the thrust belt along this transect, as evidenced by the Mw 7.6 Chi-Chi earthquake in 1999. This suggests deactivation of the internal parts of the initial main detachment by its progressive tilting into an orientation unfavourable for slip transmission. We presume that Central Taiwan is at present characterised by actively ongoing mechanical and kinematic separation of the detached upper crust from its lithospheric root, with a new basal detachment forming in a hangingwall shortcut position.