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Discussions

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Interactive comment on "Marine regime shifts in ocean biogeochemical models: a case study in the Gulf of Alaska" *by* C. Beaulieu et al.

Anonymous Referee #3

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This manuscript aims to apply a new method to the detection of regime shifts in time series of biological and physical variables. The Gulf of Alaska was selected as a test case for presentation of this method. I like the overall approach that the author has taken with his analysis, which presents a more rigorous method for identification of shifts in time series, including the filtering out of more red noise type events. Unfortunately I found too many grammatical errors, and odd word usage or confusing sentences which detracted from the enjoy-ability of this paper to suggest that it is ready to publish as is. I have tried to highlight an example of some of these in my specific comments but revision should be carefully checked for grammar. Additionally, I did not get the feeling that the author was overly familiar with the existing literature on regime shifts and ecosystem dynamics in the Gulf of Alaska as there was no discussion about either the Pacific Decadal Oscillation (PDO) or the ENSO which operates on a shorter time scale than

the PDO but could be equally important in driving ecosystem dynamics in this region. If the manuscript was revised to address these concerns I think it could be a valuable contribution to the literature.

Specific comments: {} - odd word choice [] - suggested replacement

Page 14004

L14 ..Our study demonstrates that ocean biogeochemical models are capable of simulating the late 1970s shift, {indicating} [manifested as] an abrupt increase in sea surface temperature forcing followed by an abrupt decrease in nutrients and biological productivity.

L20....the 1980s shift was {constrained} [driven by] by changes in mixed layer

L22.....simulate regime shifts in the Gulf of Alaska region, {thereby} [These models can therefore be considered useful tools to enhance our] {providing a better} understanding..

Page 14005

L8. The regime shift can be.... This is a run-on/confusing sentence that needs rewording

L18...respond differently to [an ecosystem subject only to] natural disturbances

L20 . It might be better to replace 'global-warming' with climate change.

L22... shifts in bottom-up control in the food web via phytoplankton or zooplankton. This needs to be expanded on. Presumably you mean through temporal or spatial changes to the lower trophic level carbon production but this is not clear.

L32 – This sentence sound repetitive of the one preceding it. I would suggest combining the two.

Page 14006

L6 –A substantial part... This information doesn't seem to fit here. I would move this whole paragraph to the end of the introduction – just prior to Paragraph 5 where you describe organizational flow.

L6- Multivariate principle component analysis can tell us how the different components of the ecosystem are responding together. I think this is what you are doing but you should say as much to inform the reader not familiar with this type of analysis.

Page 14007

L1 {forcings} I would replace with [events]

L3..and [able to] distinguish these...

L7..and threw response {can be} [was] explored..

L24.. [More] specifically[,] in the Gulf of Alaska, a modeling study..

L27.Increases in spring zooplankton biomass were observed.. Over what time period?

Page 14008

L2 – over what time period were the observed increases?

L7 – Inconsistent use of tense. ..climate shift occurred...ecological response varie{s}[d]

L8 – Further south – Than what? Presumably the GOA but it is not clear in this paragraph.

L12..not a return to pre 1977.. So what were the changes ? would be good to inform the reader of this.

L22. It is unlikely that we will be able to have long term predictions of regime shifts that correspond to the timing of an actual regime shift. You would not expect the forward looking climate models that are used to driving the ocean models to capture the timing of the regime shifts. The may be able to predict regimes in a statistical sense

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in that they have the right number occurring over the right time frame i.e. decadal, but all models of this nature generally have limited success simulating the timescales of variability and the chaotic randomness (internal variations) found in the real world and should not be expected to align temporally with a model's internal variations (Walston et al., 2014).

L29 to be {described} [assigned] only to their representation...

Page 14010

L3 – {errors} due to the physics —I don't think it's correct to talk about errors- unless you are assessing which of a suite of physical models is better . I would just call them [differences]

L9 ..dissolved oxygen [initial condition] fields...

Page 14012

L5 – Does the CORE forcing have a 'shift' in the forcing? Presumably it does and this is what is driving the shift in ocean temperature that you see. Is CORE a re-analysis product that assimilates temperature observations? If so we would expect it to reflect reality and the timing of the regime shift. If not, it would be quite surprising that it managed to simulate the correct timing for the shift.

Page 14013

L17 For the models with [a detectable] shift..

Page 14014

L5 – if a model with [a] shift.

L9 – {can be} [was] added...

L11 – The explanation of the Monte Carlo simulation that starts on line 21 needs to be incorporated here. Otherwise it is not at all clear what you are talking about.

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Page 14016 Results are usually presented in past tense

Page 14017

L20 –Even though our analysis.. This sentence needs re-wording for clarity.

Page 14018

L26 – There is one {possible} exception .. It is an exception, not a possible one.

L29 {forcing} [driver]

Page 14019

L1 {Therefore} the forcing. . .

L6. . .suggesting a linear [biological] response

Page 14019

In general there appeared to be quite a bit of repetition of the results here and less inference of what the results can tell us, why this may be significant for the Gulf of Alaska ecosystem and how this compares to others finding in this area.

L16 – would you expect this shift given the forcing you used to drive the models?

Page 14021

L14 – The fact that Polovina used observations and found a shallowing mixed layer post regime in this region but the models are all predicting a deepening warrants a more in-depth discussion. Are the models all wrong? What use are they if they can simulate regime shifts but with the wrong response?

Page 14023

L2- Predictability. . .See earlier comment about predictability of regime shifts

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