

Interactive comment on “Carbon Export and Fate Beneath a Dynamic Upwelled Filament off the California Coast” by Hannah L. Bourne et al.

Anonymous Referee #2

Received and published: 4 December 2020

Summary: This paper describes measurements of sinking particle flux collected from the California Current Ecosystem – LTER site. A series of deployments of Carbon Flux Explorers, which are autonomous platforms that collect and image sinking particles, was conducted from onshore to offshore inside and outside of a high-chlorophyll filament. The data show a large particle flux signal and large differences inside and outside of the filament. Additionally, there appears to be a great deal of vertical variability of particle flux which departed from a traditional “Martin curve” flux profile in all cases and increased with depth in many of the observations.

General comments: The authors have collected a detailed, valuable set of data using state-of-the-art sampling technology. In situ imagery of sinking particles is difficult to collect and provides important information about particle origins and physical prop-

C1

erties. In addition, this data set was collected within the context of the long-running CCE-LTER timeseries and will add a lot to our understanding of this complex system. For these reasons I hope to eventually see these data published.

However, the present interpretation of the observations is a difficult read, and many of the authors’ conclusions are not strongly supported by the data as they are currently presented. In general, the number of figures and length of the text need to be reduced to focus on the evidence that supports the authors’ main conclusions. Many of the methodological details relating to the CFE could be shortened and replaced with a reference to Bishop et al. (2016).

There are many qualitative or weakly-supported statements about the observations that should be removed, replaced with quantitative, statistically robust interpretations, or supported with additional references to other studies or data. Certain conclusions may need to be revised depending on whether they are actually supported by the data. For instance, while uncertainties in Martin “b” exponents were computed (Table 2), and are relatively large, they do not seem to have been considered in the interpretation. All discussion of Martin “b” values should take the uncertainties into account, and all statements made about the measured “b” values should first be evaluated for statistical significance given the very large relative uncertainties. The overall conclusions of the paper should be reevaluated once the uncertainties in the “b” values are considered.

I offer a few specific comments below to suggest places where revisions should be made, and places where statements are not strongly supported by the data as presented and additional references are necessary

Line 107: Please provide the trap funnel aspect ratio or a reference describing this.

Line 126: How is the weight of the shark known? Unless it was actually measured, please use a word like “large” instead. If it was measured, please provide a reference.

Line 141: What is the physical meaning of these “volume attenuation” units?

C2

Section 2.2.2: Please add a few additional words to clarify that the calibration from Bourne et al. (2019) was reused here.

Line 154-155: This statement should go in the Discussion instead of the Methods.

Line 166: Replace “now in progress” with a reference.

Lines 169-227: Much of this text should be reduced. First, statements about the possible caveats, future developments or applications of these methods need to be moved to the Discussion (and, consider referencing the Giering et al., 2020 review which considers some of the same issues). Second, presentation of results and descriptions of identified particles should be moved to the Results. Or, to reduce the length of the paper, consider moving all of this material to an appendix or supplement.

Line 182,183,213 (and elsewhere): It is unclear how particles were assigned to the “aggregate” and “ovoid fecal pellet” categories, except for size and attenuation thresholds. At a minimum it would be helpful to include some representative images. There are also particle categories referred to later on that are not introduced, here.

Line 246: Were UVP particles at least classified into living and non-living prior to analysis here?

Lines 357-363 (and elsewhere): Reference is made to a number of particle types (anchovy pellets, copepod pellets, larvacean houses) whose assignments and definitions are not described in the Methods section. How were they identified? Give some example figures.

Line 360: What method was used to determine that copepod fecal pellets contributed 50% of the flux?

Lines 365-369: The description of how Martin curve exponents were calculated should go in the Methods. Uncertainties are presented in Table 2 but no mention is made of how these were determined. Note that a linear fit to log-transformed data will tend to amplify the influence of lower points relative to higher ones, but a nonlinear least-

C3

squares method will avoid this.

Line 380-381: “SEM imagery of CFE-Cal samples . . .” Please provide the data and methods, or a reference to them.

Line 386: By “particle flux” do you specifically mean “attenuance flux”?

Line 388-389 (also Line 565): The inference about particle sinking speed is speculative – are there other tests that were done to support this, or a reference that confirmed this behavior?

Line 423-433: Please move the description of the calculation method to the Methods section, and make sure that the nitrate data are either in an appendix or provide a reference.

Lines 444-445: “As CFEs are Lagrangian . . .” Please provide a reference to support this statement.

Lines 485-486: Please provide a reference to this statement.

Lines 493-499: This section should reflect the uncertainties in the computed “b” values (see above)

Lines 521-524: I suggest including some references to the literature here; most of these mechanisms have been discussed in other settings as well.

Lines 552-554: These statements should be supported by references.

Lines 625-627: Please provide some supporting references.

Lines 689-690: “The efficiency of export was clearly affected by trophic structure”. This statement needs to be more strongly connected to observations of trophic structure, which are not presented in this study. Please provide a reference to such observations.

Line 691: Please provide a reference to the measurements of phosphorus in the sinking particles.

C4

