Review of SE MS "Asthenospheric anaelasticity effects on ocean tide loading in the East China Sea..." by Wang *et al.*

This paper looks at observed M_2 tides in the vertical displacement of continuous GPS stations and compares them with model tides, especially model tides for ocean loading. The paper starts with an excellent depiction of where the differences in loading from anelastic and elastic Green functions are largest; the authors choose to look at the region around the East China Sea.

The authors examine a wide range of ocean tide models for this region, including many global models, though in the end they focus on predicted load tides from the regional model of Matsumoto *et al.* (2000), NAO99Jb, which they choose based on their own tidal analysis of sea level from 75 tide gauges. (They also use a global model, but this will make only a small contribution). They find that NAO99Jb provides a much better RMS fit (Table 2) to the observed M_2 ocean tide at these gauges than any of the global models. Computing the ocean loads with NAO99Jb and a PREM Green function, they find misfits to the observed M_2 vertical displacement tide. These can be reduced by using a local crust-mantle model instead of PREM, and also by allowing for anelastic dispersion. Their final choice is a modification of the local model with a shallower asthenosphere.

The extraction of observed M_2 tides from the data, the computation of Green functions from the different models, and the load computation have been done well: an impressive amount of work. Despite this, I think the paper requires major revision, because some of the choices made are not well justified, and also because the paper draws conclusions that do not seem well supported by the data.

To make a general point at the outset, using RMS as the sole measure of disagreement is hazardous. For example, in Figure 2, how do we know that the large RMS on the coast of China is not just one badly discrepant model rather than a Gaussian-like scatter? Or, alternatively, perhaps this RMS is large because the many global models used do not agree well: what I would want to know is how well the three most modern ones (FES2014b, TPXO9-Atlas, and GOT4.10c) agree.

Another general point is that the "East China Sea" in the title is misleading: the authors use data from the many GPS stations on Kyushu, a smaller number (but still quite a few) from the Ryukyu Islands, three in Korea, two in Taiwan, and one on the Chinese mainland. For tide gauges the same distribution is similar, except that there are six stations on the Chinese mainland and none on Korea. Any results, particularly any RMS values, will therefore be only about the first two areas, and especially Kyushu: for the GPS, the Pacific is likely to be as or more important than the East China Sea in producing almost all of the loads. I appreciate that the authors want to use as many stations as they can, but I think the paper would be much better if the few non-Japanese stations were omitted. This would also avoid a problem with Figures 4 and 5, which is that where most of the data is, it is impossible to see the results in any detail. Even if the authors do keep the few other stations, they should use a set of more focused maps, perhaps with the Kyushu-Ryukyu stations shown using an Oblique Mercator.

This geographic imbalance leads to another problem, namely the authors' conclusion that the NAO99Jb model should be used, despite its age, because of its lower RMS compared to the tide gauges. But the authors' own Table 2 shows that for the most modern high-resolution global tide models (again, FES2014b, TPXO9-Atlas, and GOT4.10c) this lower RMS is confined to nearly-enclosed seas: for these NAO99Jb does much better. As the authors note, this is hardly surprising. The question is, how important are these enclosed seas in computing the loads?

One virtue of the station-centered grid in SPOTL is that it is very easy to combine models. So I found three polygons that enclosed these inland seas (this is very easy to do with Google Earth) and computed loads on a grid over the region. Figure 1 shows both the polygons (red) and the grid points (black): an irregular grid with smaller spacing near coastlines.

I computed loads in two ways. A was to use all of the NAO99Jb model, and TPXO7.2atlas for the remaining global parts: close to the authors' procedure. B was to use the NAO99Jb model *only* inside the polygons and TPXO7.2atlas everywhere else. Figure 2 shows the results, as contours of the ratio of the M_2 amplitude in vertical displacement for B, divided by the same thing for A. Two features of this plot are notable. First, the ratio is spatially smooth, which means that these enclosed seas only contribute to the estimated load for very nearby stations, so that NAO99Jb needs to be used only in these limited areas. The other is that there is, clearly, a systematic difference between loads that used NAO99Jb regionally and those that used it locally: this systematic difference might well make a difference in the authors' comparisons and conclusions. So I'd like to see the authors compute the loads using NAO99Jb only for limited areas, and more modern models (the three I've mentioned) for everywhere else.

Another major problem is that the conclusion about determining Earth structure seems inadequately supported by the evidence. Table 4 shows that once we adjust for anelastic attenuation, PREM gives RMS values that are basically indistinguishable from those for the regional model (which the authors more or less admit). Changing the model can reduce the RMS a bit more, but there is no demonstration that the reduction is significant given the added degrees of freedom: certainly the conclusion about asthenosphere depth (p. 13 lines 18-19) is not at all warranted.

A few other comments, by page and line:

8: 25-30. I have grave doubts about this method of finding errors in the loading computation. It depends, as the authors note, on the terms in the sum being uncorrelated, and that they certainly are not. So I am dubious about all subsequent invocations of errors in the loads.

In this same vein, Figure 3 shows standard deviations much larger than the RMS values of the loads from different models: this suggests that the computed errors are much too large.

I hope the final version of the paper will include a supplement with text files giving the authors' M_2 estimates (GPS and tide gauges) as well as the Green functions.

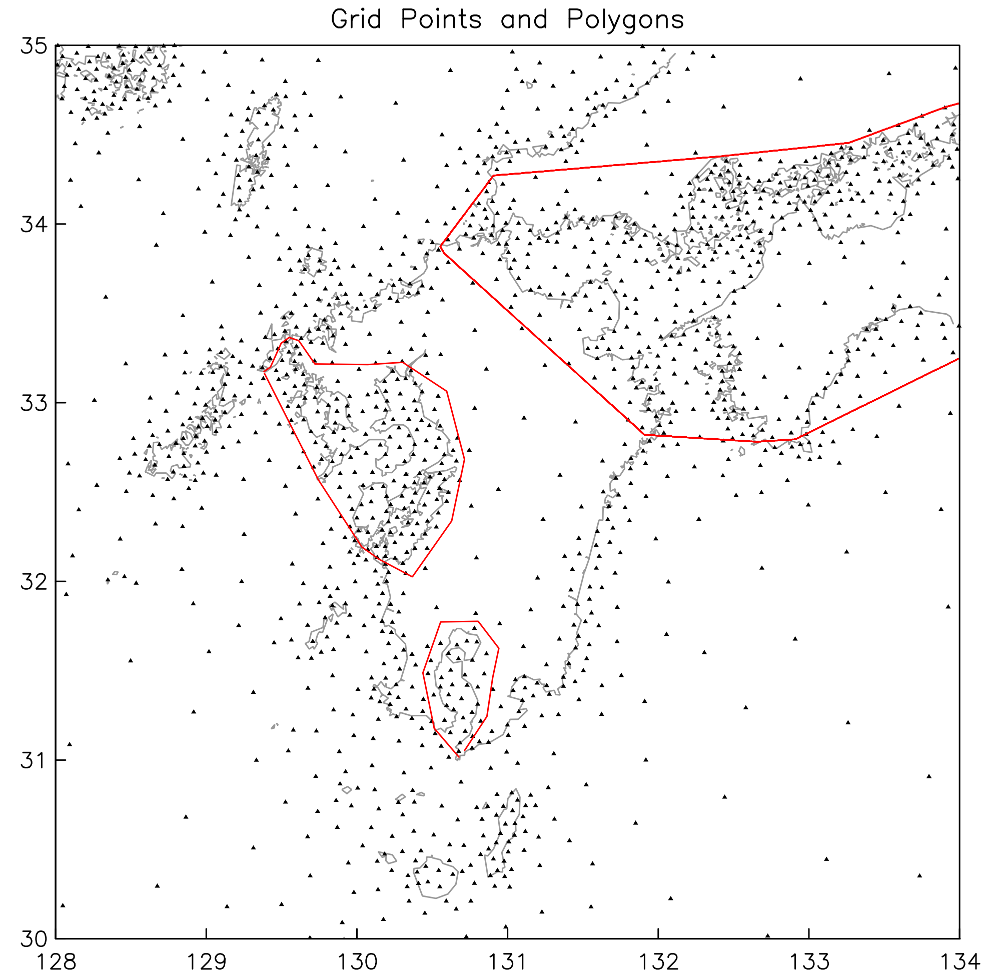
Grid Points and Polygons
35
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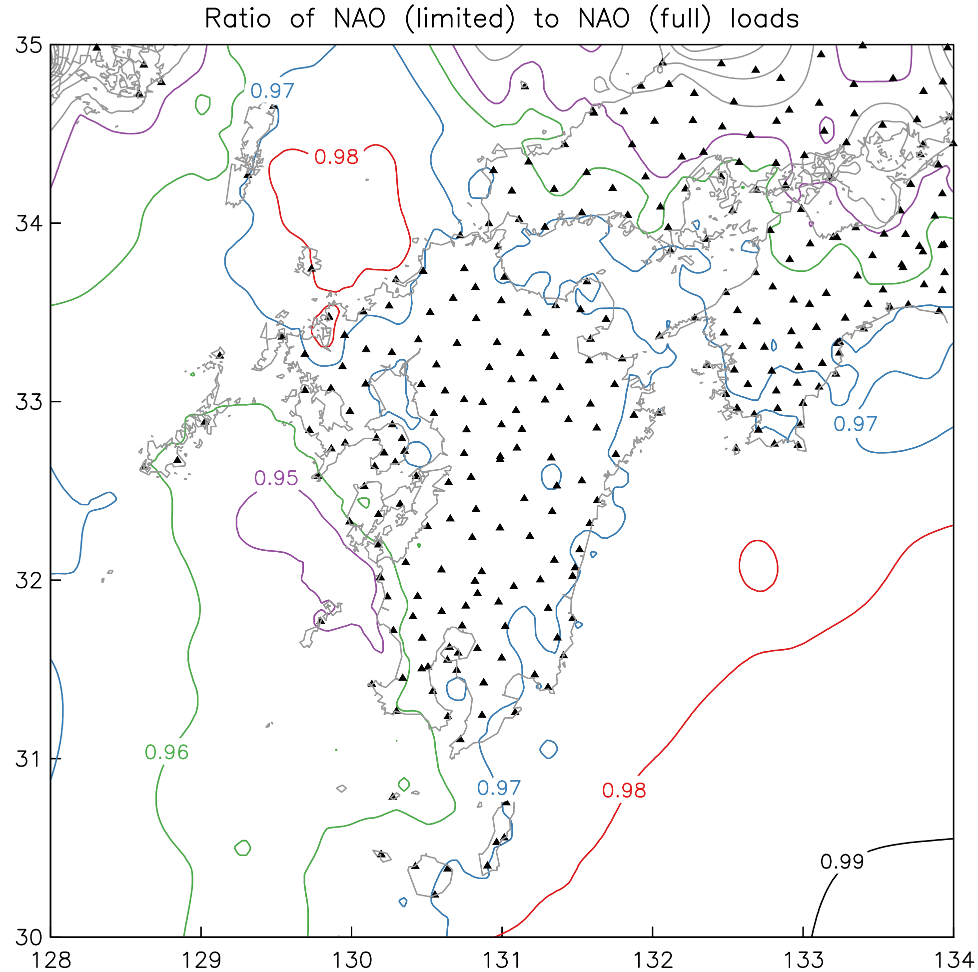
Figure 1


Ratio of NAO (limited) to NAO (full) loads
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32
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129
130
131
132
133
134
0.97
0.98
0.95
0.96
0.97
0.98
0.97
0.99

Figure 2