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Interactive comment on "Back to the Future II: Tidal evolution of four supercontinent scenarios" *by* Hannah S. Davies et al.

Hannah S. Davies et al.

hdavies@fc.ul.pt

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We would like to thank anonymous reviewer 2 for their helpful and constructive comments on the paper.

1. "Could the authors provide some comment as to the choice of modelling only the M2 constituent (and not including K1 for example), and on why they retain the Earth-Moon orbit configuration (specifically the 12.42 hr period forcing) throughout the future simulations? Are there projections as to how this may to change within 250Ma that may be referenced? It will impact the age/size at which future ocean basin configurations form tidal resonance. This prompts a thought on the validity of the extrapolation of particular values (particularly the buoyancy frequency and ocean volume) from present

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day climatology for the calculation of tidal dissipation/amplitude in the future scenarios. Can the authors address these simplifications to their simulations?"

Modelling was carried out initially with both the M2 and the K1 constituents however the volume of data quickly became too much to present concisely in one paper. Furthermore, not only did the results for the K1 constituent corroborate the hypothesis of resonance - albeit at different wavelengths and ocean sizes - the tidal energy dissipated as a result of the K1 constituent was an order of magnitude lower than the M2 making it less impactful to the overall tidal environment.

With regards to the change in tidal, oceanographic, and orbital parameters over the period modelled. After 250 Myr, the M2 tidal period increases to 12.53 hours and lunar forcing decreases to 97%. Buoyancy frequency and ocean volume were deemed too dynamic over time to accurately predict their changes. It was therefore concluded that all parameters would be kept at present-day values. We have since added a paragraph to the results section of the manuscript presenting the change in tidal period and lunar forcing over time, and stating we kept all parameters at present-day values for all simulations.

2. "Could the authors state clearly if equilibrium forcing is used at the pole boundaries in this study (as done in Green et al. 2018) or if vertical walls were used – the reading from Line 117 is slightly ambiguous. Since this study provides higher temporal resolution for future continent configurations from Green et al. 2018, does the equilibrium forcing (or vertical wall) at the boundary interfere with any potential tidal resonance in basins/enclosures present in this study but not present in the scenarios Green et al. 2018 considered? It is difficult to tell from the map projection used for the figures in the supplement."

Equilibrium forcing at the poles was not used, vertical walls at the poles were used instead. Green (personal comm.) found that the introduction of an open boundary with an equilibrium tide as forcing does not change the results. We have clarified this part

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of the methods section in the revised manuscript.

3. “Regarding the 4 km deep ocean calculation at Line 209: Does the average depth of any ocean basin change significantly to retain ocean volume between the four future scenarios (e.g. due to differing continent polygon overlap and/or destruction of shelves)? How applicable is this calculation of when resonance occurs for the multiple different basin shapes shown in the different scenarios?”

Changing ocean depth does influence the resonant width of the ocean however the deviation in abyssal ocean depth from 4 Km in the models to retain ocean volume is not large enough to change ocean resonance by a large amount. We have updated the manuscript to show that the resonant width scales with the square root of the depth so to change the resonant width of an ocean, the depth must change by a factor of four.

4. “The paper professes to support a link between the super-tidal and super-continent cycles. Since each continent cycle may be comprised of one or multiple Wilson cycles (to which a super-tidal cycle seems more intrinsically linked to), is there not a lack of a well defined relationship between the period of each?

The Supercontinent cycle, Wilson cycle, and Super-tidal cycle are secularly linked. We have clarified this link between the three cycles and their relationship with regards to the super-tidal cycle in the updated manuscript.

Technical corrections: line 11 – remove comma after “planet”

Done.

line 11 – Perhaps “...oceans *can* move...”

Clarified this sentence and mproved its structure.

line 47 – “at best” is strange wording, perhaps “at a minimum of”

Agreed, changed in manuscript.

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lines 75-80 – various subscripts are printed as normal sized text

Subscripts corrected.

line 129 – I assume “The results” refer to amplitudes. Could this be made clearer what is being compared to TPXO9.

This whole section has been revised as a result of both reviewer comments

line 152 – is PD defined in the text before its first use here?

PD now defined as "Present-day" in first use.

line 246 – “...which, when combined, produce...”

Improved sentence structure.

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