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## ***Interactive comment on “Cumulative areawise testing in wavelet analysis and its application to geophysical time series” by J. A. Schulte***

**Anonymous Referee #2**

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Referee report

Manuscript ID: npg-2015-34

Title: Cumulative areawise testing in wavelet analysis and its application to geophysical time series

Author: J. A. Schulte

The author presents a new method called the cumulative areawise test to evaluate the statistical significance of the wavelet spectrum spanning the time and the frequency axes. In particular, the author introduces the concept of homology to regard the wavelet spectrum in the time-frequency domain as an object in algebraic topology, counting the number of holes or the number of irreducible connected paths. I find the author’s devel-

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opment interesting. The work presented in the manuscript has in principle a potential to appear as an article in NPG for the reason that the wavelet spectral estimator is a widespread method in geophysical time series data analysis. The readers of NPG working on geophysical times series data would benefit from the areawise test. However, unfortunately, the manuscript assumes too much and is hard to read. Some parts in the manuscript are redundant and too long, and the other parts are too short. I spent nearly 2 weeks to read the manuscript by repeating the text over and over again to understand the contents. Though I see a potential in this manuscript, I cannot recommend the manuscript for publication, at least in its present form.

First of all, the manuscript has two distinct goals, one on the methodology and the other on its application. This distracts the audience from reading the manuscript.

The second critical point is that the manuscript has an imbalance in section structure. Section 1, 2, and 3 have understandable text volume, but section 4 is very long (with 6 subsections). Section 5 and 6, in contract, are very short. I cannot read section 4 so easily (i.e., without repeating from the beginning of the section) for its tiring construction.

The manuscript is organized as follows. Here are my comments on each section.

Section 1 addresses the wavelet estimator among other spectral estimators, and discusses the problem or importance of the test for statistical significance in the wavelet spectrum. The goal of the manuscript is not clearly set and it is difficult to follow the strategy of the method development in the manuscript.

Section 2 reviews the significance tests such as pointwise and geometric tests. This section essentially overlaps with the author's recent paper (NPG, 22, 139-156, 2015). I propose to delete this section. The contents are already published by the author. Also, Figure 1 distracts the audience from concentrating on the new method with homology.

Section 3 finally (on page 12) presents the method of the homology with an application

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to red-colored noise. Nevertheless, the exact or quantitative definition is not given, so it is unclear to the readers how the algorithm is constructed to evaluate the persistent topology. This section needs a lot more explanations with equations and definitions. As the concept of the homology is not quantitatively defined, I do not follow the homology method.

Section 4 is hard to read. It is too long (13 pages and 6 subsections). The subsections are: 4.1 Geometric pathways, 4.2 Pointwise significance level selection: maximization method, 4.3 Application to ideal pathways, 4.4 The null distribution, 4.5 Computational remarks, 4.6 Comparison with geometric test. This structure is not understandable, and I do not see what the author wants to say in this section.

Section 5 (Climate applications) is a small section with only 1.5 pages (35 lines), and presents an application of the developed method. The text volume is too small and I do not see any necessity or reason to add this section into the manuscript. Delete the section.

Section 6 (Conclusions) is merely summarizing the manuscript and does not discuss the method in depth. For examples, what is the limit of the method? Also, I do not appreciate to state that a Matlab software is available without presenting the algorithm in this manuscript. Delete the sentence.

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Interactive comment on Nonlin. Processes Geophys. Discuss., 2, 1227, 2015.

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