No. 3, 2002

# CIC NEWSLETTER

*Center for International Cooperation*

*Ocean Research Institute*

*The University of Tokyo*

## Message from the Director

*Isao KOIKE*

*Director and Professor*

*Ocean Research Institute*

The previous two years 2000-2001 have been a big turning point for the institution in a number of ways. Ocean Research Institute (ORI), the University of Tokyo, was established in 1962 for a cooperative research of the ocean sciences in Japan. Also, education of graduate students in various fields of ocean sciences was another role in ORI from the beginning of the establishment. During the development of ORI, the scientific staff has expanded to compose 16 scientific divisions in the fields of physical oceanography, chemical oceanography, biological oceanography, marine biology, geology and geophysics of the ocean floor, and fisheries science.

By the fiscal year of 2000, previous 16 scientific divisions were reorganized into 6 research departments to stimulate interdisciplinary studies and to expand the study area, *i.e.* physical oceanography, marine chemistry and chemical oceanography, geology and geophysics of the ocean floor, ocean life sciences, marine ecosystem dynamics, and marine fisheries resources. A new research center to promote marine environmental studies, including assessment of the ocean dynamics and their relation to global change, was also established in 2000. ORI now has three research centers, which are Otsuchi Marine Research Center, Center for International Cooperation, and the above mentioned newly established Center for Environmental Research. ORI operates two research vessels, R/V Tansei Maru (610t) and R/V Hakuho Maru (3991t), and joint research with domestic as well as foreign ocean scientists becomes the central activities of ORI using those facilities.

Another important progress in year 2001 was the establishment of new graduate student program named Marine Environmental Studies as a sub-course of natural environmental studies within the Graduate School of Frontier Sciences. In addition to two on-going graduate student programs, which are jointed with Graduate School of Sciences and Graduate School of Agricultural and Life Sciences, this new sub-course indicates our intention to strengthen education of graduate students of marine sciences in our institution. In April 2001, we welcomed some 40 master course students including 11 students from the new course of marine environmental studies to our Nakano campus. In the near future, we like to establish a new graduate course of integrated marine environmental studies within the Graduate School of Frontier Sciences to expand our involvement of higher education of integrated marine studies within the University of Tokyo.

Year 2001 is also a turning point for the whole national university system of Japan. Within a few years, the University of Tokyo will become so called one university agent and be required more responsibility for its management and budget. The same situation will be also the case for the various components of our university system including our institution.

Now, universities are also encouraged to collaborate with private business sector for receiving research fund. The ocean is essential to us as food and minerals, an economic means of transportation goods, a place of recreation, and also as control of global environmental change. The knowledge obtained from basic studies of ocean should certainly lead to the benefit of our human society and also economic activities of private sector. However, the aim of ORI is to explore and deepen our basic knowledge of the ocean, which imposes difficulties on us to raise research fund from private sectors. To obtain basic research fund from our governmental or international funding agencies, our first priority is to present higher quality of our science than the other oceanographic institutions in the world. I am sure that all academic members in ORI understand the situation.

We have many future plans which are still in pending situation, including moving to a new campus and replacement of 20-year-old R/V Tansei Maru. We need a considerable effort to achieve the above improvement plan, but more importantly our institution should achieve and maintain top leveled ocean science in the world. With a strong support of domestic and international colleagues in the ocean science, we can challenge this transient period to establish new ORI under the new university system.

# The 11th JSPS Joint Seminar on Marine Science

*Toyoji KANEKO*

*Associate Professor*

*Center for International Cooperation*

The 11th JSPS Joint Seminar on Marine Science was held at National Olympics Memorial Youth Center, Yoyogi, Tokyo, on November 20-22, 2000. Over ten years have passed since JSPS launched the Core University Program in the priority field of Marine Science under cooperative arrangements with LIPI (Indonesia), NRCT (Thailand) and VCC (Malaysia). A series of JSPS Joint Seminars has provided favorable opportunities to exchange scientific information and to present up-to-date results obtained through cooperative projects between Japan and those Southeast Asian countries.

The 11th Seminar addressed the topic "Future Aspects of Marine Science in Asia" and assembled about 100 participants from 7 countries, including 14 Malaysian, 12 Indonesian and 6 Thai scientists. In the Seminar, recent advances in the field of marine science were presented in 39 oral and 22 poser papers, and opinions were actively exchanged.

The successful cooperation programs lasting over 10 years terminated in March 2001, and the Seminar also functioned as a forum to summarize the long-term projects. Following the Bilateral Cooperative Programs, we have launched a new Multilateral Cooperative Program. Taking the opportunity of the 11th Joint Seminar, the participants from various Asian countries discussed our future cooperation in the 21st century for sustainable utilization of marine resources and further development of marine science in Asia.


Opening address by Prof. K. Taira


Presentation at the seminar

Welcome party

# JSPS Multilateral Cooperative Research Program
## - Coastal Oceanography -

*Makoto TERAZAKI*

*Professor*

*Director of Center for International Cooperation*

The Core University Program provides a loose framework for bilateral scientific cooperation centering on university designated as "core universities" in Japan and the counterpart Asian countries. Under the program, universities and individual scientists in the affiliated countries carry out cooperative research activities in specific fields. The Core University Program includes scientist exchanges, cooperative research and scientific seminars. The Japan Society for the Promotion of Science (JSPS) launched the Core University Program in priority field of Marine Science under cooperative arrangements with LIPI, NRCT and VCC in 1988, 1989 and 1991, respectively. These bilateral research projects between Ocean Research Institute, the University of Tokyo, as the Japanese Core University, and Research and Development Centre for Oceanology of LIPI, Chulalongkorn University and University of Technology Malaysia (University of Agriculture, Malaysia at the beginning).

These bilateral projects were integrated into one Multilateral Cooperative Program titled "Coastal Oceanography" from April 2001 and Philippines (Marine Science Institute, the University of Philippines) and Viet Nam (Haiphong Institute of Oceanography) joined.

We dispatched 432 Japanese scientists to three countries (Table 1) and invited 350 Asian scientists to Japan during 13 years (Table 2) and total 11 of Joint Seminar were held.

The multilateral program is focused on supporting cooperative research sharply specified research topics that are conducted by the research groups composed of scientists from Japan and five ASEAN countries.

Our multilateral program is made up of four core projects as follows:

- Project-1: Water circulation and the process of material transport in the coastal area and marginal seas of the East and Southeast Asia
- Project-2: Ecology and oceanography of harmful marine microalgae
- Project-3: Biodiversity studies in the coastal waters of the East and Southeast Asia
- Project-4: Pollution of hazardous chemicals in the coastal marine environment and their ecological effect

Table 1. Detachment of Japanese scientists to Southeast Asia (1988-2000)

| Country | Normal Exchange | Cooperative Research | Total |
|---|---|---|---|
| Indonesia | 83 | 87 | 170 |
| Thailand | 98 | 55 | 153 |
| Malaysia | 68 | 41 | 109 |
| Total | 249 | 183 | 432 |

Table 2. Invitation of Southeast Asian scientists to Japan (1988-2000)

| Country | Normal Exchange | Cooperative Research | Long-term | Total |
|---|---|---|---|---|
| Indonesia | 85 | 59 | 3 | 147 |
| Thailand | 90 | 30 | 6 | 126 |
| Malaysia | 48 | 26 | 3 | 77 |
| Total | 223 | 115 | 12 | 350 |

# Surface Circulation in the Subarctic Gyre of the North Pacific

*Yutaka MICHIDA*

*Associate Professor*

*Center for International Cooperation*

Subarctic Gyre Experiment (SAGE) has been implemented as a 5-year research programme with financial support by Promotion Fund for Science and Technology since 1997. Surface drifter experiments have been carried out as part of SAGE programme by an initiative of the Hydrographic Department, Japan Coast Guard (HD/JCG) (PI: Hiroyuki YORITAKA), to study on the surface circulation and its variability in the subarctic gyre of the North Pacific.

I have collaboratively participated in the programme to investigate a research subject, 'Estimation of the wind-driven component in the velocities of surface drifters.' It will be essential in discussing the surface current field in the subarctic gyre to precisely estimate the wind-driven component contained in the velocities of surface drifters, because there are expected to be a relatively strong Ekman drifts, particularly in winter when bigger wind stress dominates the region, in comparison with rather weaker geostrophic currents.

The surface drifters used in the analysis are those deployed by HD/JCG within SAGE programme and from historical archive since 1980s (Fig. 1), and almost all of them are drogued at 15 m below the sea surface according to the specification of the Surface Velocity Programme of the World Ocean Circulation Experiment (WOCE-SVP). Therefore, the trajectories of drifters are anticipated to follow the current at 15 m below the sea surface when drogued, and at the layer just below the surface (1 m) when undrogued, respectively. Both of the layers can be considered well inside the surface Ekman layer.

The estimation of Ekman current has been made by applying the steady state Ekman's theory and using monthly climatological wind field, typical value for drag coefficient and 40 m for the Ekman depth. The calculated Ekman currents basically explain the significant southward drift of the drifter trajectories in the southern half of the subarctic gyre in winter when a strong westerly wind blows.

Mean surface current field was calculated for 5° × 10° bins from drifter tracks with correction of the Ekman component. It displays big seasonal difference as seen in Fig. 2; the southern half of the gyre has a northward component resulting in narrower eastern gyre comparing with the western gyre in summer (July), on the other hand in winter (January), there are continuous eastward flows with smaller meridional component. Our present knowledge regarding the circulation in the region (cf. Otani) seems to be similar to the field in summer of Fig.2. There is a possibility that the present picture has not been representing the annual mean of the current field that should have strong seasonal changes, but the field in summer.

It is necessary for us to discuss more in detail about the seasonal changes of the current field of the subarctic gyre.

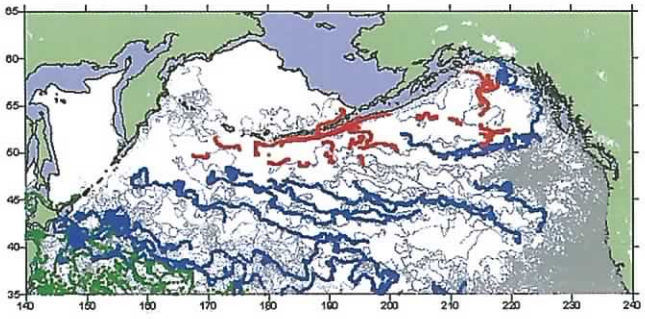



Fig.1 Drifter tracks (colored: deployed by HD/JCG, black: SVP archive) in the subarctic region of the Pacific. (by H. Yoritaka)

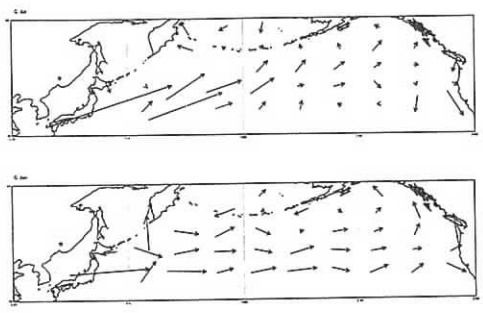


Fig. 2 Mean current field for 5° × 10° bins in summer (July) and winter (January), with correction for wind-driven Ekman component applied.

# Monitoring the Ocean Current by Using the Submarine Cable

*Kunio RIKIISHI*

*Visiting Professor (April 1998 – March 2001)*

*Faculty of Science and Technology*

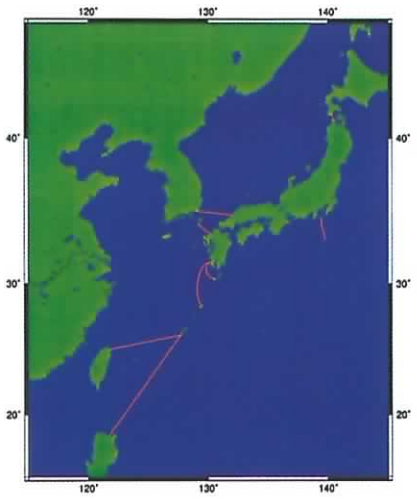
*Hirosaki University*

In the geomagnetic field the motion of the sea water induces the voltage as predicted by the theory of electro-magnetic induction. The motion-induced voltage, which can be measured if submarine cables are available, increases with current velocity or volume transport. It is therefore practicable to monitor the time variation of ocean currents by measuring the voltage difference across channels by using submarine cables. Western part of the North Pacific provides us with such good opportunities because many islands exposed to ocean currents are connected by telephone cables. Accordingly, we are measuring the motion-induced voltages at 10 stations by using 14 submarine cables around Japanese islands.

Results from the Tsugaru and Tsushima Straits show that the voltages are highly correlated with the cross-stream sea-level differences or the geostrophic surface current. The voltage also shows a linear correlation with the volume transport measured by ADCP. Conversion factor from the voltage to the volume transport has been found to be $12\times10^6$ $m^3/s$. It is then possible to monitor the volume transport by using this empirical relationship. It has also been found that time variation of the Tsushima Warm Current is highly correlated with that of the surface air pressure (Liu and Kim 2000) or cross-stream, air pressure difference (Hashimoto et al. 2000). Explanation must be given why this kind of strong correlations are found between the atmosphere and the ocean or how the atmosphere drives the ocean current in the straits.

Recently, we have compared the tidal signal of the measured voltages with the tidal current deduced from the tidal model by Matsumoto et al.(2000). It has been found that the voltage of 1 volt corresponds to the volume transport of $60\times10^6$ $m^3/s$ for the Izu Islands region and $24\times10^6$ $m^3/s$ for the Tokara Strait. This big difference in the conversion factor may be ascribed to the fact that the resistivity of the sea bed or earth's crust may differ from place to place. The tidal signal of the voltage shows a clear seasonal fluctuation owing to the seasonal change of the sea water temperature. Gradual increase in the amplitude of the tidal signal might suggest that the resistivity of the crust between Oshima and Miyake Islands are increasing owing to the recent volcanic and seismic activity.

The measured voltage includes various information not only on the ocean but also on the atmosphere, lithosphere, magnetosphere, and heliosphere. New frontier of the earth science seems to lie before us.




The submarine cable network for monitoring the ocean currents of the north-western Pacific.

# Large-scale Gravity Sliding Along the Flanks of the Hawaiian Islands

*Gregory F. Moore*

*Visiting Professor (January 2001 – May 2001)*

*Department of Geology & Geophysics, SOEST*

*University of Hawaii*

In 1998/9 a joint Japan-US study of large-scale gravity sliding along the flanks of the Hawaiian Islands began with a 1-month seismic reflection and multibeam mapping cruise on the R/V *Ewing*, a 1-month mapping and ROV diving cruise on the R/V *Kairei*, and a 1-month mapping and submersible diving cruise on the R/V *Yokosuka*. Although basaltic seamounts are ubiquitous throughout the Pacific Basin, we know very little about their history of slumping and collapse. This joint project with scientists from the University of Hawaii and U.S. Geological Survey on the American side and JAMSTEC, Tokyo Institute of Technology and Geological Survey of Japan on the Japanese side was designed to fully map the morphology of two major debris avalanches and one active slump, image their subsurface structure and sample their flanks.

This work has already lead to a revision of the "classic" scenario for the evolution of Hawaiian volcanoes. Hawaiian volcanoes are buttressed on one side due to being built on the flanks of older volcanoes. The volcanoes are forced apart during intrusion at the axial rift zone. The buttressed side cannot move, but the seaward side is free to move and giant landslides occur. This process seems to occur during the active shield-building stage.

Our program mapped large and small blocks of the ~ 1-2 ma debris avalanche deposits that slid off the flanks of O'ahu and Molokai (Nu'uanu and Wailau slides). Our studies show that the large blocks can be fit back together like a giant "jig-saw puzzle" into the flanks of O'ahu and Molokai. The seismic reflection records show a significant accumulation of pre-slide sediments under sliding surface (décollement) as well as about a kilometer of post-slide sediments on the flank of O'ahu and between the blocks. The sediment thickness is different on the NW and SE sides of Tuscaloosa Seamount, the largest block (2.5 x 16 x 28 km=1120 $km^3$ volume), which moved at least 90 km from O'ahu. We recognize one set of blocks with long axes aligned parallel to O'ahu and second group aligned parallel to Molokai.

The Nu'unu landslide is believed by K. Satake of GSJ and J. Smith of UH to have caused a huge Pacific-wide tsunami that could have been as high as 100 m on O'ahu, 70 m in southern California, and 5-10 m on Japanese coasts.

We also surveyed the presently active large-scale submarine slump on the flank of Kilauea Volcano (Hilina Slump). GPS measurements document up to 10 cm/yr of seaward motion along the flank. Our marine multichannel seismic reflection data show that the distal flank has undergone about 15-24 km of lateral motion. The subsurface structure of the flank resembles that of an accretionary prism, recording significant accretion and deformation of volcaniclastic strata, building a broad and laterally extensive midslope bench. A landward-dipping thrust fault rises from the top of the Cretaceous oceanic crust, and displaces the primary volcanic edifice seaward onto folded and faulted bedded strata. To the southeast, imbrication of seaward thrust sheets builds a broad bench which ponds sediments behind it in a deep midslope basin. Sediments in the basin record the history of uplift and tilting due to thrusting of the seaward flank.

During the large-scale landsliding, sediments spread out in front of volcano. The "proximal" deposits are big blocks and large debris flows that spread laterally to turbidites at their more distal fringes. This progression generates an overall thickening and coarsening upward sequence as the volcanoes grow laterally, sliding on top of these sediments. The volcano flanks build out during spreading and accretion, but are constantly being torn down by large and small scale erosion.

Our project will continue with two months of mapping and ROV/submersible diving on JAMSTEC vessels in 2001/2.

# My Impressions of Ocean Research Institute and Japan

*Gregory F. Moore*

I joined Ocean Research Institute (ORI) on 12 January 2001 to begin my term as a Visiting Professor for four months at the Center for International Cooperation. Because of ORI's very productive work environment, I was able to make significant progress on two current research projects: "Deformation and Fluid Flow in the Nankai Trough Accretionary Prism" and "Giant Landslides on the Flanks of the Hawaiian Islands". The excellent connection to the internet allowed me to collaborate with two of my students in Hawaii – we submitted one paper in February, resubmitted another in April and worked on pre-stack depth migration of one of our Nankai Trough seismic lines. In addition, I was able to work with Prof. A. Taira on a paper about ODP Leg 190 drilling in the Nankai Trough. Prof. Taira and I were co-chief scientists on that leg during summer of 2000.

Prof. A. Taira of CIC, and Prof. H. Tokuyama and the students and staff of the Taiseki Group made my visit very enjoyable. My interactions with the graduate students were particularly fruitful and mutually beneficial. While I was helping them with seismic processing and interpretation, they were helping me with Japanese language and travel arrangements. ORI students are among the best in the world, and I hope that we can work out a long-term exchange of graduate students and post-docs between ORI and SOEST.

During my visit to ORI, I was able to join 3 field trips, one to Miura to observe soft-sediment deformation in volcaniclcastic sediments, one to Boso to observe the Mineoka Ophiolite and one to the Mt. Fuji region to observe young orogenic sediments from the Izu collision zone. It was great for a former field geologist who has been tied to computers and ships for the past 15 years to be able to get out and look at some very interesting examples of Japanese geology.

I also visited several Universities and Labs outside ORI, including Tsukuba University, JAMSTEC, JNOC-TRC, and JAPEX Geoscience Inc. where I presented talks on my research work. The ability to meet so many Japanese researchers was a great opportunity that will likely result in future collaboration on several topics.

Life in Tokyo was an enjoyable change from my normal existence in Hawaii. I really enjoyed the several O-hanami parties in April and seeing the azaleas in May. Living in Todai's International Lodge in Shirokanedai was very comfortable and allowed me to commute via train and bus rather than driving by car. During weekends, I investigated many parks and gardens in and around Tokyo, and even visited the mountains of Niigata for two days of downhill skiing. I took a week off to visit Kyoto and Hakone when my mother came to visit and took my wife to Nikko and Izu after my official tenure ended in May.

I am grateful to the University of Tokyo for offering me this opportunity to do collaborative research at ORI. I thank Prof. K. Taira, former Director of ORI and Dr. M. Terazaki, Director of the Center for International Cooperation for arranging my visit and for their kind help and support during my tenure.

Lecture of Prof. Moore

# Introducing a New Visiting Professor of CIC

*Shinsuke TANABE*

*Visiting Professor (April 2001 – March 2002)*

*Center for Marine Environmental Studies*

*Ehime University*

Prof. Dr. Shinsuke Tanabe has been newly appointed as a Visiting Professor of CIC from 1 April, 2001, in order to cooperate and support the JSPS Core University Program, particularly for carrying out a cooperative research project titled "Pollution of Hazardous Chemicals in the Coastal Marine Environment and Their Ecological Effect (POME)".

Dr. Shinsuke Tanabe is a Professor of Environmental Chemistry and Ecotoxicology at the Center for Marine Environmental Studies (CMES), Ehime University. He received M.S. from Ehime University (1975) and Ph.D. from Nagoya University (1985). The emphasis of his research has been the global environmental monitoring of persistent organic pollutants (POPs) and their biological accumulation and toxic effects in marine ecosystems, particularly in mammals and birds. His research group has developed new analytical methodologies for PCBs, dioxins, organochlorine pesticides, organotins and heavy metals, and made clear their environmental behavior/fate, temporal and spatial contamination in marine ecosystems, and mechanism of toxic action (including genotoxicity) in wildlife and humans. He has authored and co-authored over 200 research papers in peer reviewed international journals and 690 oral/poster presentations in conferences/symposiums.

He was the recipient of the Okada Prize from the Oceanographical Society of Japan in 1985, Nissan Science Prize from Nissan Science Foundation in 1999 and Citation Classic Awards in Japan from ISI Thomson Scientific in 2000. Dr. Tanabe is currently the editorial board member of the journal "Marine Pollution Bulletin" (Pergamon) and "Marine Environmental Research" (Elsevier). He is a member of the International Mussel Watch Committee and its Scientific Director in Asia-Pacific Phase.

Green mussel *(Perna viridis)*, an excellent bioindicator for marine pollution monitoring of POPs.

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