Marine Heatwaves Impacts on the Global Surface Phytoplankton Variability

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Under the global warming, the marine heatwaves have been more frequently occurred and extended their durations and these changes were observed both observations and the future model results (Oliver et al., 2018, Frölicher et al., 2018). The previous studies have proposed that the marine heatwaves have strong impacts on the oceanic ecosystem and fisheries including coral bleaching, drastically decreased copepods and reduced biodiversities. In the present study, we showed the global marine heatwaves spatio-temporal impacts on the phytoplankton, which is the basis of marine ecosystem, by analyzing the high-resolution SST and chlorophyll satellite observations and mixed layer reanalysis data with the modified definition of marine heatwaves. Phytoplankton responds to the marine heatwaves differently depending on each latitude despite of the same mixed layer shoaling. These heatwave driven mixed layer shoaling changed the environment of the ocean including nutrient and light availability, which are the dominant control factors of phytoplankton growth. We have suggested different mechanisms how phytoplankton interacts with mixed layer depending on each latitude under marine heatwaves and showed that nutrient abundance is key factor for this phenomenon. Quantitively, we have suggested that duration and maximum intensity of marine heatwaves are important factors in determining the magnitude of chlorophyll responses to the marine heatwaves.

Key words: Marine Heatwaves, Extreme Events, Biogeochemical Cycle, Phytoplankton, Latitude Dependent Response