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Nonlinear Processes in Geophysics
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Interactive comment on "Tipping point analysis of ocean acoustic noise" *by* Valerie N. Livina et al.

Anonymous Referee #2

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The paper "Tipping point analysis of ocean acoustic noise", by Valerie Livina et al. is an interesting study of the ocean acoustic dynamical system analysed in terms of its deterministic and stochastic components. Using tipping point analysis, they detect a few bifurcations in the acoustic data measured off the south-west shore of Australia, the strongest of which surprisingly coincides with the recent (2016) very strong El Niño event. This result suggests that the signature of El Niño can be found in the distant ocean acoustic data, whilst it may inspire future studies to understand the origin of other perturbations which the proposed method detects. The paper is well-written and of interest to the geophysics community, as well as to specialists in other disciplines: acoustics, time series analysis, statistical physics, and others.

One can see the signature of the recent (2016) very strong El Niño in the potential analysis plot, Fig 5, which supports their hypothesis. Do the authors suggest using acoustic signal as a possible precursor of El Niño? Will this be useful in detection of El

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Niño in future?

The lower panel of Fig 4, shows a long-term decreasing trend in variance, which seems to stabilise shortly before 2015. There is a sharp increase in autocorrelations around the time when the variance seems to stabilise. Do the authors attribute this to El Niño, too?

Although the clearest change in the number of potential wells (Fig 5, page 10) coincides with the strongest El Niño in 2016, a few less clear changes in potential structure are visible in the upper panel of Fig 5 which apparently do not coincide with El Niño events (lower panel). It may be useful to signal the El Niño events more clearly. I have a few suggestions regarding Figure 5, page 10:

- The x-axes of the upper and lower panels are not well aligned. This makes it harder to notice the coincidence between the 2016 El Niño event (lower panel), and the change from triple to double potential wells (upper panel). To make the Figure clearer, the scale could be aligned, and a gridline added in the lower panel.

- should the y-axis of the lower panel be aligned to make the zero value for the ONI and SOI coincide?

- The SOI index looks very noisy. If El Niño is indicated by simultaneous positive ONI and negative SOI values, the only very clear indication of El Niño is the last one (2016). Accordingly, this is when we see the clearest change in the number of potential wells, spanning all time scales (upper panel). Why do the authors use these noisy indices instead of direct records of, for example, sea-surface temperature?

- Is it important that the changes in the number of potential wells span the entire time scale at a given time? Regarding the results shown on Figure 7, page 12, could the authors explain what is the variable “s”?

The authors could explain better why using colour noise is important in modelling climatic variables.

Minor comments/typos:

Page 2, line 55, is it “polynomial of given order”, instead of “even order”?

Page 4, line 100: “(. . .) and sigma is the noise level.” Replace eta by sigma.

Page 7, line 164: what is n in “r=n-d”? In Eq 10, do both t and k run from 1 to m?

Fig 7, page 12: could resolution be improved?

The authors should correct the Eq 11, page 13, where the derivative in time should be denoted by dot. Fig 8, page 14: I have difficulty reading the legend in the upper right panel. The font (or figure) is too small and the resolution is not optimal.

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