Victoria Turbulence Observation Retreat

Dates: October 17 – 21, 2016
Location: Rockland Scientific Office, Victoria, BC, Canada
Cost: $ 1,500 per delegate
No of delegates: Maximum 12

Invitation video at: https://youtu.be/sDB3J_B8atg

Overview – Daily Learning Units

Day 1
1. Fundamental Fluid Dynamics of Turbulence
2. Ocean Turbulence Theory

Day 2
3. Introduction to the VMP-250
4. Data Acquisition Software (ODAS5IR)
5. Pre-deployment Checks

Day 3 (on ship deployments)
6. Ocean Turbulence Measurement Techniques
7. Ocean Turbulence Measurement Sensors

8. VMP-250 Deployment

Day 4
9. VMP-250 Maintenance
10. Data Conversion & Processing
11. Signal Conditioning

Day 5
12. Advanced Techniques in Data Processing
13. Special Topics: Biophysical microstructure observations using fluorometers

Detailed Learning Goals

Unit One: Fundamental Turbulence Theory
- Define turbulence
- Identify the Navier-Stokes equation
- Apply the Reynolds decomposition to the Navier Stokes equation to derive mean and second order properties of turbulent flow

Unit Two: Ocean Turbulence Theory
- Apply dimensional analysis to derive length scales, such as Buoyancy frequency, Ozmidov scale, Komogrov scale, and Batchelor scale
- Reduce the viscous dissipation of turbulent kinetic energy to a single term under isotropic conditions
- Describe the Osborn and the Osborne & Cox models
- State the Taylor Frozen Field hypothesis
- Identify, define, and describe the 1D velocity spectra, the shear spectra, and the Nasmyth spectra

Unit Three: Introduction to the VMP-250
- Explain the basic mechanics of a vertical profiler
- Locate and identify sensors, probes, and axes of orientation
- Install and remove probes
- Confirm proper orientation of the shear probes
- Safely disassemble and assemble the VMP-250
- Differentiate between a piston seal and a face seal
- Locate and identify the boards and understand their function
- Describe the flow of information and analog signal processing that occurs in the VMP

Unit Four: Data Acquisition Software (ODAS5IR)
- Establish a serial console connection between the computer and the VMP
- Describe the file structure of the data logger
- Run the 'calibrate all' function and interpret the results
- Set up RSILink for data file transfer
- Transfer files to and from the data logger using a USB connection
- Interpret and edit a configuration file (setup.cfg)
- Differentiate between the [root], [matrix], [vehicle_info] *new*, and [channel] sections of the configuration file
- Identify which calibration parameters are board-specific and which ones are probe-specific
- Describe the data file format
- Interpret the log file

Unit Five: Pre-deployment Checks
- Perform a bench test with dummy probes; process and interpret the data
- Identify every sealing surface on the instrument and confirm their integrity

Unit Six: Ocean Turbulence Measurement Techniques
- Identify key limitation of measuring fluxes in most regions of the ocean
- Explain why the velocity field is measured into the dissipation range
- Calculate the noise level required for deep ocean measurements
- Classify different operating environments, their average dissipation, and the corresponding length scale of eddies
- Recognize implicit and explicit profiling requirements

Unit Seven: Ocean Turbulence Measurement Sensors
- Identify the components of a shear probe and explain the underlying theory of operation
- Describe the shear probe calibration technique
- Identify the components of an FP07 thermistor
- Compare the sensor limitation of the shear probe and the FP07 thermistor
- Describe the SBE7 Micro Conductivity sensor

Unit Eight: VMP-250 Deployment
- Preform pre-deployment checks (Unit 5) at sea
- Deploy and recover the VMP-250

- Recognize successful data recording and interpret log file
- Identify data contamination from mechanical sources, if present

Unit Nine: VMP-250 Maintenance
- Disassemble the VMP into its components
- Determine if an O-ring needs to be replaced
- Recognize corrosion and moisture damage
- Perform routine post-cruise and annual maintenance
- Reassemble the VMP and all of its components

Unit Ten: Data Conversion and Processing
- Extract, edit, and patch a configuration file string into an existing data file
- Convert .p data file into physical units and save as a .mat file
- Extract "profiles" from a data file
- Assess kinematic quality of profiles and deployment
- Identify mechanical contamination of data files
- Identify turbulent regions form shear, temperature, and conductivity traces
- Modify key parameters in data processing including, but not limited to: fft length, overlap, and dissipation length
- Calculate shear spectra
- Calculate rate of TKE dissipation

Unit Eleven: Signal Conditioning
- Distinguish between a channel with and without pre-emphasis
- Describe the concept of pre-emphasis
- Adjust key parameters of the despiking routine
- Discuss the Goodman coherent noise removal technique

Unit Twelve: Advance Techniques in Data Processing
- Integrate auxiliary data into an RSI data file, using a hotel file
- Perform *in situ* calibration of temperature probes
- Optimize despiking routine to remove erroneous data

Unit Thirteen: Special Topics: Biophysical microstructure observations using fluorometers
- Explain biophysical phenomena
- Interpret the output of the fluorescence sensor
- Describe the limitations of the fluorescence sensor
- Discuss phytoplankton patchiness and turbulence