VENUS
Victoria Experimental Network Under the Sea

Fall 2007

University of Victoria

Saanich Inlet & Strait of Georgia

KEEPING CURRENT

Newsletter Contents

NODE POD DEPLOYMENT

Paul Macoun

In May 2007, the VENUS backbone cable was laid in the Strait of Georgia. Integrated into the cable are two frames, 9 km apart, designed to support two Node Pods at depths of 170 and 300 meters. In October 2007, the first Pod, manufactured at OceanWorks and destined for the 170 m deep location, was loaded on to the CCGS Vector.

Node Pod Deployment October 2007

Poor weather and loading complications pushed the Pod deployment to the final day of the cruise. This timing unfortunately coincided with a strong flood tide, providing a unique set of challenges. Challenges notwithstanding, the Pod was successfully lowered to the seabed within 40 m of the base frame.

The next step of the Node Pod deployment was to lower the ROV ROPOS into the water. The Pod's light weight design (~25 kilos in water) enabled ROPOS to transport the Pod from the seabed to the base frame. Unfortunately, strong currents and reduced visibility hindered the transition. After several attempts, the Pod was finally secured within the base frame.

The final step was to plug in the communication and power connectors. Typically both manipulators on the ROV are required to do this. One is used to secure the ROV to the Node Pod, and the other is used to connect the wet-mate connector.

Unfortunately, during earlier attempts to align the Pod in the base frame, one of the manipulators was damaged and rendered useless for this final task. Despite this limitation and the strong current, the ROPOS team managed to connect up both connectors (Bravo!).

It was then discovered that the shore station was unable to supply power to the Node Pod and a quick resolution was not forthcoming. Hence, following the subsequent deployment of two instrument systems (which were plugged into the Pod), the ship and ROV left for home before the system could be tested.

Epilogue: The shore station power issue was resolved early the next week and power was applied to the Node Pod. It was very disappointing when the Pod did not come to life. It was then determined the Pod needed to be recovered, which took place on December 12th. The Pod is now in the hands of OceanWorks. We look forward to a resolution of the problem and deployment of both Strait of Georgia Node Pods and the first instrument package in February 2008.

We thank Sally Leys (U of A) for dive time in October, and the great support from the Canadian Scientific Submersible Facility.

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20 MONTHS UNDER THE SEA

Richard Dewey

As of early December 2007, VENUS has been collecting data in Saanich Inlet for over 20 months. We have learned many things operationally, have serviced the instruments on 4 separate cruises, and are gradually filling disks on the DMAS and UVic servers. Soon we will have data flowing from both Saanich Inlet and the Strait of Georgia, where the tides are vigorous and the signals likely to be more dynamic. Here I'd like to give a brief summary of a few key signals that are revealing annual and inter-annual variability. Some instruments have not been active for the entire duration, so I will limit the discussion to the CTD data from our Seabird which, along with the ASL Zooplankton Acoustic Profiler, has been one of our workhorse instruments.

What's Up and Down with the Temperature / Salinity / Oxygen Signals?

From the very first few days of data collection in late February 2006, we have witnessed both short and long term variability in the near bottom temperature, salinity, and oxygen signals in Saanich Inlet. While the tides relentlessly ebb and flow giving a 3.5 meter range to the sea level over our Node, the T/S/O signals have proven much more complex. Figure 1 shows four days of data from early December (3-7), 2007 (UTC).

Although the full scale variations in both T and S are relatively small, oceanographically, the changes are not obviously systematic with the tides. Rather, the largest fluctuations (in fact full scale on this plot) occur over relatively short periods, as little as an hour (i.e. 16:00 Dec 4, 2007 UTC). The same is true for the oxygen, which fluctuates between levels as low as 0.2 ml/l to 1.6 ml/l over the same one hour period.

Note that T & S are positively correlated and move together, both upward and downward, indicating that we are within a vertical structure that is density stratified by the dominant salinity structure, which supports a weak temperature inversion (cooler water over-lying warmer water).

Also note that the colder fresher water is also the more oxygenated, and that the hypoxic water is warmer, saltier, and more dense, representing conditions deeper in the inlet. The latest plots of these variables are available in near real time on the VENUS web site under Data Plots.

Inter-Annual Variability: 2006-2007

By early March 2008 we will have two complete years of data from Saanich Inlet. However, there is already sufficient data to identify both similarities and differences between 2006 and 2007. Figure 2 shows the temperature (red), salinity (green), and density anomaly sigma_t (blue) time series from the SBE mounted on the VENUS Instrument Platform (VIP) at 96m in Saanich Inlet.

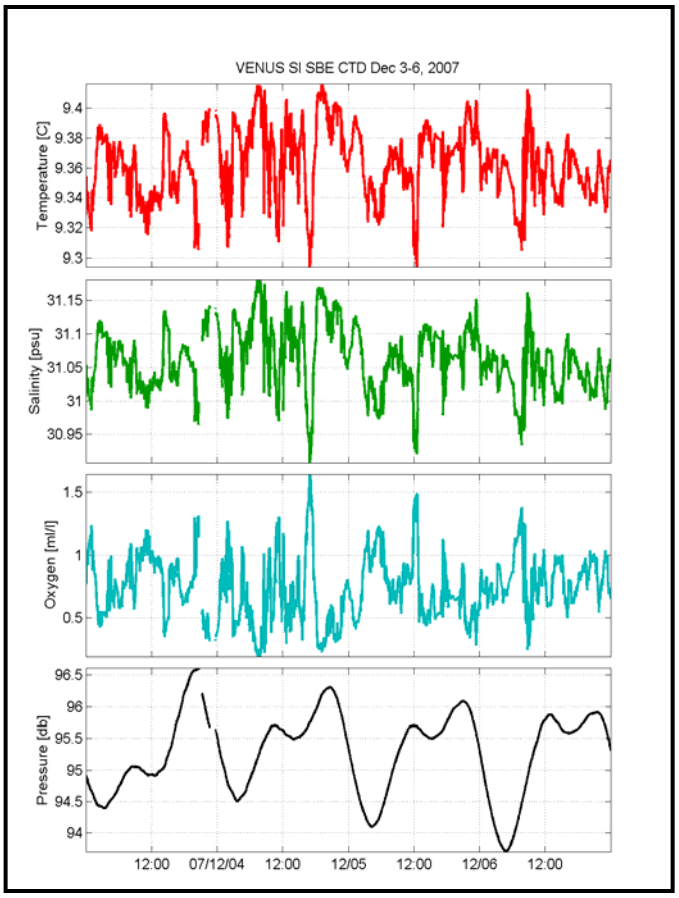

Figure 1. Time series of temperature (red), salinity (green), oxygen concentration (cyan), and pressure (black) from the Saanich Inlet SBE CTD at 96m depth on the VIP for December 3-7, 2007 (UTC). Short gaps in the data late on Dec. 3 were a result of a winter storm causing a power outage at IOS.

The vertical axis for temperature has been scaled to show relative contribution to the density as compared to salinity. In other words, over the range of temperature and salinity at this location, salinity is four times as influential on the in situ density compared to the temperature. In fact, the observed temperature variations are working against the salinity variations and reducing the effective density range.

General features of note include: winter cooling between mid December and May, a nearly coincident influx of fresher water between November and April, and a warm saline trend from May through to October. The summer/fall densification tends to occur through a series of abrupt intrusions, with a single upward step at one month intervals (i.e. early July, August, Sept and October, 2006). These can be explained by dense water exchange following the weak neap tides that occur once per month [D. Masson, Deep Water Renewal in the Strait of Georgia, in *Estuarine, Coastal and Shelf Science*, **54** (115-126), 2002].

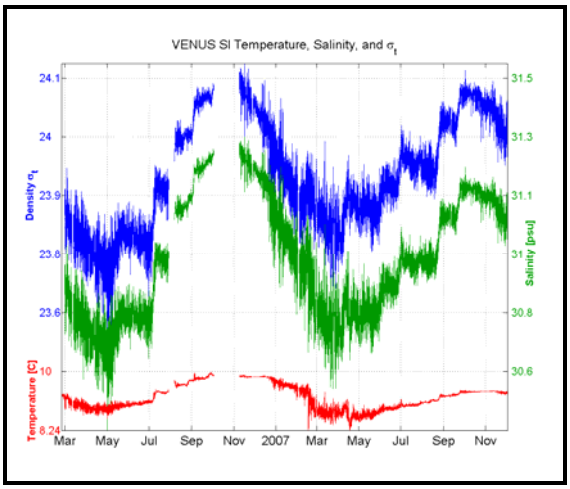

Figure 2. Time series of temperature [red], Salinity [green], and sigma_t [blue, density(T,S,0)-1000] from the Saanich Inlet SBE CTD at 96 m depth on the VIP for Feb. 2006 – Dec. 2007 (UTC). Temperature has been scaled to show its (minor) contribution to density relative to salinity.

A prediction for similar dense, deep water renewals by me for the July-Sept period of 2007 was only partially successful, as I did not predict the step at the end of June 2007, predicted one for the end of July 2007 that didn't occur, and was vindicated by a "classic" renewal during the week of August 21-26, 2007. (A more comprehensive explanation of the conditions and causes for these renewals warrants a dedicated article.)

The late winter/spring cooling and freshening occurs more steadily over time, but with a much noisier signal that suggests shorter term, frequent vigorous transition events. We can also note the relatively tranquil or uniform temperature conditions in December prior to the cooling trend. Inter-annual differences are more subtle: May 2006 was a little warmer, fresher, and less dense than May 2007. Winter 2006 (i.e. December) was warmer and saltier than 2007, although the effective density of the winter waters were similar.

Check back in future issues of this newsletter for additional updates on signals in our data, explanations tied to local oceanography and, once the Strait of Georgia systems are installed, comparisons between regions.

Strait of Georgia Shore Station

The VENUS SOG Shore Station is now complete. The Project installed a BRITCO Bulldog field office to house the array power system and network equipment. The Bulldog sits on a purpose built concrete pad and underground conduits carry the power and communication cables back to the Main Administration building at the Iona Waste Water Treatment Plant.

VENUS Visits Taiwan

In November, Verena Tunnicliffe and Adrian Round were invited to Taiwan by the National Weather Bureau to a small workshop to discuss cabled observatories. The Bureau is sponsoring a group of seismologists at National Central University to design and build an observatory deployed off north eastern Taiwan. Professors Hsu and Liu are leading the MACHO Project to deploy about 90km cable down to 1000m depth. Because Taiwan is on the junction of two subduction zones, seismic activity is intense; the extended observatory will acquire greater precision on subsea quakes and, possibly, provided needed seconds of early warning of a large event. Together with NEPTUNE Canada, ESONET and DONET representatives, we each presented our plans and discussed advances and pitfalls. We also visited the proposed shore station in a telecommunications building. It is fascinating to see the growing interest in ocean observatories around the world.

Damage from the 1999 Taiwan earthquake.

An eelpout takes up residence in the lower jaw of a pig.

VENUS Eye in Saanich Inlet

In September, Dr. Gail Anderson deployed another pig carcass in Saanich Inlet. By the end of October, the flesh was stripped by amphipods, crabs and some large scavengers. We view the experiment with the VENUS Camera controlled by the experimenter. Occasionally, other users access the camera to take pictures that are archived at University of Victoria. Soon, we will open access to all these images. In the meantime, you can see a selection on the website at http://www.venus.uvic.ca/data/image_video.html. The bottom life is active this fall: flatfish, herring, zooplankton and seals (yes, at 100m depth).

Project Overview

VENUS is a research facility that is supporting coastal oceanography and providing data for processes studies, seasonal cycles, and long term climate studies in British Columbia waters. The VENUS network of instruments is dedicated to real-time observations of oceanographic processes in our marine environment. The VENUS Data Archive supports data mining and communication among users. Measurements, images, and sound are delivered to scientists, managers, the public, and a data archive via seafloor fibre-optic cables laid from two separate landfall sites. These cables are delivering power for instruments, lights, and robots, transmitting commands from project scientists, as well as serving information back on the state of our oceans.

The VENUS Project includes two interactive laboratories, one currently installed and operational in Saanich Inlet and a second in the Strait of Georgia to be fully installed by the spring 2008.

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