Reviewer #1

The paper by Cheung et al. uses satellite data to test whether Ekman pumping is likely to be detectible in marine sediment records from the Southern Californian margin through proxy records, especially those relating to SST and productivity. They conclude that important processes, such as Ekman pumping, do not occur across all timescales, and that an integrated proxy record is unlikely to accurately reflect the spatial variability associated with Ekman pumping. They further show that inclusion of multiple sites may increase the reliability of proxy records. Overall, this is an interesting study and the conclusions seem sound and well supported. I do have a few comments, which I hope can serve to improve the manuscript.

We thank the reviewer for pointing out sections that require clarification and providing constructive comments. Point to point reply to comments are below.

First, I am surprised the authors have not included much of a temporal element in applying their modern observations to sediment core reconstructions. The authors are quite convincing in showing that annually averaged (or seasonally weighted) models do not represent the true spatial extent of Ekman upwelling. However, what they don't seem to test is whether time averaged variability in these phenomena would be captured in the sediment. After all, this is what the vast majority of marine sediment studies record – temporal variability (even relative) at a site, rather than comparison between sites in a world with perfect age models. I think including a test of how integrated variables compare across different intervals would be relevant to addressing this point.

Although we did not address directly the issue of proxy averaging because averaging windows of proxy records are typically longer than the observational record used in this study, we attempted to show the effects of timescale averaging on large scale circulation (defined by the EOF patterns of the study region) by comparing spatial patterns using daily averaged, 30 day averaged, and 365 day averaged data (Figs. 5-7). A separate concern for sediments, if the proxy records are not a pure average, but an average weighted toward particular seasons (e.g., based on productivity variability or sedimentation rates by season) is occurring is a highly complex and proxy-dependent discussion. Taking that into account fully is far beyond the scope of this paper. However, we now include a more detailed discussion on the implications of proxy interpretations based on the results we present, specifically pointing out how different patterns seen when using different time averaged data imply the need to interpret proxies differently depending on the timescale proxies average (e.g. seasonal vs annual) and whether those averages include non-uniform weighting.

Second, even after extremely close reading, I am struggling to understand how exactly the pseudo-proxy time-series presented in Figures 8-10 were generated. I'm under the impression that each of these is an integration of satellite data at a specific point. Is this correct? If so, this could be made more explicit, and an explanation of how and why particular sites were chosen would be helpful.

We agree that this was not very clear. We have remade the figures and we are also adding a more detailed description on how Figures 8-10 were generated, providing the explicit algorithms and equations.

Minor comments:

Page 2, Line 3 – Missing the end of this sentence.

Thanks for pointing it out. The sentence is now completed in the updated manuscript.

Figure 8 – Something is going on here with the labeling of “best”, “median”, and “worst.” I don’t think this is correct.

We went back and double checked the script that generate this figure. We realized there was a mistake in computing the scaling factor, which has been corrected. Furthermore, we double-checked the selection criterion for “best”, “median”, and “worst” and made sure that the correct instances are being selected and presented here.