Solid Earth Discuss., 5, C906–C908, 2014
www.solid-earth-discuss.net/5/C906/2014/

Solid Earth
Discussions
Open Access

Interactive comment on "Lithosphere and upper-mantle structure of the southern Baltic Sea estimated from modelling relative sea-level data with glacial isostatic adjustment" *by* H. Steffen et al.

P. Wu (Referee)

ppwu@ucalgary.ca

Received and published: 21 January 2014

With the addition of "new" relative sealevel (RSL) data in Northern Europe, this paper estimated the lateral variation of lithospheric thickness and upper mantle viscosity underneath. The comparison between the inferred variation in lithospheric thickness with those obtained from thermal and seismic data is also interesting. The methodologies in computing sea levels and in the inference of lithospheric thickness and mantle viscosities are those typically used today, however not all the assumptions are clearly stated (see below). The results and their interpretation are also reasonable. The following

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

points should be addressed or clarified in the revision:

1. Kaufmann & Wu (2002, EPSL 197:1-10) showed that if the ice history is known, then the current method of detecting lateral changes in lithospheric thickness with 1-D earth models by dividing RSL data into regional subsets, can give accurate estimation only if there is no lateral change in mantle viscosity below the lithosphere – otherwise the inferred lateral variations in lithospheric thickness can only be estimated qualitatively. Since both conditions are not met here, it is unclear how accurate are the estimated lithospheric thicknesses. In any case, the paper should include a discussion of this important point.

2. What is the justification of not considering the presence of an asthenosphere in the modeling? For sure, this part of Northern Europe is not that close to the continental margin as in Barents Sea, but can you be sure that it can be neglected here? In any case, some discussion is necessary. If the data can justify the absence of an asthenosphere, that would be even better.

3. I understand that the RSL data are sub-divided in regional subsets according to Lambeck et al. (1998) and Vink et al. (2007), but what are the criteria for assigning certain RSL data to a particular regional subset? For example, why are the sites in northern Denmark grouped with those of Oslo Graben? Or why not group those in SW Sweden with those in Oslo Graben? And how does assigning some of them to another subset affect the inferred lithospheric thickness? In addressing this issue, you compared the results of Lambeck et al. (1998), but it is not clear if those differences are due to the "new" data or the grouping. So, it would be useful to show the effect with the data in this paper, at least for a few cases.

4. Would be useful to have a map that shows the location of places like Fyn High, Rugen Island, Darss Peninsula, Danish Great Belt, etc.

5. In what ways are the three models in Fig. 5 different from each other physically? It might be useful to know why does the model of Priestly & McKenzie (2013) seem to

SED
5, C906–C908, 2014

better agree with the result inferred from RSL data, but not the other two models.

6. Fig. 3 shows that the lithospheric thickness (under the German Baltic Sea coast west of Darss and Poland) inferred from RSES ice model is different from that from ICE-5G. In Fig. 5, it is not clear which lithospheric thickness (from which ice model) is used? Also the effect of ice models on the finding should also be discussed more clearly.

7. Page 3, lines 234: Not clear what the sentence mean. Do you mean the relation between terrigeneous influx and sealevel rise? Line 239: For the benefit of the readers, please explain what is “threshold depth” and “Index points”. For the RSL data, how are the ages calibrated? And how are the “errors” in age determination taken into account or represented?

Minor comments: First paragraph in Abstract can be condensed; Line 44, reference for 10oC lower than today; Line 47, replace “suppressed” by “deformed”; Line 50, peripheral bulge is formed because of mantle flow from under the load to the outside and accumulate near the ice margin; Line 338, replace “can be spotted” by “was located”; Line 387, “160 km and more”? Line 459-498, would be nice to supplement this discussion with a figure comparing the results of the two studies. Actually, a table that compares the results of this study with previous studies would be very beneficial to the readers.

Interactive comment on Solid Earth Discuss., 5, 2483, 2013.