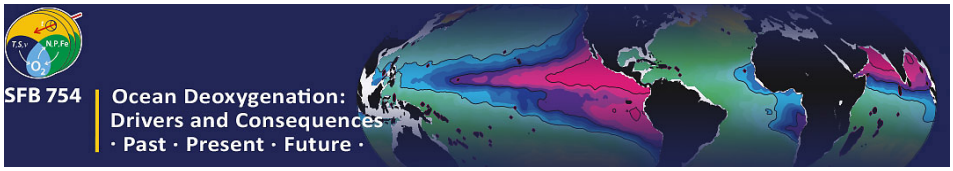

Contribution ID : **75** Type : **Poster**

Interannual variability of the Eastern South Pacific OMZ off Chile (30°-38°S): A modelling study

One of the most large oxygen minimum zone (OMZ) is located in the Eastern South Pacific. It extends southward along the Chilean coast due to the Peru-Chile Undercurrent (PCUC), which transports Equatorial Subsurface Water (ESSW) (characterized by low dissolved oxygen, high nutrients and relatively high salinity) along the slope. Despite the importance of this OMZ on the biogeochemical cycles and regional oceanographical conditions, the main processes controlling its variability remain rather unknown. Here, we assess the interannual variability of the southern tip of the OMZ off Chile (30-38°S) using a high-resolution regional physical-biogeochemical coupled model simulation for the period 2000-2008. First, we describe the main features of the OMZ: its volume, the mean DO, its spatial variability and mean depth. Then, we relate these characteristics with some relevant climatic indices for the Pacific, like different ENSO indices, including the El Niño Eastern Pacific (EP), El Niño Central Pacific (CP), and the Pacific Decadal oscillation (PDO) and the Southern Annular Mode (SAM). Additionally, we contrast the periods of more intense (lower values of DO) and weaker OMZ during the study period, and we analyze the mechanisms that would be associated to these extrema. The OMZ volume showed a significant correlation (r=0.6) with the equatorial indices (ONI, CP and MEI) and with PDO (r=0.5), but a lower correlation (r=<0.3) with SAM. Maximum and minimum values of the OMZ-volume anomalies were observed during 2001 and 2007 respectively. In 2001, the OMZ-volume increase up to ~33% related to the mean value for the study period, displaying a large decrease in the mean oxygen concentration, together with a greater offshore and southward extension, as well as an increase in temperature and salinity. In contrast, in 2007, the OMZ volume was reduced by ~23% and became more oxygenated, showing a lesser offshore and southward extension, together with a decrease in temperature and salinity. These changes of the OMZ were related to changes in the PCUC transport, i.e., positive (negative) OMZ volume anomalies were mostly related with the intensification (weakening) of the PCUC. We observed that highest correlation (r=0.8) between the PCUC and the oxygen concentration inside the volume rather than with the volume itself variability. An important fraction of the interannual variability of the PCUC off central Chile, and thus the southern tip of the OMZ, is of equatorial origin and it co-varies with the ENSO, and likely with other fluctuations that modulate the tropical Pacific.

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Track Classification : 03 Ventilation and Oxygen Supply