

## ***Interactive comment on “Seismic structure of the lithosphere beneath the ocean islands near the mid-oceanic ridges” by C. Haldar et al.***

**C. Haldar et al.**

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Specific comments/questions: Q1. Please clearly separate introduction, data, results and discussion.

REPLY: We have now separated the Introduction, data, results and Discussion sections. However, Results and Discussion sections are still merged into one section, since the we don't have enough stations and exhaustive results leading to far fetching interpretations. Here try to be modest.

Q2. How your results compare to published results, including wide-angle seismic studies? Provide adequate references.

REPLY: The crustal models are primarily based on the wide-angle information. We

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have now cited a number of references comparing our results with the published ones. We also added another reference to a paper that appeared recently.

Q4. Up to now it is not clear to me, what are effects of the MORs and of the plumes assumed beneath the ocean islands.

REPLY: Out of 5 stations used, we find indications of an additional low velocity layer below the LAB, at 2 stations. Taking clue from the findings of Montagner and Ritsema (2001), we interpret these features in terms of ridge-plume interaction. We think that these LVL might relate to the magma present below the mid-oceanic ridge.

Q5. How your results compare to other seismological studies on ocean islands?

REPLY: There are few active seismological studies in our study region. However, for station RPN, results from passive seismology are available from the works of Heit et al., (2007) and Rychert et al., (2007). Our results are in agreement with theirs. The result for the station ASCN is consistent with the observations by Li, et al (2003a) and Evangelidis et al., (2004). These are now mentioned in the text at relevant places.

Q6. Please discuss also from a petrological point of view, if your models presented in figure 3 make any sense? How these models compare to other models globally?

REPLY: In view of our lack of expertise on petrological aspects, we refrain from such a discussion. We have discussed our results with other seismological studies from a few places on the globe.

Q7. How relevant are the results (especially for the mantle transition zone) away from the islands?

REPLY: We mentioned in the text that our TZ results may not truly represent the ocean Islands, since the piercing points of the Ps conversion from the 410 and 660km discontinuities are far from these. However, they provide information on the TZ structure of the oceanic plates in a manner similar to the work of Kawakatsu et al (2009, Science) who analyzed the BBOBS data on the old oceanic plate away from ridge. They show a

simple lithospheric configuration.

Q8. How did you estimate your uncertainties? Are they realistic?

REPLY: The errors are the standard error based on bootstrapping technique. Here we took 2SE, which we think is fine for our RF case.

Technical corrections/questions: page 1642, lines 17-19, sentence not clear to me

REPLY: We have now rewritten the sentence as also suggested by Reviewer #1

line 20, better "oceanic lithosphere"?

REPLY: Change made

line 24, please correct reference (name)

REPLY: Corrected

page 1643, lines 5-6, sentence not clear, what you want to say?

REPLY: We have rewritten the sentence to improve clarity.

line 8, what kind of tomography, what is about the second reference?

REPLY: Now we have included.

line 9, what means a "few seismic ... studies", please provide appropriate references!  
correct names

REPLY: Appropriate references are added with correct names.

line 28, "the deeper structure ..." - why?

REPLY: We have clarified this point in the text

page 1644, line 8,  $M_b > 5.5$ , did you really use events with that low magnitudes? Why then only that few events are listed in Table 1

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REPLY: This is a general problem for stations located on the oceanic islands. Most of the traces have very low signal to noise ratio where even the P-waves are not visible. We picked only the clear P-waves in the vertical component for further analysis.

line 15,  $\delta$  is quite low for deviations in incidence angle, it could strongly deviate because of shallow seismic structure of the ocean islands

REPLY: This is the threshold we kept to get good quality data set.

page 1645, lines 1-2, what is about multiples???

REPLY: We allow the multiples to be modeled. We now clarify this in the text.

line 10, "other studies" - what are the references? How your results compare to these studies?

REPLY: As mentioned by us, we use crustal models from the other studies as constraints for our forward modeling. In the absence of such information, we considered similar values. We have cited few more references (line 112-113).

lines 11-12, What is the basaltic layer? I think there are better references, which should be used!

REPLY: we have added the more references

lines 14-15, where is the "low velocity layer" for station PSCM?

REPLY: This is typographical mistake. We were referring to station ROSA.

lines 17-23, introduction?

REPLY: We introduced a line as introduction.

lines 24 ff, what are uncertainties, where do they come from?

REPLY: The uncertainties come from bootstrap resampling technique.

page 1646, lines 3-4, references?

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REPLY: Reference added.

lines 11-12, reference? What are the differences to the other islands?

REPLY: Reference added. The differences to the other islands are not dealt with, since they are beyond the scope of the present work at the moment.

line 19, "correspond to an oceanic LAB" - what else?

REPLY: Seismologically, what we observe is a negative polarity phase and we are interpreting this phase as a LAB.

page 1647, lines 3-4, reference?

REPLY: Reference added.

lines 7-10, argumentation is too short, even it might be true could you support your assumptions with modelling or references?

REPLY: Few sentences have been added in support of the argument.

line 21, "Low Velocity Layer" – where?

REPLY: We mean the sub-lithospheric low velocity layer

line 22, there is not only "an additional negativ phase", but for most stations more of them. However, the questions is, if these phases are significant?

REPLY: That's why we do not emphasize these observations. However, there are a few stations where these LVLs are just above the  $\pm 2SE$  error bounds.

lines 24-25, are these studies appropriate for your region?

REPLY: Yes.

page 1648, lines 1-4, to me it is not clear how you discriminate between effects from plumes and MORs. Maybe a station far distant from any MOR might help to compare

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REPLY: Yes, you are absolutely right, we are not confident enough about these two causatives. We just took the idea from the others work (reference mentioned), that the LVLs observed in our traces might represent features as interpreted by workers like Nowlacki and Montagner & Ritsema. We think that our results present an interesting corroboration to the findings based on surface wave data.

lines 5ff, discussion presently not clear to me, which plumes you mean?

REPLY: We mean the mantle plumes which are shallower.

line 16, why not "7 km"?

REPLY: Now the figures are changed slightly. We paid much more attention to the modeling.

line 19, what is expected following Stein & Stein, 1992

REPLY: The expectation is that the plate should thicken with its age.

line 23, 67 s is not delayed!

REPLY: Thanks for pointing out the mistake. Now we have corrected the sentences.

lines 25-26, how far away are the piercing points (show them on a map)

REPLY: We have shown the conversion points on the map in Figure 1.

page 1649, lines 1-2, The sentence is not clear to me. Why plumes should be close to MOR?

REPLY: This is not entirely our interpretation. We perused an already exiting interpretation to explain our observations of delayed 410-660. Also, we think that this type of study is important to understand plume-ridge-lithosphere interaction.

Table 1, Please give references for ages. What are the coordinates and elevation of stations? (what is depth of surrounding seafloor?) Number of totally analysed events? Time period of observations analysed in this study.

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REPLY: We have now added references, mentioned the station coordinates and elevations in the table. Since bathymetry can be sometime highly variable, we ignore the spot values and deal only with the average values. Total data analysed are now mentioned in Section 2. Time period of the data is also mentioned in Section 2.

Figure 1, please add local maps showing the distribution of piercing points.

REPLY: The maps are now added.

Figure 2, Are all amplitudes the same? Why you did interpret some phases and did not others? What are significant amplitudes? Where are multiple phases? When you expect them from the models? Station PSCM is extremely noisy, looking at negative delay times. Why you think your phase identification is valid?

REPLY: No, all amplitudes are not same. We interpret only those phases which are above the 2 sigma error limit. We have now indicated the multiples and modelled them to constrain the structure better. We are aware that data from oceanic stations are noisy, that's why we consider only those phases which are reliable (beyond the error limits).

Figures 2/3 - How the shallow structure is constrained? Please also show L traces to get an impression on quality of the receiver functions. Please provide models also in table form.

REPLY: We have mentioned in the text that the crustal part is mainly constrained by reflection/refraction data. Now we present the inversion results also. A new figure with L-comp at each station is included (as Figure 3).

I am sorry that my review could not be more positive, but I hope that my comments will help to improve your manuscript.

REPLY: Thank you for the detailed and highly informative comments.

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Interactive comment on Solid Earth Discuss., 5, 1641, 2013.

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