

ID: W2238128463

TITLE: The OMZ and nutrient features as a signature of interannual and low-frequency variability in the Peruvian upwelling system

AUTHOR: ['Michelle Graco', 'Sara Purca', 'Boris Dewitte', 'Carmen G. Castro', 'Octavio Morón', 'Jesús Ledesma', 'Georgina Flores', 'Dimitri Gutiérrez']

ABSTRACT:

Abstract. Over the last decades, the Humboldt Current upwelling ecosystem, particularly the northern component off the coast of Peru, has drawn the interest of the scientific community because of its unique characteristics: it is the upwelling system with the biggest catch productivity despite the fact it is embedded in a shallow and intense oxygen minimum zone (OMZ). It is also an area of intense nitrogen loss and anammox activity and experiences large interannual variability associated with the equatorial remote forcing. In this context, we examined the oceanographic and biogeochemical variability associated with the OMZ off central Peru from a monthly time series (1996–2011) recorded off the coast of Callao (12° 02' S, 77° 29' W). The data reveal a rich spectrum of variability in the OMZ that includes frequencies ranging from seasonal to interannual scales. Due to the efficient oceanic teleconnection off Peru, the observed variability is interpreted in the light of an estimate of the equatorial Kelvin wave contribution to sea level anomalies considering the peculiarities of its vertical structure (i.e., the first two baroclinic modes). The span of the data set allows us to contrast two OMZ regimes. The strong regime is associated with the strong 1997–1998 equatorial Pacific El Niño, during which the OMZ adjusted to Kelvin-wave-induced downwelling conditions that switched off the upwelling and drastically reduced nutrient availability. The weak regime corresponds to the post-2000 period associated with the occurrence of moderate central Pacific El Niño events and enhanced equatorial Kelvin wave activity, in which mean upwelling conditions are maintained. It is shown that the characteristics of the coupling between physics and biogeochemistry is distinct between the two regimes with the weak regime being associated with a larger explained variance in biogeochemical properties not linearly related to the ENSO oceanic teleconnection. The data also reveal a long-term trend from 1999 corresponding to a deepening of the oxygen-deficient waters and warming. The implications of our results for understanding the OMZ dynamics off Peru are discussed.

SOURCE: Biogeosciences

PDF URL: <https://bg.copernicus.org/articles/14/4601/2017/bg-14-4601-2017.pdf>

CITED BY COUNT: 47

PUBLICATION YEAR: 2017

TYPE: article

CONCEPTS: ['Upwelling', 'Downwelling', 'Kelvin wave', 'Oxygen minimum zone', 'Oceanography', 'Climatology', 'Teleconnection', 'Context (archaeology)', 'Geology', 'Environmental science', 'El Niño Southern Oscillation', 'Paleontology']