Review: Beddow et al.: "A comparison of two astronomical tuning approaches for the Oligocene-Miocene Transition from Pacific Ocean Site U1334 and implications for the carbon cycle" submitted to Climate of the Past.

General Comments:

Dear Beddow et al.,

The idea of using two different proxy series for astronomical tuning, and especially evaluating the differences between them in detail and the paleoclimatological implications is excellent. I believe that the spirit of the paper, and the material presented, fall perfectly within the scope of the "Climate of the Past" journal. There are however some aspects that deserve further elaboration or better explanation to further improve the quality of the manuscript before publication. Below you can find my comments and suggestions.

Specific Comments:

Title:

"approaches" was confusing to me, first thought was that you used two different techniques to do the tuning, while you used two different signals/proxies (and corresponding phase relationships)from the same record. Suggest rephrasing of the title to make this more clear.

Abstract:

Lines 25-30: confusing, you mention two different phase-assumption, but both are inverse and in-phase???

L30-32: Not convinced that the two-end member idea is that well known to the average CP reader, and as such might not be clear in an abstract, more for later in the manuscript.

L33: what is 'correct'?, maybe use something like 'the most consistent with other data', the most probable etc…

Introduction:

L62: 'tuning signal' and 'target curves', while in L19-20 you use 'climate proxy records and astronomical solutions', to mean (as I understand it) the same thing. A consistent use of terminology might avoid needles potential confusion.

Methods:

Not clear/obvious why you estimate CaCO3 from the MS signal. A motivation for this should be given in the introduction, so that the reader is not confused. Doesn't one loose information, quality of data, by this extra step. The correlation is good, but not one-to-one.

Explain better sources data (place Wilson citation not optimal), and motivate selection of, plate-paired spreading rates. Maybe instructive to indicate those on your Fig. 1?

Results:

Presentation of the CaCO3 data is absolutely not clear, different numbers in diff figures, and the text. Adding stages in the plots would make reading much easier.

Not convinced by the mentioned higher frequencies in the CaCO3 record. Would be curious to see the MS spectra too. Could discuss the evolutionary spectrum also more, change over the boundary? Climate dynamics, changing sed rates?

Astronomical Tuning:

Side: Why are the sedimentation rate reconstructions for the CaCO3 done on the full eccentricity scale, and for the d13C on a higher resolution???

Side question. How is the tuning done? Manually extremum per extremum or with a software/script? Explain somewhere. Suggestion.

In the d13C tuning this 50 kyr period will be close to 41 kyr, could this be an argument in favor of the d13C tuning (because tuning on the eccentricity makes the obliquity come out stronger, and you would expect an obliquity component no?)???

L343: earlier on you mentioned the variability, sensibility of bandpass filters to varying parameters, now you use the bandpassfilters to discuss phase relationships. How robust is this, or is there no problem? Also the phase relationships on Fig. 5 seem to be very sentive to the used age models…

And see 'other comments' too please.

Discussion:

L443: I expected this discussion much earlier… it affects the interpretation of the previous paragraphs

L509-510: What might be the influence of the detrending (or not fully) of this d13C shift? Might it effect the BP filtering, be related to this peak in SR in C6Cn2r, add in the end an offset in age models??? Just an observation/thought…

Conclusions:

L525: 'insolation forcing' (actually also in your discussion), you tune on eccentricity, but eccentricity as such is only a very small component in the insolation term, eccentricity kicks in as amplitude modulator, non-linear feedbacks etc… should we be careful with the terminology?

References:

Not all consistent (for later, editing)

Missing in my opion: Laurin et al., 2017, Paleoceanography

Suggestion, because very recent, Khider et al., 2017, Paleoceanography.

Other Comments:

L24: again ‘tuning approaches’

L58: submitted, in ref list as ‘in review’, published in CPD, be consistent.

L62: ‘tuning signal’ and ‘target curves’, while in L19-20 you use ‘climate proxy records and astronomical solutions’, to mean (as I understand it) the same thing. A consistent use of terminology might avoid needles potential confusion.

L83-84: now you specify ODP and IODP, while you already referred to the concept of ‘Sites’ in the previous paragraph, maybe do this specification earlier in the manuscript.

L84: capital needed for ‘Middle Miocene’? is this an official term?

L85: strange place to refer to Laskar et al., 2004, you didn’t specify the tuning sources for the previous paragraph, be consistent.

L88: be consistent in your referencing style, and make at the same clear which reference is for which record.

L89: remove ‘very’, suggestion

L91: first time mentioning 110 and 405 kyr periods, maybe for the first time mention explicit link to eccentricity and explain why you use the number of ~110 kyr.

L95: what exactly was the first advantage? Clear cycles or good agreement?

L99: miss reference(s), how significant would that effect be (for the OMT)?

L102: what about differences in age and duration estimates?

L114: also the CaCO3?

L117: two end-member concept can use more explanation

L119: diff methods? More diff proxies (with corresponding phase interpretations), not my favorite formulation.

L120: now you talk about “records” (before: proxy or signal), I would prefer one consistent terminology. Mention explicitly, between brackets, which records.

See main comment about motivation for this CaCO3 estimate, and potential loose of quality of your data.

L148-153: not really ‘Methodology’

L160: “a”, typo?

L161: “and n” typo?

L172: resampled? What were the original and new resolutions? From Fig. 2 it seems that not all isotopic data has the same resolution, could this be important?

L173: small motivation for 6 m and 600 kyr? They don't seem to represent the same amount of your signal???

L176: maybe mention that the bandwidths are mentioned in the fig captions.

L178-179: window sizes and which method (e.g. FFT?) or evolutive analyses.

L182: Would make more sense to discuss the Wilson, 1993 paper in the introduction, where it is currently missing. Also is this paper the (original) source of your spreading rates?

L184: missing ")"

L184-186: sources rates for all Wilson paper? What is your motivation to select these four sets?

L199: which reversals?

L206-207: the ranges on your plot 2a and 2b, and Fig 3 for CaCO3 and MS are different!!! How is this possible, highly confusing. Is one from core logging and others from discrete sampling? Needs to be clarified.

L208: below 70%? Also at other places? What is the point? Include the stages on the plots, this will make things much easier for all readers that might not be as familiar with the magnetostratigraphy as you are.

L213: where is the OMT on your figure?

L215: refer to (sub)figure, where does this age come from?

L216: is this higher amplitude variability so convincing? Often single points?

L217: more positive or less? Lower values, reversed axis?

L224: where do you see these 1.83 and 2.8 c/m peaks in the CaCO3 record? I don't…

L225: which high-amp cycles? Specify, be 100% clear.

L228: any biostrat in addition to the magnetostrat?

L233: can refer to Table 1. Fig. 4

L235: isn't evolutive a form of power spectrum?

L238: what does significant mean?

L240 CaCO3 est => different CaCO3 values ? never different on your figures…

L245: I see your point, but here you took twice the same filter and is the different outcome because the different variations in both signals. Remove very.

L253: be consistent with your spelling of time(-)series

L256: reference to wrong figure, not Fig. 7

L257-261: repetition of intro, and this time with reference. Do once expanded in the intro.

L272: again, somewhere in the beginning you referred to different phase relationships???

L273-279: this would have been useful to read much earlier in the manuscript.

L284-286: maybe shortly explain mechanistical link? Why higher CaCO3 in cooler period?

L287: clearly deniated? Before you made the argument that is not always so easy? Some peaks are clear, but not all 23.

L293: where is the OMT? Not so much higher sed rates…

L296-298: what figure do you refer too? (Fig. 5?) Confusing description, the evolutive shows where you see the cycles over the record, maybe state something that the 405 kyr is the most consistently present over the records for all proxies or something of the sort. Also (L298), it is difficult to see the highest amplitudes on the evolutive??? Maybe on the power spectra, but there I don't see a much stronger short eccentricity cycle for the CaCO3, it seems however more present over the whole record, compared to the stable isotope records.

L301-302: indicate on relevant figure(s)where this OMT, and peak glaciation conditions occur

L308: 50 kyr cycle, not immediately clear specific for d13C (continuation), or in general.

In the d13C tuning this 50 kyr period will be close to 41 kyr, could this be an argument in favor of the d13C tuning (because tuning on the eccentricity makes the obliquity come out stronger, and you would expect an obliquity component no?)???

L315-325: it might not be clear to all readers how by looking at Fig. 5 (which shows phases in degrees) you get to duration in kyr, small clarification (e.g. in methodology) would make it easier to interpret. Suggestion.

L329: Laurin et al., 2017, Paleoceanography, recent reference, maybe include.

L332: Is Early Miocene with capital? Indicate your (sub-)stages on your figures.

L343: earlier on you mentioned the variability, sensibility of bandpass filters to varying parameters, now you use the bandpassfilters to discuss phase relationships. How robust is this, or is there no problem? Also the phase relationships on Fig. 5 seem to be very sensitive to the used age models…

Side question. How is the tuning done? Manually extremum per extremum or with a software/script? Explain somewhere. Suggestion.

L357: Fig 7e. Peak in sed rate around C6Cn2r, potentially skipping an eccentricity cycle? How would including another short eccentricity cycle in the d13C tuning affect your outcomes?

L358: 1) different units of sedimentation rate in text and figures, confusing. 2) 1.7 cm/kyr peak????

L361: could this one cycle difference be related to the comment "L357"?

L362: refer again to fig 5, helps with following. (for me)

L368: confusing, different frequencies on fig. 5, and kyr-periods in text descriptions. Would be good to mention the frequencies you point at in the text (or plot evolutive diagrams in function of periods)…

Is the 41 kyr the case for all proxies? See also comment on 50 kyr cycle.

L371-379: the phase results for the different proxies seem much more similar to each other than for the CaCO3 tuning. Can you comment on that?

L385: can refer to the Wilson paper for more info on principle, also on uncertainties etc of this type of data, not all readers might be familiar with this.

L393: what are the dotted lines on Fig. 8? How would this plot look like with the additional d13C short eccentricity in your tuning?

Side: Why are the sedimentation rate reconstructions for the CaCO3 done on the full eccentricity scale, and for the d13C on a higher resolution???

L391-393: conclusions before description results…

L412: reference to Tab. 1 would be useful. In the text you use duration difference, which are not includes in the Table… could make it easier for the reader.

L426-427: specify which interval.

L435: On=> One? Typo.

L443: I expected this discussion much earlier… it affects the interpretation of the previous paragraphs

L468: be consistent in ref style.

L494: Zachos et al. (2010), EPSL interesting additional reference?…

L501: Laurin et al., 2017; Paleoceanography.

L503-505: where do we see this change???

Fig 6 & 7: detrended records? Mention.

L509-510: What might be the influence of the detrending (or not fully) of this d13C shift? Might it effect the BP filtering, be related to this peak in SR in C6Cn2r, add in the end an offset in age models??? Just an observation/thought…

L519: the CacO3 content in this case is a 'derivative' of original MS data…

L525: 'insolation forcing' (actually also in your discussion), you tune on eccentricity, but eccentricity as such is only a very small component in the insolation term, eccentricity kicks in as amplitude modulator, non-linear feedbacks etc… should we be careful with the terminology?

L533: "C6AAr.r3" = only place in the manuscript where this name occurs???? Typo? Different notation, then explain.