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Anomalous transport of heat and salt by a long-lived anticyclonic eddy in the northeast tropical Pacific Ocean

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During RV Sonne expedition SO268 to the northeast tropical Pacific Ocean between March and May 2019, the impact of a mesoscale eddy on the seawater properties was investigated by conducting a multiple of observations. A subsequent analysis of an altimeter data revealed the formation of an anticyclonic mesoscale eddy in the Tehuantepec gulf between 15 and 20 June 2018 with a mean radius of 185 km and an average speed of 13 cm/s. This extremely long-lived eddy carried sea-water characteristics from near coastal Mexican waters westward far into the open ocean. The water mass stayed largely isolated during the 11 months of travel time due to high rotational speed.

The eddy exhibited a conical-shape vertical structure with concurrent deepening of the main thermocline. The water in the eddy core showed an extreme positive temperature anomaly of 8°C, a negative salinity anomaly of -0.5 psu and a positive dissolved oxygen concentration anomaly of +160 µmol/kg centered at 80 m depth. The sub-surface impact of the eddy is clearly evident in the temperature and salinity profiles at a depth of 1500 m. For dissolved oxygen the eddy-induced anomaly reached even deeper to the seafloor.

This study provides new insights to the offshore transport of heat and salt driven by the long-lived anticyclonic eddy in the northeast tropical Pacific Ocean. Considering the water column trapped within the eddy, a positive heat transport anomaly of $1-3 \times 10^{11}$ W and a negative salt transport anomaly of -8×10^3 kg/s were estimated. However, due to the rare occurrence of long-lived anticyclone eddies in this region, they likely do not play a significant role in affecting the heat and salt balance of the northeastern tropical Pacific Ocean.