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Discussions

Interactive comment on "The impact of sea-level rise on organic matter decay rates in Chesapeake Bay brackish tidal marshes" *by* M. L. Kirwan et al.

Anonymous Referee #1

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This research group should be commended for attempting an experiment comparing the effects of inundation on decomposition rates. The idea of the experiment is laudable, but aspects of the experiment design are inadequately explained and the statistical analysis is lacking. Specific comments follow.

Introduction Page 3, Line 5. Rates of productivity are maximized at an optimum flooding frequency, but this statement should be confined to a specific region. The actual rate of productivity related to an ecosystem type depends on geographical region, and this is particularly true of coastal marshes over their worldwide distributional range.

Methods How was inundation estimated? A reference is given to Weiss et al., but this calculation is a fundamental part of the paper and should be explained fully in this paper. Also, total annual inundation may or may not reflect overall hydrology. These

areas must be tidal? Also, the decomposition rate is likely to be highly dependent on drawdown or flood periods, and this needs to be described in the paper. Mean values of salinity are given, but decomposition is very sensitive to salinity level. If there are periods of time during the year with salinity levels outside the mean and/or fluctuation in inundation (flood or high tide), these periods must be considered in the analysis of the data. Page 5, Line 13. Correct the spelling of Schoenoplectus. Page 6, Line 21. Should explain why bags might gain weight (e.g., sediments, microbes). Page 6, Line 5. Peat was used for the decomposition? Peat is not just one thing, and is comprised of wood, leaves and roots. of different ages. These components decompose at different rates. Was there an attempt to separate out wood pieces, which is very recalcitrant. Lack of homogeneity in the decomposition material could have led to a great deal of variability in the results. Page 7. The analytic methods are particularly lacking. There are 3 sites with various numbers of platforms and years of study. It is tough to come up with a simple and powerful method to analyze these data, and it is not surprising that the regression methods chosen did not find any patterns. I see patterns when I look at the regressions in Fig. 3, and wonder why these were not captured in the statistical analysis. An ANOVA approach to compare Rhodes and Blackwater may be the way to detect differences related to inundation. An ANOVA approach would allow you to test for the variability related to site differences and time. Transquaking may have too little data to do this, although it should be considered. For Rhodes and Blackwater, if some of the analysis shows that some factor is not an important (e.g., year), it may be possible to collapse the annual data for one of the sites, and then to do a balanced comparison of Rhodes and Blackwater with means of years. If some aspects of the data set are unbalanced, in may be possible to use some distributionless tests to do the analysis. At any rate, an ANOVA approach may be the only way that you can account for the variability that needs to be accounted for to try to make the main point of this paper, which is that "inundation does matter". It is likely that the situation here is a case in which inundation and decomposition were not adequately dealt with in the analysis. Also keep in mind that k values are not linear, so an ANOVA on k values would reflect

the spontaneous rates of change of these negative exponentials. Again, using k values should add to the power of an ANOVA approach to analyze these data. If the ANOVA cannot be done, then you are left with the regression approaches that you are currently using in the paper, and you may not be able to account convincingly for variability related to site and time differences. That is a real weakness of the regression analysis used currently in the paper. See additional details related to regression approaches for data analysis under "Fig. 3". Page 9. Sea level rise would also change salinity levels, so this study is more of a test of inundation than sea level rise. For that matter, you have used means of salinity, and discounted salinity as a factor. Ignoring salinity may be a mistake because of event-based, seasonal or tidal conditions related to salinity. The same may be true of inundation. Nutrients may also differ between the sites, but salinity is likely to be important here. Page 11, Line 5. Another source of error may be differences in the constituents of the peat material itself. Fig. 3. Page 19. The k values should be statistically analyzed using ANOVA and nested by site. Some of the sites also were done in more than one year (Rhode River), and this needs to be accounted for in the model. Inundation periods might be grouped into categories. Differences are examined by site in the regression (but the shapes of curves not compared), and this approach is not likely to pick up differences related to inundation. Using this type of analysis, at the very least the shapes of the curves should be compared statistically. Even so, a regression approach will not identify the main sources of variability in the way that an ANOVA can. Fig. 3. Percentage of mass loss should be log transformed before analysis (if used). I assume that the values in Fig. 3a are the same values are used in Fig. 3b and 3d, so that only one of these analysis procedures should be used. It's not really valid to give various analysis procedures for the same data set in a paper. K values reflect the spontaneous rate of change peat decay over time, so that this value may be the one to use in the data analysis. Following Fig. 3c, I can see that the curves of k values by site seem to be 2nd order polynomials with lowest values in medium levels of inundation. I doubt that the Transquaking site can be analyzed with only 3 inundation levels. It should be possible to compare the shapes of the curves

of Rhodes and Blackwater though to test the difference across inundations % levels. The patterns are not likely to be linear so second order polynomials and exponentials should be fitted to the data. Keep in mind that a k value reflects a negative exponential. Also, site means might be used to fit these curves, which would reduce the variation contributed by site conditions or unidentifiable factors, and capture the variation related to inundation (See Underwood 1997). In the end, I'm not sure which data analysis approahc should be used. The problem is that I can see patterns in the data, and it is not convincing that the statistical analysis did not detect these patterns. Fig. 4. The same problem may be true of the C and N regressions in Fig. 4. The means may be fairly clear, and show differences between sites across inundations. These are percentages losses of C and N, so the values likely need to be arcsine square root transformed before analysis.

Underwood, A.I. 1997 . Experiments in ecology. Cambridge University Press, Cambridge, UK.

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