

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Bibliography for the Second Scientific Meeting

The Oceanography Society



U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

National Environmental Satellite, Data, and Information Service

National Oceanographic Data Center

Library and Information Services Division

March 1991

INTRODUCTION

The role of CO₂ and the cycling of carbon through the earth's oceans and atmosphere have been focal points in the discussion of the effect of humanity on the earth. The sources, sinks, and cycling mechanisms of CO₂ are important, and still widely disputed, variables in both their potential for affecting the earth's climate and in the development of accurate models of ocean circulation.

The National Oceanographic Data Center (NODC) is pleased to present the attendees of the Second Scientific Meeting of The Oceanography Society with this special publication, CO₂ Transport and Transformation in the Ocean. This publication provides a list of recent reference works about CO₂ transport, which were found by searching several online files and several CD-ROM products available at the National Oceanic and Atmospheric Administration (NOAA) Library.

The NODC is one of three discipline-oriented data centers operated with the National Environmental Satellite, Data, and Information Service (NESDIS) of the NOAA, U.S. Department of Commerce. The other two NESDIS environmental data centers are the National Climatic Data Center (NCDC), and the National Geophysical Data Center (NGDC). These organizations serve as national repositories and dissemination facilities for global oceanographic, climatological, and geophysical data.

Data held by each center are acquired from a variety of sources including government agencies, universities and research institutions, private industry, and foreign organizations. Foreign data are obtained through bilateral exchanges and through the World Data Center (WDC) system. The WDC system comprises WDC-A in the United States, WDC-B in the U.S.S.R., WDC-C in Western Europe and Japan, and WDC-D in the Peoples Republic of China. This multiple-center network is maintained to facilitate international data exchange, to protect data collections from catastrophic loss, and to make data accessible to users around the world. Most WDC-A subcenters are located at and operated by the corresponding NESDIS national data centers. WDC-A for Oceanography, for example, is operated by the NESDIS National Oceanographic Data Center.

Many of the reference works described in this publication are available from the NOAA Central Library and Information Services. Addresses and telephone numbers of contact points are:

NOAA Library and Information
Services Division, E/OC4
6009 Executive Boulevard
Rockville, MD 20852
301 443 8330

NODC User Services Branch
E/OC21
1825 Connecticut Avenue, N.W.
Washington, DC 20235
202 673 5549

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Abe, Yutaka, and Takafumi Matsui. "Evolution of an impact-generated H SUB 2 O-CO SUB 2 atmosphere and formation of a hot proto-ocean on Earth." *Journal of the Atmospheric Sciences*, 3081-3101. 45. 1988.

Adem, Julian. "Numerical simulation of the sea surface temperature for 18,000 years ago, in the Northern Hemisphere." American Geophysical Union 1988 fall meeting. *Eos, Transactions, American Geophysical Union*, 1228. 69. 1988.

Alekseev, V. V., M. Ya Lyamin, and S. V. Kiseleva. "(A study of CO sub(2) exchange in coastal areas of the Caspian Sea.); Issledovanie protsessov obmena uglekislym gazom v pribrezhnykh rajonakh Kaspijskogo morya." *Meteorol. Gidrol*, pp. 89-95. NO. 11. 1989.

Alekseev, V. V., S. I. Zaitsev, and S. V. Kiseleva. "Absorption of carbon dioxide by the ocean as a function of its atmospheric concentration." *Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana*, V24, N5, (1988): P563-6.

Anderson, Leif G., David Dyrssen, and E. Peter Joens. *Dep. Anal. Mar. Chem., Chalmers Univ. Technol., Goeteborg, Swed.* "An assessment of the transport of atmospheric carbon dioxide into the Arctic Ocean." *J. Geophys. Res., (Oceans)*, V95, NC2, (1990): P1703-11.

Andreae, Meinrat O. "The oceans as a source of biogenic gases." *Oceanus (Woods Hole)*, 27-35. 29. 1987.

Arthur, M. A., W. E. Dean, and L. M. Pratt. "Global ocean-atmosphere geochemical and climatic effects of the Cenomanian/Turonian marine productivity event." American Geophysical Union, 1988 spring meeting. *Eos, Transactions, American Geophysical Union*, 300. 69. 1988.

Barron, Eric J. "Alternatives to modern atmosphere-ocean circulation in the geologic record." Geological Society of America, 1987 annual meeting and exposition. Abstracts with Programs - Geological Society of America, chairperson Dickinson, William R. 581. 19. 1987.

Bauer, J.E., R. B. Spies, J. S. Vogel, D. E. Nelson, and J. R. Southon. Univ Calif San Diego, Scripps Inst Oceanog, Div Marine Res, La Jolla, CA 92093 "Radiocarbon Evidence of Fossil-Carbon Cycling in Sediments of a Nearshore Hydrocarbon Seep." *Nature*, November 15, 1990, 348, 6298, 230-232.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Berger, W. H., and A. Spitzzy. "History of atmospheric CO₂ ; constraints from the deep-sea record." *Paleoceanography*, 401-411. 3. 1988.

Bolin, Bert, Anders Bjoerkstroem, Berrien Moore, and John W. Kidson. "Uptake by the Atlantic Ocean of excess atmospheric carbon dioxide and radiocarbon." *Understanding climate change. Geophysical Monograph*, Berger, Andre editor, and Robert Earl (editor) Dickinson. 57-78. 7. *Geophysical Monograph*, 52. 1989.

Bottinga, Y., and M. Javoy. *Inst. Phys. Globe*, F-75252, Paris, Fr. "MORB degassing: Bubble growth and ascent." *Chem. Geol.*, V81, N4, (1990): P255-70.

Boyle, E. A. "Control of glacial atmospheric carbon dioxide by vertical nutrient redistribution." *American Geophysical Union; 1988 ocean sciences meeting. Eos, Transactions, American Geophysical Union*, 1778. 68. 1987.

Boyle, Edward A. "The role of vertical chemical fractionation in controlling late Quaternary atmospheric carbon dioxide." *Journal of Geophysical Research; C, Oceans*, 15,701-15,714. 93. 1988.

Boyle, Edward A. *Dep. Earth, Atmos. Planet. Sci., Massachusetts Inst. Technol., Cambridge, MA.* "Vertical oceanic nutrient fractionation and glacial/interglacial carbon dioxide cycles." *Nature (London)*, V331, N6151, (1988): P55-6.

Brewer, Peter G., Catherine Goyet, and David Dyrssen. *Dep. Chem., Woods Hole Oceanogr. Inst., Woods Hole, MA.* "Carbon dioxide transport by ocean currents at 25.degree.N latitude in the Atlantic Ocean." *Science (Washington, D. C., 1883-)*, V246, N4929, (1989): P477-9.

Broecker, W. S. "Carbon dioxide circulation through ocean and atmosphere." *Nature*; 308(5960) :602; 1984.

Broecker, W. S., and T. H. Peng. *Lamont-Doherty Geol. Obs., Columbia Univ., Palisades, NY.* "The oceanic salt pump: Does it contribute to the glacial-interglacial difference in atmospheric carbon dioxide content?" *Global Biogeochem. Cycles*, V1, N3, (1987): P251-9.

Broecker, W. S. and T. Takahashi. "Is there a tie between atmospheric CO₂ content and ocean circulation? (abstract)." *Proceedings of the Symposium on Ice and Climate Modelling held at ... Evanston, ... USA, ... 1983; International Glaciological Society; Cambridge; :201; Annals of Glaciology* 5; 1984.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Broecker, Wallace S. "The biggest chill." Global climate change linkages conference; acid rain, air quality, and stratospheric ozone, editor White, James C. 13-22. New York, NY, United States: Elsevier Sci. Publ. Co., 1989.
Reprinted with permission from Nat. Hist., Vol. 96, No. 10, 1987.

Broecker, Wallace S. "Unpleasant surprises in the greenhouse?" Nature (London), 123-126. 328. 1987.

Broecker, Wallace S., and Tsung-Hung Peng. "The cause of the glacial to interglacial atmospheric CO₂ change; a polar alkalinity hypothesis." Global Biogeochemical Cycles, 215-239. 3. Oak Ridge Natl. Lab., Publ. No. 3386; Lamont-Doherty Geol. Obs., Contrib., No. 4531. 1989.

Broecker, Wallace S., and Tsung Hung Peng. Lamont-Doherty Geol. Obs., Columbia Univ., Palisades, NY. "The role of calcium carbonate compensation in the glacial to interglacial atmospheric carbon dioxide change." Global Biogeochem. Cycles, V1, N1, (1987): P15-29.

Bryan, K., S. Manabe, and M. J. Spelman. "Interhemispheric asymmetry in the transient response of a coupled ocean-atmosphere model to a CO₂ forcing." J. PHYS. OCEANOGR, pp. 851-867. VOL. 18, NO. 6. 1988.

Byutner, E. K., and A. I. Kolomeitsev. Gos. Gidrol. Inst., USSR. "Intensity of mean annual exchange of oxygen and carbon dioxide between the ocean and the atmosphere." Meteorol. Gidrol., N2, (1987): P46-53.

Carpenter, Roy. Sch. Oceanogr., Univ. Washington, Seattle, WA. "Has man altered the cycling of nutrients and organic carbon on the Washington continental shelf and slope?" Deep-Sea Res., Part A, V34, N5-6A, (1987): P881-96.

Chen, C. T. A., and D. Halpern. "On the depth of anthropogenic CO₂ penetration in the Atlantic and Pacific oceans." Vertical Motion in the Equatorial Upper Ocean. Proceedings of the International Symposium on Vertical Motion in the Equatorial Upper Ocean and its Effects Upon Living Resources and the Atmosphere, UNESCO, Paris, France, 6-10 May 1985, eds. Barber, R. T. pp. 97-102. Montrouge (France): Gauthiers-Villars, 1987.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Chen, Fu, and Xiaqing Zhu. "A theoretical approach to P CO SUB 2 evolution in the atmosphere based on associations of sedimentary minerals." *Scientia Sinica, Series B: Chemical, Biological, Agricultural, Medical & Earth Sciences* = *Chung-Kuo K'o Hsueh Yuan, Chu Pan*, 1509-1519. 32. 1989.

Crane, A. J., H. Charnock, J. E. Lovelock, P. S. Liss, and M. Whitfield. "The use of tracers in modelling the oceanic uptake of carbon dioxide." *Tracers in the ocean. Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences*, 23-41. 325. 1988.

Crawford, G. B. Wave Propagat. Lab., Natl. Oceanic Atmos. Adm., Boulder, CO. "Contribution of bubbles and waves to air-sea carbon dioxide flux, with implications for remote sensing." 33 pp. Report, NOAA-TM-ERL-WPL-145; Order No. PB87-203980, 1987.

Davies, Anthony G. "Marine ecology; taking a cool look at iron." *Nature (London)*, 114-115. 345. 1990.

Debus, Allen A. "Changing Earth (Part 6)." *The Earth Science News (Earth Science Club of Northern Illinois)*, 13-17. 40. 1989.

Debus, Allen A. "Changing Earth; Part 7, The seasymbol of tranquility?" *The Earth Science News (Earth Science Club of Northern Illinois)*, 11-14. 40. 1989.

Degens, E. T. "Dynamic of the carbon dioxide cycle." *VDI-Ber.*, V703, *NKlimabeeinflussung Menschen*, (1988): P105-8.

Degter'ov, A. Kh, and E. M. Filippov. "Mekhanizm formuvannya zon anomal'nogo nasichennya poverkhnevikh vod okeanu atmosfernimi gazami = The mechanism of genesis of ocean water zones anomalously saturated by atmospheric gases." *Dopovidi Akademiyi Nauk Ukrayins'koyi RSR, Seriya B: Geologichni, Khimichni ta Biologichni Nauki*, 6-8. 1990.

Degterev, A. Kh. Morsk. Gidrofiz. Inst., USSR. "Flux of carbon dioxide between atmosphere and the Atlantic Ocean." *Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana*, V25, N3, (1989): P333-4.

Degterev, A. Kh, and E. M. Filippov. *Mor. Gidrofiz. Inst., Sevastopol, USSR*. "Mechanism of the formation of anomalous zones for saturation of ocean surface waters with atmospheric gases." *Dokl. Akad. Nauk Ukr. SSR, Ser. B: Geol., Khim. Biol. Nauki*, N1, (1990): P6-9.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Degterev, A. Kh, and V. V. Guretskii. Morsk. Gidrofiz. Inst., USSR. "A three-dimensional advective-diffusive model of carbon dioxide transfer in the South Atlantic." Meteorol. Gidrol., N11, (1988): P101-7.

Duplessy, J. C. "The marine carbon cycle, the ocean circulation and the atmospheric CO SUB 2 content; comparison of the present and past conditions." Carbon dioxide and other greenhouse gases; climatic and associated impacts: proceedings of a symposium. , Fantechi, Roberto editor, and Anver editor Ghazi. 55-66. Dordrecht, Netherlands: Kluwer Acad. Publ., 1989.

Elliott, William P., and James K. Angell. Air Resour. Lab., NOAA, Silver Spring, MD. "On the relation between atmospheric carbon dioxide and equatorial sea-surface temperature." Tellus, Ser. B, V39B, N1-2, (1987): P171-83.

Eremeev, V. N., and A. Kh Degterev. Mor. Gidrofiz. Inst., Sevastopol, USSR. "Seasonal variability of carbon dioxide field in the tropical Atlantic." Dokl. Akad. Nauk Ukr. SSR, Ser. B: Geol., Khim. Biol. Nauki, N5, (1987): P6-9.

Erickson, David J., III. "Variations in the global air-sea transfer velocity field of CO SUB 2." Global Biogeochemical Cycles, 37-41. 3. 1989.

Etcheto, J., and L. Merlivat. "Satellite determination of the carbon dioxide exchange coefficient at the ocean-atmosphere interface: A first step." J. Geophys. Res. (C Oceans , pp. 15669-678. vol. 93, no. C12. 1988.

Faure, Hugues. Lab. Geol. Quat., CNRS, 13288, Marseille, Fr. "An amplifying mechanism for the climatic cycle: the "sea ice lid effect" controls the changes in atmospheric carbon dioxide." C. R. Acad. Sci., Ser. 2, V305, N6, (1987): P523-8.

Feely, R. A., R. H. Gammon, B. A. Taft, P. E. Pullen, L. S. Waterman, nway T. J. Co, J. F. Gendron, and D. P. Wisegarver. "Distribution of chemical tracers in the eastern equatorial Pacific during and after the 1982-1983 El Nino/Southern Oscillation event." J. Geophys. Res. (C Oceans , pp. 6545-6558. vol. 92, no. C6. 1987.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Flohn, H., and A. Hense. "Evidence for recent atmospheric-oceanic processes controlling composition of air and climate change." Carbon dioxide and other greenhouse gases; climatic and associated impacts: proceedings of a symposium. , Fantechi, Roberto editor, and Anver editor Ghazi. 77-90. Dordrecht, Netherlands: Kluwer Acad. Publ., 1989.

Frei, Allan, Michael C. MacCracken, and Martin I. Hoffert. "Eustatic sea level and CO SUB 2." Northeastern Environmental Science, 91-96. 7. 1988.

Gal'chenko, V. F., M. V. Ivanov, and A. Yu Lein. "Mikrobiologicheskiye i biogeokhimicheskiye protsessy v vodnoy tolshche okeana kak pokazateli aktivnosti podvodnykh gidroterm" Microbiological and biogeochemical processes in oceanic water as indicators of activity of submarine hydrotherms." Geokhimiya, 1075-1088. 1988. 1988.

Garcon, V. C., L. Martinon, C. Andrie, P. Andrich, and J. F. Minster. "Kinematics of CO sub(2) fluxes in the Tropical Atlantic Ocean during the 1983 northern summer." J. Geophys. Res. (C Oceans , pp. 855-870. vol. 94, no. C1. 1989.

Gaudry, Andre, Patrick Monfray, Georges Polian, and Gerard Lambert. Cent. Faibles Radioact., 91190, Gif-sur-Yvette, Fr. "The 1982-1983 El Nino: a 6 billion ton carbon dioxide release." Tellus, Ser. B, V39B, N1-2, (1987): P209-13.

Gorshkov, V. G. "Disturbance of global carbon cycle as inferred from changes in carbon-13/carbon-12 ratios in natural objects." Dokl. Akad. Nauk SSSR, V295, N6, (1987): P1332-6 (Geophys.).

Haake, B., and V. Ittekkot. Geol.-Palaeontol. Inst., Univ. Hamburg, D-2000, Hamburg, Fed. Rep. Ger. "The wind-driven "biological pump" and carbon removal in the ocean." Naturwissenschaften, V77, N2, (1990): P75-9.

Hamilton, J. M., M. R. Lewis, and B. R. Ruddick. "Vertical fluxes of nitrate associated with salt fingers in the world's oceans." J. Geophys. Res. (C Oceans , pp. 2137-2145. vol. 94, no. C2. 1989.

Hardy, J. T., and C. W. Apts. "Photosynthetic carbon reduction: High rates in the sea-surface microlayer." Mar. Biol , pp. 411-417. vol. 101, no. 3. 1989.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Henderson-Sellers, B. "Modelling sea surface temperature rise resulting from increasing atmospheric carbon dioxide concentrations." *Clim. Change*, pp. 349-359. vol. 11, no. 3. 1987.

Holligan, P. M., and A. Morel. "Remote sensing of ocean colour for studies of biological productivity and biochemical cycles." *Ocean Color Workshop*, ed. Guyenne, T. D. pp. 19-22. Paris (France): ESA, 1987. NTIS Order No.: N88-16296/1/GAR.

Inoue, Hisayuki, and Yukio Sugimura. *Geochem. Res. Div., Meterol. Res. Inst., Tsukuba, Japan*. "Distribution of the pCO₂ in surface seawater of the western and central Equatorial Pacific during the 1986/87 El Nino/Southern Oscillation Event." *Geophys. Res. Lett.*, V15, N13, (1988): P1499-502.

Jasper, John P., and J. M. Hayes. "A carbon isotope record of CO₂ levels during the late Quaternary." *Nature (London)*, 462-464. 1990.

Keir, R. S. *Scripps Inst. Oceanogr., Univ. California, San Diego, La Jolla, CA*. "Paleoproduction and atmospheric carbon dioxide based on ocean modeling." *Dahlem Workshop on Productivity of the ocean: present and past*. (1989): *Life Sci. Res. Rep.*, V44, NProd. Ocean, P395-406.

Kondratyev, K. Y. "Global scale climate changes and their causes." *Gerlands Beitrage zur Geophysik*, 93-103. 96. 1987.

Koropalov, V. M., E. V. Kryukov, D. R. Cronn, R. H. Gammon, V. V. Pozdeev, and Yu M. Cherkasov. *Inst. Prikl. Geofiz, USSR*. "Trace gases in the atmosphere over the ocean." *Izv. Akad. Nauk SSSR, Fiz. Atmos. Okeana*, V24, N8, (1988): P835-43.

Kovalevich, V. M. "K probleme evolyutsii sostava okeanicheskoy vody v fanerozoie The problem of the evolution of sea water composition in the Phanerozoic." *Geokhimiya*, 1527-1535. 1987.

Kromer, B., C. Pflleiderer, P. Schlosser, I. Levin, K. O. Muennich, G. Bonani, M. Suter, and W. Woelfli. *Inst. Umweltphys., Univ. Heidelberg, Heidelberg, Fed. Rep. Ger.* "AMS carbon-14 measurement of small volume oceanic water samples: experimental procedure and comparison with low-level counting technique." *Nucl. Instrum. Methods Phys. Res., Sect. B*, VB29, N1-2, (1987): P302-5.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Krumgalz, B. S., J. Erez, and C. T. A. Chen. Natl Inst. Oceanog., Haifa, Israel. "Anthropogenic CO₂ penetration in the Northern Red-Sea and in the Gulf of Elat (Aqaba)." *Oceanologica Acta* 13(3) (1990): p. 283-290.

Labeyrie, L. D., E. Michel, N. Kallel, Jean-Claude Duplessy, and Leclerc A. Juillet. "Changes in thermohaline circulation and atmospheric pCO₂ SUB 2 between glacial and interglacial." International congress of geochemistry and cosmochemistry. Chemical Geology, editor Bottinga, Yan. 109. 70. 1988.

Labeyrie, Laurent D., Jean-Claude Duplessy, E. Michel, and F. Maitre. "Glacial/interglacial changes in ocean circulation and atmospheric pCO₂ SUP 2." Late Cenozoic ice age symposium. Quaternary Newsletter, editor Taylor, B. J. 33. 59. 1989.

Lapenis, A. G. Gos. Hidrol. Inst. Leningrad, USSR. "Biodynamic mechanism of changes in atmospheric carbon dioxide concentration." *Geokhimiya*, N6, (1988): P794-9.

Lashof, Daniel Abram. "The role of the biosphere in the global carbon cycle: evaluation through biospheric modeling and atmospheric measurement." Univ. California;, 1987.

Lindstrom, D. R., and D. R. MacAyeal. "Scandinavian, Siberian, and Arctic Ocean glaciation; effect of Holocene atmospheric CO₂ SUB 2 variations." *Science*, 628-631. 245. 1989.

Lindstrom, Dean R. "The Eurasian ice sheet formation and collapse resulting from natural atmospheric CO₂ SUB 2 concentration variations." *Paleoceanography*, 207-227. 5. 1990.

Liss, P. S., H. Charnock, J. E. Lovelock, P. S. Liss, and M. Whitfield. "Tracers of air-sea gas exchange." Tracers in the ocean. Philosophical Transactions of the Royal Society of London, Series A: Mathematical and Physical Sciences, 93-102. 325. 1988.

Lohrenz, S. E., R. A. Arnone, D. A. Wiesenburg, and I. P. DePalma. "Satellite detection of transient enhanced primary production in the western Mediterranean Sea." *Nature*, pp. 245-247. vol. 335, no. 6187. 1988.

Lyle, Mitchell, and Nicklas G. Pisias. "Ocean circulation and atmospheric CO₂ SUB 2 changes; coupled use of models and paleoceanographic data." *Paleoceanography*, 15-41. 5. 1990.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Manning, M. R., D. C. Lowe, W. H. Melhuish, R. J. Sparks, G. Wallace, C. A. M. Brenninkmeijer, and R. C. McGill. "The use of radiocarbon measurements in atmospheric studies." *Radiocarbon*, 37-58. 32. 1990. Presented at the 13th international radiocarbon conference in Dubrovnik, Yugoslavia on June 20-25, 1988.

Martin, John H. "Glacial-interglacial CO₂ change; the iron hypothesis." *Paleoceanography*, 1-13. 5. 1990.

McMurtry, G. M., D. M. Karl, B. Tilbrook, and P. N. Sedwick. "Chemistry and microbiology of Loihi Seamount hydrothermal vent fields." American Geophysical Union, 1987 fall meeting. *Eos, Transactions, American Geophysical Union*, 1553. 68. 1987.

Mearns, L. O., S. H. Schneider, S. L. Thompson, and L. R. McDaniel. Natl. Ctr. Atmos. Res., Boulder, CO. "Analysis of climate variability in general circulation models- comparison with observations and changes in variability in 2xCO₂ experiments." *Journal of Geophysical Research-Atmospheres* 95:D12 (Nov. 20, 1990): p. 20469-20690.

Mel'nichuk, V. I. "Basic characteristics of carbon dioxide redistribution in global atmosphere-ocean-sediment model." *Fiz.-khim. Modeli v Geokhimii*, Novosibirsk, (1988): P81-94.

Metzl, Nicolas, Berrien III Moore, Anne Papaud, and Alain Poisson. "Transport and carbon exchanges in Red Sea; inverse methodology." *Global Biogeochemical Cycles*, 1-26. 3. 1989.

Mix, Alan C. Coll. Oceanogr., Oregon State Univ., Corvallis, OR. "Influence of productivity variations on long-term atmospheric carbon dioxide." *Nature (London)*, V337, N6207, (1989): P541-4.

Monfray, Patrick, Andre Gaudry, Georges Polian, and Gerard Lambert. Cent. Faibles Radioact., 91190, Gif-sur-Yvette, Fr. "Seasonal variations of atmospheric carbon dioxide in the southern Indian Ocean." *Tellus, Ser. B*, V39B, N1-2, (1987): P67-71.

Moore, Berrien III, and Bert Bolin. "The oceans, carbon dioxide, and global climate change." *Oceanus (Woods Hole)*, 9-15. 29. 1987.

Murnane, R.J., J. L. Sarmiento, and M. P. Bacon. Princeton Univ, Program Atmospher & Ocean Sci, Princeton, NJ 08544. "Thorium Isotopes, Particle Cycling Models, and Inverse Calculations of Model Rate Constants." *Journal of Geophysical Research-Oceans*, September 15, 1990, 95, C9, 16195-16206

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Oba, Tadamichi. Coll. Lib. Arts, Kanazawa Univ., Kanazawa, Japan. "Oceanic environmental change from the last glacial to postglacial periods." Chikyu Kagaku (Nippon Chikyu Kagakkai), V22, N1, (1988): P13-19.

"Oceans and the global carbon cycle; an introduction to the Biogeochemical Ocean Flux Study of NERC Marine Sciences Directorate." 17. Plymouth, United Kingdom: Plymouth Mar. Lab., BOFS Off., 1989.

Oeschger, H., and U. Siegenthaler. "How has the atmospheric concentration of CO SUB 2 changed?" Dahlem Workshop on the Changing atmosphere. Physical, Chemical and Earth Sciences Research Reports, Rowland, F. S. (editor), and Ivar S. A. (editor) Isaksen. 5-23. 7. 1988.

Oeschger, H., B. Stauffer, R. Finkel, C. C. Langway, E. T. Sundquist, and W. S. Broecker, eds. "Variations of the CO₂ concentration of occluded air and of anions and dust in polar ice cores." The carbon cycle and atmospheric CO₂: natural variations archaean to present; American Geophysical Union; Washington, D.C. :132 - 142, Geophysical Monograph 32; 1985.

Oglesby, R. J., and B. Saltzman. Yale Univ., Dept. Geol. & Geophys., New Haven, CT. "Sensitivity of the equilibrium surface-temperature of a GCM to systematic changes in atmospheric carbon-dioxide." Geophysical Research Letters 17(8) (July 1990): p. 1089-1092.

Oudot, C. "O sub(2) and CO sub(2) balances approach for estimating biological production in the mixed layer of the Tropical Atlantic Ocean (Guinea Dome area)." J. Mar. Res, pp. 385-409. vol. 47, no. 2. 1989.

Oudot, C., C. Andrie, and Y. Montel. Inst. Francais Rech. Sci. Dev. Coop., Dakar, Senegal. "Evolution of oceanic and atmospheric carbon dioxide in the tropical Atlantic in 1982-1984." Deep-Sea Res., Part A, V34, N7A, (1987): P1107-37.

Oudot, C., and C. Andrie. Inst. Francais Rech. Sci. Dev. Coop., Dakar, Senegal. "Short-term changes in the partial pressure of carbon dioxide in eastern tropical Atlantic surface seawater and in atmospheric carbon dioxide mole fraction." Tellus, Ser. B, V41B, N5, (1989): P537-53.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Packard, T. T., M. Denis, M. Rodier, and P. Garfield. Cent. Oceanol., Fac. Sci. Luminy, F13288, Marseille, Fr. "Deep-ocean metabolic carbon dioxide production: calculations from ETS activity." Deep-Sea Res., Part A, V35, N3A, (1988): P371-82.

Palais, Julie M. "Polar ice cores." Oceanus (Woods Hole), 55-60. 29. 1987.

Peng, T. H., and W. S. Broecker. "Modeling the effect of the oceanic salt pump on the glacial-interglacial difference in atmospheric CO₂." American Geophysical Union; 1988 ocean sciences meeting. Eos, Transactions, American Geophysical Union, 1691-1692. 68. 1987.

Peng, T. H., W. S. Broecker, G. Kipphut, N. Shackleton, and et al. "Benthic mixing in deep sea cores as determined by C - 14 dating and its implications regarding climate stratigraphy and the fate of fossil fuel CO₂." p. 355 - 373 in Fate of fossil fuel CO₂ in the ocean. Edited by N.R. Andersen and A. Malahoff New York, Plenum Press, 1977.

Pisias, N. G., A. Mix, N. Shackleton, and J. Imbrie. "Response of the carbon system over the Milankovitch frequency band." American Geophysical Union, 1988 spring meeting. Eos, Transactions, American Geophysical Union, 299. 69. 1988.

Ryabchenko, V. A. Inst. Okeanol. im. Shirshova, Leningrad, USSR. "Decrease of atmospheric carbon dioxide during the latest glacial maximum." Okeanologiya (Moscow), V29, N1, (1989): P71-8.

Saltzman, B., and A. Sutera. "The mid-Quaternary climatic transition as the free response of a three-variable dynamical model." J. Atmos. Sci., pp. 236-241. vol. 44, no. 1. 1987.

Saltzman, Barry, and Kirk A. Maasch. Dep. Geol. Geophys., Yale Univ., New Haven, CT. "Carbon cycle instability as a cause of the Late Pleistocene ice age oscillations: Modeling the asymmetric response." Global Biogeochem. Cycles, V2, N2, (1988): P177-85.

Sarmiento, J. L., G. Thiele, R. M. Key, and W. S. Moore. Princeton Univ, Atmospher & Ocean Sci Program, Princeton, NJ 08544 "Oxygen and Nitrate New Production and Remineralization in the North-Atlantic Subtropical Gyre." Journal of Geophysical Research-Oceans, October 15, 1990, 95, C10, 18303-18315

Sarmiento, J. L. and J. R. Toggweiler. "New Model for the role of the oceans in determining atmospheric PCO₂." Nature, P. 621-624, 308 (5960). 1984.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Sarmiento, J. L., J. R. Toggweiler, and R. Najjar. Program Atmos. Oceanic Sci., Princeton Univ., Princeton, NJ. "Ocean carbon-cycle dynamics and atmospheric PCO₂." Philos. Trans. R. Soc. London, A, V325, N1583, (1988): P3-21.

Sarnthein, Michael, Kyaw Winn, Jean-Claude Duplessy, and Michel R. Fontugne. "Global variations of surface ocean productivity in low and mid latitudes; influence on CO SUB 2 reservoirs of the deep ocean and atmosphere during the last 21,000 years." Paleoceanography, 361-399. 3. 1988.

Sarnthein, Michael, Kyaw Winn, Rainer Zahn, Wolfgang H. Berger, and Laurent D. Labeyrie. "Paleoproductivity of oceanic upwelling and the effect on atmospheric CO SUB 2 and climatic change during deglaciation times." Abrupt climatic changes; evidence and implications. NATO Advanced Study Institutes Series. Series C; Mathematical and Physical Sciences, 311-337. 216. 1987.

Schlesinger, Micheal E. "The Longmans lecture model projections of greenhouse-gas-induced climate change." Late Cenozoic ice age symposium. Quaternary Newsletter, editor Taylor, B. J. 34-35. 59. 1989.

Schlesinger, Michael E., and Zong Ci Zhao. Clim. Res. Inst., Oregon State Univ., Corvallis, OR. "Seasonal climatic changes induced by doubled carbon dioxide as simulated by the OSU atmospheric GCM/mixed-layer ocean model." J. Clim., V2, N5, (1989): P459-95.

Schlitzer, Reiner. Cent. Meterol. Phys. Oceanogr., Massachusetts Inst. Technol., Cambridge, MA. "Modeling the nutrient and carbon cycles of the North Atlantic 1. Circulation, mixing coefficients, and heat fluxes." J. Geophys. Res., C: Oceans, V93, NC9, (1988): P10699-723.

Schlitzer, Reiner. Univ. Bremen, 2800/33, Bremen, Fed. Rep. Ger. "Modeling the nutrient and carbon cycles of the North Atlantic. 2. New production, particle fluxes, carbon dioxide gas exchange, and the role of organic nutrients." J. Geophys. Res., C: Oceans, V94, NC9, (1989): P12781-94.

Semiletov, I. P. Tikhookean. Okeanol. Inst., Vladivostok, USSR. "Thermal effect of dissolution of atmospheric carbon dioxide in the ocean." Dokl. Akad. Nauk SSSR, V307, N4, (1989): P984-7 (Oceanol.).

CO2 TRANSPORT AND TRANSFORMATION IN THE OCEAN

Semiletov, I. P., E. F. Radaev, and V. L. Korets. Tikhookean. Okeanol. Inst., Vladivostok, USSR. "Carbon dioxide variability in the atmosphere-ocean system (the equatorial zone of the Indian Ocean)." Dokl. Akad. Nauk SSSR, V295, N5, (1987): P1229-32 (Oceanol.).

Shackleton, N. J. "The carbon isotope record of the Cenozoic; history of organic carbon burial and of oxygen in the ocean and atmosphere." Marine petroleum source rocks., Brooks, J. editor, and A. J. (editor) Fleet. 423-434. 26. 1987. Geological Society of London, Marine Studies and Petroleum Geochemistry Groups, special meeting. Geological Society Special Publications.

Shackleton, N. J. "Deep sea sediment evidence for changing atmospheric carbon dioxide levels." International Union for Quaternary Research; XIIth international congress; Union Internationale pour l'Etude du Quaternaire; XII SUP e congres international. Congress of the International Union for Quaternary Research, 262. 12. 1987.

Shaffer, Gary. "Ocean submodels for studies of global biogeochemical cycling." American Chemical Society, 198th national meeting. Abstracts of Papers - American Chemical Society, National Meeting, GEOC 8. 198. 1989.

Sherwood, C. R., and J. P. Downing. "Ocean general circulation models: Report on proceedings of a Meeting of Ocean and Climate Modelers held at Sequim, WA on July 30, 1987." Meeting of Ocean and Climate Modelers: Ocean General Circulation Models. Tech. Rep. Battelle Pac. Northwest Labs , 1988. NTIS Order No.: DE88005530/GAR. CONF-8707147-Sum.

Siegenthaler, U., and T. Wenk. "A box model for CO SUB 2 in the Equatorial Pacific Ocean and variations with ENSO." International congress of geochemistry and cosmochemistry. Chemical Geology, editor Bottinga, Yan. 203. 70. 1988.

Smith, S. V., and Fred T. MacKenzie. "The ocean as a net heterotrophic system; implications from the carbon biogeochemical cycle." Global Biogeochemical Cycles, 187-198. 1. Hawaii Inst. Mar. Biol., Contrib. No. 741; Hawaii Inst. Geophys., Contrib. No. 1919. 1987 1988.

Souvermezoglou, E., N. Metzl, and A. Poisson. "Red Sea budgets of salinity, nutrients and carbon calculated in the Strait of Bab-El-Mandab during the summer and winter seasons." J. Mar. Res , pp. 441-456. vol. 47, no. 2. 1989.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Staudigel, Hubert, Stanley R. Hart, Hans-Ulrich Schmincke, and Brian M. Smith. "Cretaceous ocean crust at DSDP sites 417 and 418; carbon uptake from weathering versus loss by magmatic outgassing." *Geochimica et Cosmochimica Acta*, 3091-3094. 53. 1989.

Sugimura, Y. "Increasing CO₂ in air and oceanic carbon cycle." Program of the First International Marine Biotechnology Conference (IMBC '89), p. 4. 1989.

Takahashi, T., J. Olafsson, W. S. Broecker, J. Goddard, D. W. Chipman, and J. White. "Seasonal variability of the carbon-nutrient chemistry in the ocean areas west and north of Iceland." *Rit Fiskideildar*; 9 :20 - 36, 1985.

Tanaka, M., T. Nakazawa, and S. Aoki. Fac. Sci., Tohoku Univ., Sendai, Japan. "Seasonal and meridional variations of atmospheric carbon dioxide in the lower troposphere of the Northern and Southern Hemispheres." *Tellus, Ser. B*, V39B, N1-2, (1987): P29-41.

Tanaka, Masayuki. Fac. Sci., Tohoku Univ., Sendai, Japan. "Global concentration change of carbon dioxide." *Kagaku (Tokyo)*, V59, N9, (1989): P566-73.

Tans, Pieter P., Inez Y. Fung, and Taro Takahashi. Coop. Inst. Res. Environ. Sci., Univ. Colorado, Natl. Oceanic Atmos. Adm., Boulder, CO. "Observational constraints on the global atmospheric carbon dioxide budget." *Science (Washington, D. C., 1883-)*, V247, N4949, Pt. 1, (1990): P1431-8.

Taylor, J. A. Coop. Inst. Res. Environ. Sci., Univ. Colorado, Boulder, CO. "A stochastic Lagrangian atmospheric transport model to determine global carbon dioxide sources and sinks. A preliminary discussion." *Tellus, Ser. B*, V41B, N3, (1989): P272-85.

Thomas, Fabienne, C. Perigaud, L. Merlivat, and J. F. Minster. CNES, 31055, Toulouse, Fr. "World-scale monthly mapping of the carbon dioxide ocean-atmosphere gas-transfer coefficient." *Philos. Trans. R. Soc. London, A*, V325, N1583, (1988): P71-83.

Thoning, K. W., P. Tans, T. J. Conway, and L. S. Waterman. Air Resour. Lab., Natl. Oceanic Atmos. Adm., Silver Spring, MD. "NOAA/GMCC (National Oceanic and Atmospheric Administration/Geophysical Monitoring for Climatic Change) calibrations of carbon dioxide-in-air reference gases: 1979-1985." 68 pp. Report, NOAA/TM-ERL-ARL-150; Order No. PB87-164992/GAR, 1987.

CO₂ TRANSPORT AND TRANSFORMATION IN THE OCEAN

Toggweiler, J.R. Princeton Univ, Geophys Fluid Dynam Lab, POB 308, Princeton, NJ 08542 "Biogeochemical Cycling - Bombs and Ocean Carbon Cycles." *Nature*, September 13, 1990, 347, 6289, 122-123.

Toggweiler, J. R., J. L. Sarmiento and et. al. "Glacial to interglacial changes in atmospheric carbon dioxide: the critical role of ocean surface water in high latitudes." *American Geophysical Union. Geophysical monograph* 32, p. 163-184, 1985.

Volk, Tyler. Dep. Appl. Sci., New York Univ., New York, NY. "Sensitivity of climate and atmospheric carbon dioxide to deep-ocean and shallow-ocean carbonate burial." *Nature (London)*, V337, N6208, (1989): P637-40.

Volk, Tyler, and Zhongze Liu. Dep. Appl. Sci., New York Univ., New York, NY. "Controls of carbon dioxide sources and sinks in the Earth scale surface ocean: Temperature and nutrients." *Global Biogeochem. Cycles*, V2, N2, (1988): P73-89.

Wagener, K., and A. de Luca Rebello. Dep. Chem., Pontif. Univ. Catol., Rio de Janeiro, Brazil. "On the effectiveness of the ocean's biological pump in global carbon dioxide scenarios." *Mar. Chem.*, V22, N2-4, (1987): P249-56.

Weissert, Helmut. "C-isotope stratigraphy, a monitor of paleoenvironmental change; a case study from the Early Cretaceous." *Surveys in Geophysics*, 1-61. 10. 1989.

Welsh, David. "More indicators for the greenhouse effect." *Energie*, V42, N4, (1990): P54-5.

Wilson, C. A., and J. F. B. Mitchell. Bracknell, Berkshire, UK. "A doubled carbon dioxide climate sensitivity experiment with a global climate model including a simple ocean." *J. Geophys. Res., D: Atmos.*, V92, ND11, (1987): P13315-43.

Zhan, Bingui, and Yongping Zhao. "CO₂ sub(2), ocean and climate." *Oceanol. Limnol. Sin./Haiyang Yu Huzhao*, pp. 92-99. vol. 20, no. 1. 1989.