Solid Earth Discuss., 5, C152–C156, 2013
www.solid-earth-discuss.net/5/C152/2013/

Solid Earth
Discussions
Open Access

Interactive comment on "New constraints on the geometry of the subducting African plate and the overriding Aegean plate obtained from P receiver functions and seismicity" *by* F. Sodoudi et al.

W.H. Geissler (Referee)

wolfram.geissler@awi.de

Received and published: 15 May 2013

general comments:

The authors present a comprehensive overview about the Moho and slab structure beneath the Aegean region combining new and published receiver function and seismicity data. Their main conclusions are that there is widespread serpentinisation of mantle in the forearc zone and that the dip of slabs is different in the western and eastern parts of the study area. Later observations are interpreted in terms of varying temperature and dehydration. Furthermore, the authors claim to observe a low velocity zone which they interpret as the asthenosphere.

With the exception of mixed results and discussion (chapter 4) the manuscript is well-structured and the figure have a good quality. However, the deeper parts of the slab are not that "clear" in figures 5 and 6. In my opinion, some of the main points of interpretation should be strengthened in a revised version. Some of these points (e.g., variations in dip angle or conversion amplitudes) are actually unsupported so far.

specific comments:

Why there should be a "normal" Moho in the forearc? Are there alternative interpretations of the missing Moho phases from the overriding plate? Why a negative Moho contrast is indicative of a serpentinized mantle wedge? How can you differentiate between different lithologies?

Why a weak slab-Moho phase should indicate reduced dehydration (dehydration of what)? Sometimes authors mix terms "slab" and "moho". What is about geometrical effects on amplitudes of converted phases?

Why a steep slab implies lower temperatures?

What is about the transition between the western and eastern parts of the slab. It is continuous or is there a break somewhere? Could you show it in a section?

In case you really observe the lithosphere-asthenosphere boundary beneath the Aegean, are there variations in observed amplitudes that could be interpreted in relation to the position of the magmatic arc?

For me the discussion of the re-thickening of mantle lithosphere is not clear. When and why old lithosphere was removed? Can you observe it in the deeper parts of the upper mantle?

Why deeper parts of the slab should be of continental affinity? How this should work?

Can you image the top of the subducting slab?

How you explain the superposition of two slabs? Could you show your observations

also in EW sections or a final structural sketch? So far, I have problems to understand your interpretation.

The discussed evolution of the mantle lithosphere should be strengthened and supported by a sketch. I do not know the referenced articles, but if there was a widespread removal of the complete uppermost mantle and maybe lower crust, where is the evidence for widespread magmatic activities? What are alternative interpretations? Why just extension would not be enough to cause the observed thicknesses? What is about recent thermal or fluid-induced erosion from below?

Is there any interpretation for the Vp/Vs ratios? How realistic are the low values? What are uncertainties?

Are there any shallow convertors which correlate with seismic active zones?

Fig. 7 – there is an overlap of some of the boxes (P and S receiver functions), but the arrival times of interpreted phases do not coincide!

technical corrections:

Page 428, line 5 – “Moho depth”

Page 428, line 13 – what means “significantly”?

Page 428, line 22 – what means “low dip”? Please add values.

Page 431, line 17 – “hypocentre distribution” instead of “seismic activity”

Page 431, data and methodology – what is about the distribution of events, is there a bias of backazimuth

Page 432, you should give also some of the classical references to the receiver function method

Page 433, line 1 – what is a “forearc of subduction”

Page 433, lines 6+7 – what is about the forearc region?

Page 433 – maybe add observed delay times in parentheses

Page 434, line 2 – “plate interface”, please refer to a figure

Page 434 – maybe add a paragraph describing the observations of seismicity

Page 435, line 1 – what is the motivation to use conversion points at 200 km depth?

Page 435 – the location error is valid both in horizontal and vertical directions? What is the major uncertainty in the depth estimation of converters, the velocity model? What is the depth error in 200 km depth, still only 5 km?

Page 435/436 – Why you did not use a filter with lower cut-off frequency?

Page 436 – what means “shallow dip” and “larger dip”? Please provide some values.

Page 436, line 5 – why some parts are not well resolved by P receiver functions? Any idea?

Page 436, line 10 – “island arc”, Which arc do you mean?

Did you study azimuthal variations of amplitudes? Are there any effects of dipping boundaries?

Page 437 – what is the motivation for using binning and not only migration? Which migration method did you use?

Page 439, line 5 – “8%”, what does this mean in absolute velocities? Which Vp/Vs ratios did you use for the different layers? Which filter was used?

Page 439, lines 24 ff – can you show the area with the pronounced LVZ in a map?

Page 440, line 26 – “recent”?

Fig. 2 – how it looks with a lower cut-off frequency (2 or 3 s)?

Fig. 3 – which filter was used. I would strongly suggest to show more than 80 km in depth scale. I do not see the seismicity data.

Fig. 4 – I would not mark the negative phase in the Forearc a “Moho”. What is about the top (and bottom) of the subducting plate? Fig. 4b – red dotted lines close to overinterpretation?

Fig. 5 – maybe add a pseudo-depth scale

Interactive comment on Solid Earth Discuss., 5, 427, 2013.