FICHE META\_INFORMATION\_PARAMETRES

(à remplir par le responsable du paramètre)

#### 

### Nom du DATASET / Data SET NAME

*Data set Name (list of the measured parameters):*

**AOP** - **Multispectral radiometric data acquisition for estimation of apparent optical properties (AOP).**

Radiometric measurements of atmospheric and marine irradiance and/or radiance (downwelling and upwelling, all collected with cosine collectors), along with ancillary data like latitude and longitude (not always). These measurements can be used to estimate AOP, like diffuse attenuation coefficient (Kd), remote sensing reflectance (Rrs) or photosynthetic available radiation (PAR). In the data set provided, the irradiances values (smoothed when profiling) as well as few PAR values are given. **See the html file “GE.Optics.AOP.report.html” for detailed explanations**.

Exhaustive list of the provided parameters:

* Multispectral (19 wavelengths) above surface downwelling irradiance Ed(0+, λ),
* Multispectral (19 wavelengths) downwelling irradiance profile Ed(z,λ),
* Multispectral (19 wavelengths) downwelling [ir]radiance profile Eu(z,λ) and / or Lu(z,λ),
* Instantaneous above surface downwelling photosynthetically available radiation PAR(0+),
* Daily above surface downwelling photosynthetically available radiation PARdaily(0+),
* Instantaneous downwelling photosynthetically available radiation profile PARd(z),
* Instantaneous downwelling light transmission profile PARdpercent(z),
* Daily downwelling photosynthetically available radiation profile PARddaily(z),
* Downwelling photosynthetically available radiation profile Integrated over 1 hour around local noon PARd1h-noon,
* Downwelling photosynthetically available radiation profile Integrated over 1 hour before the closest rosette / CTD (closest in distance) PARdp1h,
* Downwelling photosynthetically available radiation profile Integrated over 3 hours before the closest rosette / CTD (closest in distance) PARdp3h,
* Downwelling photosynthetically available radiation profile Integrated over 24 hours before the closest rosette / CTD (closest in distance) PARdp24h,
* Downwelling photosynthetically available radiation profile Integrated over 48 hours before the closest rosette / CTD (closest in distance) PARdp48h,
* Downwelling photosynthetically available radiation profile Integrated over the local day PARdday-LOC,
* Instantaneous upwelling photosynthetically available radiation profile PARu(z),
* Instantaneous upwelling light transmission profile PARupercent(z),
* Daily upwelling photosynthetically available radiation profile PARudaily(z),
* Upwelling photosynthetically available radiation profile Integrated over 1 hour around local noon PARu1h-noon,
* Upwelling photosynthetically available radiation profile Integrated over 1 hour before the closest rosette / CTD (closest in distance) PARup1h,
* Upwelling photosynthetically available radiation profile Integrated over 3 hours before the closest rosette / CTD (closest in distance) PARup3h,
* Upwelling photosynthetically available radiation profile Integrated over 24 hours before the closest rosette / CTD (closest in distance) PARup24h,
* Upwelling photosynthetically available radiation profile Integrated over 48 hours before the closest rosette / CTD (closest in distance) PARup48h,
* Upwelling photosynthetically available radiation profile Integrated over the local day PARuday-LOC.

### PROJET-ETUDE / *PROJECT TITLE*

*Campaign NAME* : GreenEdge – AMUNDSEN – 2016 *LEG :1a, 1b*

*Date* *begin : 09 June 2016*

*Date end : 10 July 2016*

*Chief Scientist*: Marcel Babin (leg 1a), Jean-Eric Tremblay (leg 1b)

*Address :*

Université Laval - UMI Takuvik

1045 avenue de la médecine

Québec, QC, G1V0A6, Canada

*Sampling method: an optical light profiler, the Compact Optical Profiling System (C-OPS, Biosoherical), consisting of a support kite-shaped frame holding 2 out of a set of 3 available optical radiometers: downwelling irradiance, Ed(z,λ) and either upwelling irradiance Eu(z,λ) or upwelling nadir radiance Lu(z,λ)). The profiler is lowered either from a hole in the ice or in open waters from the deck of the ship (Amundsen or barge) until a depth of up to 100 m. The frame is manually lowered at a rate of approximately 30 cm/s in the case of ice measurements, and free-falling at approximately the same descent rate in the case of open water measurements. On the downcast, the sensors record radiometric measurements (downwelling or upwelling irradiances and/or radiances) at an acquisition frequency of 15 Hz. Above the surface, another irradiance sensor fitted on a tripod (ice) or on a mast (open water) records above surface (i.e. bottom of atmosphere) irradiance, and sometimes GPS geo localization (different sets of sensors have been used for ice and open water measurements, and not all of them were fitted with a GPS receiver).*

*All the measurements are performed along 19 wavelengths, regularly spread in the visible spectrum (bold indicate the common wavelengths of the 2 C-OPS):*

* *Ice measurements were performed at: 320, 330,* ***340****, 380,* ***412, 443, 465, 490, 510, 532, 555, 589, 625, 665, 683, 694, 710, 780*** *and* ***875*** *nm,*
* *Open water measurements were performed at:* ***340, 412, 443, 465, 490, 510, 532, 555****, 560,* ***589****,* ***625, 665,*** *670****, 683, 694, 710,*** *765,* ***780*** *and* ***875*** *nm.*

*2 instruments were used, to avoid to modify the design (Ice vs. open water) too often. The C-OPS system form the LOV has been used for open water and lead in broken ice measurements, and the ICEPRO system from UQAR has been used for ice based data acquisition.*

*Station number - Cast number:*

***Open water / lead in broken ice measurements:***

*G100, G102, G104, G107, G110, G204, G207, G300, G303, G308, G310, G315, G321, G400, G406, G418, G500, G503, G507, G506, G510, G512, G515, G603, G605, G615, G612, G604.5, G608, G618, G703, G700, G100, G102, G104*

***Ice floe based measurements:***

*G113, G201, G204, G312, G318, G324, G403, G409, G413, G519, G600*

*Operation code : AOP*

### **RESPONSABLE SCIENTIFIQUE du paramètre / *PI of the parameter***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nom / *name* | adresse /*address* | téléphone / *phone number* | fax /*fax number* | adresse mél /*email address* |
| **Simon Bélanger** | UQAR, Rimouski | **+1 (418)** 723-1986, ext 1969 | **N.a.** | [simon\_belanger@uqar.ca](mailto:simon_belanger@uqar.ca) |
|  |  |  |  |  |

### DATASET contact

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nom / *name* | adresse /*address* | téléphone / *phone number* | fax /*fax number* | adresse mél /*email address* |
| **Simon Bélanger** | UQAR, Rimouski | **+1 (418)** 723-1986, ext 1969 | **N.a.** | [simon\_belanger@uqar.ca](mailto:simon_belanger@uqar.ca) |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Nom / *name* | adresse /*address* | téléphone / *phone number* | fax /*fax number* | adresse mél /*email address* |
| **Guislain Bécu** | U.Laval, pav. VACHON, local 2052 | **+1 (418) 656 2131 x 8567** | **+1 (418) 656-2339** | [Guislain.Becu@takuvik.ulaval.ca](mailto:Guislain.Becu@takuvik.ulaval.ca) |
|  |  |  |  |  |

### INFORMATION GEOGRAPHIQUES */ GEOGRAPHIC INFORMATION*

*Predefined site (if relevant):*

*3 main types of sites were sampled. 1. Open water, 2. ice floe, 3. Open water lead in broken ice.*

*C-OPS measurements from the barge or the Amundsen bow (open water and leads in broken ice).*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Date** | **Station** | **Station Type** | **Lat** | **Lon** | **Deployement** |
| **Leg 1a** | | | | | |
| 2016-06-09 | G100 | FULL | 68N28.92 | 56W47.06 | Amundsen |
| 2016-06-10 | G102 | FULL | 68N29.78 | 57W28.93 | Amundsen |
| 2016-06-11 | G104 | BASIC | 68.501 | -58.146 | Amundsen |
| 2016-06-11 | G107 | FULL | 68N30.4 | 59W16.7 | Barge |
| 2016-06-12 | G110 | FULL | 68.5312 | -60.1457 | Barge |
| 2016-06-15 | G204 | FULL | 68.7053 | -59.2532 | Barge |
| 2016-06-16 | G207 | FULL | 68N48.24 | 58W31.24 | Barge |
| 2016-06-17 | G300 | FULL | 68.999 | -56.7682 | Amundsen |
| 2016-06-18 | G303 | BASIC | 68.997 | -57.4736 | Amundsen |
| 2016-06-18 | G308 | FULL | 69.0011 | -58.7379 | Amundsen |
| 2016-06-19 | G310 | BASIC | 69.0255 | -59.0656 | Amundsen |
| 2016-06-20 | G315 | BASIC | 69N00.4097 | 60W10.8257 | Amundsen |
| 2016-06-21 | G321 | BASIC | 68.9625 | -61,6331 | Amundsen |
| **Leg 1b** | | | | | |
| 2016-06-24 | G400 | BASIC | 67.9978 | -62 | Amundsen |
| 2016-06-26 | G406 | BASIC | 68.0667 | -60.8175 | Amundsen |
| 2016-06-28 | G418 | FULL | 68.11 | -57.75 | Amundsen |
| 2016-06-29 | G500 | BASIC | 70 | -56.85 | Amundsen |
| 2016-06-30 | G503 | BASIC | 70 | -57.46 | Amundsen |
| 2016-06-30 | G507 | FULL | 70 | -59.125 | Amundsen |
| 2016-06-30 | G506 | BASIC | 70N00.79 | 58W39.244 | Amundsen |
| 2016-06-30 | G510 | BASIC | 70N00.048 | 59W49.016 | Amundsen |
| 2016-07-01 | G512 | FULL | 69N59.521 | 60W19 | Amundsen |
| 2016-07-01 | G515 | BASIC | 69N59.758 | 61W14.61 | Amundsen |
| 2016-07-04 | G603 | BASIC | 70N30 | 63W03 | Amundsen |
| 2016-07-04 | G605 | FULL | 70N28 | 62W28 | Amundsen |
| 2016-07-05 | G615 | FULL | 70N30.3 | 59W32.1 | Amundsen |
| 2016-07-06 | G612 | BASIC | 70N30.44 | 60W25.4 | Amundsen |
| 2016-07-06 | G604.5 | FULL | 70N29.9 | 62W37.6 | Amundsen |
| 2016-07-06 | G608 | BASIC | 70N29.9 | 61W36.6 | Amundsen |
| 2016-07-07 | G618 | BASIC | 70N29.8 | 58W38.88 | Amundsen |
| 2016-07-07 | G703 | FULL | 69N30.1 | 58W43 | Amundsen |
| 2016-07-08 | G700 | BASIC | 69N30.0 | 57W52.3 | Amundsen |
| 2016-07-08 | G707 | FULL | 69N31.0 | 59W47.58 | Amundsen |
| 2016-07-09 | G713 | FULL | 69N30.0 | 61W34.8 | Amundsen |
| 2016-07-10 | G719 | FULL | 69N29.6 | 63W12.1 | Amundsen |

*IcePRO measurements from the ice floe*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Date** | **Station** | **Station Type** | **Lat** | **Lon** | **Deployement** |
| **Leg1a** | | | | | |
| 2016-06-12 | G113 | FULL | 68N23.7 | 61W16.86 | Ice |
| 2016-06-13 | G201 | FULL | 68N36.40 | 59W55.25 | Ice |
| 2016-06-15 | G204 | FULL | 68N41.666 | 58W7.760 | Ice |
| 2016-06-19 | G312 | FULL | 69N0.765 | 59W34.37 | Ice |
| 2016-06-20 | G318 | FULL | 69N00.56 | 60W57.65 | Ice |
| 2016-06-21 | G324 | FULL | 68N59.31 | 62W20.20 | Ice |
| **Leg1b** | | | | | |
| 2016-06-25 | G403 | FULL | 68N 04.422 | 61W36.50 | Ice |
| 2016-06-26 | G409 | FULL | 68N05.824 | 60W00.63 | Ice |
| 2016-06-27 | G413 | FULL | 68N 07.440 | 59W04.95 | Ice |
| 2016-07-02 | G519 | FULL | 70N00.26 | 62W25.37 | Ice |
| 2016-07-03 | G600 | FULL | 70N28.5 | 64W00.6 | Ice |

### DESCRIPTION DES INSTRUMENTS / INSTRUMENTS DESCRIPTION *(if Relevant)*

*Instrument Type: set of 3 profiling radiometers (more precisely, 1 above the surface and 2 profiling).*

*Manufacturer: Bioshperical Instruments Inc.*

*Model: Compact - Optical Profiler System (C-OPS), for open waters, and its ice floe version, the IcePRO, for the on-ice operations.*

*Instrument Features / Calibration:*

* *Factory calibration for the C-OPS unit #1 (LOV C-OPS): May 2015, then cross calibrated in lab early 2016,*
* *Factory calibration for the C-OPS unit #2 (UQAR IcePRO): December 2015.*

### DESCRIPTION DES PARAMETRES */ PARAMETERS DESCRIPTION*

# Ce qui a été collecté, mesuré et comment / *How was the parameter collected and measured (include references for analytical methods)?*

*Sampling: vertical profiles, recording on downcast only.*

*Analytical procedure : (briefly, could be a short recall to a published reference):*

*A factory provided software allows for the acquisition of the radiometric data as well as for the calibration coefficient application.*

*A R package (cops) developed by Bernard Gentilli at LOV and maintained by Simon Bélanger (UQAR) is used to derive the AOPs from the COPS. Data processing follows NASA recommendations as well as some addition specific for the COPS.*

**See the html file “GE.Optics.AOP.report.html” for detailed explanations**.

*Units:*

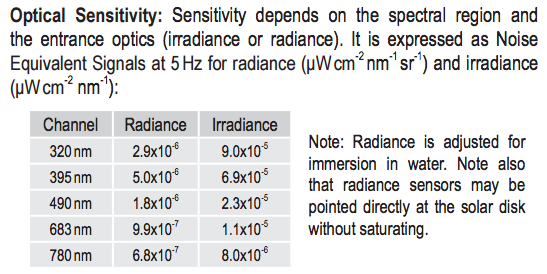
*Irradiances are acquired in (µW/(cm².nm)*

*radiances in (µW/(cm².nm.sr)*

*instantaneous PAR are provided in μEin/(m2.s)*

*integrated PAR are provided in Ein/(m2.[period]), [period] being either 1 hour, 3 hours, 24 hours or 48 hours.*

*Sensor Precision: see below from the factory spec. sheet for the C-OPS instrument:*

**

**Cosine Error Irradiance Instrument:** ±3% for zenith angles smaller than 60°; ± 5% for zenith angles 60–70°, and ±10% for zenith angles from 70–80°.

# Décrire quels types de données sont nécessaires pour vous compléter votre propre jeu de données **avant** envoi à la base de données, et estimer le délai avant la disponibilité de vos données pour la base de données / *Post-cruise data analysis/treatment required, and the time frame for this*

*Estimated Date of Delivery :* fall 2017 more likely.

### REFERENCES BIBLIOGRAPHIQUES

Antoine, D., S. B. Hooker, S. Bélanger, A. Matsuoka, and M. Babin (2013), Apparent optical properties of the Canadian Beaufort Sea – Part 1: Observational overview and water column relationships, *Biogeosciences*, *10*(7), 4493–4509, doi:10.5194/bg-10-4493-2013.

Bélanger, S., C. Carrascal-Leal, T. Jaegler, P. Larouche, and P. S. Galbraith (2017), Assessment of radiometric data from a buoy in the St Lawrence Estuary, *Journal of Atmospheric and Oceanic Technology*, in review.

Morrow, J. H., S. B. Hooker, C. R. Booth, G. Bernhard, R. N. Lind, and J. W. Brown (2010), *Advances in Measuring the Apparent Optical Properties ( AOPs ) of Optically Complex Waters*, edited by J. H. Morrow, NASA Goddard Space Flight Center, Greenbelt, MD.

Mueller, J. L. et al. (2003), *Ocean Optics Protocols For Satellite Ocean Color Sensor Validation , Revision 4 , Volume III : Radiometric Measurements and Data Analysis Protocols NASA / TM-2003- Ocean Optics Protocols For Satellite Ocean Color Sensor Validation , Revision 4 , Volume II*, Greenbelt, MD.