chone_metadata_optics

Project Name	Start Date	End Date	Lat range	Lon range
CHONe	2016-08-23	2019-06-05	49.9994 50.2689	-66.6009 -66.0298

Role	Name	Affiliation	Email
PI	Simon Bélanger	UQAR	Simon_Belanger@uqar.ca
Database contact	Véronique Thériault	UQAR	Veronique_Theriault2@uqar.ca

Citation:
Université du Québec à Rimouski. Aquatel Laboratory. (2019). CHONe II project (Canadian Healthy Oceans Network): baseline bio-optical data in the Bay of Sept-Iles, optical data. [Version 1.0] Data published on St. Lawrence Global Observatory-SLGO. [https://slgo.ca]. Access date: [YYYY-MM-DD].

Project Description:
The NSERC Canadian Healthy Oceans Network II (CHONe II), a strategic partnership of Canadian university researchers and government scientists, brings together 39 researchers from universities and federal research labs from coast to coast in Canada. The Network trains many interdisciplinary undergraduate and graduate students, as well as postdoctoral researchers.

CHONe II's research explores the characteristics that define how Canada's oceans will respond to management strategies such as networks of Marine Protected Areas (MPAs), spatial closures, and restoration efforts. Our research also addresses how ocean stressors such as pollution, climate change, and fishing - individually and collectively - alter ocean life and how ocean environments work, including intensively used environments that provide food and other resources.

Under this research program, 10 field campaigns were conducted in the Bay of Sept-Iles (BSI) area from 2016 to 2019 in order to establish baseline bio-optical information to promote and develop optical remote sensing tools for monitoring purposes, at the Bay scale. This particular dataset refers to the optical parameters sampled within the water column such as above-water radiometry and reflectance.

Funders:
Funded by the Natural Sciences and Engineering Research Council of Canada (NSERC) in partnership with Fisheries and Ocean Canada and the Northern Institute for Research in Environment and Occupational Health and Safety (INREST, representing the Port of Sept-Îles and City of Sept-Îles).

Datasets Table of Content

data_dictionary_optics_chone.csv

Description:
The "data_dictionary_optics_chone.csv" file contains the description and units of all parameters included in each dataset (each csv file). Parameter's names are based on SeaBass standardized field names when possible (https://seabass.gsfc.nasa.gov/wiki/stdfields).

Dataset Contact:

Name	Affiliation	Email
Veronique Theriault	UQAR	veronique_theriault2@uqar.ca

Instruments:
NA

Sampling and Analysis:
NA

References:
NA

watercolumn_station_chone.csv

Description:
This dataset is used as a reference table and contains basic information on stations sampled for optical data parameters. Date, time, latitude, longitude, boat used, water depth, secchi disk and forel-Ule scale are the parameters given for each station. The “station_id” column is the primary key to which other datasets can refer to perform joins.

Dataset Contact:

Name	Affiliation	Email
Veronique Theriault	UQAR	veronique_theriault2@uqar.ca

Instruments:
NA

Sampling and Analysis:
NA

References:
NA

Ed_cops_long_chone.csv

Kd_10p_cops_long_chone.csv

Kd_1p_cops_long_chone.csv

Rb_cops_long_chone.csv

Rrs_cops_long_chone.csv

Description:
Optical parameters measured in situ include remote sensing reflectance at sea surface (Rrs), diffuse attenuation coefficient (Kd, at 1 and 10 percent of Ed), downwelling irradiance (Ed) and bottom reflectance (Rb) using the C-OPS. Refer to the “watercolumn_station_chone.csv” dataset for additional information on the station sampled, based on the “station_id” column.

Start Date: 2016-08-23
End Date: 2019-06-05

Dataset Contact:

Name	Affiliation	Email
Simon Bélanger	UQAR	Simon_Belanger@uqar.ca
Raphael Mabit	UQAR	raphael.mabit@uqar.ca

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
Compact Optical Profiler System (C-OPS)	Biospherical Instruments	SN 13	

Sampling and Analysis:

Sampling: Optical data was gathered both inside and outside the Bay of Sept-Îles. The sampling at sea was made on a fisherman boat based at the Sept-Iles port. Three to five C-OPS profiles were performed on each station. Most of the time, the boats were drifting during the measurements and the instrument was kept outside any disturbance or boat shadow. In very shallow waters (less than 2 m) where tidal currents were strong, the boats were anchored to stay on station and the instruments were transported away from the boat shadows.

Analytical procedure: The C-OPS data were processed in R software with the “Cops” package first developed by Dr. B. Gentili at the Laboratoire d'Océanographie de Villefranche (LOV) and now maintained by Dr S Bélanger (the source code is available at https://github.com/belasi01/Cops). The data processing respects the NASA protocols (Mueller et al. 2003) but additional features have been developed to optimize the data processing.

Wavebands available on the C-OPS systems used from 2016 to 2019.

UQAR SN 13
NA
320
330
340
380
NA
412
443
465
490
510
532
555
NA
589
625
665
683
694
710
780
875

References:

- Mueller, James L et al. 2003. Ocean Optics Protocols For Satellite Ocean Color Sensor Validation , Revision 4 , Volume I: Introduction, Background and Conventions

Rrs_hocr_long_chone.csv

Description:
Remote sensing reflectance at sea surface (Rrs) measured with the HOCR. Refer to the "watercolumn_station_chone.csv" dataset for additional information on the station sampled, based on the "station_id" column.

Start Date: 2019-06-04
End Date: 2019-06-05

Dataset Contact:

Name	Affiliation	Email
Simon Bélanger	UQAR	Simon_Belanger@uqar.ca

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
Radiometer	SeaBird Scientific	hyperOCR (HOCR)	Calibrated by manufacturer before deployment

Sampling and Analysis:
Sampling: In 2019, we adapted a Satlantic HyperSAS system to measure in-water hyperspectral reflectance (Rrs) from small boats with the capacity to navigate in very shallow waters. The HOCR spectral range spans from ~380 to 800 nm at ~3 nm resolution. In-water upwelling radiance below the sea surface was measured using two hyperOCR radiometers (HOCR) held away from the boat with a pole and submerged at two different depths. The surface sensor was lowered at ~5 to 15 cm depth, while the second sensor was ~30 cm deeper (i.e., ~40 to 55 cm depth). This set up, while avoiding the surface sky glint correction, allows the calculation of the attenuation coefficient of the up-welling radiance, KLu. Simultaneously, incident Ed(0+) was measured above water using a radiometer attached to the side of the boat above the structure to avoid shadow.

Analytical procedure: HOCR data were processed using the open-source R-package HyperocR available on the GitHub platform (https://github.com/belasi01/HyperOCR). The processing includes the extrapolation of Lu to the sea surface using estimated value of KLu and its transmission across the air-water interface, which is used to estimate the Lw(0+) and Rrs. Note that the instrument self-shadow correction was considered negligible for HOCR due to the small radius of the instrument (~3cm).

References:

NA

a_long_chone.csv

Description:
Spectral non-water absorption coefficient (a) measured in situ with the a-sphere. Refer to the “watercolumn_station_chone.csv” dataset for additional information on the station sampled, based on the “station_id” column.

Start Date: 2016-08-23
End Date: 2019-06-05

Dataset Contact:

Name	Affiliation	Email
Simon Bélanger	UQAR	Simon_Belanger@uqar.ca

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
a-sphere	HOBILabs		Factory calibrated before field campaign

Sampling and Analysis:

Sampling: Optical data was gathered both inside and outside the Bay of Sept-Îles. The sampling at sea was made on a fisherman boat based at the Sept-Iles port. Vertical profiles of the spectral non-water absorption coefficient (*a*) were done from the boat using an a-sphere. The HOBILabs a-sphere is a submersible teflon integrating sphere. The instrument was factory calibrated before the field campaign with pure water. The a-sphere measures the absorption at 1500 wavelengths between 360 and 764 nm, that are binned at 1 nm resolution. The absorption coefficient a is binned at 81 varying wavelengths between 400 and 756 nm.

Analytical procedure: For the a-sphere, raw data were converted into absorption coefficients using the manufacturer software and calibration files. The parameter was corrected for temperature and salinity as measured with the CTD at the same depth using the coefficients published by Röttgers et al. 2014.

All the processing is implemented using the Riops R package (https://github.com/belasi01/Riops).

References:

- Röttgers, D. McKee, and C. Utschig, 2014. Temperature and salinity correction coefficients for light absorption by water in the visible to infrared spectral region. Opt. Express, 22, 25 093–25 108, doi:10.1364/OE.22.025093.

bbp_long_chone.csv

Description:
Backscattering coefficient of particles (bbp) measured in situ with the Hydroscat-6. Refer to the "watercolumn_station_chone.csv" dataset for additional information on the station sample, based on the "station_id" column.

Start Date: 2016-08-23
End Date: 2019-06-05

Dataset Contact:

Name	Affiliation	Email
Simon Bélanger	UQAR	Simon_Belanger@uqar.ca

Instruments:

Instrument Type	Manufacturer	Model	Instrument Features / Calibration
HydroScat-6P	HOBILabs		2015, 2017, 2019

Sampling and Analysis:
Sampling: Optical data was gathered both inside and outside the Bay of Sept-Îles. The sampling at sea was made on a fisherman boat based at the Sept-Iles port. Vertical profiles were done from the boat using an hydroscat-6. The Hydroscat-6 measured the volume scattering function at 140^{o}, β(140) with bands centered at 394, 420, 470, 532, 620 and 700 nm. The instrument was factory calibrated in 2015, 2017 and 2019 following the method of Maffione and Dana 1997.

Analytical procedure: The bbp for HS6 is derived from integrating the β(140). Tthe attenuation of scattered photons along the detector's viewing pathlength is corrected using the total absorption coefficient measurements from the a-Sphere (see a_long_chone.csv.) following Doxaran et al. (2016). For the effects of salinity on the pure seawater scattering, correction after Zhang et al (2009) has been performed. The processing has been implemented in the Riops R package (https://github.com/belasi01/Riops) (Araújo and Bélanger, 2022).

References:

- Carlos A.S. Araújo, Simon Bélanger, 2022. Variability of bio-optical properties in nearshore waters of the estuary and Gulf of St. Lawrence: Absorption and backscattering coefficients, Estuarine, Coastal and Shelf Science, Volume 264,2022,107688,ISSN 0272-7714,https://doi.org/10.1016/j.ecss.2021.107688.

- Doxaran et al., 2016. D. Doxaran, E. Leymarie, B. Nechad, A. Dogliotti, P. Gernez, E. Knaeps, Improved correction methods for field measurements of particulate light backscattering in turbid waters, Opt Express, 24 (2016), pp. 5415-5436, 10.1364/OE.24.003615.
- Maffione, Robert and Dana, David, 1997. Instruments and methods for measuring the backward-scattering coefficient of ocean waters, Applied optics,   24 (36),6057-6067.
- Zhang, X., L. Hu, and M.-X. He, 2009: Scattering by pure seawater: Effect of salinity. Opt. Express, 17, 5698–5710, doi:10.1364/OE.17.005698.