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Solid Earth Discussions

Interactive comment on "Seismicity at the Rwenzori Mountains, East African Rift: earthquake distribution, magnitudes and source mechanisms" *by* M. Lindenfeld et al.

Anonymous Referee #1

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General comments;

This manuscript addresses a heterogeneous distribution of seismicity and focal mechanism within the Rwenzori Mountains area in the western branch of the East African Rift. Deploying temporary seismic network, many earthquakes seem to be relocated with higher accuracy than previous studies. Vertical sections of the seismicity indicate that the maximum focal depths vary significantly within the Rwenzori area. It is interesting that there is no seismicity within the uppermost 10 km beneath the rift valley, whereas beneath the rift shoulders seismicity range from the surface to the Moho depth. The authors discuss this lateral variation of seismicity linking with that of Moho

depths derived by teleseismic receiver functions imaged by a previous study. This is nice paper that I think could be published in SE. However, before the publication, several revisions are needed. I have some major comments about the concentration of earthquakes at 16 km depth (velocity boundary), and interpretations of Moho depths, in addition to minor comments.

Specific comments (individual scientific questions/issues);

As authors claimed, the depth distribution of earthquakes shows clear maximum of activity at 16 km in Fig. 7. However, this depth of 16 km corresponds to a velocity jump in assumed velocity model to relocate earthquakes (Table 1). Horizontal concentrations of earthquakes near a velocity boundary are frequently caused by an insufficient coverage of seismic network. Indeed, sharp concentrations of earthquakes are clear at transects C1-C2, D1-D2 and E1-E2, where the seismic network is sparse. Thus, I wonder that the horizontal concentration of earthquakes at 16 km depth (velocity boundary), that is interpreted to be a stripe, is apparent due to insufficient coverage of the seismic network. It is needed to check how the depth-distribution of hypocenters changes if you employ different sets of velocity models including a simple half-space velocity model.

You discuss that the seismicity seems to trace the upper and lower edge of a low velocity zone (LVZ) that was identified by receiver function inversion in Figure 9 (E1-E2). Show a histogram of travel-time differences between S and P-waves for the upper and lower edge seismicity at almost the same epicentral distance. The histogram having two peaks against depth strongly supports the author's model.

P575; Along C1-C2 section, there is no significant change of Moho depths between NGIT and KASS (25 km and 24 km, respectively), while the depth distribution of seismicity shows lateral change corresponding to the rift system. It is possible to re-interpret the Moho depth at NGIT, as well as SEML? If no, why can you re-interpret the Moho-depth at SEML? Detailed explanations about the re-interpretation of Moho

depth should be added.

To determine focal mechanisms using SV/P amplitude ratios, it is better to take some station corrections of SV/P amplitude ratios into account (e.g., Hardebeck and Shearer, 2002). Do you include the station correction terms?

The authors documented that 2% of the analyzed events are pure thrust faults. Where are they located in the rift- system? Are they clustered?

Interestingly, a similar little seismicity in the top upper curst has been reported from the ancient rift system buried beneath the thick sedimentary basin (Kato et al. 2009). Thick sedimentary layer may show aseismic deformation, resulting in little seismicity in the top upper crust. The seismicity in Rwenzori Mountains area is similarly argued to relate to rift structure.

Technical corrections;

p570; State the location errors for horizontal and vertical directions independently.

What is meaning of “a crustal root”? Please explain it in the text. It is better to add some discussions about the crustal root.

In each cross-section in Figure 9, add horizontal locations of the rift valley and rift shoulders, to make reader easily identify these locations.

P576; a strong velocity degrease -> a strong velocity decrease?

In Figure 12b, add the data points of SV/P amplitude-ratio for each station.

Interactive comment on Solid Earth Discuss., 4, 565, 2012.