EGU2020-8152
https://doi.org/10.5194/egusphere-egu2020-8152
EGU General Assembly 2020

Evaluation of global ocean model on simulating deep western boundary current in the Pacific

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As an important branch of the global overturning circulation, the deep western boundary current (DWBC) in the Pacific was poorly understood due to sparse observations. Six state-of-the-art global ocean model outputs were used herein to evaluate their performance for simulating the DWBC in the Melanesian Basin (MB) and Central Pacific Basin (CPB). These model outputs were compared to the historical observations, in aspects of water-mass characteristics, spatial structure and meridional volume transport of the DWBC, and seasonal variation. The results showed that most of the models reproduced the DWBC in the two basins well. Besides OFES with obvious cold and salty biases, the other models had minor deviations of the temperature and salinity in the deep layer. These models can reconstruct the spatial structure of the DWBC in detail and simulate appropriate transports of the eastern branch DWBC, ranging from 6.36 Sv to 8.55 Sv. But the western branch DWBC was underestimated in the models except HYCOM (4.48 Sv). HYCOM performed best for the DWBC with a whole transport of 12.84 Sv. Analysis of the temperature and salinity from Levitus data demonstrates the existence of annual and semi-annual cycles in the deep water of the MB and CPB, respectively, with warmer and saltier water mass in summer and autumn. Overall, the six models have good abilities to simulate the seasonal variations of temperature and volume transport of the DWBC in the Pacific. The seasonal signals probably originated from the DWBC upstream and propagated along its pathway.