ASSESSMENT OF AIR-SEA CO_2 EXCHANGE RATES IN THE WORLD'S OCEANS USING BOMB ^{14}C INVENTORIES

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ABSTRACT

The inventory of nuclear bomb produced ^{14}C (bomb ^{14}C) in the ocean is a major constraint of CO_2 exchange between the atmosphere and ocean in numerical models and analytical estimates of gas exchange. New ^{14}C data in the ocean, improved methods of separating the bomb ^{14}C from the natural background of ^{14}C in the ocean, and reassessment of previous inventories are challenging the canonical estimates of the air-sea gas transfer. An improved method of separating natural ^{14}C from the observed ^{14}C distribution is being used to estimate the bomb ^{14}C distribution and inventory. We use GEOSECS ^{14}C data to represent the global distribution in 1975, and the new WOCE dataset for 1995 to get two time representations of inventory. To reduce the bias error for averaging zonal bomb ^{14}C inventories from limited observation stations during the GEOSECS times, we use zonal averages given by Peacock [2004] for re-evaluation of 1975 air-sea CO_2 exchange rates. Zonal inventories for 1995 will be from GLODAP mapping results using WOCE data [*Key et al.* 2004]. Lateral transport models developed by Broecker et al. [1985] are used to assess the regional air-sea CO_2 exchange rates as well as an appropriately weighted global mean. Four independent methods of estimating bomb ^{14}C inventory in the ocean show that the original estimate by Broecker et al. [1995] could be about 25% too high, the air-sea CO_2 exchange rates derived from this original bomb ^{14}C inventory could also be too high by a similar amount. Results of this assessment will be presented.

REFERENCES

Broecker, W. S., T.-H. Peng, H. G. Ostlund, M. Stuiver. The distribution of bomb radiocarbon in the ocean, Journal of Geophysical Research, 90, 6953-6970, 1985.

Broecker, W.S., S. Sutherland, W. Smethie, T.-H. Peng, and G. Ostlund, Oceanic radiocarbon: separation of the natural and bomb components, Global Biogeochem. Cycles, 9, 263-288, 1995.

Key, R.M., A. Kozyr, C.L. Sabine, K. Lee, R. Wanninkhof, J. Bullister, R.A. Feely, F. Millero, C. Mordy, T.-H. Peng, A global ocean carbon climatology: Results from Global Data Analysis Project (GLODAP), Global Biogeochem. Cycles, 18, GB4031,doi:10.1029/2004GB002247, 2004.

Peacock, S. Debate over the ocean bomb radiocarbon sink: Closing the gap. Global Biogeochem. Cycles, 18, doi:10.1029/2003GB002211, 2004.