**Responses to Reviewer 2**

Provided below are responses to reviewer comments, which are highlighted using bold text.

**Summary**

**This paper considers the problem of detecting and quantifying nonlinearities in nonstationary time series with wavelet-based approaches. The author aims to study abilities of the higher-order wavelet analysis in application to the Quasi-biennial Oscillation time series. He considers five objectives, namely, to develop significance testing methods for higher-order wavelet analysis, to apply statistical methods controlling false positive detection, to develop a procedure for calculating confidence intervals corresponding to the sample estimates, to solve the problem of selection of a time interval for calculations, and to introduce a local biphase spectrum.**

**The paper is well written and contains a clear description of approaches for wavelet bicoherence estimation that could be interesting for researchers dealing with nonstationary and nonlinear time series. In my opinion, the description of the methods and their geophysical applications can be used as a part of a review paper or a monograph devoted to the higher-order wavelet analysis. However, I have doubts concerning publishing this manuscript as a research paper. Actually, earlier known approaches are applied to simple testing signals and geophysical data, and the originality and the novelty of the discussed approaches and the obtained results is unclear.**

The author is thankful for the detailed comments provided by the reviewers. Both reviewers found the paper to be well-written and without eroor but felt that it was not orginal. No substantial changes have been made to the manuscript besides some additional text to better highlight the research undertaken in the use of the new methodologies. While not any one method presented in the manuscript is a significant original contribution, the synthesis of methods together with small improvements of existing methods represents an original contribution to higher-order wavelet analysis. The literature regarding the subject has primarily focused on its theoretical and geophysical applications and to a lesser extent on the statistical aspects of the subject. This paper represents the first synthesis and detailed discussion of various statistical procedures that should be considered when applying

higher-order wavelet analysis. This paper largely follows the overall structure of the well-known works of Grinsted (2004) and Torrence and Compo (1998), which bridged gaps between the signal processing aspects of wavelet analysis and statistical facets of the subject. Indeed, the manuscript has put higher-order wavelet analysis in a statistical framework and bridges that same gap as the aforementioned works. The author has also created the first higher-order wavelet analysis Matlab software package corresponding to the paper, which will be of importance to a broader geophysical community.

No substantial changes have been made to the manuscript besides some additional text to better highlight the research undertaken in the use of the new methodologies.

**Specific Points**

**Thus, in particular, the significance testing method used the author has only minor distinctions from those discussed in other papers (e.g., Grinsted et al, 2004). Also, I did not found novelty in the used statistical methods controlling false positive detection and in calculating confidence intervals corresponding to the sample estimates. The author did a good work in application of known techniques and their description with pointing out many important things, however, the claimed objectives are different from the presented results. In conclusion, I think that the considered topic may be interesting for a broad physical community, but I do not recommend publication of this work in its present form.**

Please see responses to comments 2 through 5 of Reviewer 1