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Comment

***Interactive comment on “Coccolithophore  
response to climate and surface hydrography in  
Santa Barbara Basin, California, AD 1917–2004”  
by M. Grelaud et al.***

**Anonymous Referee #1**

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Grelaud et al., present an intriguing new dataset with unrivalled resolution of changes in coccolithophore assemblages and weights during the last 90 years from the varved record of the Santa Barbara Basin. Specifically, they are able to reconstruct a history of ENSO but also to chart changes in the weight of the coccolithophores over the timescale of anthropogenic change.

I am not so qualified to comment on the spectral analysis and application of the assemblages as a measure of PDO and ENSO through time but this appears to be a valid and interesting new methodology. However, the annual and decadal changes in weight are much larger than those of the trends over the last 90 years. The authors

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do not really comment on what could be driving the changes in interannual variability and yet this is the larger component of the signal which is worthy of greater discussion and detail. I am also interested by the degree of preservation of the coccolithophores through time. Could there be any preservation biases down the core?

One of my main concerns is the state of the waters at the site with regard to equilibration of CO<sub>2</sub> with the atmosphere. If we want to invoke a change in the coccolithophores with the changing chemistry of the atmosphere, it is essential to know whether the surface is at equilibrium. At the very least, it appears that the cold CC brings nutrients and waters from upwelling and so likely has a greater charge of CO<sub>2</sub> from remineralisation and is actively effluxing carbon dioxide to the atmosphere. Are the waters at this site a source or sink of CO<sub>2</sub> to the atmosphere or are they at equilibrium? If there is a change in the relative proportion of upwelling waters to subtropical waters then that could affect the carbonate chemistry independent of the change in the atmosphere associated with anthropogenic change.

How much can the changes in size and weight be attributed to any trend in the ENSO or PDO indices? Also, we know that the calcification can be affected by changes in the carbonate chemistry, but perhaps most starkly by changes in phosphate availability with limiting phosphate inducing large increases in calcification. Is there any evidence to suggest that the trend could be a result of changing phosphate limitation through time? Are there any other features of the core which could be interpreted as changing nutrient availability?

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