Published Datasets

Prepared by Ocean Networks Canada

Ocean Networks Canada is proud to offer the following pre-packaged datasets.

Collection: Ocean Networks Canada datasets related to deep-water renewal processes in the Strait of Georgia from 2008-2021

This collection contains datasets produced by Ocean Networks Canada between 2008-09 to 2021-12 from the Strait of Georgia (SOG) at the Central Node, and from the West Coast of Vancouver Island at the Folger Node, used in the publication “A Predictably Intermittent Rotationally Modified Gravity Current in the Strait of Georgia” by Masoud, M., Pawlowicz, R., and Dewey, R., (2022). The SOG Central Node, located in the south-central part of the Strait of Georgia (300 m), is located near the deepest part of the Strait’s cross-section and was designed in part to measure deep-water renewal processes which replace the bottom water of the Strait. These processes involve the downslope flow of dense water from the Boundary Pass area to the SE to the deepest parts of the Strait off Nanaimo to the NW. These downslope flows occur at monthly or biweekly intervals, and are often associated with a rise in turbidity near the bottom. There are also strong tidal currents. The Folger Node is at the mouth of Barkley Sound, and measurements of the density of bottom water can be used to deduce the timing of coastal upwelling processes on the West Coast.

These datasets include (1) water column currents at the Central Node, (2) the combined “State of the Ocean” datasets for the SOG Central Node and Folger Node which contain temperature, salinity, and density measurements, (3) turbidity measurements at the SOG Central Node, (4) water column currents and density measurements at an autonomous mooring placed near the SOG Central Node in 2018. Turbidity and water column current measurements in particular were subject to extensive post-processing and error correction. For full details on the quality control and processing of this data please see Masoud et al., (2022).

Six years (2009-2015) of oceanographic temperature, salinity, pressure, density and dissolved oxygen observations from a Vancouver Island shelf cabled observatory

Ocean Networks Canada operates and maintains innovative cabled observatories that supply continuous power and Internet connectivity to various scientific instruments located in coastal, deep-ocean, and Arctic environments. Instruments at Folger Deep are mounted on an steel and plastic instrument platform (IP) placed on the seafloor. The IP also houses a junction box which is part of the system that facilitates power and communications. The near-coast location of the platform off the West Coast of Vancouver Island is well suited for the monitoring of the variability of the coastal water properties (e.g. temperature, salinity, oxygen) and hence the timing of upwelling and downwelling circulation associated with the northern end of the California Current system which is the prime driver of the local oceanic environment. The instrument deployments in the 6 year dataset were conducted over six expeditions, spanning 28th August 2009 to 5th May 2017. Based on a two year calibration schedule, the CTD and oxygen sensors were either recovered and returned to the manufacturer for servicing and replaced by a new instrument, or serviced on the ship and then redeployed. Due to ship-based deployments, minor differences in location and depth have occurred between deployments. Underwater maintenance was performed by various remotely operated vehicles and video recordings of the work are accessible through SeaTube, ONC’s video player.

Ten years (2006-2016) of oceanographic temperature, salinity, pressure, density and dissolved oxygen data from the Saanich Inlet cabled observatory

Along the southern coast of British Columbia, ONC maintains a cabled array and instrument platform at a depth of roughly 100m in Saanich Inlet, a fjord on Vancouver Island. The instrument platform was deployed in February 2006 and has been maintained continuously since then. The core oceanographic instrument on the Saanich Inlet instrument platform is an industry standard pumped Conductivity, Temperature, and Depth (CTD) suite of sensors, including sensors to measure the concentration of dissolved Oxygen. These data are used to generate time series of seawater temperature, salinity, pressure, and dissolved oxygen. Over the duration of the time series, the pumped CTD has generally sampled at one-minute intervals, varying slightly during maintenance and servicing periods. These data have been inspected, passed through various data quality checks (e.g. consistent with QARTOD standards), and averaged into one-hour uniform samples. This data set represents the first ten years (February 2006 through February 2016) of water property data from the Saanich Inlet cabled observatory. Instruments are re-calibrated on an annual basis. Comparison to and validation against periodic ship based CTD profile data indicates the observatory time series are highly representative of the oceanographic conditions in Saanich Inlet, but are sufficient to resolve rapid and long-term variations not accessible by any other means.

Identifying deep sea fish from videos of a benthic ecosystem in Barkley Canyon

This data set contains 1004 high-resolution 30-second video clips from Barkley Canyon Axis and accompanying species annotations. Barkley Canyon is a submarine canyon located approximately 80 km off the west coast of Vancouver Island, British Columbia, Canada. The canyon axis site is located in roughly the middle of the canyon. The 30 second clips (about 60MB each) are captured 3 times a day for a year (2:00AM, 10:00AM, 6:00PM UTC), with higher frequency sampling every 2 hours for the first week of the collection period. The subsampling period was selected to reduce aliasing from tides. For all videos, the camera was facing northeast with a view of the seafloor at 45° down from horizontal, so that the field of view imaged was approximately 2m^2 of the sediment-covered seabed. Four species of interest were identified in the videos – hagfish (Eptatretus sp.), eelpouts (Lichenchelys sp.), poachers (Agonidae family) and sablefish (Anoplopoma fimbria). Videos were reviewed by a biological expert annotator who recorded what species were present and when individuals entered and exited the field of view for each video. The dataset was originally curated to support the development of computer vision algorithms capable of identifying the four species of interest.

CTD profile in IODP CORK U1364A borehole at ONC NEPTUNE observatory site Clayoquot Slope, Cascadia Accretionary Prism

Ocean Networks Canada (ONC) operates and maintains innovative cabled observatories that supply continuous power and Internet connectivity to various scientific instruments located in coastal, deep-ocean, and Arctic environments. The Clayoquot Slope IODP (Integrated Ocean Discovery Program) borehole observatory CORK U1364A is located in the Vancouver Margin of the northern Cascadia Subduction Zone, ~20km landward of the accretionary prism toe. Here, sediments scraped from the subducting Juan de Fuca plate are deposited and the accreted sedimentary section is ~5 km thick with gas hydrate formation in the upper hundred meters of sediment. The CORK (Circulation Obviation Retrofit Kit) observatory was installed in 2010 during IODP Expedition 328 (Davis & Malone, 2010; Davis & Heesemann, 2011). This location was chosen to observe the fluid flow, mechanical and formation properties of the accretionary prism, allowing for long-term monitoring of deformation, seismic activity, and gas hydrate accumulation. In May 2014 a temperature profile was measured by lowering a CTD (Conductivity-Temperature-Depth) down IODP borehole observatory CORK U1364A. The CTD profile was obtained during Ocean Networks Canada NEPTUNE Maintenance Cruise 2014-05 using the remotely operated vehicle (ROV) CSSF-ROPOS from the CCGS John P. Tully. Dive log entries are available from Dive R1694 and a video recording of the experiment is accessible through SeaTube, ONC's video player (https://data.oceannetworks.ca/SeaTube?resourceTypeId=1000&resourceId=1001&diveId=410&time=2014-05-24T15:43:08.000Z). CTD data was collected using the factory calibration settings and downloaded from the instrument using the CTD manufacturers software. The initial purpose of this experiment was to determine the open depth of the borehole. The data of the hydrological observatory have been used in multiple subsequent studies to investigate pressure and temperature changes of the subseafloor (Becker et al. 2020, Mcguire et al. 2018). Boreholes drilled within the accretionary prism help to better understand the relationship between dynamic processes such as tectonic motion and deformation, internal plate strain, and earthquakes, as well as gas hydrate formation and accumulation.

Prepared by Research Community

Long-term and high-resolution time series datasets of vent species abundance from the Grotto hydrothermal edifice (Main Endeavour Field, Juan de Fuca Ridge)

Focused on vent ecology, the TEMPO-mini ecological observatory module is deployed on the active Grotto hydrothermal edifice (Main Endeavour Field, Juan de Fuca Ridge), selected as a target site for the deep-sea cabled observatory Ocean Networks Canada. To study long-term temporal dynamics of vent communities, the camera was programmed to record 20-min video sequences six times a day (02.00, 06.00, 10.00, 14.00, 18.00 and 22.00 UTC) with three zoom levels per sequence corresponding to 'large', 'medium' and 'fine' views. The camera was focused on a *Ridgeia piscesae* tubeworm assemblage harbouring a dense community of associated fauna. Temporal variation in the observed abundances of four visible taxa (Ammotheidae pycnogonids, Polynoidae polychaetes, Buccinidae gastropods and Zoarcidae eelpouts) was quantified using the large and medium views (see Figure). To avoid 'observer bias' among consecutive measurements, video sequences were analysed in random order. The first observation strategy had a fixed daily observation time set at 10.00 UTC encompassing two years from 20 June 2013 to 20 June 2015. The second observation strategy was designed to identify seasonal components of macrofaunal and environmental variability. All six observations (observation frequency of TEMPO-mini) were analysed during one summer (June 2014) and three winters (November 2014, December 2014 and January 2015) months. These specific time windows were selected to minimize the amount of missing data generated by temporary shortcomings of the observatory and to maximize the presence of high-quality video imagery. Details on these observation methods and analyses conducted on a part of these datasets are published in Lelièvre et al. 2017 (DOI: 10.1098/rspb.2016.2123).

Data from: Drivers of temporal beta diversity of a benthic community in a seasonally hypoxic ocean fjord

Global expansion of oxygen deficient (hypoxia) waters will have detrimental effects on marine life in the Northeast Pacific Ocean (NEP) where some of the largest proportional losses in aerobic habitat are predicted to occur. However, few studies have accounted for the high environmental variability in this region while including natural community-assembly dynamics. Here, we present results from a 14-month deployment of a benthic camera platform tethered to the VENUS cabled observatory in the seasonally hypoxic Saanich Inlet. Our time series continuously-recorded, natural cycles of deoxygenation and reoxygenation that allowed us to test whether a community from the NEP showed hysteresis in its recovery compared to hypoxia-induced decline and to address the processes driving temporal beta diversity under variable states of hypoxia. Using high-frequency ecological time series we reveal (1) differences in the response and recovery of the epibenthic community are rate-limited by recovery of the sessile species assemblage, (2) both environmental and biological processes influence community assembly patterns at multiple time-scales, and (3) interspecific processes can drive temporal beta diversity in seasonal hypoxia. Ultimately, our results illustrate how different time scale dependent drivers can influence the response and recovery of a marine habitat under increasing stress from environmental change.

Grotto hydrothermal edifice: abundance and isotopic data from Ocean Networks Canada's Expedition 2015 and 2016: Wiring the Abyss

Abundances and isotopic data of inventoried species within tubeworm assemblages of the hydrothermal edifice Grotto (Main Endeavour Field, Juan de Fuca Ridge), during the oceanographic cruises Ocean Networks Canada's Expedition 2015 and 2016: Wiring the Abyss. Six sampling units were collected to represent variate stages of ecological succession on the edifice. Details on the sampling method and analyses are published in Lelièvre et al. 2018 (https://doi.org/10.5194/bg-15-2629-2018).

Data from: Ecophysiological limits to aerobic metabolism in hypoxia determine epibenthic distributions and energy sequestration in the northeast Pacific ocean

Expansion of oxygen deficient waters (hypoxia) in the northeast Pacific Ocean (NEP) will have marked impacts on marine life. The response of the resident communities will be a function of their ecophysiological constraints in low oxygen, although this remains untested in the NEP due to a lack of integrative studies. Here, we combine in situ surveys and lab-based respirometry experiments were conducted on three indicator species (spot prawn Pandalus platyceros, slender sole Lyopsetta exilis, squat lobster Munida quadrispina) of seasonally hypoxic systems in the NEP to test if metabolic constraints determine distributions and energy sequestration in a hypoxic setting. These experiments were integrated with a global review of critical oxygen levels (math formula; lower threshold of aerobic metabolism) for crustaceans to determine if math formula-based hypoxia thresholds are different among ocean basins. Our results show that species-specific differences in math formula and standard metabolic rates (1) determine the lowest environmental oxygen ([O2]env) at which in situ populations occur, (2) result in disproportionate shifts in distributions among co-occurring species during summer hypoxia expansion events, and (3) characterize shifts in megafaunal community respiration rates due to marked spatio-temporal variability in [O2]env. Our results show that math formula-based hypoxia thresholds are significantly lower in the East Pacific Ocean relative to other major ocean basins, which suggests that the physiological response of local fauna to deoxygenation can be determined by the natural variability and oxygen exposure in a region. In order to establish realistic predictions on the biological consequences of marine deoxygenation, we suggest integrating metabolism-based traits to calculate hypoxia thresholds for marine ecosystems.

Data from: The oceanic biological pump: rapid carbon transfer to depth at continental margins during winter

Dataset from a monitoring strategy combining satellite (MODIS), surface ocean weather-buoy (http://www.ec.gc.ca), and multi-sensor time-series data (including video, photographic and acoustic seafloor imaging) of benthic boundary layer processes using Ocean Networks Canada (ONC) seafloor cabled observatory. ONC's network consists of five subsea observatory nodes linked by 800 kilometers of powered electro-optic cables, looping across the northern Juan de Fuca tectonic plate. Daily data&fluxes: averaged data from 1 Hz measurements of an internet operated vehicle (IOV) at 870 m water depth in Barkley Canyon, from the NASA MODIS satellite and from a weather buoy near the study site. Weekly data: calculated weekly averages of our analyses with SeaDAS in comparison with the MODIS, 8-day composites provided by NASA for the same period. Hourly data: averaged data from 1 Hz measurements of an internet operated vehicle (IOV) at 870 m water depth in Barkley Canyon, from the NASA MODIS satellite and from a weather buoy near the study site. Fluxes: averaged half hourly data of flow velocity and calculated along- and across canyon fluxes of chlorophyll at 870 m in Barkley Canyon. SeaDAS: estimations of POC from MODIS satellite-based observations derived via SeaDAS from monthly correlations (December, April) of chlorophyll/POC in surface waters. Benthos: relative abundances (%) of benthic fauna at the study site and environmental conditions at that time, using sensor data from the IOV.

Data from: Expert, crowd, students or algorithm: who holds the key to deep-sea imagery 'big data' processing?

Contains all the data acquired by the PhD student referred as the expert. Details of the columns are as follows: Date: Date of video acquisition Time: Time of video acquisition Counts: Number of sablefish in the video MatchDateTime: Date and Time used to match the counts among the different groups.

Supplement to: Römer, M et al. (2016): Tidally controlled gas bubble emissions: A comprehensive study using long-term monitoring data from the NEPTUNE cabled observatory offshore Vancouver Island

Long-term monitoring over 1 year revealed high temporal variability of gas emissions at a cold seep in 1250 m water depth offshore Vancouver Island, British Columbia. Data from the North East Pacific Time series Underwater Networked Experiment observatory operated by Ocean Networks Canada were used. The site is equipped with a 260 kHz Imagenex sonar collecting hourly data, conductivity-temperature-depth sensors, bottom pressure recorders, current meter, and an ocean bottom seismograph. This enables correlation of the data and analyzing trigger mechanisms and regulating criteria of gas discharge activity. Three periods of gas emission activity were observed: (a) short activity phases of few hours lasting several months, (b) alternating activity and inactivity of up to several day-long phases each, and (c) a period of several weeks of permanent activity. These periods can neither be explained by oceanographic conditions nor initiated by earthquakes. However, we found a clear correlation of gas emission with bottom pressure changes controlled by tides. Gas bubbles start emanating during decreasing tidal pressure. Tidally induced pressure changes also influence the subbottom fluid system by shifting the methane solubility resulting in exsolution of gas during falling tides. These pressure changes affect the equilibrium of forces allowing free gas in sediments to emanate into the water column at decreased hydrostatic load. We propose a model for the fluid system at the seep, fueled by a constant subsurface methane flux and a frequent tidally controlled discharge of gas bubbles into the ocean, transferable to other gas emission sites in the world's oceans.

Second-order seasonal variability in diel vertical migration timing of euphausiids in a coastal inlet (supplemental data)

Contains processed acoustic data file exactly as used for the following paper, as well as an example code. Detailed analysis method was described in Sato et al. (2013). Original raw data are available through the Ocean Networks Canada.

Sato, M., J.F. Dower, E. Kunze, and R. Dewey. 2013. Second-order seasonal variability in diel vertical migration timing of euphausiids in a coastal inlet. Marine Ecology Progress Series 480: 39-56. doi: 10.3354/meps10215

Data from: Oxygen limitations on marine animal distributions and the collapse of epibenthic community structure during shoaling hypoxia

Data are animal counts and environment data collected during remotely operated vehicle imagery surveys in Saanich Inlet, Vancouver Island, British Columbia, Canada from 2006-2013. Each row entry equals a second of annotated ROV video with associated metadata (e.g. video file properties), water column data (e.g. depth, temperature, oxygen), or species data (presence/absence or counts). Extended details can be found with the associated README file. Data was collected as part of a PhD thesis (Chu) and is A Canadian Healthy Oceans Network Ecosystem Function project, EF-13.

Data from: Multi-parametric study of behavioural modulation in demersal decapods at the VENUS cabled observatory in Saanich Inlet, British Columbia, Canada

Understanding biological rhythms in benthic ecosystems and their modulation by habitat cycles has important implications for resource and ecosystem management. The recent development of permanent, multi-sensor seafloor observatories in deep-water environments provides opportunities for the in situ investigation of the behaviour of benthic organisms in relation to habitat variability. This paper describes a multi-disciplinary investigation at the VENUS observatory platform in Saanich Inlet, an intermittently anoxic fjord (Vancouver Island, Canada). A remotely operated digital camera (103 m depth) was used to document changes in the abundance of shrimp (Spirontocaris spp.) and the squat lobster (Munida quadrispina), as well as bacterial mat coverage (Beggiatoa spp.). These data were used as proxies of diel rhythms related to day–night and internal tidal cycles. Seafloor photos were acquired hourly during consecutive days, before, during and after oxygen intrusion events in the fall of 2009. In order to relate biological fluctuations to habitat cycles, bottom water pressure, temperature, dissolved oxygen, and nitrate data were also acquired from the observatory database. Periodogram analysis showed a weak internal-tide-associated rhythmicity for Spirontocaris spp. that was absent in M. quadrispina and in bacterial mat coverage. Waveform analysis confirmed the absence of any day–night fluctuation in all tested species. However, a rapid intrusion of oxygenated water at the study site influenced visual counts of species, possibly blurring detectable activity rhythms. Temperature and nitrate fluctuations were more accentuated during spring tides but cross-correlation analysis indicated an absence of species responses to these habitat variables. Results are discussed within the context of the complex oceanographic dynamics of Saanich Inlet and with respect to understanding the ecological consequences of expanding hypoxia in the global ocean.

Data from: A year in hypoxia: epibenthic community responses to severe oxygen deficit at a subsea observatory in a coastal inlet

Changes in ocean ventilation driven by climate change result in loss of oxygen in the open ocean that, in turn, affects coastal areas in upwelling zones such as the northeast Pacific. Saanich Inlet, on the west coast of Canada, is a natural seasonally hypoxic fjord where certain continental shelf species occur in extreme hypoxia. One study site on the VENUS cabled subsea network is located in the hypoxic zone at 104 m depth. Photographs of the same 5 m2 area were taken with a remotely-controlled still camera every 2/3 days between October 6th 2009 and October 18th 2010 and examined for community composition, species behaviour and microbial mat features. Instruments located on a near-by platform provided high-resolution measurements of environmental variables. We applied multivariate ordination methods and a principal coordinate analysis of neighbour matrices to determine temporal structures in our dataset. Responses to seasonal hypoxia (0.1–1.27 ml/l) and its high variability on short time-scale (hours) varied among species, and their life stages. During extreme hypoxia, microbial mats developed then disappeared as a hippolytid shrimp, Spirontocaris sica, appeared in high densities (200 m22) despite oxygen below 0.2 ml/l. The slender sole Lyopsetta exilis was abundant in severe hypoxia and diminished as oxygen increased in the summer. This planktivore may be responding to changes in the depth of the diurnal migration of zooplankton. While the squat lobster Munida quadrispina was common at all times, juveniles disappeared in fluctuating conditions. Despite low oxygen conditions, animal densities were high indicating that the risk from hypoxia is balanced by factors such as food availability and escape from less tolerant predators. As hypoxia increases on the continental shelf, we expect benthic communities to become dominated by low diversity, hypoxia-tolerant species of low commercial significance.

Supplementary Files for: Sponge behaviour and the chemical basis of responses: a post-genomic view

Sponges perceive and respond to a range of stimuli. How they do this is still difficult to pin down despite now having transcriptomes and genomes of an array of species. Here we evaluate the current understanding of sponge behaviour and present new observations on sponge activity in situ. We also explore biosynthesis pathways available to sponges from data in genomes/transcriptomes of sponges and other non-bilaterians with a focus on exploring the role of chemical signalling pathways mediating sponge behaviour and how such chemical signal pathways may have evolved. Sponge larvae respond to light but opsins are not used, nor is there a common photoreceptor molecule or mechanism used across sponge groups. Other cues are gravity and chemicals. In situ recordings of behaviour show that both shallow and deep-water sponges move a lot over minutes and hours, and correlation of behaviour with temperature, pressure, oxygen and water movement suggests that at least one sponge responds to changes in atmospheric pressure. The sensors for these cues as far as we know are individual cells and, except in the case of electrical signalling in Hexactinellida, these most likely act as independent effectors, generating a whole-body reaction by the global reach of the stimulus to all parts of the animal. We found no evidence for use of conventional neurotransmitters such as serotonin and dopamine. Intriguingly, some chemicals synthesized by symbiont microbes could mean other more complex signalling occurs, but how that interplay might happen is not understood. Our review suggests chemical signalling pathways found in sponges do not reflect loss of a more complex set.

CTD profile in IODP CORK U1364A borehole at ONC NEPTUNE observatory site Clayoquot Slope, Cascadia Accretionary Prism

CTD (Conductivity-Temperature-Depth) profile measured during an experiment to determine the open depth of IODP borehole observatory CORK U1364A. The CTD profile was obtained during Ocean Networks Canada NEPTUNE Maintenance Cruise 2014-05 using the remotely operated vehicle (ROV) CSSF-ROPOS from the CCGS John P. Tully. Video and dive log entries of the experiment were recorded during Dive R1694 and are accessible at https://data.oceannetworks.ca/SeaTube?resourceTypeId=1000&resourceId=1001&diveId=410&time=2014-05-24T15:43:08.000Z. This data set contains all raw, metadata, and calibrated data files that were retrieved and generated from the CTD after the experiment