

Dynamic Processes of Fluids in Ridge Environments

Monitoring the “heart-beat” of a hydrothermal venting system: Realtime observations of the currents, water properties and thermal output at the Endeavour segment of Juan de Fuca Ridge

The proposal will provide realtime profile measurements of the currents, water properties, and integrated heat fluxes for the main vent fields within the axial valley of Endeavour Ridge. Focus will be on the principal time scales of variability (from minutes to years) and the associated impacts that this variability has on ecosystem productivity within the water column within the axial valley. The program will build on the results of the NSF-funded “Discrete measurements as a test of the seabreeze flux-meter hypothesis” presently being conducted at the Main Endeavour and High Rise hydrothermal vent fields. Focus will be on: (1) temporal variability of the currents, water property structure, and optical properties of the lower 500 m of the water column within the valley; (2) temporal variability in the distribution and aggregation of zooplankton, fish and other acoustic scatterers within the water column; (3) temporal variability in vent-derived particle concentrations and size distributions; (4) temporal variability in redox chemical species; and (5) modeling the ridge and hydrothermal venting-modulated affects on trophic level interaction below, within and above the vent plumes. Realtime identification of wind-induced along-ridge “flushing events” and anomalous hydrothermal venting events will be significant aims of the experiment. Observational data will be incorporated into fully three-dimensional operational oceanographic circulations models of the currents and water properties in the vicinity of the axial valley. Results from the physical models will be used to drive ecosystem models examining trophic interaction dynamics from carbon fluxes, to zooplankton, to fish.

The observations will entail installation of upward-looking ADCPs at four along-axis sites within the valley, possibly as part of profiling water column packages carrying a CTD, transmissometer, ADCP or other acoustic profiler, laser *in situ* scattering and transmissometers, and voltammetric electrochemical analyzers. From south to north, the moorings would lie south of the Mothra Field, midway between the Main Endeavour and High Rise fields, and north of the High Rise field. The NEPTUNE observations could be embedded within a broader array of conventional moorings in the vicinity of the valley. Turbulence measurements would be a key component of the profiling package. The realtime data and the numerical modeling results will be of considerable important for other research at the ridge, particularly geological and geophysical studies of variability of Endeavour Ridge hydrothermal systems.