

Interactive comment on “Seismic anisotropy inferred from direct S-waves derived splitting measurements and its geodynamic implications beneath southeastern Tibetan Plateau” by Ashwani Kant Tiwari et al.

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Review of Seismic anisotropy inferred from direct S-waves derived splitting measurements and its geodynamic implications beneath southeastern Tibetan Plateau

General Comments

The authors present new teleseismic direct-S wave splitting measurements recorded on an array in eastern Tibet. Large-scale features are similar to prior estimates from SKS splitting, but several stations which had previously reported null results now result in non-null splitting measurements. This provides evidence against a prior hypothesis

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that the subducting Indian plate may be isotropic. Perhaps the most important consequence of this study is that it provides another example of direct-S splitting with the newly developed Reference Station Technique. This has implications for other study regions where SKS coverage may be limited or researchers may be interested in complementary phases and raypaths.

In response to the fifteen review questions: 1. Yes, this paper addresses relevant scientific questions within the scope of Solid Earth. 2. The paper presents an application of a novel tool in a geologically interesting area. 3. The conclusions reached are not particularly substantial, but sufficient for publication. 4. The scientific methods and assumptions are valid and clearly outlined. 5. The results are mostly sufficient to support most of the interpretations and conclusions. However, much of the discussion focuses on prior observations and hypotheses, which are only loosely tied to their dataset. 6. The description of the experiments and calculations is sufficient. 7. The authors give proper credit to related work and clearly state their own contributions. 8. The title clearly reflects the contents of the paper. 9. The abstract provides a concise and complete summary. 10. The overall presentation is well structured and clear, but see the next point. 11. The language is not fluent and precise. Significant copy-editing is needed. I'd suggest a native English speaking editor revise. 12. Mathematical formulae, symbols, abbreviations and units are correctly used. 13. There is need of some specific clarification addressed in Specific Comments below. 14. The number and quality of references is appropriate. 15. I did not find any supplementary material.

Specific Comments

Page 3, around line 10. The authors discuss a possibility of isotropic Indian plate lithosphere. This appears to come from some previous observations of null splitting, but I would be surprised if a continental lithosphere was really isotropic. More likely, the SKS splitting sampled a near vertical path where either downwelling mantle forms a coherent downward flow pattern or the existing anisotropy is aligned vertically. Direct S splitting may sample the region differently and therefore its anisotropy comes from a

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different raypath.

Page 4, line 9. Why did you choose to remove the instrument response? Is that to improve the correlations between the target and reference stations? It's reasonable to do so, but since splitting measurements typically come from a single station, it is not commonly necessary.

At multiple points in the document, visual inspection or manual quality control are indicated and appear to have a significant effect on the final dataset. What criteria is used during this step?

Page 4, line 26. You discuss “arbitrary” splitting parameters. My understanding is these are not arbitrary, but the result of a grid search. Maybe it would be better to state that you search over certain bounds in fast axis and delay time?

Page 4, line 30 and figures 4,5,6. You show figures for one target with one reference. How do the results for a given target station vary if you vary the reference station? I could you use multiple reference stations to get at a distribution of splits. This may have important consequences based on the inter-station azimuth.

Page 5, line 11. What is the confidence level used?

Page 5, line 15. You've described what causes nulls, but more importantly, why would a station show a null in SKS splitting and non-null direct S splitting?

Page 5, line 32. What do you mean by “significant”? Usually, that requires a statistical test at some p value. Maybe better to simply state that the splitting delay times are non-negligible or non-zero or on a similar scale as is typical for SKS splitting measurements?

Page 6, line 24. The splits do not appear “very complex” at all. There is largely an east-west orientation through the west and center of your array, with a rotation to northwest-southeast in the eastern region. This is pretty much what we might expect from the SKS splitting and the idea of material extruding to the east and the flow patterns being

perturbed by strong blocks.

Page 7, line 31. I do not know what a “crush” zone is. Please clarify.

Page 9, line 2. I think the orientation of the splits are NW-SE, not NE-SW.

Page 9, line 7. Absolute Plate Motion does not require one of the plates to be fixed. So not sure what you're testing with different reference plates. It could be no-net rotation or hot spot reference frames?

Page 9, line 23. What evidence does Sol present for the point?

Page 9, line 26. No, receiver functions are not sensitive only to fossilized fabrics. They reflect the current state of the velocity structure.

Page 10, line 4-6. You've just spent the prior paragraphs tying deformation and crust-mantle coupling to splitting parameters and geodetic measurements, so why have this sentence?

Page 10, line 11. I'd say the results are inconsistent with the isotropic mantle hypothesis, but as mentioned above, that seems like a weak hypothesis anyways.

Technical Corrections

I've uploaded a pdf attachment with highlights. Most are to indicate areas where some grammatical correction is needed, but also contains in-line comments. The authors may email me a word document version at rwporritt@gmail.com and I'll edit with track changes if desired.

Please also note the supplement to this comment:

<http://www.solid-earth-discuss.net/se-2016-134/se-2016-134-RC1-supplement.pdf>

Interactive comment on Solid Earth Discuss., doi:10.5194/se-2016-134, 2016.

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