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Interactive comment on "The role of diatom resting spores for pelagic-benthic coupling in the Southern Ocean" *by* Mathieu Rembauville et al.

Anonymous Referee #2

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This manuscript by Rembuaville et al describes lipid fluxes and compositions for five deep-water sediment traps deployed in the Southern Ocean to evaluate relationships between Fe fertilization and organic matter (OM) flux to the seafloor and the effects of seasonality in upper ocean ecology and particle morphologies on the ON flux. The major conclusions are that labile lipid fluxes are higher at the three iron-fertilized sites that at the two lower productivity HNLC sites, that lipid fluxes are greatly attenuated with depth, and that specifics of lipid flux and composition depend on ecological factors in the upper ocean. The conclusion that diatom resting spores and zooplankton grazing on the main phytoplankton that produces fecal pellets of various morphologies are major determinants on OM and lipid flux to the seafloor at these sites, and specifics of the fluxes and types of particles varies between the site. Unfortunately there are some

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serious flaws with the present form of the manuscript that would require attention of the authors before proceeding further. First and foremost, the lipid compositional data are actually given short shrift. Are they supposed to be in Supplemental table 1 (noted at line 137 and again at line 297), which apparently was either not included (intended or otherwise?) or simply not available to this reviewer. This would actually include the seasonal data for the plot shown in Fig 4. Without a more complete data set (indeed at line 276 "quantitative datasets on both compound and organisms fluxes are required" tells all). The lipid compositional data that are included in the text are too sparse for the generalized conclusions that are drawn. Throughout the text, and in Table 2, there is some confusion about fluxes vs concentration. E.g., at line 284, the "spring lipid flux is low (0.3 mg/m2). . .", but this is a rate not a flux without some time frame. Is it supposed to be per day, or over the deployment period, or annualized? Likewise, in Table 2, the "normalized total lipid fluxes, mg lipid/g OC" are concentrations not fluxes (it is correct that lipid flux/OC flux will give a concentration of mg lipid/g OC). (Note that in figs 2a, c, g, and e fluxes have correct units.) Other comments: P 6 - were the traps treated with some sort of poison or preservative to preserve the integrity of the OM over the entire deployment period (if this is given in one of the references it was not clear)? Line 173 - this is the first instance of the flux "units" being incorrect. See also line 185 – a concentration. . .. What are the annualized primary productivity levels at the five sites? And annualized chl-a concentrations (is that what's in fig 1?). This information is important to give some sense of the quality of the OM produced at each site, as this impacts the comparative fluxes near the seafloor. Line 187- what are monounsaturated FAMES MUFAs, and polyunsaturated FAMES PUFA, but saturated FAMES are FAMES (why not Sat-FAMES or SFMES) for consistence. After all, everything measured is a FAME. Line 201 - isn't "unsaturated alkenols" redundant since alkenols are unsaturated by definition? Line 209 - maybe spell out the name of EPA the first time it is used. Line 252 - why does the cholesterol reflect the dominance of diatoms are the base of the food web? The references cited later (e.g., Rampen et al., 2010; line 328) shows that C27-5 is a relatively minor component of many diatoms. What about 24-methylene

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cholesterol (C28-5,24(28)? It's hard to evaluate these statements without the data, which as noted above are missing for some reason. See also paragraph at line 326. Line 266 – The conclusion that lipids are selectively degraded/remineralized during sinking relative to OC because lipid/OC ratios decrease between the shallower and the deepest traps also depends in part on the lipid/OC ratios of the starting material. Since there are apparently differences in production, or chl-a, or ecology between the Fe-fertilized sites and the HNLC sites, what are lipid/OC ratios in the material that is initially exported out of the surface waters? Fig. 2. Are the units on the abscissa supposed to be fluxes. Under "refractory", what is the "other" category? Table 2 – are POC and BSi annual "fluxes" with flux units? There is no discussion of BSi in the manuscript.

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