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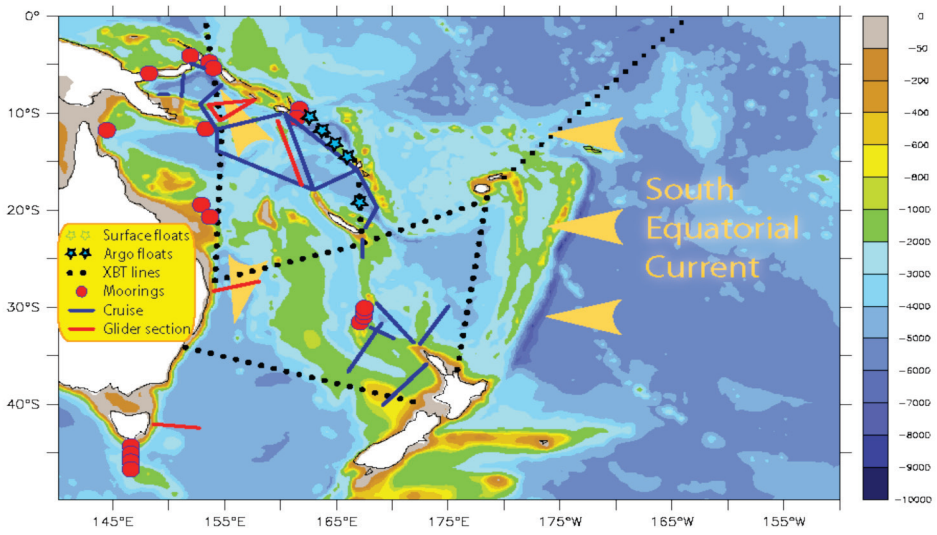

From CLIVAR Pacific Observational Programs: page 7. Figure 2: SPICE field experiment (see the text for progress; moorings against Australia coastline are part of IMOS-GBROOS).

Bernadette Sloyan (CSIRO, Australia), continuing Panel members Masao Fukasawa (JAMSTEC, Japan), Nicolas Gruber (ETH-Zurich, Switzerland), Gregory Johnson (NOAA, USA), and Toste Tanhua (IFM-GEOMAR, Germany), and new Panel members Masao Ishii (MRI-JMA, Japan), Brian King (NOCS, UK), Lynne Talley (SIO, USA), and Richard Feely (NOAA, USA, ex-officio).

A 1-day international planning meeting in conjunction with the AGU / ASLO / TOS Ocean Sciences Meeting in Portland, Oregon, USA is tentatively planned for 21 February 2010 to discuss the way forward. This meeting is open to all, and scientists wishing to attend should contact Maria Hood at the IOCCP, or join the GO-SHIP email list to stay informed of the latest news.

For more information, visit the GO-SHIP web-site (www.go-ship.org), join the GO-SHIP email list by sending an email to sympa@lists.unesco.org with "subscribe go-ship" in the subject line, or contact Maria Hood at maria.hood@ioccp.org.

The First PACSWIN Submarine Cable Workshop

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1. Introduction

Submarine cables are simple and cost-effective systems for monitoring ocean transport – only a voltage recorder and computer are needed to make the observations (aside from calibration data) and as such, cables are promising sensors for obtaining long-term ocean climate measurements. This technique is especially useful in shallow straits and marginal seas such as the Indonesian seas, which are not sampled by the Argo network due to technical constraints. The PACSWIN (Indonesian Throughflow: PACific Source Water INvestigation) international ocean climate program will measure the Indonesian Throughflow (ITF) with submarine cables in addition to a broad range of standard oceanographic measurements (ADCP and XBT using commercial ships, satellite, moorings and floats etc.).

Submarine cables have monitored the Florida Current transport since the 1980s and have also been used around the world. Ocean currents studied by cables include the Kuroshio between Taiwan and Luzon, Taiwan and Okinawa, and Honshu and the Izu Islands; the Tsushima Current in the Korea / Tsushima Strait; transports between Gran Canaria and Tenerife; and wind-forced flow in the Baltic Sea. However, so far the application of submarine cables to oceanic currents has been carried out for only

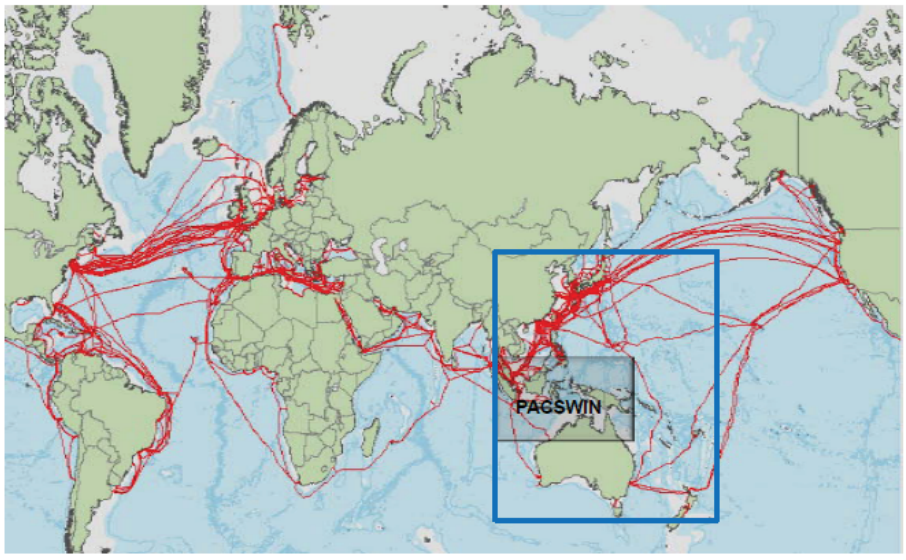

Figure 1. The global distribution of submarine cables (courtesy of Alcatel-Lucent) is shown by red lines; the domain of PACSWIN is shown by the green square and covers the region including and adjacent to the Indonesian seas; and the region of CLIVAR-endorsed-and-endorsing programs (SPICE, PACSWIN, NPOCE, GAIA and OKMC) in the western Pacific is shown by the blue square.

a minor proportion of the existing cable networks (see Figure 1) and, as yet, the technique is not being exploited to its fullest.

The western Pacific is an important region because of strong western boundary currents, closely-coupled atmosphere and ocean, and the upper-limb return flow of the global overturning circulation through the marginal seas of Indonesia. The ITF is complex and passes through many straits. Only recently were simultaneous mooring measurements (the INSTANT project, 2004-2006) carried out in this region to measure the ITF velocity and transport. It is very costly to maintain a set of moorings for timescales longer than a few years, however, and submarine cables allow long-term measurements to be continued on a sustainable basis.

Several submarine cables cross straits through which the ITF flows (Figure 2). In particular, two cables cross Makassar Strait, which contains the majority (estimated at 70-80%) of the ITF transport. PACSWIN has set the submarine cable as one of its priority monitoring components along with ADCP and XBT using commercial ships, satellite, moorings and floats. The cable routes in the Indonesian seas avoid the magnetic equator, which lies to the north near Mindanao.

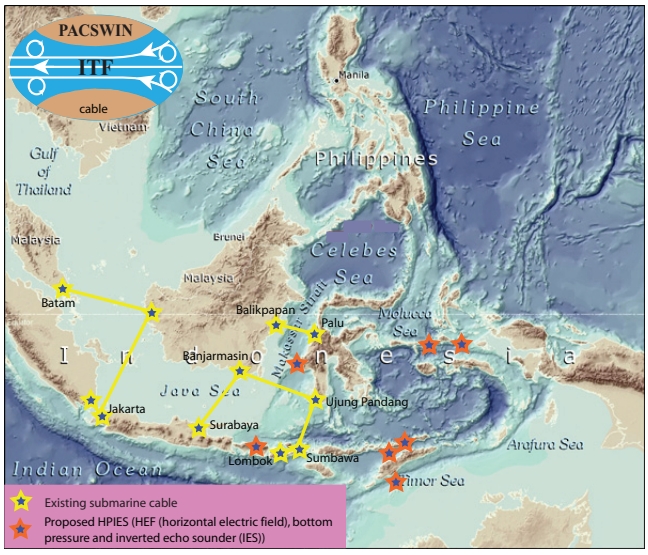

Figure 2. Submarine cables in the Indonesian seas (You et al., 2009) and proposed EFS/IES (E-field sensor/inverted echo sounder) for the straits without a cable.

2. Organization of the workshop

The First PACSWIN Submarine Cable Workshop was endorsed by CLIVAR on April 23, 2008. The workshop, held at the Howard International House, Taipei on 9-10 Sept 2009, included one and half days of presentations and a half day of discussion. One additional day was arranged for a field tour of the cable station that measures the Kuroshio transport between Taiwan and Okinawa.

Yuzhu You and Tom Sanford co-chaired the Organizing Committee responsible for the scientific program. Other committee members include Peter Sigray, Cho-Teng Liu and Momoki Koga. Two Organizing Committee meetings were held during the workshop for instructing the workshop activities. Cho-Teng Liu, as chair of the Local Organizing Committee, arranged the multiple activities with enthusiasm and hospitality.

The workshop was sponsored by the National Taiwan University, Taiwan Ocean Research Institute, the (Taiwanese) Coast Guard Administration and Environmental Protection Administration. After an official welcome speech and two opening speeches, the workshop comprised two invited lectures, given by Profs. Tom Sanford and Chao-Shing Lee (the National Taiwan Ocean University) and nine scientific presentations by scientists from Australia, USA, Germany, Russia, Japan, Sweden, Korea, Indonesia and Taiwan. A half-day discussion on the afternoon of the second day covered technical details and how to implement the cables. There were nearly 30 people in attendance (see the workshop photo, Figure 3).

3. Outcomes

The workshop provided an opportunity to update the community about recent developments in cable measurements and to review and promote the technique. Scientists familiar with this technique exchanged their experiences and shared their knowledge with those less familiar.

Since calculating meaningful water transport from cable measurements depends upon accurate determination of parameters such as tides, sediment conditions, channel depth, local magnetic field and comparison with independent velocity and transport measurements, the workshop allowed cable users to exchange methodologies to help standardize the technique. Discussions were focused on the issues of cable installation and calibration led by Peter Sigray and Tom Sanford.

Workshop participants agreed the basic setup for taking data (a voltmeter, time from GPS-synchronized clocks, and a computer for recording the data), the need for sampling every minute (or less) since rapid sampling might reduce noise and provide better hourly averages, the importance of knowing the electrochemical potential of the cable ends and/or the local ground, the necessary extensive and repeated calibrations to assure accurate performance and interpretation, and hourly mean data as a standard output.

Compared with the success story of the Florida cable, the workshop made a diagnosis for two other cables. First, the cable measurement of the Kuroshio between Taiwan and Okinawa (the OKITAI cable) shows time-varying cable calibrations dependent on the presence of cold and warm eddies and which may be associated with bottom topography (an empirical correction using data from repeat surveys, moorings, or ship measurements is anticipated to provide a more accurate calibration). Second, the cable measurement of the Tsushima Current in the Korea/Tsushima Strait has recently exhibited a

small but unexplained linear trend. After confirming that concurrent velocities from moorings, do not allow for a linear trend, the electrodes and devices should be checked for anomalous electrochemical changes and offsets.

To help establish the cable component of PACSWIN for long-term and cost-effective monitoring of the ITF, a scientific steering committee has been set up and its operation is being prepared. The next workshop will be after the initial implementation of the program and will likely be held in Indonesia in 2010.

More generally, the workshop not only prepares for the PACSWIN cable or the ITF monitoring program, but also for an increased global use of submarine cables. More detailed information can be found in the workshop webpage, http://sol.oc.ntu.edu.tw/pacswin/index.htm, with presentations in both digital and video forms to be available soon.

Acknowledgments
We thank CLIVAR for their endorsement of this workshop, especially Director Dr. Howard Cattle of CLIVAR IPO for his strong support. The sponsorship from the National Taiwan University, Taiwan Ocean Research Institute, the (Taiwanese) Coast Guard Administration and Environmental Protection Administration is gratefully acknowledged. The staff and a group of postgraduate students from the Institute of Oceanography, National Taiwan University, and from the Central Police University, are especially acknowledged for preparing the workshop and working hard to make the workshop successful.

Reference

Y. You, T. Rossby, W. Zenk, A. G. Ilahude, M. Fukasawa, R. Davis, D. Hu, D. Susanto, P. L. Richardson, C. Villanoy, C.-T. Liu, J. H. Lee, R. Molcard, W. W. Pandoe, M. Koga, T. Qu, R. A. Fine, A. Gabric, R. Robertson, Y. Masumoto, S. Riser, H. Hasumi, P. Sigray and T. Lee, 2009: Indonesian Throughflow: PACific Source Water INvestigation (PACSWIN): An international ocean climate program. In: Climate Alert: Climate Change Monitoring and Strategy, Y. You and A. Henderson-Sellers (eds.), University of Sydney Press, in press.

Figure 3. The participants of the PACSWIN 2009 workshop.

The PAGES/CLIVAR Intersection: Vision for the future

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The PAGES/CLIVAR Intersection Working Group is jointly sponsored by PAGES and the Climate Variability and Predictability (CLIVAR) project of the World Climate Research Programme (WCRP), and plays an important role in developing and implementing the overlapping research interests of both these programs. The formation of the Intersection was predicated on the idea that paleoclimate studies provide a useful adjunct to studies of modern climate variability and likely future change. Since its establishment in the mid-1990's, the goals of the Intersection have evolved with the changing focus of each parent organization. At the Panel meeting in Italy in June 2008 the goals were again updated and are now detailed in a new PAGES/CLIVAR Vision Document.

A number of key scientific issues were identified by the Panel and will be addressed by the Intersection over the coming years. They are categorized into overarching cross-cutting issues, in addition to four more specific topical issues.

1) Overarching and cross-cutting issues
Forward modeling of proxy data:

- Whereby the proxy data is modeled directly by Earth System Models (ESM), is considered of fundamental importance to improving model-paleodata comparisons.
- Reducing uncertainties in proxy reconstructions (and data synthesis in general)
- Are important for improving climate modeling targets and for understanding the intrinsic variability and forced response of the climate system.
- Calibration of proxies against variability seen in the instrumental period
- Is a pre-requisite for improved synthesis of proxy- and observation-based approaches and requires interaction