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Interactive comment on "Co-variation of metabolic rates and cell-size in coccolithophores" *by* G. Aloisi

Anonymous Referee #1

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Review of "Co-variation of metabolic rates and cell-size in coccolithophores" by G. Aloisi.

The manuscript of G. Aloisi presents a model describing the relationship of coccolithophore cell (resp. coccosphere) and coccolith size to cellular rates such as growth rate and photosynthesis. Coccolithophores are an important phytoplankton group responsible for the majority of pelagic calcium carbonate production in the ocean. Understanding the underlying physiological mechanisms of the relation between coccosphere/coccolith sizes and cellular rates is important for marine phytologists as well as paleoceanographers as coccosphere and coccolith sizes are frequently used to reconstruct past environmental conditions. Thus, the manuscript is timely and well positioned in the journal "Biogeosciences" and represents a valuable contribution for

the scientific fields of paleoceanography, climate change research and phytology. The manuscript is well presented and the model underlying physiological mechanisms and assumption are well described and reasonable. Clearly this model can be further developed with more data coming available, however, I think that the model's approach is unique and justifies publication and recognition inside the scientific community. In summary, I recommend this manuscript for publication in BG after considering some small modifications which can be easily overseen by the editor.

General comments:

The author points out that coccosphere size data from laboratory experiments under light:dark cycles need to be normalized with respect to the time of sampling whereas experiments under continuous light do not because of a desynchronized cellular division cycle. Interestingly, fossil coccospheres represent an integrated sample over the whole natural light:dark cycle and thus should be more comparable to laboratory samples from desynchronized cultures instead of single time point measurements during a light:dark cycle. I think that it might be worse to stress this point in the manuscript.

I recommend including the recent publication by Bach et al. in the discussion. Their study and presented concept will be a valuable addition the present manuscript. Bach, L.T., et al. A unifying concept of coccolithophore sensitivity to changing carbonate chemistry embedded in an ecological framework. Prog. Oceanogr. (2015), http://dx.doi.org/10.1016/j.pocean.2015.04.012

Detailed comments:

P. 6216, L. 14: "An increase in phosphate or temperature produces the opposite effect"

Care has to be taken here when mentioning the effects of phosphate concentrations and temperature on the physiology of coccolithophores. In theory, physiological parameters will follow phosphate concentrations following a saturation curve whereas temperature induces optimum curve behaviour. Therefore, the effects of these two

parameters are not comparable because temperature can have positive and negative effects depending which locations on the optimum curve are compared.

P. 6217, L. 7: In my understanding the expression “exoskeleton” for the coccosphere is misleading because the coccoliths have no skeletal function.

Interactive comment on Biogeosciences Discuss., 12, 6215, 2015.