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Global ocean chlorophyll in a changing climate

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Oceans are the Earth's principle sink for atmospheric CO_2. While the impact of individual El Niños on ocean productivity have been investigated, how the ocean biology responds to recent changes in climate across a range of time scales has not been previously characterised. A doubling in the intensity of El Niños in the central equatorial Pacific over the past 30 years should have affected ocean productivity and thereby the sink of CO_2. Based on near-global satellite remote-sensed chlorophyll-a (Chl-a) estimates since the late 1990s (omitting the anomalous 1997/98 El Niño event) , we find that the dominant Chl-a interannual variability couples with central Pacific (CP) El Niño (in contrast to current understanding), and includes a decadal, or longer-term, trend. The limited length of the satellite record precludes an attribution of this trend to anthropogenic forcing. However, by projecting the dominant Chl-a empirical orthogonal function onto sea surface temperatures and reconstructing the time series back to 1870, we demonstrate that CP El Niño has been the key driver of Chl-a changes in the recent decade. We also find that CP El Niño acts to increase ocean net primary productivity (NPP), contrary to our current understanding of El Niño effects. This highlights the important distinction between El Niño 'flavours' on the global system. We estimate that there is an equivalent offset at the rate of $\sim$10% of current anthropogenic CO_2 emissions during peak CP El Nino events, due to the increase in NPP.