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Phytoplankton decline in the eastern North Pacific transition zone associated with atmospheric blocking

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ABSTRACT

Global climate change can significantly influence oceanic phytoplankton dynamics, and thus biogeochemical cycles and marine food webs. However, associative explanations based on the correlation between chlorophyll‐a concentration (Chl‐a) and climatic indices is inadequate to describe the mechanism of the connection between climate change, large‐scale atmospheric dynamics, and phytoplankton variability. Here, by analyzing multiple satellite observations of Chl‐a and atmospheric conditions from National Center for Environmental Prediction/National Center for Atmospheric Research reanalysis datasets, we show that high‐latitude atmospheric blocking events over Alaska are the primary drivers of the recent decline of Chl‐a in the eastern North Pacific transition zone. These blocking events were associated with the persistence of large‐scale atmosphere pressure fields that decreased westerly winds and southward Ekman transport over the subarctic ocean gyre. Reduced southward Ekman transport leads to reductions in nutrient availability to phytoplankton in the transition zone. The findings describe a previously unidentified climatic factor that contributed to the recent decline of phytoplankton in this region and propose a mechanism of the top‐down teleconnection between the high‐latitude atmospheric circulation anomalies and the subtropical oceanic primary productivity. The results also highlight the importance of understanding teleconnection among atmosphere–ocean interactions as a means to anticipate future climate change impacts on oceanic primary production.