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Interactive comment on "Quantifying the Cenozoic marine diatom deposition history: links to the C and Si cycles" *by* Johan Renaudie

Anonymous Referee #2

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This paper provides an important review of the constraints on marine diatom deposition in the modern ocean and evaluates diatom distribution through time using smear slide estimates compiled from the DSDP and most of the ODP cruises. The maps produced are very useful in understanding the spatial distribution of marine diatoms through time and their patterns are mostly supported by the literature. However, there are fundamental problems with the assumptions of using this data. Shipboard sedimentologists who have variable experience in the recognition of microfossils traditionally compile smear slide abundance data. Smear slide preparation is not uniform and is subject to bias based on the preparation technique. Estimation of the relative abundance of various microfossils can be quite different depending on the magnification at which the smear slide is examined. For example, the most abundant diatoms typically are very small compared to radiolarians and may be missed at magnifications of X250 or less.

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It is acknowledged on line 25 of p. 7 that the smear slide data presented does not represent accumulation rates: however, there is no justification for the statement that that "globally averaged smear slide data should largely track variations in global accumulation rates". In most of the sediments recovered from tropical ocean DSDP-ODP sites, as well as those from the Atlantic Ocean as a whole, calcium carbonate is most abundant biogenic sediment component observed in smear slides. Treatment of these samples in hydrochloric acid reveals abundant diatoms. Such acid treatment has been the subject of numerous papers on diatom biostratigraphy published in the DSDP-ODP literature. Similarly, along active margins, such as the eastern coasts of North America, diatoms are masked in smear slide abundance by detrital materials. In both cases, biostratigraphic and quantitative studies have revealed quite different diatom abundance patterns than those shown on Figure 4. Baldauf and Barron (1990) and Barron et al 2015), which are both cited in this paper, take this into consideration and present quite different results for the Eocene. Compilation of accumulation rates requires knowledge of the rates of sediment accumulation.

Specific points – 1) The abstract mentions a diatom abundance peak in the late Eocene, but Figures 3 and 4 show that this peak is actually just above the Eocene/Oligocene boundary. 2) Figure 4 suggests that late Oligocene increase in smears slide diatom abundance is limited to the Southern Ocean. I suspect that in may reflect a decrease in calcium carbonate abundance south of the Antarctic Polar Front. 3) The reader should be aware of a 2016 PNAS (v. 113, no. 25) paper by Crampton et al., which gives a thorough discussion of the response of Southern Ocean diatoms to CO2 changes during the past 15 million years.

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