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Interactive comment on "Density structure and geometry of the Costa Rican subduction zone from 3-D gravity modeling and local earthquake data" *by* O. H. Lücke and I. G. Arroyo

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We appreciate your comments and welcome your observations. To the four main questions we reply as follows:

1. The slab geometry proposed in southeastern Costa Rica:

The steepening of the slab in southeastern CR is modeled according to the geometry observed in the seismicity and the gravimetric response of the density model. We interpret that the earthquake hypocenters show a distribution in depth consistent with a steep slab which constrains the geometry of the plate interface of the density model. Hence, the steepening of the slab at 50km from the trench has been modeled in order to accommodate the geometry outlined by the earthquakes. The gravimetric response of the modeled geometry along with the presence of a continuous slab fits the measured gravity data.

2. The gravity model:

The wide angle seismic data from the mentioned authors has been incorporated into the model in two ways. First, interfaces such as the Moho and top of the slab from wide angle seismic data were incorporated as constraints for the geometry. Second, the seismic velocities from Vp were used to constrain the density of the modeled bodies via empirical formulas which are used to obtain density from Vp. The results were considered as a start model from which the densities were modified to achieve best fit with the measured gravity. Since the bodies (or polygons) resolved by the seismic data do not coincide exactly which those of the density model, ranges of Vp were considered and not discrete values. The obtained densities are well inside those ranges shown by the Vp constraints. A summary of the densities constrained by Vp has been published previously by Lücke (2014) and is not explicitly included in the current manuscript. Since it was deemed redundant, we chose to refer the reader to Lücke (2014) for details on seismic constraints.

3. Shallow seismicity under the Talamanca Range:

Shallow seismicity under Talamanca Range is considered to occur on the crustal domain (see figure 4d). The moho depths from Airy type isostasy and receiver functions from Dzierma et al. (2010) as well as the Moho depth from Lücke (2014) show a depth greater than 35 km this means that the shallow seismicity under Talamanca occurs in the crust considering the preferred model with a continuous slab. This is an argument against a shallow moho required by the alternative slab detachment model shown in figure 6, a shallow Moho would require an alternative interpretation for the shallow seismicity.

4. Normal faulting along Cocos Ridge:

The ridge is affected by normal faulting. The argument is that the faulting is not pervasive as it is for the NW smooth sector and the Seamount Province. Furthermore, by considering the abnormal crustal thickness for the ridge (18.5 km from Sallarès et al. (2003); 21 km for this model) it is unlikely that the faulting cuts through the Moho and serpentinizes the upper mantle in the same way and extent that it does for the other segments.

With regards to the technical corrections, we appreciate the input and we will incorporate the corrections in the revised version of the manuscript.

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