

Weather Clim. Dynam. Discuss., referee comment RC1
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Comment on wcd-2022-51

Anonymous Referee #1

Referee comment on "Revisiting conceptual oscillator models for the quasi-periodic component of the El Niño Southern Oscillation" by Lina Boljka et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2022-51-RC1>, 2022

Review of „Identifying quasi-periodic variability using multivariate empirical mode decomposition : a case of the tropical Pacific“ by Boljka et al.

Recommendation: Major revisions

Summary: The authors use a multivariate empirical model decomposition (MEMD) method to find the dominant quasi-periodic variability in the tropical Pacific and find two modes with ~ 2 and ~ 3 year period, that can reproduce the bandpass filtered SSTa of Nino3 very well. The ENSO dynamics are further analyzed in conceptual models and a climate model and finally the prediction skill of a statistical model based on MEMD is shown.

Overall opinion: This study is an interesting study to an important topic of ENSO research and it is well structured and well written. The results are well elaborated and convincing. I have only a few major and minor comments that need be addressed before this manuscript is ready for publication.

Major comments:

Sect. 3.1 and Fig. 2: Why do you only show IMF13 in Fig. 2 and not IMF12? Maybe IMF12 represents the nonlinearity of ENSO as EOF-2 does? Please show the same analysis for IMF12 as shown for IMF13 in Fig. 2, at least as supplement so that one gets a feeling how these two modes interact with each other to represent ENSO.

Sect. 4.1 Model evaluation: Please show same analysis as shown in Fig. 1 & 2 for your climate model so that one can see how well these modes represent ENSO in the climate model and to highlight similarities and differences!

Minor comments:

L47-58: "This feedback alone would result in continuous warming (cooling) in the eastern tropical Pacific, therefore negative feedbacks are necessary for quasi-oscillatory behaviour in the eastern tropical Pacific ..." I am missing here the discussion of the contribution of the seasonal cycle for the growing and decaying of ENSO events, as positive feedbacks are in general stronger in boreal autumn and the negative feedbacks are stronger in boreal spring (Wengel et al. 2018). Is this seasonal forcing included in these conceptual models? The seasonal cycle is a very important contributor of growth and decay of ENSO.

L103 & L106: I do not understand why you state here "not shown" in the introduction. What don't you show? Please make clear or delete the "not shown".

Fig. 3: Please improve the legend in Fig 3, as it is hard to distinguish solid, dashed and dotted lines in the legend.

L302f: "and deeper thermocline in Niño6 region" In Fig. 2a the thermocline is deepest at the equator in the western Pacific and not north of the equator. Please change.

Fig. 4 caption: Why do you give a range for the high-pass and low-pass filter? Normally you just give one cutoff period.

L516f: "Similarly, predictions from tropical Pacific mean thermocline depth are not considered here as they did not improve predictions (not shown)" This sounds strange to me as the mean thermocline depth gives us the predictability of 6 months in climate model predictions. Please explain why you think that it reduces the prediction skill here!

L546f: Similar as above: Why is prediction with only SST better than with all variables in a)? This sounds strange to me. Please explain!

References

Wengel C, Latif M, Park W, et al (2018) Seasonal ENSO phase locking in the Kiel Climate Model: The importance of the equatorial cold sea surface temperature bias. *Clim Dyn* 50:901–919. <https://doi.org/10.1007/s00382-017-3648-3>