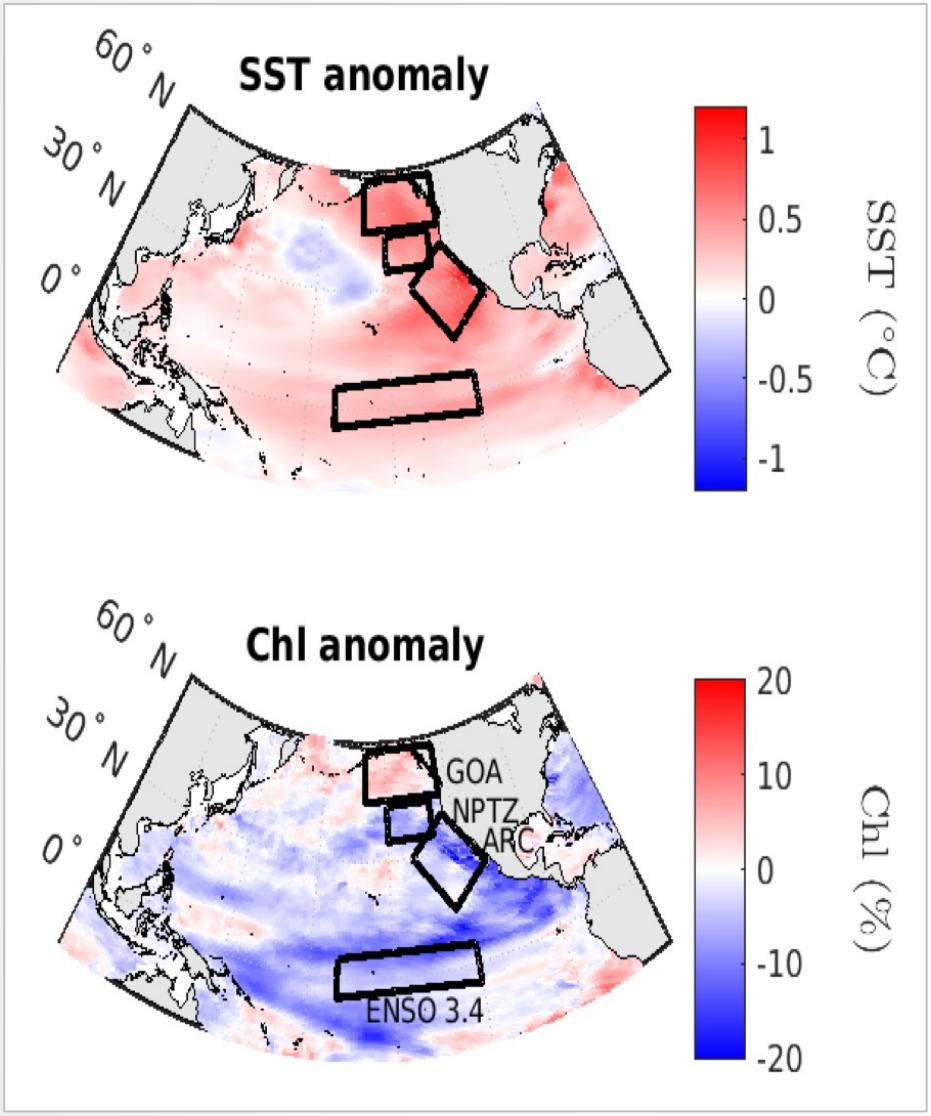
Impact of Pacific Ocean Heatwaves on Phytoplankton Community Composition

National Aeronautics and Space Administration



Since 2013, marine heatwaves have become recurrent throughout the equatorial and northeastern Pacific Ocean and are expected to increase in intensity relative to historic norms. Among the ecological ramifications associated with these high temperature anomalies are increased mortality of higher trophic organisms such as marine mammals and sea-birds, which are likely triggered by changes in the composition of phytoplankton, the base of the marine trophic food web. We assimilated satellite ocean color data into an ocean biogeochemical model to describe changes in the abundance of phytoplankton functional types (PFTs) during the last decade's (2010s) warm anomalies in the equatorial and northeastern Pacific Ocean. We find important changes associated with the "Blob" warm anomaly in the Gulf of Alaska, where reduced silica supply led to a switch in community composition from diatoms to dinoflagellates, resulting in an increase in surface ocean chlorophyll during the Summer–Fall of 2014. A more dramatic change was observed in the equatorial Pacific, where the extreme warm conditions of the 2016 El Niño resulted in a major decline of about 40% in surface chlorophyll, which was associated with a nearly total collapse in diatoms.

Figure: Mean modeled sea surface temperature (SST) and surface chlorophyll (Chl) anomaly over the anomalously warm period between March of 2013 and December 2020, inferred by the NASA Ocean Biogeochemical Model.