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Interactive comment on "Technical Note: Multiple wavelet coherence for untangling scale-specific and localized multivariate relationships in geosciences" *by* W. Hu and B. C. Si

Anonymous Referee #2

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General Comments

The multiple wavelet coherence methodology presented in the manuscript by Hu and Si represents an important contribution to wavelet analysis. In particular, Hu and Si build upon the previous work of Ng and Chan (2012) to extend multiple wavelet coherence to case of more than two predictor variables. The authors further demonstrate that the new multiple wavelet coherence methodology is better suited for situations where the predictor variables are cross-correlated. The problems with the traditional formulation are clearly stated and consistent with the objective of the paper proposed in the introduction section. Theoretical examples were also presented to highlight the advantages of the new methodology relative to existing ones. I their recommend that

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the manuscript be accepted after the substantial correction of grammatical errors and the consideration of more specific comments presented below.

Specific comments

The conclusion section simply summarizes the results of the paper. The authors could consider expanding the conclusion section into a discussion section to comment on limitations of the method. After all, wavelet analysis, while useful, is not a scientific panacea. More specifically, the inclusion of more predictor variables may result in the statistical significance threshold at a particular wavelet scale and time to approach unity, which would impose a limit on how much statistical information can be gained. This phenomenon occurs with the traditional multiple wavelet coherence formulation, where the threshold for 5% significance, for example, is higher than that for bivariate wavelet coherence at a given wavelet scale.

The author may also consider discussing at least briefly the problem of simultaneously testing multiple statistical hypothesis, as discussed in Maraun and Kurths (2004), Maraun et al. (2007), Schulte et al. (2015), and Schulte (2016). Multiple-testing problem is a major problem in wavelet analysis and therefore merits consideration in a discussion section. Presenting clearly the methodological limitations will better guide the likely interdisciplinary readership in making decisions regarding what analysis tools to implement.

Throughout the manuscript, the authors mention how geoscience data are often non-stationary. Perhaps the term is used too loosely in some instances and is sometimes inconsistent with the strict time series analysis definition. Even white and red-noise processes contain time and scale-localized features in wavelet space, even though their respective statistics are stationary at all orders. Time- and scale-localized features are evident in the wavelet power spectrum of say, the North Atlantic Oscillation (NAO), even though the statistics of the NAO are consistent with a first-order Markov process (Feldstein, 2000). Therefore, in some instances, I recommend changing the word “non-

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stationary" to "transient" or "transitory".

Some Technical Corrections

Page 2 Line 3536. Change "geoscience data is" to "geoscience data are".

Page 2 Line 39. Is it better to say bivariate wavelet coherency rather than "simple wavelet coherency" Page 5, Line 97. Add comma before "respectively".

Page 9, Line 169-171. The sentence can be slightly simplified by changing "white noise with a mean of 0" to "zero-mean white noise". Perhaps it is redundant to write that the white noise processes were generated. Authors could consider just saying that white noise was added to the predictor variables.

Page 9, Lines 171-173. The sentence "The resulting noised series are termed weakly, moderately, 172 and highly noised series respectively, and have a correlation coefficient of 0.9, 0.5, 173 and 0.1 respectively, with their original predictor variable" needs to be rewritten and simplified. Consider breaking the sentence into two separate sentences.

The authors should carefully check for grammatical errors and make similar changes throughout the manuscript.

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