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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Instability and change detection in exponential families and generalized linear models, with a study of Atlantic tropical storms" *by* Y. Lu and S. Chatterjee

Anonymous Referee #1

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Summary: This paper proposes a likelihood ratio test for testing the stability of parameters of exponential family distributions in the framework of sequential monitoring. The proposed test extends the traditional Normality-based CUSUM test by considering the more general exponential family. My major concern is the practical value of the current paper because (1) the assumption that all parameters are known seems quite restrictive; (2) the validity of the method is not clearly justified either by theory or simulations. Below are some specific comments.

- The assumption that all the parameters other than τ are known seems unrealistic. In practice, the parameters of the exponential family distributions are typically

unknown and are replaced by the corresponding estimates (such as MLEs). Similarly, in generalized linear models, the coefficients β are unknown and need to be replaced by suitable estimates (such as the estimates from estimating equation). The authors claimed that such extension is easy but did not provide any details or discussions. Based on my own experience, I believe that this is a nontrivial and important extension. Overall, the current setting seems rather narrow and may not be useful in real applications.

- The key theoretical results (e.g. Theorem 3.1, Theorem 3.3 and Theorem 4.1) in the paper are presented without providing any mathematical arguments. The absence of the technical details bothers me (the authors should at least make them publicly available). I also notice that some of the theoretical results are not rigorously presented. For example, in Theorem 3.3, it is unclear to me that whether the convergence holds in probability or almost surely and whether the convergence is uniform for all n.
- I am confused with the choice of L and the rationale behind it. Also I wonder how the value of ARL_0 can be determined in practice. It would be better to provide some discussions on this point.
- The extension to the generalized linear model seems useless. The proposed test is infeasible as the coefficients β are in fact unknown.
- In the data analysis, the unknown parameters are replaced by their estimates. I doubt that the proposed method is valid if the estimation effect is not taken into account.
- If the underlying process is stable, how δ (which measures the magnitude of change) can actually be estimated as its true value is zero (the authors set $\delta = c\hat{\sigma}$ in the data analysis, which is ad hoc).

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