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Interactive comment on "Crustal structure of southeast Australia from teleseismic receiver functions" *by* Mohammed Bello et al.

Anonymous Referee #2

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Review of

Crustal structure of southeast Australia from teleseismic receiver functions

by

BELLO, CORNWELL, RAWLINSON, READING, LIKKASON

This carefully researched and well-written contribution places solid constraints on the crustal structure of southeast Australia by the construction and inversion of teleseismic receiver functions underneath a series of high-quality seismic stations. Building on these results for the thickness and sharpness of the crust, the authors put forward

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Discussion paper

a tectonic interpretation, or rather a substantiation of earlier geological theories, involving magmatic underplating, which places the structure of the region into a proper geodynamic context.

I have relatively little to offer in the form of scientific criticism or comments on the seismological methods, which are sound, well-established, and well executed, although I am making a number of suggestions related to the presentation of the materials.

I am judging the paper primarily on its seismological merits, and not on the finer points of the interpretation. My main point related to the interpretation is that the comparison with earlier results by other authors is mostly qualitative, in the form of a color-coded figure, where I would have preferred a more detailed cross-comparison including a statistical analysis of uncertainty. How different can two crustal models made at two nearby stations be before tension develops with the interpretation? How different can two crustal models made at the same station be before we must dig into the details in order to interpret one of them as “better”, or both of them as “equivalent”? The authors leave a bit of material on the table here.

I am attaching a hand-annotated manuscript. I will number and restate my most important comments here. I will not repeat “obvious” but necessary corrections here.

MAJOR COMMENTS

L261 What are those degrees of freedom, how do you determine them? The reference to Gouveia and Scales is too vague.

L310 In the same vain. I know it is hard to formally justify, but if you have the right number of degrees of freedom, and you have the right amount of independence in the entries of the summand, the reduced-chi-squared value that you should be aiming for is 1. Are you looking at the distribution of your misfits to establish that they ARE indeed chi-squared distributed? Are you sure that you are using the right amount of degrees of freedom? Are you sure that your lowest chi-squared values are not overly optimistic

(as in: that they could be nearly perfect fits to models with too many free parameters).

L832 I assume we are talking about the same criterion here, and so the caption should explicitly refer to it.

On the whole, I would like to read more about your misfit criterion, and I would like you to make explicit the now implicit distributional assumptions made about your metric.

L831 I definitely would put the numbers in call-out boxes on the maps also. A color scale is hard to read for some, and any additional clarity that can be gleaned from a multiplicity of representation is to be welcomed.

L835 Let the caption teach us how to read the top and bottom axes in the left-hand panel.

L850 Again, it is hard to see differences when they are presented on a busy colored map in a smooth gray-scale representation. A table would be nice in the main text. Spell out the differences, attempt to make sense of them relative to their uncertainty and their spatial proximity. Make us confident that your study is not just "another opinion", make us confident that other studies weren't just "another study", in other words: integrate the results of your an other studies and talk us through the similarities and differences. In the text, emphasize the common points and the differences, in particular in light of the interpretation.

MINOR COMMENTS

L10, L15, L26 "understanding", "this", "explains" -> those are all vague terms. After reading the manuscript it became clear to me that you had more detail in mind, some of which you have room to put into the abstract.

L17 "postulated Precambrian continental" -> I propose "putative" if the postulate refers to the fragment being "continental" or "putatively" if it refers to being "Precambrian".

L50, L55 -> Establish a consistent notation and typographical conventions

L150, L152, L186, L186 -> Fix typos and inconsistencies

L287 “relatively average to high” -> we need a basis for comparison, and a different word than “average” - in my book, values are not “average” unless they are “averages”, and you most likely mean that these values are “unremarkable”, “usually/frequently observed” (compared to what then?)

L325 -> Fix typo/inconsistency

L376 There is a lack of referencing in this sentence, which must refer to specific studies for each of the assertions made in it. Also “depicted” is not the greatest choice of word here.

L447 -> Fix typo/inconsistency

L777, L788, L791, L809 -> Fix capitalization

L798 Personally I would leave ETOPO1 out of the caption unless I was willing to put a color scale to it. At this scale and with this projection and without a color scale it’s immaterial what topography model is being used.

L802 I would label the phases with letters on the graph also, right now the colors are not all that distinct on the screen, and they won’t be on a black and white printer or photocopier, either.

END

Please also note the supplement to this comment:
https://se.copernicus.org/preprints/se-2020-74/se-2020-74-RC2-supplement.pdf

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