University National Oceanographic Laboratory System
Research Vessel Technical Enhancement Committee

Interface

A UNOLS-RVTEC newsletter exploring the interface of Technology with Science at sea

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Editor's Corner

Your 1992-1994 UNOLS-RVTEC Chairman Rich Findley and I urge you the Technical Support Group members at each participating institution to exchange information about technical support for UNOLS science at sea! We hope all of you contribute to the discussion of topics that is already underway through the UNOLS.RVTEC/Omnet mailing list, but we also hope you'll so enjoy seeing Your Name in Print that you'll innundate me as well with short articles and critiques/opinions that can be featured in Newsletter format. This first issue spans a variety of topics, from planning for an informal get together at the upcoming April 93 TOS meeting to the performance of (or non performance of!) Transmissometers and XBTs, to worries about what we're all measuring with ADCPs. Future issues will have similar general coverage, or (we hope!) we'll have topical discussion issues when groups of members have common experiences and problems. So come on, now! Let's hear from you!

MARCHEM Doings

Our colleagues interested in improved chemical instrumentation for oceanography have set up a bulletin board called MARCHEM.93 on Omnet. The board is used to exchange information in preparation for annual meetings that bring together scientists interested in improved chemical oceanographic instrumentation and representatives from companies that build instruments. Their MARCHEM.91 meeting was the first in this series and resulted in a workshop report that according to organizers identified several problem areas that were impeding progress. MARCHEMists plan to meet 1-5 August 1993 in Steamboat Springs (Co.) to focus on two topics. According to MARCHEM.93 meeting organizer Lou Codispoti, "one is technologically prosaic, but a source of offending grief, and the other gets a bit more into the zone of 'nifty' technology". For more information, refer to (and get Omnet.Service to prompt you for) MARCHEM.93!

(Lou Codispoti, Dana Kester, Alan Shiller, and others are frequent contributors to MARCHEM.93)

Note for Internet Users

Editor's Note: Since some of our UNOLS-RVTEC interested and involved users don't use Omnet (or for whom Omnet is not the preferred electronic mail option), Dale Chayes at LDGO points out that NASA Ames supports an Omnet/Internet gateway:

Alternative gateway for Internet<->Omnet traffic
[Effective: 22 Jan 91]

NASA Ames supports an omnet/internet gateway. To send messages from internet to omnet mailbox, use the following addressing convention:

username@omnet.nasa.gov

For example, to send Doug Biggs mail at his Omnet mailbox -

mail D.BIGGS@omnet.nasa.gov

Turnaround time is typically < 1 day.
Recipients of messages sent this way will be able to respond directly to you -- the message text carries the appropriate instructions.

To go from Omnet to internet:

Command? compose
To:(UN:POSTMAN,O:NASA,PRMD:NASAMAIL,
ADMD:TELEMAIL,C:USA)
Cc:
Subj:
Test:
TO: dale@lamont.ldgo.columbia.edu

(remainder of text of message)...

---- cut here ----
If you wish to test this, feel free to send Dale a test message!

[information contributed by Dale Chayes, LDGO]

RVTEC Get Together Planned for TOS

It is planned to have an Information Exchange among UNOLS-RVTEC members who attend the 3rd scientific meeting of The Oceanography Society, which is scheduled for 13-16 April 93 in Seattle. Rick Pieper will coordinate this informal exchange as an evening session, so let him know ASAP if you prefer one night to another (Mon 12th, Tue 13th, Wed 14th, or Thu 15th). Watch the OCEAN and UNOLS.RVTEC bulletin boards for more details.

Working Together

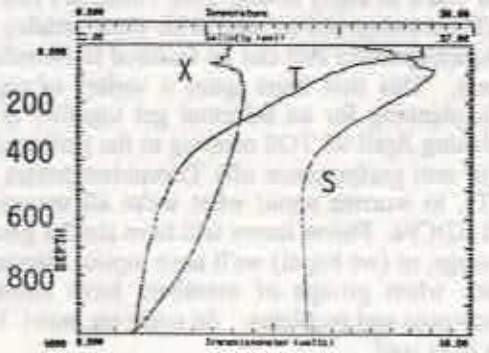
Dale Chayes, a Senior Staff Associate at LDGO, was recently involved in a cooperative adventure which gave him the opportunity to use the expertise in Hydrosweep which he'd developed (albeit painfully, Dale jokes) on *Ewing* to evaluate and trouble shoot the Hydrosweep-DS multibeam swathmapper on the *Thompson*. With travel support from Lisa Rom at NSF, Dale went along on a one week UW-sponsored "student" leg of Thompson, from 16-23 December 1992. Based on Dale's summary comment that he expects "to further develop some kind of cooperative support for the Hydrosweep systems in the UNOLS fleet", he must have a great pre-Christmas cruise in Hawaii!

Also at sea in December 1992 (and for most of January 1993) on a cruise with another institution was TAMU Marine Technician Dennis Guffy. Dennis, an autoanalyzer specialist, sailed on WOCE cruise JUNO Leg 2 aboard *Knorr* (Chief Scientist Jim Swift, SIO). Though most of the at sea tech support was provided by SIO-ODF, Dennis participated (via a subcontract from Lou Gordon's group at OSU) as one of 2 autoanalyzer technicians. The 50 day trip 4 Dec 92 - 22 Jan 93 offered not only the opportunity for Dennis to celebrate Christmas at sea, but the chance for roundtable interaction among SIO, TAMU, and OSU autoanalyzer specialists. For more info about JUNO Leg 2 or other recent WHP cruises, see WOCE.TOGA.STATUS bulletin board on Omnet ("P17E/P19S Update"].

Editor's Note: These are just 2 examples of recent exchanges in which not only scientific PIs but technical support staff as well had the opportunity to do brief "sabaticals at sea" on cruises fielded on non-home institution ships. Please keep me posted on such exchanges and/or about planning for field tests of new technology(s) or new application(s) to oceanography, so I can publicize these in future issues of *Interface*.

How Many Times Has This Happened to You?

Users of SeaTech model 025D transmissometers at TAMU and at LUMCON have noted data artifacts in some of the transmissometers in their inventory. These artifacts have suddenly appeared in some model 25D instruments purchased 1990-1992 after a few months to more than a year of otherwise "normal" use. In the Gulf of Mexico, the artifact is especially evident on the downcast when instruments coupled to CTD/rosette multisampler packages reach the middle thermocline. The artifact shows up as a driftlike reduction in output voltage which begins abruptly after temperature decreases below about 12C. This drift does not always begin at the same depth (temperature), even on successive casts at the same location, although we have never noticed when temperature is above 15C. For instruments experiencing this problem, it is easy to demonstrate the artifact is temperature related rather than pressure related artifact by packing the transmissometer pressure case in ice while on deck. An example from a CTD cast to 1000m in water depth of 3 km in the central Gulf of Mexico follows:



Note that after decreasing from 8.8 volts at the surface through a local minimum 50-120 m that chlorophyll sampling shows was associated with the DCM, voltage output began to drift lower below about 200 m (12C). By the bottom of the cast (1000 m), the VO was markedly lower than it had been within the DCM. As the package was retrieved, the voltage drifted back up scale so that by the time it was back above 200 m VO upcast tracked VO downcast. However, between 1000 - 200 m upcast VO did not track downcast VO (upcast VO > downcast VO).

At TAMU, 3 different SeaTech transmissometers have exhibited such aberrant behavior in the last 2 years. In 2 of 3 cases, SeaTech diagnosed a "loose LCD" and was able to correct the problem after instrument was returned to manufacturer for service. In the 3rd case, however, SeaTech was unable to find a cause for this behavior, and that instrument (outfitted with a deep ocean pressure housing) exhibited errant drift until it met with an untimely loss at sea.

[by D.Biggs, with anecdotal contributions from W. Gardner and D. Wiesenburg, Department of Oceanography, TAMU, and from C. Riffe, LUMCON]

Drop Rate Correction for XBTs

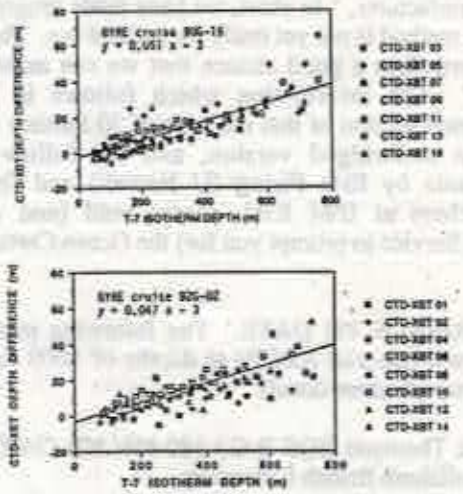
A recent posting to the bulletin board WOCE.TOGA.Status on Omnet is repeated below, to continue and extend discussion of the error noted by Hananawa & Yoritaka [*J. Oceanogr. Soc. Jpn., 43*: 68-76, 1987] and by Singer [*J. Atmos. Oceanic Technol., 7*: 603-611, 1990]:

"There has been widespread concern amongst the community of XBT users regarding the accuracy of the manufacturer's fall rate equations for expendable devices. The IGOSS Task Team on Quality Control of Automated Systems (TTQCAS) has done much work to develop a revised version of the fall rate equation. After hearing reports from the TTQCAS, the TOGA/WOCE XBT/XCTD Programme Planning Committee at their meeting in October 1992 concluded that the revised fall rate equation for T4, T6 and T7 XBT probes manufactured by both Sippican and TSK was now sufficiently well documented as to justify its adoption. The Committee recommended that the target date for full implementation of the revised equation should be 1 January 1995, i.e. immediately following the TOGA ten-year observing period. The IGOSS Coordinator, with assistance from the TTQCAS, undertook to coordinate implementation. Amongst the required actions are changes to the WMO BATHY code (JJXX report) for real time transmission on the Global Telecommunications System (GTS) to accommodate information concerning probe type and fall rate equation used, and corresponding adjustments to the data centre archives and data exchange procedures. Manufacturers of deck units and processing software will be urged to provide their users with the updated software and hardware necessary to implement the revised equation by 1 January 1995. The Committee strongly recommended that the fall rate equation currently in use should be maintained in all data exchanges, both real time and delayed mode, until 1 January 1995. Details concerning the revised equation and its implementation will be found in the reports of the meetings of both groups and in a scientific article on the subject to be submitted to a refereed journal early in 1993. Please direct comments or questions to WOCE.IPO or INTL.TOGA."

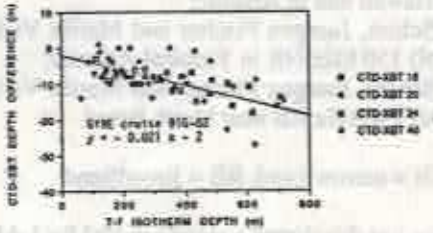
[from US.WOCE.Office, 22 Jan 93]

Editor's Comment: From my own field work in the Gulf of Mexico with Sippican T7 XBTs, Sparton (of Canada) T7 XBTs, and Sippican T5 XBTs dropped at the same location immediacly before or immediately after we've done CTD casts, I've found software for the Sippican Mk-9 Deck Unit to consistently underestimate true depth for T7 XBTs by about 5%.

Editor's Comment (con't): Plotting the [CTD-XBT Depth Difference] against the [T7 Isotherm Depth] as suggested by Singer (1990), I found a first order fit of y = 0.051 x - 3 for Sippican T7 XBTs dropped at 7 stations on R/V *Gyre* cruise 90G-15 at which we then made CTD casts (SBE-09) and a first-order fit of y = 0.047 x - 3 for Sparton T7 XBTs dropped at 8 stations on R/V *Gyre* cruise 92G-02 immediately following CTD casts:



In contrast, the same manufacturer's software overestimates the true depth for the larger T5 "Deep Blue" probes, by about 2%:



On R/V *Gyre* cruise 91G-02, CTD casts were made at 4 stations immediately following the deployment of Sippican T5 XBTs.

Whether such differences between T7 and T5 performance reflect variations in laminar v turbulent flow around falling short (T7) v long (T5) probes, or whether they arise from differences in rate at which the trailing copper wire stretches, or both, remain open to discussion. Colleagues with similar experiences have also reported to me that they have seen marked probe-to-probe differences in drop rate of XBTs within the same lot (from the same manufacturer's production run). Presumably, such differences can arise from individual variations in nose weight shape, or other differences in probe geometry.

Had similar experiences?? Do drop rate errors persist when using XBT (Mk-12) interface boards for PCs? Please share your views on the UNOLS.RVTEC bulletin board!!

Status of Lowered ADCPs

A recent posting to the bulletin board Ocean.Currents by ADCP manufacturer RD.Instruments summarized progress to date in development of lowered ADCP full-ocean-depth profiling capability. According to the manufacturer, " In short, we have made progress, but the method is not yet ready for general use. There is nevertheless a good chance that we can make it work." The information which follows is my condensed version of that message of 20 January 93; for the unabridged version, and for follow-up comments by Eric Firing (U Hawaii) and from researchers at IFM Kiel, please read (and ask Omnet.Service to prompt you for) the Ocean.Currents board:

EXPERIENCE TO DATE. The following people have used lowered ADCPs at depths of 5000 m or more (except where noted):

1) Rick Thomson (IOS B.C.) 150 kHz NB (2400 m max), offshore British Colombia;
2) Eric Firing (U. Hawaii) 300 kHz NB near Hawaii and near Equator;
3) Bill Johns (U. Miami) 150 kHz NB in Gulf Stream;
4) Doug Wilson (AOML) and Eric Firing 150 kHz BB near Hawaii and in Atlantic;
5) Fritz Schott, Juergen Fischer and Martin Visbeck (IFM Kiel) 150 kHz NB in Tropical Atlantic;
6) Fritz Schott, Juergen Fischer and Martin Visbeck (IFM Kiel) 150 kHz BB near North Brazil

note: NB = narrow band, BB = BroadBand

Eric Firing has developed a simple model for LADCP performance. Two papers have been published (one by Firing/Gordon and the other by Fischer/Visbeck) and LADCP scientific results have been presented at several conferences.

HARDWARE PROBLEMS (numbers refer to the above list)

1) Transducer leaks. IFM Kiel (#5). We have also experienced leaks on other long-term deployments. This fault caused beam 3 to fail.

2) Data recording drop-outs. IFM Kiel (#6). The problem was caused by a design fault in the power-timing circuit board. This fault prevented IFM from obtaining data during part of the return trip to the surface.

MANUFACTURER'S ANALYSIS: Both of these hardware problems are solvable via straightforward engineering (we believe they have been solved).

LOW BACKSCATTER. The above deployments (except #1 and #3) encountered backscatter that was on the order of 30 dB less than is typically found near the surface. The result was that profiling range was substantially reduced below about 1 km deep. BBs are particularly affected by low backscatter. The NB 150 kHz deployments obtained 100-150 m range with 8 and 16 m bins. Using standard setups, the AOML BB 150 kHz deployment saw around 40 m range. In response to this experience, we modified IFM Kiel's BB 150 kHz as follows:

1) higher power
2) reduced system bandwidth (from 30% to 9%)
3) recommended a special profiling mode

With these changes, IFM Kiel obtained a range of about 100 m with 9 m bins. The measurement uncertainty with the setup they used was nearly the same as what they would have achieved with a 150 kHz NB. A consequence of using higher power was that battery packs had to be changed each for each profile.

CHOICES AND TRADE-OFFS. There are a number of choices and trade-offs available to optimize LADCP performance. Choices include the following:

1) 150 vs. 300 kHz. Compared with 150 kHz, 300 kHz sees higher backscatter (thus range should be more than half the 150 kHz range), has smaller velocity standard deviation and uses less power (limited by shock formation).

2) Bandwidth. Reduced bandwidth increases both range and standard deviation.

3) Power. Increased power gives more range but uses batteries faster. 150 kHz can increase power much more than 300 kHz.

4) Depth cell size. Increasing depth cell size reduces standard deviation, increases power consumption, increases range and makes vertical resolution coarser.

5) Profiling modes. A variety of different profiling modes are available, each with differing levels of robustness in velocity shear, sensitivity to vertical velocity fluctuations (from ship's heave), profiling range and velocity standard deviation. It would also be possible to implement data acquisition algorithms specifically for LADCP.

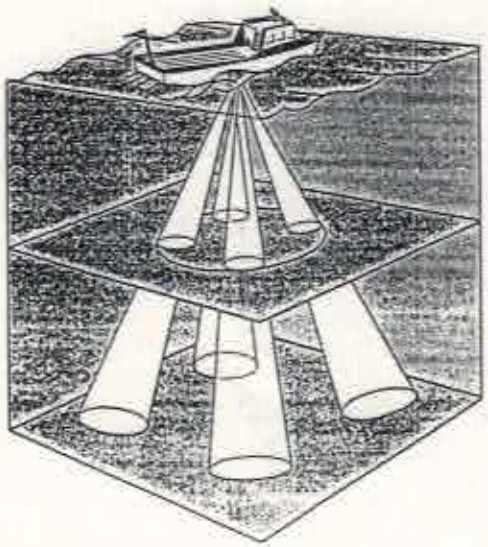
Status of Lowered ADCPs (concludes)

MANUFACTURER'S ANALYSIS: We are not satisfied that we can adequately evaluate Choices and Trade-offs given our present understanding of LADCP performance. We do not know which ADCP errors are important sources of error in the LADCP algorithm and we do not understand what their roles are in the LADCP error budget.

MANUFACTURER'S RECOMMENDATIONS: Of all that could be done to improve system performance, we believe that the most productive will be to develop an LADCP performance model adequate to evaluate performance trade-offs. We would like to see this done before much more money is spent on trial-and-error engineering development coupled with ocean tests. A good LADCP performance model will give us a standard for comparison and evaluation when further ocean tests are carried out. At some point we would like to see a test combining a *Pegasus* with an LADCP to produce directly-measured current profiles for comparison with profiles computed via LADCP integration.

FUTURE WORK. Doug Wilson plans to compare 300 kHz and 150 kHz BB performance in the Atlantic in February 93.

Editor's Note: I've been out in the Atlantic in February, as have many of us, and I know ya'll join me in wishing Dr. Wilson "fair winds and calm seas"!



Schematic diagram (Courtesy of RD Instruments) showing beam orientation of vessel mounted Acoustic Doppler Current Profiler (ADCP). Beams are directed fore, aft, port, and starboard. Transducer geometry is fixed such that beam angles are 30 degrees from the vertical.

Ship-Mounted ADCPs: What to do with all the Data?!?

The abstract which follows by Bo Lundgren of The Danish Institute for Fisheries and Marine Research, North Sea Centre, P.O. Box 101, DK-9850 Hirtshals, Denmark, is from a paper prepared for the ICES Hydrography Committee (C.M. 1992/C:15):

"The ship-mounted ADCP (Acoustic Doppler Current Profiler) has many advantages compared to previous current measuring instruments. It can measure almost instantaneous current profiles with very high depth resolution, vector averaged over any selected time period, has a reasonable accuracy and stores data automatically on computer readable form. It is even possible to get bottom related measurements from a moving ship, when the bottom depth is within certain limits. The instrument has therefore been obtained by many research institutions for their research ships."

"The problem is that the instrument can produce large amounts of data which are not easily related to other types of data collected by research ships, particularly in areas with strong tides. Examples are water mass properties like salinity, temperature, and nutrients or other biological parameters. Also there are many ways of setting up the instrument, for example averaging periods and depth resolution which may make it difficult to compare data between ships."

In the 16 page paper which follows, Lundgren reviews where ADCP instruments are located in the ICES area (Norway, Denmark, Faroe Islands, France, Germany, Scotland, England) and gives examples of their setups, data storage procedures, and references to the literature using the data. Lundgren also recommends that common guidelines for data collection and storage procedures be established in ICES, and he suggests some general ideas.

[Thanks to Lisa Rom, NSF, for sending Lundgren's paper]

Editor's Note: For a copy of the full paper, contact the UNOLS Office (phone 401-792-6825 or UNOLS.Office on Omnet) . Since a half-day session on ADCPs was one of the agenda items identified for our annual meeting this coming 20-21 September 1993, discussion of Lundgren's guidelines for data collection may be of general interest.

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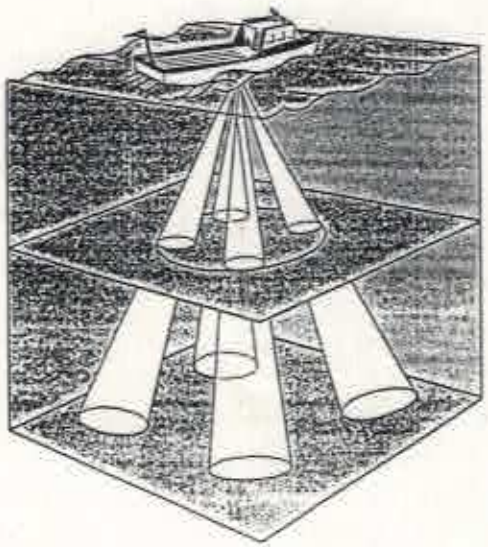

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