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# Marine Heat Waves in the Peruvian Upwelling System: from 5-day localized warming to year-long El Niños

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Extreme climatic events, such as marine heatwaves (MHWs), have been shown to globally increase in frequency and magnitude over the last decades, and can disrupt ecosystems significantly. Coastal upwelling systems, because they are biodiversity hot-spots and socioeconomic hubs, are particularly vulnerable to those rapidly developing anomalously warm marine events. The Peruvian coastal system in particular is highly exposed to climate variability because of its proximity to the equator. As such it is regularly impacted by El Niño events whose variability has been related to the longest and most intense MHWs in the region. However the intensively studied El Niño events tend to overshadow the MHWs of shorter duration that also have an important impact on the coastal environment as they can trigger other extreme events such as nearshore hypoxias and harmful algal blooms.

Using 38 years of satellite sea surface temperature data, we investigate the characteristics (spatial variability, frequency, intensity and duration) and evolution of MHWs in the South Tropical Eastern Pacific, with a focus on the Peru Coastal Upwelling System. The separation of events by duration allows to identify a spectrum, from El Niño events to shorter scale MHWs. Results show that the statistical distribution of MHWs properties, their spatial organization and preferential season of occurrence varies significantly in function of their duration. Besides, when removing large El Niño events, an increase of occurrences, duration and intensity is observed over the last 38 years, contrary to the reduction that is observed in the region when considering all MHWs. Finally, the possible drivers are discussed to disentangle the role of the local (wind stress) and remote (equatorial variability) forcing in function of the events duration.