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Interactive comment on "Evaluation of statistical methods for quantifying fractal scaling in water quality time series with irregular sampling" *by* Qian Zhang et al.

Anonymous Referee #2

Received and published: 25 July 2017

I find the manuscript is well-written and technically rigorous, with results that can be generalized beyond hydrologic time series. This manuscript tackles a challenging and highly relevant topic - the quantification of fractal scaling behavior for irregularly sampled data - and provides needed synthesis on the most promising methods to estimate this behavior. For these reasons, I recommend the manuscript be accepted subject to minor revisions.

I do, however, have a number of comments that would help improve clarity of the manuscript and emphasize the more practical aspects of this work.

Major comments:

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1) Lines 127-129: It would be interesting to the reader and for understanding the important contribution of this work to detail the effects of non-normal data and persistence, seasonality, and the presence of long-term trends on the estimation of Beta.

2) Lines 264-265: It is noted that the results which demonstrate that the approach used in this manuscript to mimic the sampling irregularity performs well as compared to other simulation methods are not shown. I think these results are important to show, as this approach is what underlies the remainder of the analysis of the methods. This can be added to the supplementary material.

3) There are a large number of interpolation methods (n=11) presented here. I would argue that some of these methods are not very realistic in the context of what one would experience in terms interpolation for irregular samples. Unless the authors provide sound technical justification for each scenario, I would consider removing scenarios that would not generally be considered in standard practices (examples are scenarios B3, B4, and select a smaller subset of LOESS smoothing parameter values). This would also streamline the results and text.

4) Line 412: For Monte Carlo analysis, average values of the simulated parameter of interest are computed from sample sizes of 100 or more - not 30. Was this tested in your experiments?

Minor clarification comments:

1) Lines 3-4: Consider adding a phrase or sentence to explain why spectral slope is important to trend detection.

2) Line 15: Is the “modified form” being newly introduced here? Or does it already exist. Clarify.

3) line 38-39: The fact that ACF is summable seems a non-sequitor here. It is later that the connection is made to summability and the presence of fractal behavior. Perhaps it is not necessary to comment on the summability of the ACF?

4) lines 90-103: Moving this paragraph to the end of Section 1.1 would provide more immediate clarity as to the scope and value of this work.

5) Line 158: Consider the of the work “interpolating” instead of “modeling”

6) Section 2.1: Highly clever way to define sampling irregularity.

7) line 216 (and throughout): I do not think “gappy” is a word and chuckled at its appearance. Please replace with “irregularly-spaced”.

8) line 237: Please be more specific in how you arrived at this equation for the shape parameter.

9) line 247 (as an example): Please add units to values provided in this section and throughout. This will help the reader follow the results and methods.

10) line 473: Hirsch and DeCicco (2015) is the reference to the user manual for WRTDS. The method itself is explained in Hirsch et al. (2010). I would cite the original paper.

Hirsch, R. M., Moyer, D. L. and Archfield, S. A. (2010), Weighted Regressions on Time, Discharge, and Season (WRTDS), with an Application to Chesapeake Bay River Inputs. JAWRA Journal of the American Water Resources Association, 46: 857–880. doi: 10.1111/j.1752-1688.2010.00482.x

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