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Solid Earth Discussions

Interactive comment on "The lithosphere-asthenosphere boundary observed with USArray receiver functions" *by* P. Kumar et al.

Anonymous Referee #2

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The manuscript provides a straightforward but brief assessment of exciting new S receiver function results from USArray. The main point is that a negative velocity gradient is present at 50-150 km depth beneath the entire area imaged. This feature is broadly consistent with expectations of lithospheric thickness in the tectonically active western U.S., but in stable regions of the U.S. the negative gradient appears to be within the thermal lithosphere as inferred from longer wavelength surface wave imaging and heat flow. Recent views on this topic are presented in a concise and limited manner in the discussion.

Generally I think the text is well written and interesting, though more information regarding construction of the RF images is warranted. The abundance of figures and new results will attract many readers, but I get the impression the results presented

overlap almost entirely with those in Kumar et al. 2012 SRL. Below are some suggestions and comments for the authors to consider.

1. The text should include more information on how the RF images are constructed. Are the 'string-like' features in the images individual RFs? Are the RFs gathered and stacked by common mid-points? If so, what is the length-scale for stacking? The quantitative procedure for making the images should be made clear to the reader or at least provide a reference if the identical procedure has been previously used. More on the S receiver function analysis also seems appropriate (e.g., data selection criteria).

2. How was the 'LAB' interface picked – by hand or some automated algorithm? If it was automated, what is the procedure? Most sections in the figures are straightforward but in some cases it is more ambiguous.

3. The text is very brief considering the large volume of data processing and exciting new results. It seems that little effort has been made to consider the results in the context of North America tectonics.

4. A relevant reference for discussion of the MLD in North America is Chu et al. 2012 G-cubed, who use refracted phases from small intra-plate earthquakes to study lithospheric structure beneath the central U.S. with higher frequencies.

5. In addition to Currie and Beaumont 2011, Schmandt and Humphreys 2010 EPSL also suggested that portions of the flat-subducting Farallon slab may have basally accreted to North America, specifically mentioning the Colorado Plateau and Wyoming. There is a strong correlation between a high velocity anomaly in body-wave tomography and surface wave tomography (Pollitz and Snoke 2010 GJI; Obrebski et al. 2011 GJI) and greater 'LAB' depth from S RFs in this region.

6. The deep ($\sim$120-140 km) negative gradient beneath the TX/OK border is noteworthy as it is a prominent anomaly and positioned below a Proterozoic aulacogen. Any ideas why a failed $\sim$1 Ga rift would result in deepening of the LAB or MLD would be

interesting. For a reference on the large-scale geologic provinces the authors may find Whitmeyer and Karlstrom 2007 Geosphere and references therein to be helpful.

7. A minor point: The authors generally have a preference for citing classic studies (which is good), however for receiver function analysis there were many studies in decades before 2000 as I'm sure the authors are aware. Perhaps it would be appropriate to cite some of the earlier work or a review paper since the current text gives the impression that the method is only about 10 years old.

Interactive comment on Solid Earth Discuss., 4, 1, 2012.