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A Study on the Origin and Fate of Mode Water in the Southern Pacific Ocean.

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Mode waters (MW) found at intermediate depth in the subtropical Pacific Ocean store a large volume of CO2, heat, nutrients and freshwater. These properties are in equilibrium with the atmosphere during the MW formation in the deepest winter mixed layers, and are then exported to lower latitudes at depth, isolated from the atmosphere. In this study, the regions of last ventilation and the pathways that MW particles follow before and after formation have been investigated, as well as the transformation of their characteristics during their export. For this, we used an interannual forced ocean and sea ice coupled model run (NEMO DRAKKAR G70) that was compared to observational data. Validation was completed using a collocation method that interpolated model data onto observations in time and space in order to test the model robustly. The comprehensive comparisons gave us confidence in the model's capacity to reproduce MW characteristics. A quantitative Lagrangian analysis was performed to follow MW particles selected via the density criterion [26.8-27.4] kg.m-3 and which are exported at 42ºS. Four different water masses have been identified corresponding to different formation regions with specific salinity ranges. This study modifies the traditional view of MW showing their homogenization at intermediate depth in the Pacific Ocean as previously revealed in the Indian Ocean.