HOT HyperPro Deployment Protocols

Jasmine Nahorniak

updated October 15, 2013

Protocols developed with input from:

Jasmine Nahorniak (OSU)
Ricardo Letelier (OSU)
Curt Davis (OSU)
Angel White (OSU)
Nick Tufillaro (OSU)
Benedetto Barone (UH)
Mike Ondrusek (NOAA)

Contents

Why have the protocols changed?

Surface products, such as normalized water-leaving radiance, can be derived by extrapolation from profiles of light measurements to the sea surface. Changes to the protocols are needed to improve the accuracy of these surface retrievals. These hyperspectral surface measurements are invaluable data for cal/val of satellite data products.

From the HyperPro II manual (Rev K):

> A new technique for deploying the profiler in free fall was developed by Dr. Giuseppe Zibordi of the Joint Research Centre, particularly for coastal waters to improve the retrieval of normalized water leaving radiances. The technique was adopted by a NASA cal/val project, SORTIE (Spectral Ocean Radiance Transfer Investigation and Experiment) to lower uncertainties in water leaving radiances and specialized processing to take advantage of this new technique has been implemented in ProSoft 8.0. By using the technique described in this section, investigators can easily achieve regressions for diffuse attenuation coefficients and water leaving radiances with over 100 samples/m even with hyperspectral systems. This leads to significant improvements in derived parameter precision and accuracy in both Case-I and Case-II waters.

Changes to existing protocols are highlighted in yellow throughout the document.

Summary of protocol changes

Protocol element	Old protocol	New protocol	Explanation
Personnel communication	No protocol	Include all personnel on all HOT HyperPro correspondence	Open communication about HyperPro issues and calibrations is needed to keep everyone on the same page.
Calibration requirements	No protocol, but usually every two years	Annual with stray light and thermal corrections	Frequent calibrations are necessary to ensure accuracy of the derived products. A specific request must be made to Satlantic to include coefficients for stray light and thermal corrections in the calibration files.
ProSoft version	No protocol, but version 7.7.16 was in use	Version 8.1.1 (multicast) or higher	Version 8.1.1 (multicast) applies stray light and thermal responsivity corrections, can process yo-yo data, and yields more accurate surface products.
Equipment required		Accurate ruler, tape measure or calipers	The sensor offset distances must be measured at the start of each cruise.
Sensor distance offsets	Constant value assumed	Measure the sensor distance offsets at the start of each cruise	The sensor distance offsets may vary between deployments and after calibration or reconfiguration.
Time of deployment	13:00 – 13:30 HST	14:00 – 14:30 HST	This time maximizes the likelihood of matching an AQUA or SNPP satellite overpass with low sunglint.
Cloud cover text	Old example: “2/8 clouds”	New example: “2/8 clouds, clear sun”	Satellite cal/val can only be made when the sun is not obscured by clouds during the cast.
Comments text		New example: “PRESS 0.726 m, ED 0.118 m, LU 0.145, PUC 0.152 m”	The sensor distance offsets must be recorded in the metadata for each cast.
Pressure tare orientation	In water at surface	Vertically upright on deck	Recommended by Satlantic and the cal/val team.
Cast sequence	1) profile 1 2) profile 2 3) profile 3	1) profile 1 2) profile 2 3) yo-yo	A yo-yo cast provides additional data points near the sea surface, improving the accuracy of surface retrievals.
Yo-yo cast		Yo-yo	A series of 5 short casts to 20 meters depth collected in a single file. Duration 10 minutes.
Depth of profile	200 m	180 m	The pressure sensor saturates at approximately 190 m. Saturated values cause processing issues.

Personnel

HyperPro S/N 120 is owned by the HOT program. It is stored, maintained, and operated by HOT personnel at the University of Hawaii under the direction of Ricardo Letelier (Oregon State University). The data are processed and analyzed by personnel at Oregon State University. The processed data are made available via the HOT program website and Oregon State University. Calibrations are performed by the instrument manufacturer (Satlantic). The table below lists all relevant contacts and their roles.

Role	Name	Affiliation	e-mail address
HOT director	Matt Church	University of Hawaii at Manoa	mjchurch@hawaii.edu
PI	Ricardo Letelier	Oregon State University	letelier@coas.oregonstate.edu
co-investigator	Angel White	Oregon State University	awhite@coas.oregonstate.edu
operator	Benedetto Barone	University of Hawaii at Manoa	bbarone@hawaii.edu
operator	Lance Fujieki	University of Hawaii at Manoa	fujieki@hawaii.edu
data processor	Jasmine Nahorniak	Oregon State University	jasmine@coas.oregonstate.edu
calibrations	Darrell Adams	Satlantic	darrell@satlantic.com

Correspondence regarding the HOT HyperPro (issues, calibrations, etc.) should be sent to all personnel in the above table (except the Satlantic rep., unless appropriate). This will ensure that everyone is on the same page at all times.

Calibration requirements

An annual calibration of each HyperPro is necessary to ensure accurate output products.

Recent versions of ProSoft (8.1.1 and higher) are capable of correcting the data for stray light and thermal responsivity. To apply these corrections, calibration files containing stray light and thermal coefficients are needed. The calibration files sent from Satlantic may or may not include these coefficients. If not, a revised calibration file may be obtained on request from Satlantic.

Copies of new calibration files should be posted ASAP to the HOT ftp site (ftp://ftp.soest.hawaii.edu/dkarl/hot/light/hyperpro) where they can be downloaded by Oregon State University for use during data processing.

Deployment protocols

A summary of HyperPro deployment protocols is given below.
More details can be found in:
Operation Manual for the Profile II, revision K, 10 December 2012

A. Equipment required

1. HyperPro (profiler, reference sensor, cables, deck unit, battery, sensor covers)
2. Accurate ruler / tape measure / calipers (at least 3' long, for measuring the sensor distance offsets; preferably metric)
3. Black electrical tape (for dark count measurements)
4. Kim Wipes (for cleaning the sensors)
5. Computer with SatView, the latest calibration files, and ProSoft 8.1.1 or higher (optional)
6. Radios (if out of hearing range from the second operator during deployment)

B. Sensor distance offsets

To correct for the different vertical locations of the various sensors on the profiler, several distance measurements are required. Since the positions of the Ed and Lu sensors can be variable, these distance measurements should be made once per cruise before the first deployment; if the instrument configuration is changed between deployments, the distance measurements must be re-made.

In units of meters, make and record the four measurements illustrated in the figure:

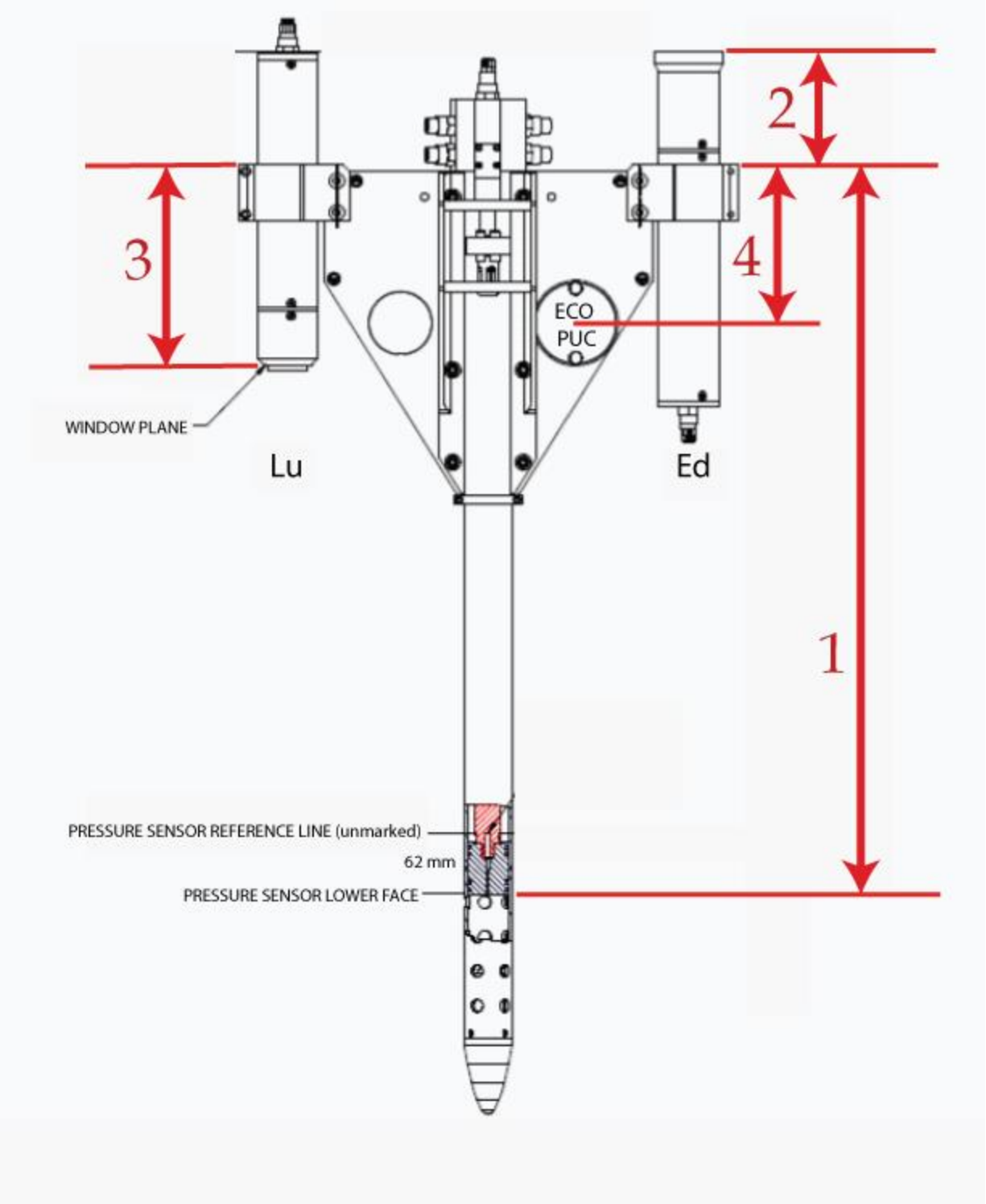
(1) **PRESS: Top of Ed clamp to the lower face of the pressure sensor**
The lower face of the pressure sensor can be seen through the holes in the lower part of the instrument; see figure. This distance value should stay constant for a given instrument.

(2) **ED: Top of Ed clamp to the face of the Ed sensor**
This distance value may vary between deployments, calibrations, and configuration changes.

(3) **LU: Top of Lu clamp to the window on the Lu face**
This distance value may vary between deployments, calibrations, and configuration changes.

(4) **PUC: Top of Ed clamp to the center of the ECO PUC window**
This value should stay constant for a given instrument.

These values must be recorded in the **COMMENTS** field of the "Station Setup" window in SatView for every deployment. Use the format "**PRESS 0.726 m, ED 0.118 m, LU 0.145, PUC 0.152 m**".



Measurements required to derive the sensor distance offsets. This is an edited version of a figure from the Operation Manual for the Profile II, revision K, 10 December 2012.

C. Time of deployment

Ideally, deployments will occur within an hour of the overpass time of ocean color satellites. Satellite overpass times depend on the orbit; approximate time ranges when Station ALOHA is in view are listed in the table below. The center times are best avoided since these are the times when sunglint occurs.

Priority	Satellite-Sensor	Overpass time (GMT)	Overpass time (HST)	Maximum Glint (HST)
1	SNPP-VIIRS	22:45 – 00:45 GMT	12:45 – 14:45 HST	13:30 HST
2	AQUA-MODIS	23:00 – 00:45 GMT	13:00 – 14:45 HST	13:50 HST
3	TERRA-MODIS	20:30 – 22:00 GMT	10:30 – 12:00 HST	11:15 HST

For daily overpass predictions, please visit http://www-air.larc.nasa.gov/tools/predict.htm. This predictor provides the time, satellite elevation, and percent likelihood of glint for each overpass.

It is recommended that the HyperPro deployments occur from 14:00 – 14:30 HST.

In the past, the optics casts (ac-s, LISST) and HyperPro casts were made back-to-back. The optics casts are made at noon. The timing of the optics casts will not change, hence the two casts will no longer be back-to-back.

D. Reference sensor

Mount the reference sensor (Es) with cable ties and tape to a high spot on the vessel away from shading.

E. Cables

Surface sensor

1. Connect the surface sensor to the computer COM port (COM4) via the serial to USB converter cable.
2. Connect the surface sensor to the power supply with the power/telemetry cable.

Profiler

1. Connect the sensor cables on the profiler.
2. Connect the power/telemetry cable from the profiler to the MDU-200 deck unit.
3. Connect the RS-232 cable from the deck unit to the computer COM port (COM1).
4. Connect the deck unit to the battery.
5. Secure all mechanical connections (shackles).

F. Computer startup

1. Turn on the computer.
2. Launch SatView.
3. Turn on the power to the profiler power supply. Instruments will start automatically.
4. Instruments should be sending data to the COM ports in use.
5. *COM port settings should be: 57,600 bps baud, 1 start bit, 8 data bits, 1 stop bit, no parity*.
6. Edit the following station metadata (Log – Station Setup).

Metadata	Example	Description
CRUISE-ID	HOT-254	
OPERATOR	BB, LF	operator initials
CLOUD_PERCENT	1/8 clear sun	fraction of cloud cover, plus a note whether the sun is clear or obscured
WAVE_HEIGHT	0.25 m	
WIND_SPEED	9 kts from West	
COMMENT	PRESS 0.726 m, ED 0.118 m, LU 0.145, PUC 0.152 m	sensor distance offsets
STATION_ID	Kahe	

G. BB2F dark counts

1. Place black electrical tape on the face of the BB2F, covering the entire surface. Do not use the cap in place of the tape (the cap is reflective).
2. Use the filename convention h250_dark_01.raw
3. Click “Start Logging” in SatView.
4. Collect data for 2 minutes.
5. Click “Stop Logging” in SatView.
6. Remove the tape and make sure the BB2F window is clean.

H. Pressure tare

1. Orient the HyperPro vertically upright on the deck of the ship.
2. In the SatView software, right-click on the instrument package (MPR0120).
3. Select “View List …”.
4. Select “Ancillary View”.
5. Click on the “Pressure Tare” button when ready.
6. Repeat this procedure if either the power is cycled to the instrument or SatView is restarted.

I. Cast sequence

Two operators are required – one to deploy the HyperPro and the other to man the computer.

1. Remove the sensor caps.
2. Deploy the profiler a minimum of 20 m from the vessel.
3. Perform two profiles followed by one yo-yo cast as detailed below.

PROFILE 1

a. Use the naming convention h250_aloha1.raw for the file.
b. When then instrument starts to free fall, hit the "Start Logging" button in SatView.
c. When the instrument reaches 180 m depth, hit the "Stop Logging" button in SatView. Do not log data deeper than 180 m depth as the pressure sensor saturates.
d. Pull the HyperPro back to the surface.

PROFILE 2

same as PROFILE 1

YO-YO

The entire yo-yo cast will be logged to a single file. It should take about 10 minutes total.

a. Use the naming convention h250_aloha_yoyo1.raw for the file.
b. When the instrument starts to free fall, hit the "Start Logging" button in SatView.
c. When the instrument reaches 20 m depth, pull the HyperPro back to the surface but do not stop logging.
d. Immediately repeat this 20 m cast a total of 5 times, continuing to log to the same file.
e. When the HyperPro has reached the surface after the fifth cast, hit the "Stop Logging" button in SatView.

J. Computer shutdown

1. Exit SATView.
2. Backup data to a thumb drive.
3. Shutdown the computer.

K. Cleaning the HyperPro

1. Pull the profiler back onto the ship.
2. Power down the instrument and disconnect the cables.
3. Rinse the instrument and cables with fresh water.
4. Dry sensor heads and BB2F with Kimwipes.
5. Replace the sensor caps.

L. Processing (optional)

Use ProSoft 8.1.1 (multicast mode) or higher. Earlier versions of ProSoft will not process yo-yo data. See the HyperPro data processing instructions for details.

M. Data distribution

After the cruise, place the collected raw HyperPro data and any new calibration files on the HOT ftp site:

ftp://ftp.soest.hawaii.edu/dkarl/hot/light/hyperpro

These data will be downloaded and processed at Oregon State University.

Raw and processed HyperPro data are available online from both the HOT program and Oregon State University at the following locations:

HOT	raw	ftp://ftp.soest.hawaii.edu/dkarl/hot/light/hyperpro
HOT	processed	http://hahana.soest.hawaii.edu/hot/hot-dogs/hydisplay.html
OSU	raw & processed	http://omel_test.coas.oregonstate.edu/region/hawaii/hyperpro/data/

fin