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Interactive comment on “Climate change impacts on net primary production (NPP) and export production (EP) regulated by increasing stratification and phytoplankton community structure in CMIP5 models” by W. Fu et al.

Anonymous Referee #1

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General comment

The paper by Fu et al. presents changes in marine productivity under a global warming scenario simulated by CMIP5 models. I think this work is meaningful because comparison of marine ecosystem variables across CMIP5 models is still limited. Their indication that models having larger biases in stratification in contemporary period show stronger stratification in future climate is important. They pointed also out that representation of community composition in models is an important factor to determine productivity response to climate change, which can be a motivation to represent marine

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ecosystem dynamics more realistically in CMIP models. Their analysis, however, looks crude in some aspects, and additional investigations are required before publishing.

Specific comments

1. Controlling factors other than stratification

In this paper, the authors focused mainly on relationship between marine biogeochemical variables and stratification. Although high correlations between these variables (Fig. 10) highlight an importance of stratification, other factors, changes in light availability and temperature increase, can contribute to the simulated production changes. In p. 12869 L. 13-16, the authors concluded that increased stratification and nutrient stress are the dominant control on the production change in comparison with changes in light and temperature. There is, however, no analysis supporting this argument.

2. Spatial pattern of production change

The authors mainly discuss changes in globally averaged variables. Discussions for changes in spatial patterns can strengthen their argument. For example, although they argue that stratification is the main driver decreasing productivity, the spatial patterns of changes in stratification (Fig. 4) and NPP by diatoms (Fig. 12) are quite different. How do the authors explain this discrepancy? From my view, there are some characteristic responses in the spatial pattern of NPP change among models. In the complicated models (GFDLs, IPSLs and CESM), the responses of NPP by diatoms show decrease in the northern high latitudes, small increase in tropics and subtropics, and modest increase in the Southern Ocean (Fig. 12). In the simpler models, on the other hand, show decrease in the northern high latitudes and increase in tropics and subtropics. What controls such different response?

Minor comments and questions

1. Add units (kg/m³?) in p. 12886 Fig. 4.
2. What is the definition of the particle export ratio?

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3. p. 12897 Fig. 15 Are these regression slopes statistically significant? If so, please write it, and also describe what significant level is used.

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