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Interactive comment on "Variations of the crustal thickness in Nepal Himalayas based on tomographic inversion of regional earthquake data" *by* I. Koulakov et al.

Anonymous Referee #2

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In this manuscript, the authors present a new P-wave and S-wave velocity model for the Himalayas region and interpreted the bottom of the shallower negative P-wave velocity perturbation as the crust-mantle boundary. The seismic velocity model is computed using a regional seismic tomography code. About 800 stations, 10000 P-and 5000 S-phases are used, with a fair coverage of the central portion of the investigated volume. The results are compared with maps of gravity and magnetic anomalies. Thinned crust is interpreted as weaker crustal section, possibly related to the presence of thick sedimentary layers, where less intensive shortening occurred in the past. On the other hand, thicker crust is interpreted as stronger crustal section due to past magmatic intrusions.

Overall, the manuscript is clear and well-organized and the figures are acceptable, with some minor changes. However, the results presented are not convincing, mainly due to the sparsity of the data-set (as recognized by the authors) and due to the assumptions adopted to "measure" the Moho depth in the region. Also, as mentioned by the authors, a number of "measures" of Moho depth have been previously published in the last decade. The authors shall explicitly illustrate how their results improve our knowledge of the Moho depth in the area with respect to old studies. In my opinion, a major revision is needed before considering the manuscript for publication on Solid Earth. In the following, I list my minor and major issues.

Major points.

(A) Absolute P-wave velocity value. In general, a seismic velocity models should be presented using the absolute seismic wave velocity instead of the velocity perturbation with respect to a 1D initial model. This fact can improve the readability of the model for a wider audience. In this particular case, where the Moho depth is mapped across the P-wave velocity model, absolute P-wave velocity values are strictly required. The crust-mantle boundary should be presented as the transition to mantle P-wave velocity (e.g. 8.1 km/s).

(B) Too subjective choice of the Moho depth. Mapping the Moho depth using a subjective velocity perturbation can be misleading. I strongly recommend to picking a velocity for the mantle and track it through the model. To avoid subjective choice of the P-wave velocity, different P-wave velocity values can be selected and different Moho maps can be presented in the Supplementary Materials.

(C) Comparison with previous Moho depth estimates. As correctly reported by the authors, a number of previous studies mapped the crust-mantle boundary in the area. I expected to find some figures (e.g. the three profiles) where the authors presented their results compared to previous measures of Moho depth. For example, plotting punctual measures from Receiver Function analysis for stations deployed along the three profiles. This part of the analysis is completely missing from the manuscript. The author must add a section in the manuscript illustrating how their results improve the previous knowledge on the Moho depth in the area.

(D) Resolution. The data coverage is fair in the central portion of the study area, but is quite poor in the rest of the volume. The authors report the results of a number of synthetic test to assess the resolution of the data (and the technique) in the area. The well-resolved area seems to be highlighted in Figure 4, where map of the Moho depth is plotted only for the central portion of the study area (but this is not clearly indicated in the figure caption). The authors should illustrate in the text the criteria used to evaluate the resolution in the model and indicate the position of the well-resolved volumes in all the figures (i.e. in the cross-sections in Figures 2 and 3).

Minor points.

Figure 2. The figure can be improved showing the synthetic model used to compute the synthetic travel time. This plot can help the reader to better evaluate the resolution of the data in the region. As discussed in point (D), the boundaries of the well-resolved area should be plotted in this figure.

Figure 3. As for Figure 2, well-resolved area should be clearly highlighted in this figure. Also, using absolute value can be useful to the interpretation of the dashed line along profile A2-B2.

Figure 4. Well-resolved area must be clearly highlighted also in the maps of magnetic and gravity anomalies. Traces of the profiles reported in Figures 2 and 3 should be plotted (at least, in Figure 4A).

Interactive comment on Solid Earth Discuss., 6, 2867, 2014.