VENUS Phase II. Full Speed Ahead

CODAR - Coastal Radar
The installation of the first Coastal Radar (CODAR) station at Westshore Terminals, south of Vancouver, is well underway. When complete, in September, radial surface velocity data will be available through the VENUS website. The second CODAR station, located 22 to the north, will be operational in 2012. By combining data from both stations, VENUS will provide surface current maps in the Southern Strait of Georgia every 30 minutes.

BC Ferries Instrumentation
The installation of an instrument system on the M/V Queen of Alberni is also rapidly progressing. In October, during a scheduled maintenance dry dock period, the hull will be fitted with an external pod 2 m below the waterline. A suite of instruments will take standard measurements that will be recorded in a data logger and then transmitted via satellite to the database at UVic. Within minutes, the latest data will be available on the VENUS website. Our longer term plan is to make the data available to ferry passengers, too.

Buoy in Saanich Inlet
The design of the buoy profiling system (see graphic to the right) is nearing completion. Development of the winch system and instrument interfaces has been underway for several months. The expected delivery date for the winch system is November 2011. It will then undergo integration testing before eventually taking its place on the buoy. Surface to seafloor profiling operations will begin in summer 2012 after we link this mid-Inlet system to the VENUS node.

Bluefin AUV (Ocean Technology Lab, UVic)
The Ocean Technology Lab (UVic, Engineering Dept), a long-time partner of VENUS, has made significant progress integrating an instrument suite into their AUV. The OTL team plans testing of the vehicle in August in Saanich Inlet.

Ocean Networks Canada Applies for New Grant

Last fall, the Canadian Foundation for Innovation announced a new fund to support operations of “Major Science Initiatives”. ONC, on behalf of VENUS and NEPTUNE Canada, passed eligibility and is now preparing a grant application for 40% of the operating budget for the networks and the head office. We will also be preparing proposals for NSERC and other agencies, all for a late September submission. Many thanks to Drs. Gail Anderson, Michel André, Earl Davis, Alex Hay, Anna Metaxas, Paul Snelgrove, George Spence, Laurenz Thomsen, Rick Thomson, and Len Zedel who are taking their time in the summer to help with the applications. Let us know if you would like more information.

Graphic design of the VENUS Buoy Profiling System destined for installation in Saanich Inlet, part of the VENUS Phase II.
Monitoring Fish Movements with ADCP on VENUS  
Dr. Len Zedel, Memorial University (presented at CMOS 2011)

Normally, Acoustic Doppler Current Profilers (ADCPs) use acoustic backscatter from the water column to determine water velocities. These systems work much the same way as radar systems determine the speed of cars on the highway. However, in the case of ADCPs, information from multiple acoustic beams must be combined to recover the actual water velocity (speed and direction). There are a lot of factors to consider when deciding how to operate an ADCP and many of the adjustments depend on what it is you want to look at in the data. For example, you would average the data in a different way if you were interested in slowly varying currents than if you wanted to know what short term fluctuations are occurring. To accommodate the many possibilities, VENUS has made raw or un-processed ADCP data available to researchers for about one year now. This data allows individual researchers to manipulate the data in different ways to look at different things without compromising the ability of the instrument to provide “typical” water velocity profiles.

With access to this raw ADCP data, it is possible to process the information in a totally different way to estimate the speed of fish swimming in the water (Zedel and Dewey 2010). With one year of this data (150kHz) now available, we are starting to form an acoustical view of how fish behave in the area of the SoG East Node. And, while there is a lot of day-to-day variability, there is some consistent behavior that occurs frequently enough that it is possible to consider a characteristic or average day. Figure 1a shows the backscatter record observed on July 19, 2010. What appears most obvious in the backscatter data is the so called scattering layer composed of zooplankton which rises up to the surface at sunset and then goes back down to about 70 m depth during the day. This movement is commonly seen as zooplankton feed at the surface at night and then hide from predators in dark deeper water during the day.

Figure 1. Example of backscatter observed on a typical day (July 19, 2010). a) backscatter over the entire 24 hour period showing the vertical movement of the scattering layer and the occurrence of discrete scatterers typically at sunrise and sunset, b) backscatter expanded over the interval from 12:30 to 14:30, boxes identify sample volumes at which fish speeds have been extracted, individual detected fish are marked in black, c) green bars show average fish velocities in the sample boxes, blue profiles are the corresponding water velocities.

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Close inspection of the backscatter data in Figure 1a shows that there are discrete targets (individual fish or small schools) clearly visible at around 30 m depth at sunset; through the night less well defined but still discrete targets are seen throughout the water column from 20 to 80 m depth. Then again at sunrise, discrete targets are seen in a range from 50 to 100 m depth. Typically, the mid-depth targets seen during the night do not show movements different from that of the water, however the targets seen at sunrise or sunset are usually moving relative to the water. As an example, Figure 1b expands the backscatter over a two hour interval and shows the behavior of scattering groups at three depth intervals at the time of sunrise on July 19. The water velocity profiles for this time (Figure 1c) show a weak Northward component but the mean velocity of fish in the three selected depth intervals shows clear southward motion at about 20 cm/s.

An intriguing prospect with this system would be the ability to monitor the movements of migrating salmon. A challenge with acoustic systems is that they cannot unambiguously identify fish species; indirect indications of scatterer identity are given by behavior and target strength characteristics. Migrating sockeye salmon are expected to be within 40 m of the surface (Quinn and terHart 1987). Figure 2 shows an example where fish speeds have been extracted for such near surface schools for the three day sequence September 1, 2, and 3, 2010. On these three days, the schools identified in each case have speeds of order 60 cm/s compared to water velocities of order 30 cm/s, these speeds are clearly consistent with speeds expected for migrating salmon (Quinn 1988).

Future work will involve the somewhat tedious task of identifying fish presence in the daily data and then selecting sample intervals on which to determine velocities (as shown in the example of Figure 1). We will be looking for consistent behavior of these fish groups over time periods of days or weeks and try to identify fish species based on known behavior. A very exciting development has been the deployment on May 2011 of a 300kHz ADCP closer to the mouth of the Fraser River at the VENUS Delta Dynamics Laboratory site. This instrument is much better suited to observe migrating salmon and we are eagerly looking forward to evaluating that data as it becomes available.

References:


Figure 2. Near surface fish schools observed on three consecutive days (Sept 1, 2, and 3, 2010). The fish and water velocities have been extracted for the time and depth intervals indicated by the boxed areas for each day.
**Busy Summer at VENUS**
Rowan Fox (Co-Op Student, SEOS, UVic)

Rowan Fox (UVic) next to the instrument platform during the July Cruise of VENUS. The instrument platform hosts a dozen instruments, one of which is an AXIS webcam (inside the glass sphere). Live video feed from 300m (Strait of Georgia) is available at http://venus.uvic.ca/data/camera-stream/.

A Co-op work term with VENUS in the summer of 2011 comes at a time where Phase II is ramping up, with the observatory expanding from seafloor based measurements into water column and geospatial observations. My work term is generally divided among three projects: assimilation into the VENUS database of two time series collected by instruments aboard several BC Ferry vessels since 2001; help with new installations of SeaKeepers system onto BC Ferry vessels; as well as working on the Strait of Georgia Central Node webcam to set up automatic observation and recording.

The historical BC Ferries time series project involves assimilating time series data from two projects: instrumentation of the *Spirit of Vancouver Island* from 2001 – 2011 by Dr. Jim Gower at the Institute of Ocean Sciences, and instrumentation of the *Queen of New Westminster* by the STRATOGEM group from 2003 – 2006. These data contain sea surface observations of temperature, salinity, and chlorophyll fluorescence over a multi-year timescale and across the Strait of Georgia and the Southern Gulf Islands. My job is to assess these datasets and make them available for download from the VENUS website.

The SeaKeepers installation project will be VENUS’ continuation of these Ferry vessel time series. Ferries running the major routes over the Strait of Georgia will be instrumented with SeaKeepers 1000’s - self contained systems for measuring sea surface properties as well as weather conditions. I am working with the VENUS Phase II team to prepare for installation of the systems, beginning with the *Queen of Alberni*, running from Departure Bay to Horseshoe Bay in fall of 2011.

The Strait of Georgia Central node webcam project involves creating a process for VENUS users to easily automate lights and recording activation. This will allow the webcam to be used systematically for research as well as for public display. This comes at a good time, as recordings after the maintenance cruise are much more attractive due to cleaning the biofouling from the camera dome.

It is shaping up to be an excellent summer! I was able to give a helping hand during the July Cruise on the University of Washington’s R/V Thomas G. Thompson, and in the coming months I look forward to seeing these projects come to fruition.

**Farewell - and Hello**

NEPTUNE Canada has flourished under a decade of leadership by Prof. Chris Barnes. On June 30, he stepped down. The list of accomplishments by the NEPTUNE Canada team are a testimony to his determination and vision. In September, Ocean Networks Canada welcomes Dr. Kate Moran as the new Director. Her experiences in ocean policy, infrastructure oversight and program operations will be valuable as NEPTUNE Canada transitions from installation to operations. Her personal expertise in geotechnics, seafloor dynamics, and climate change will build international collaborations and profile for ONC. Dr. Moran is moving from a position as Associate Dean, School of Oceanography, University of Rhode Island and a current secondment in the Office of Science and Technology Policy at the White House. Dr. Moran welcomes the challenge of a deep ocean observatory linking climate, ocean and crustal dynamics.