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# *Interactive comment on* "ESD Ideas: Long-period tidal forcing in geophysics – application to ENSO, QBO, and Chandler wobble" *by* Paul R. Pukite

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Thanks for the comments, with summary response below.

As the comments were mainly directed to specific points (which were addressed in individual responses) one must also consider the commonality and parsimony of the proposed model. So my first response to the comment by reviewer RC1, which was mainly focused on ENSO, did not consider the comprehensiveness of the tidal model, which applies a common-mode forcing scheme across the various observed behaviors. In particular, besides QBO and the Chandler Wobble, the constraint of the well-understood length-of-day (LOD) variation plays a significant role in reducing the degrees of freedom allowed when matching to the observations. Figure 1 shows an

ENSO fit while simultaneously maintaining a close match of the ENSO forcing input to that used to model the Earth's dLOD, which is also tidally driven. Figure 2 shows the calibration of the ENSO tidal factor input to that estimated by Ding and Chao – notice how well the strongest tidal forcing factors align in strength. The difference is that a solid body inertial response (i.e. LOD rotation speed variations) is linear, while the ocean's response is nonlinear due to the geophysical fluid dynamics of a basin (i.e. ENSO thermocline sloshing).

So the comprehensiveness of the proposed approach has merit in interpreting a range of geophysical behaviors, making it a candidate for further consideration.

REFERENCES

[1] H. Ding and B. F. Chao, "Application of stabilized ARâĂŘz spectrum in harmonic analysis for geophysics," Journal of Geophysical Research: Solid Earth, vol. 123, no. 9, pp. 8249–8259, 2018.

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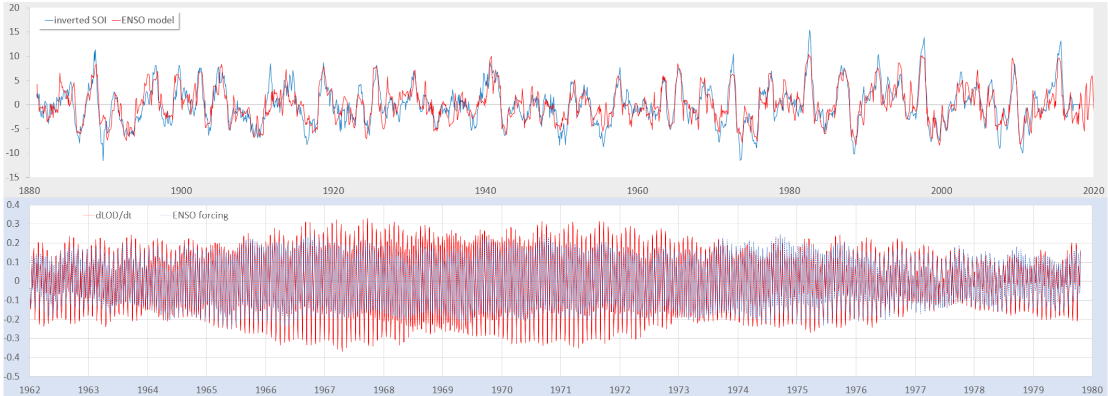


**Fig. 1.** Lower panel shows model fit to dLOD using known tidal factors, while the upper panel shows an ENSO fit applying the LTE transfer function to the same dLOD forcing, i.e. scaled linear to nonlinear map



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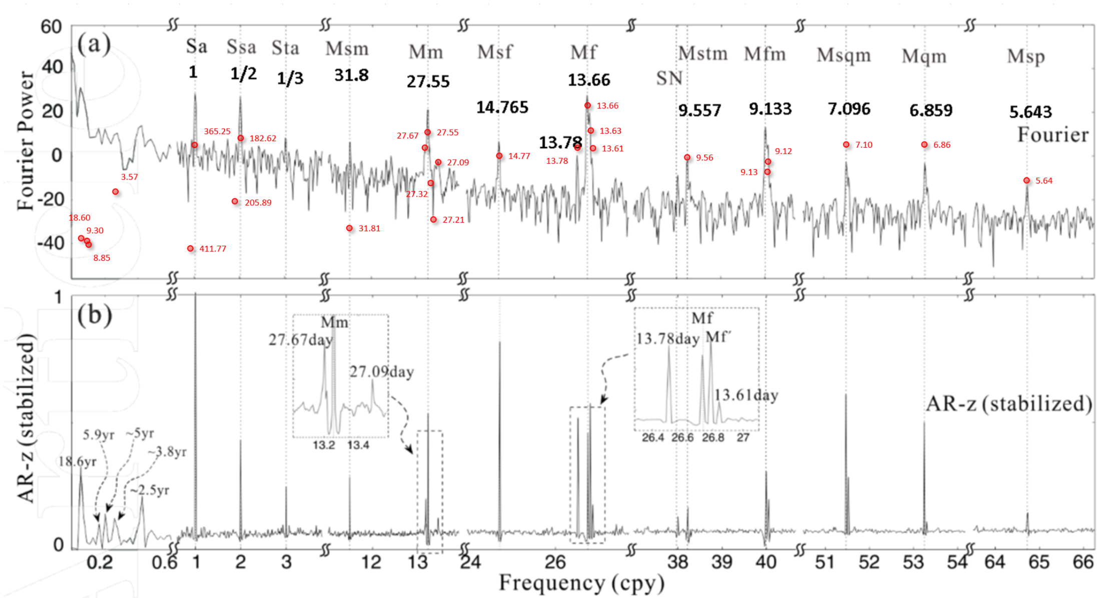


**Fig. 2.** Ding & Chao [1] apply an AR-z technique as a supplement to Fourier spectral analysis to isolate the tidal factors in dLOD. Red points used in the ENSO model align to strongest factors