

OGCMによる人為起原炭素の3次元輸送の見積もり Anthropogenic CO₂ uptake, transport, storage, and dynamical controls in the ocean: a modeling study

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Using an ocean carbon cycle model embedded in an ocean general circulation model, we examine how the budget of anthropogenic CO₂ is dynamically controlled. The budget is composed of transport, storage rate, uptake from the atmosphere, and density conversion. We estimate (1) vertically integrated budget, (2) three-layer budget, and (3) eleven-layer budget for the eleven sub-domain of the global ocean. This work is the first attempt to conduct the budget analyses in the density framework. The vertically integrated budget is appropriate for examining the inter-basin transport of the anthropogenic CO₂. The estimated budget is largely consistent with the previous studies. The three-layer budget allows us to identify how the meridional overturning circulation related transport determines the thermocline inventories for anthropogenic CO₂. It is found that Subtropical Cells and the thermohaline circulation play a fundamental role for the budget in the Pacific and Atlantic Oceans, respectively. Along with a inventory map in each isopycnal layer, the eleven-layer budget is suitable for examining how anthropogenic CO₂ is stored and transported in various water masses. For the mode waters, which serve as reservoirs of anthropogenic CO₂ accumulated in the ocean interior, it is found that uptake via gas exchange is important but much of the uptake via gas exchange occurs non-locally to the mode water formation regions through the Subtropical Cells

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