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Northwest Pacific Carbon Cycle Study (NOPACCS)-MITI

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Abstract: An introduction of Northwest Pacific Carbon Cycle Study (NOPACCS) which is a research and monitoring project of carbon cycles in the Northwest Pacific Ocean initiated by Ministry of International Trade and Industry is given. Brief summary of the results of 1990 cruise and future perspective are discussed.

Northwest Pacific Carbon Cycle Study (NOPACCS) is a research and monitoring project of carbon cycles in the Northwest Pacific initiated by Ministry of International

Table 1. Parameters for measurements of two Hakurei-Maru cruises on 1990 (NH90-3) and on 1991 (NH91-2).

NH90-3
CTD (with PAR, Fluorescence, Transmission, DO)
Surface Monitoring : pCO_2(1hr.), T-S-Fluorescence (5min.)
DO, Salinity
Carbonate System: ΣCO_2(GC), pH, Alkalinity
Nutrients: NO_3-N, NO_2-N, PO_4-P, SiO_2-Si
Chlorophyll: >20 μm, 20-3 μm, 3 μm-GF/F
Fluorescence Microscopy : Bacteria, Pico, Nanoplankton
Netplankton
Sediment Trap (0°, 15°N)

NH91-2
CTD (with PAR, Fluorescence, Transmission, DO)
Surface Monitoring: pCO_2(1hr.), T-S-Fluorescence (5min.)
DO, Salinity
Carbonate System : ΣCO_2(GC), pH, Alkalinity
Nutrients : NO_3-N, NO_2-N, PO_4-P, SiO_2-Si, NH_4-N
Chlorophyll: >10 μm, 10-3 μm, 3-1 μm, 1 μm-GF/F
Fluorescence Microscopy : Bacteria, Pico, Nanoplankton
Netplankton
POC, PON
Sediment Trap (0°, 13°N, 48°N)

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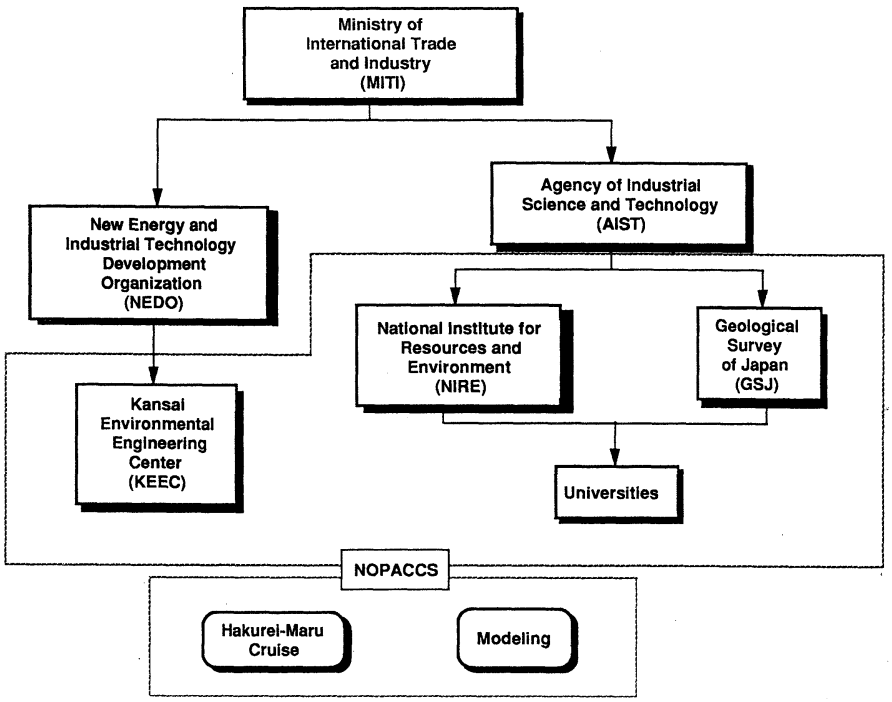

Fig. 1. Organization of NOPACCS.

Trade and Industry (MITI). Main objectives of the project are monitoring of carbon-related materials and rates of the transformations and developement of carbon cycle model in the Northwest Pacific. These objectives area important because oceanic contributions to control CO_2 gas in the atmosphere, which is one of the most significant global warming gas, are still unknown. The project started from 1990, and it will continue at least 1994 with large possibilities to be extended more years. Direct sponsor of the project is New Energy and Industrial Technology Development Organization (NEDO), and Kansai Environmental Engineering Center Coop. (KEEC) is working on the project. Two research institutions of Agency of Industrial Science and Technology (AIST) which is a part of MITI, National Institute for Resources and Environment (NIRE) and Geological Survey of Japan (GSJ), are coordinating the project with cooperation of some scientists from universities (Fig. 1).

Contribution of NIRE is mainly upper ocean processes which focuses biological activities and its influences to carbonate chemistry and to particle flux. R/V Hakurei-Maru cruises which covered from 45° N to 8° S and from 48° N to 15° S along 175° E were conducted during August to October of 1990 and 1991, respectively. Hydrographic observations of surface 300 m include CTD combined with several other sensors, carbonate system, nutrients, size-fractionated chlorophyll and plankton sampling were conducted (Table 1). Surface pCO_2, T-S, and chlorophyll were monitored continuously through the cruises.

Detail results of the cruises will be published elsewhere in near future, and ony brief summary of the results of 1990 cruise are described here. In terms of water mass distributions, we found distinct differences between subarctic water, Kuroshio Extension, subtropical gyre and equatorial region. Each region showed clearly different chemical and biological characterstics. Subarctic water

contains high nutrients and total carbonate and chlorophyll maximum at the surface. Concertration of nutrients and total carbonate decreased and chlorophyll maximum deepened to the south. Nitrate depleted and total carbonate concentration was less than 2.0 mM at the surface of subtropical gyre where the subsurface chlorophyll maximum was located about 100m deep. At the equatorial region, high-nutrients and high-total-carbonate cold subsurface water upwelled to about 75 m and chlorophyll concentrations were slightly higher than the one of gyre. Community structures of these water masses were also different. We found distinctive segregation of distributions of cyanobacteria and prochlorophyte. Partial pressures of CO_2 at the surface water were also different with water massses while the pressure in the air was almost constant. Partial pressure of surface water at the north of 38° N was smaller than one of air and indicates the possibility of CO_2 flux to ocean and possible source regions were around 30° N, equator, and 8° S.

In the last two years, no rate measurement of the carbon cycle was conducted on the cruises except the settling of mooring sediment traps through the years. More rate measurements inclading primary productivity measurements and floating sediment trap experiments, will be included from 1992 cruise which is scheduled in the same season. Spring and summer time cruises are planned in 1993 and 1994.

On the same time, coupled physical-biological-chemical modelling efforts are also started. Initially this modelling efforts focus on upper layer processes with vertically one-dimensional, time-dependent model. This model will reproduce seasonal changes of carbon cycle along 175° E. The model may be coupled with three-dimensional general circulation model in future.