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Interactive comment on "How will the key marine calcifier *Emiliania huxleyi* respond to a warmer and more thermally variable ocean?" *by* Xinwei Wang et al.

Anonymous Referee #2

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Temperature is an important driver regulating phytoplankton physiology. Previous laboratory and field investigations suggest that the trend of global warming may strongly affect future phytoplankton communities and the consequent marine biogeochemistry. Most previous studies of warming effects on phytoplankton were mainly conducted under relatively constant temperature regimes. However, under future climate change scenario, in addition to warming (i.e. increasing mean temperature), the magnitude of temperature fluctuation will also be changed. The response pattern of marine phytoplankton to thermal variations/fluctuations is still largely unknown. The present study investigated the physiological response of a well-studied marine coccolithophore species Emiliania huxleyi to not only a broad range of temperature regime, but also

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two different frequencies (one-day and two-day) of thermal variation. The examined physiological parameters include growth, photosynthetic and calcification rates, and elemental compositions. The results suggest that higher thermal variation frequency (one-day) was less inhibitory on E. huxleyi physiological processes than two-day variations especially under high temperature, indicating that the frequency of temperature fluctuation may be of importance in regulating the impacts of extreme high temperature events on key phytoplankton groups. The conclusions are valuable and help to predict the relevant marine biogeochemistry under a more realistic condition of a complex and changing marine environment. In general, the manuscript is well written and organized; the results are also well explored and discussed. I would suggest the manuscript to be accepted with minor revisions. My detailed comments and suggestions are listed below.

Line 140: How often were these cultures diluted? Does this mean that steady-state growth was not observed for 28.6°C treatment?

Lines 144-148: For the different fluctuation cycles (one-day and two-day), how was the temperature adjusted? Was temperature changed gradually during a one-day or two-day period or the cultures experienced abrupt temperature changes? Was there any lag phase for temperature changes? It would be better to provide the details of temperature fluctuation patterns in different treatments in order to better explain the observed different effects of fluctuation frequencies on Emiliania huxleyi physiology.

Lines 152-155: What was the nutrient condition in the culture medium used for dilution? What do you mean by "100 μmol L-1 nitrate and 10 μmol L-1 phosphate was added every two days"? Please clarify.

Line 170: Please delete "GFC"

Lines 174-176: "Total Particulate Carbon" and "Particulate Organic Carbon/Nitrogen" should all be lowercased.

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Line 206: I found the abbreviation of “TPC” a bit confusing here, since it refers to “total particulate carbon” in the earlier text.

Line 209: misspelling of Emiliania huxleyi

Line 210: Please specify how the equation was modified.

Line 251: Please rephrase the text to “The growth rates during the cool phase of the one-day variation cycle were lower than those. . .”

Line 419: should be revised to “ can be influenced. . .”.

Line 596 - : In this section, it might be worth to also expand the discussion on how thermal variation would affect the competition advantage of coccolithophores over other phytoplankton functional groups (such as diatoms) in the community level.

Fig. 1. The growth rates presented in the figure were supposed to be measured during steady growth phase. However, according the context, the cultures were not able to survive at 28.6°C. I assume the negative growth rate was calculated based on the decreased in-vivo fluorescence values over the consecutive sampling days. I’d suggest using the value 0 instead of negative value for fitting at this data point.

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