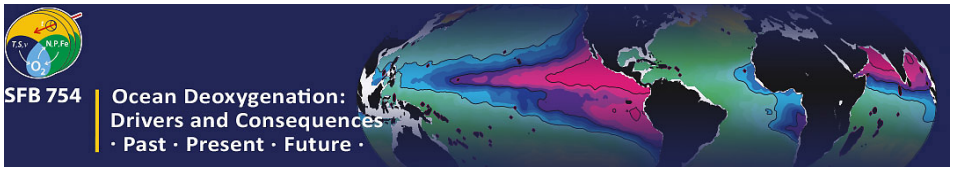

Contribution ID : **52** Type : **Oral**

Variability and drivers of the Oxygen Minimum Zone in the tropical Pacific over the past decades

Monday, 3 September 2018 15:00 (15)

Deoxygenation has been a big concern because oxygen is an essential element for all levels of marine life. Data has shown an expansion of Oxygen-Minimum-Zone (OMZ) with a declining trend in dissolved oxygen (DO) over the past decades in the tropical Pacific. However, there is a lack of quantitative analyses of sources and sinks to elucidate the underlying mechanisms. Here, we employ a validated ocean physical-biogeochemical model to test the previously proposed hypotheses for the decline of mid-depth DO, and to evaluate the variability and drivers of the tropical Pacific PMZ.

Our analyses demonstrate that changes in the size of OMZ and DO inventory in the tropical Pacific reflect a delicate balance between oxygen supply and consumption. Our analyses demonstrate that during the warming period of 1981-1997, both oxygen supply and consumption were low in the mid-waters, but oxygen consumption exceeded supply, which led to a decreasing trend in the mid-depth DO. On the other hand, oxygen supply exceeded consumption during the warming pause (post ~2000) in some parts of the basin; the strengthening of wind-driven ocean transport since around 2000 has ceased the expansion of the OMZ and led to a pause in the decline of mid-depth DO in the tropical Pacific.

Our model sensitivity studies show that the decline of mid-depth DO in the northeastern tropical Pacific OMZ (the largest OMZ) has no direct linkage to the increase of production in the upper water column. The mid-depth DO is largely influenced by the level of dissolved organic matter accumulated in the mid-waters, and partly related to thermocline depth. This study highlights the significance of physical forcing on the tropical OMZs, indicating that future climate change will have implications for ocean deoxygenation.

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Session Classification : 03 Ventilation and Oxygen Supply

Track Classification : 03 Ventilation and Oxygen Supply