

At this point I cannot approve this manuscript for publication. Although the reviewers do not question the validity of the science, the third reviewer indicates that the presentation lacks clarity and leaves a reader confused. As my editorial colleagues have already pointed out, this paper aims to present a lot of material in a very short space which, while possible, requires careful crafting of the arguments to guide a reader through. Shortening the paper by putting bits of it into an appendix and changing the title does nothing to increase its clarity.

All the authors need to sit down together to discuss how best to present this work, as it currently falls short of the quality that's needed to be published in WCD. What is needed to move this paper towards being publishable, is a clear motivation for why the paper is long and then clear signposting as the paper unfolds to keep a reader engaged. Ultimately you need to convince a reader that it's worth reading this paper, otherwise no one will bother.

I suggest that the authors re-read and reflect on the original comments from the third reviewer, particularly those major comments where the reviewer requires more clarity. Although you did respond to these comments, the reviewer found the revision weak. As editor I agree: in reading the revised manuscript I had the exact same questions as the reviewer, thus the reviewer's comments remain unaddressed.

A revision to this manuscript requires edits that are more comprehensive than tweaking a few sentences. Reviewer 3's major comments should be more substantially addressed along with the new comments in their report. More clear motivation for what the paper hopes to achieve must be given. Sections should be restructured to give a clearer map for where the paper is going and how it will address the research question.

Below are some suggestions for how to increase the clarity, along with a few "Other Points" that I noticed while reading the manuscript.

Motivation

The foundations for the paper need to be laid out in the Introduction. By the end of the Introduction a reader needs to have had it clearly explained:

- Why do we need to revisit the various oscillator models for ENSO?
- Why do we need to use MEMD to understand the oscillators? What's wrong with existing methods?
- Why are you going to analyse both observations and output from a climate model?
- How does prediction fit into this whole picture (or drop this section)?

The answers to these questions may already be somewhere in the Introduction. However, as an independent reader coming to this manuscript afresh, I can assure the authors that it is currently far from clear what the answers are.

MEMD

The description of the MEMD is a very important part of this paper and deserves its own section. The authors may wish to de-emphasise the MEMD procedure but it is a critical part of the whole paper. If a reader doesn't understand what constitutes the components for the new oscillator, they aren't going to buy into the argument that a new oscillator is even needed – see comments from Reviewer 3.

Ending this section with a summary of the crucial points needed to understand MEMD would serve a reader well as a reference for use when reading the rest of the paper.

There are elements of the MEMD section that can't just be put into an appendix. The results in Appendix B2 are absolutely fundamental to the paper so need to be in the main text. Appendices present information that is additional to paper. If they were to be removed, the paper should still make sense: this is not the case for some of the appendices in this paper.

Introduction

I would suggest that the first 3 paragraphs of the Introduction are redundant: the audience for this paper already knows what ENSO is and what its impacts are. Getting straight to the point in this paper would shorten it and keep the reader engaged.

Sections

I would suggest that the sections are restructured somewhat to have more major sections. E.g. Intro, Data, MEMD, ENSO, Oscillators, Implications, Conclusions. Remember that it is highly unlikely that this paper will be read in one go, so breaking up the paper by theme will assist a reader when they return to it. Summaries at the end of each section will help the signposting for a reader. Similarly, high level overviews of what will be achieved in each section will help a reader understand what's going on. For example, Section S3 goes straight into the mathematical detail describing the method with no introduction to what will be achieved. It is better to give an overview first and then give the details. E.g. in section S3 begin with . "As an example we shall describe how MEMD is carried out on a simple periodic time series. We shall define 4 timeseries which have a shared angular frequency of $\pi/2$ with other harmonics or phase shifts added on top. MEMD will be applied and should isolate this shared $\pi/2$ mode. ..."

There is much truth in the old mantra: "tell them what you are going to tell them, tell them, then tell them what you told them"

Prediction

I would suggest that this section be dropped. What purpose does it serve in addressing the subject: "Revisiting conceptual oscillator models for the quasi-periodic component of the El Niño Southern Oscillation"?

Other points

Paragraph beginning 115 – it is not clear from this paragraph why non-SST data are included. The emphasis of this paragraph is that SST is pre-eminent – SST weighted more in procedure, τ_x /thermocline are slaves to SST – so why even include the other variables?

Para beginning 130 – this is confusing, see comment from Rev3, it seems to imply that the variables are averaged into these boxes before they are fed into the MEMD. State what the purpose of this averaging is.

Line 155, using () here is very confusing. Just state "ordered from the highest to the lowest frequency, equivalently from the shortest to the longest period/timescale." () should only be used to indicate parenthetical statements, I.e. less important or explanatory statements, as per the usage in the following sentence. There's a weird precedent in some geosciences for their usage in other contexts, but it really should stop.

Section S3:

EMD description – in S3 add in an example of how the “envelopes” are computed in EMD to help the reader. This would help readers with a more graphic intuition.

It is Hard to parse this section.

State up front what you are doing at high level then dig into details, later. This applies to the whole paper. In most sections the procedure is described as it goes along so a reader has to work out what’s going on while the detail is being described. It is better to give an overview first and then give the details. E.g. in this section state. “As an example we shall describe how MEMD is carried out on a simple periodic time series. We shall define 4 timeseries which have a shared angular frequency of $\pi/2$ with other harmonics or phase shifts added on top. MEMD will be applied and should isolate this shared $\pi/2$ mode. ...”

Para line 196. This is a really important paragraph as it gives the motivation for the study. It needs to come way sooner in the paper.

Para line 220 – pull this out from the text for readers to refer back to. Present is as a list of steps.

Line 234 – surely this is the index of the IMFs not the IMFs of the index? These aren’t the same.

Figure 1 – be clear that the time series are of nino3 of the IMF, not the IMFs themselves.

Confusion

Line 349 -

“Since we observe clear relationships between the relevant variables (e.g., Fig. 2) that strongly resemble a unified oscillator of Wang (2001a) (see also Fig. 5 in Wang 2018), recharge-discharge oscillator (e.g., Burgers et al., 2005), and others, we now revisit the theory of ENSO dynamics using the relevant conceptual oscillator models.”

line 379 -

“However, the results from section 3.1 suggest that the average evolution on 2-3 year (average) timescale is different from the unified model and many other oscillator models discussed in Wang (2001a).”

This highlights the confused motivation for using the MEMD to revisit the oscillators.