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Tritium uptake in the ocean general circulation model of the Pacific Ocean

Yongfu Xu and Qi Ba

State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China (xyf@mail.iap.ac.cn)

Tritium is one of the important passive tracers that are often used to study the physical processes in the ocean and to assess the performance of the ocean general circulation model (OGCM). This work employs a basin-wide OGCM of the Pacific Ocean to estimate the distribution and storage of tritium, and to study the supplement of tritium from both the Japan Sea and Sea of Okhotsk to the western boundary current extension. This OGCM is based on LICOM developed by our Institute, which can well reproduce the observed physical fields, including circulation and water mass. Tritium concentrations in precipitation over the model domain during 1951-1997 are reconstructed by spatial interpolation. The OGCM with tritium is run under the forcing of atmospheric tritium from an equilibrium physical field with zero tritium content. The model reproduces the absorption process of tritium from the atmosphere to the ocean. Results show a notable difference between the North and South Pacific during the 1970s, which is revealed by either surface concentrations or water-column inventories. Total tritium mass reserved in the North Pacific is close to the data-based estimate. The model generally gives lateral ventilation of tritium form the subarctic to tropical regions along specific isopyncals, which is represented by the distribution of modeled tritium on $26\sigma\theta$. Simulated tritium distributions along several sections are generally in good agreement with the observations from both GEOSECS and WOCE. By examining the modeled alongshore currents in the western North Pacific and the distribution of tritium in different depths, it is found that both the Japan Sea and Sea of Okhotsk were two major supplementary sources for tritium stored in the western boundary current extension during 1964-1974, but the primary contribution was changed during these periods.