

R2R QA for CTD Profile Data

Status Update Report
Cyndy Chandler (WHOI)
Rolling Deck to Repository (R2R)



November 2016 Annual RVTEC Meeting



CTD – Conductivity, Temperature, Depth



Sea-Bird 911 plus

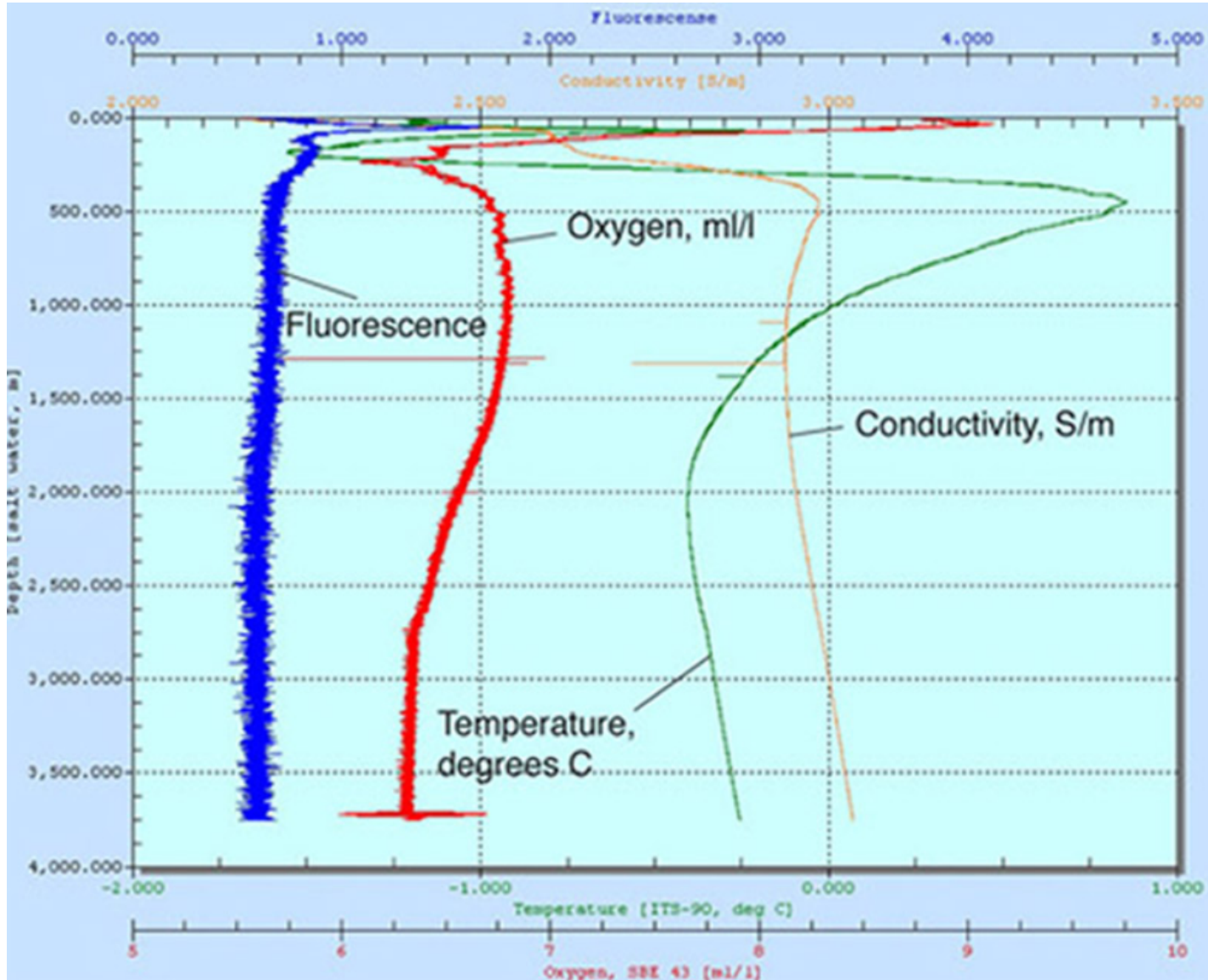
<http://www.seabird.com/sbe911plus-ctd>



(Plueddemann, WHOI; OOI KN222, 2014)

CTD data example

DEPTH (from pressure)



CTD data files

- Vessel resident CTD units with additional optional sensors (dissolved O₂, PAR, transmissometer, fluorometer)
- CTD data (and setup) file sets
- Set of files for each cast (CTD deployment)
 - Continuous profile data (down and up)
 - 'bottle files': bottle fire records

R2R QA for CTD profile data

- **Team Members**

Carolina Nobre (WHOI, Physical Oceanography Department)

Cyndy Chandler (WHOI, BCO-DMO, R2R)

Laura Stolp (WHOI, Shipboard Scientific Services)

- **General update on project status:**

- Batch SeaBird Processing

- Generates processed CTD files

- CTD QA script (python) that runs on CTD files from each cruise

- generates R2R QA summary report (XML)

Run on 978 cruise datasets (raw CTD data that had been broken out from cruise distributions)

- Processed CTD data products generated for 853 (of the 978)



R2R QA for CTD profile data

Initial results of QA processing:

- About 10% could not be assessed
 - missing files, PAR sensor issues
- CTD data from 853 cruises processed
 - ~40% of the cruises are all green lights
 - ~30% of the cruises have at least one yellow light
 - ~30% of the cruises have at least one red light

QA Dashboard – CTD Example

(Results displayed internally; pending feedback from experts)



Rolling Deck to Repository (R2R)

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R2R Quality Assessment Dashboard

This dashboard provides information about Quality Assessment (QA) tests performed by R2R. QA tests do *not* assess the scientific utility of data, but are intended to identify *suspicious data* which may indicate sensor problems. QA is performed on data files as originally delivered from vessels. This dashboard shows the output of the initial implementation of R2R QA protocols, and includes details of QA tests, thresholds used and results. We welcome your input; please contact us [HERE](#) with comments or suggestions.

SEARCH BY:






Vessel: Cruise:


Device Type:

CTD Filesets

Total Filesets: 1130 View:

Click column headings to sort

Rating	Device	Cruise	Vessel	Fileset ID			
	CTD <i>Sea-Bird SBE-911plus</i>	AE1026	Atlantic Explorer	108278	<input type="button" value="QA Summary"/>	<input type="button" value="QA Configuration"/>	<input type="button" value="File Manifest"/>
	CTD <i>Sea-Bird SBE-911plus</i>	AE1027	Atlantic Explorer	108283	<input type="button" value="QA Summary"/>	<input type="button" value="QA Configuration"/>	<input type="button" value="File Manifest"/>
	CTD <i>Sea-Bird SBE-911plus</i>	AE1029	Atlantic Explorer	108291	<input type="button" value="QA Summary"/>	<input type="button" value="QA Configuration"/>	<input type="button" value="File Manifest"/>
	CTD <i>Sea-Bird SBE-911plus</i>	AE1030	Atlantic Explorer	108295	<input type="button" value="QA Summary"/>	<input type="button" value="QA Configuration"/>	<input type="button" value="File Manifest"/>
	CTD	AE1031	Atlantic Explorer	108299	<input type="button" value="QA Summary"/>	<input type="button" value="QA Configuration"/>	<input type="button" value="File Manifest"/>






Rating	Device	Cruise	Vessel	Fileset ID	
	CTD <i>Sea-Bird SBE-911plus</i>	AE1026	Atlantic Explorer	108278	QA Summary QA Configuration File Manifest

QA Test Results Display

QA Summary Info

Cruise: AE1026
Vessel: Atlantic Explorer
Device Info: ctd (Sea-Bird SBE-911plus)

QA Tests

-  Presence of Raw Files:
Percent of Casts with all files: 100
-  Redundant T and Cond Sensors: *true*
-  Has Latitude and Longitude: *true*
-  Minimum Cast Depth: *true*
-  Sensor Data Ranges: *true*

QA Info Blocks

Total Raw Files: 16

Total Processed Files: 16

Bottles Fired: *True*

% of Casts with Bottles Fired: 100

Number of Sensors Detected: 13

Sensor Info: [*'Sensor Name : TemperatureSensor SensorID="55" Calibration Date : 21-May-10 '*,
'Sensor Name : ConductivitySensor SensorID="3" Calibration Date : 23-Apr-10 ',
'Sensor Name : PressureSensor SensorID="45" Calibration Date : 13-Feb-09',
'Sensor Name :

Rating	Device	Cruise	Vessel	Fileset ID	
	CTD <i>Sea-Bird SBE-911plus</i>	<u>AE1026</u>	<u>Atlantic Explorer</u>	108278	QA Summary QA Configuration File Manifest



QA Test Results Display

Rolling Deck to Repository (R2R)

QA Configuration Info

Cruise: AE1026
Vessel: Atlantic Explorer
Device Info: ctd (Sea-Bird SBE-911plus)

Presence of Raw Files
GREEN if 100% of the casts have .hex/.dat, .con and .hdr files; else RED
 Percent of Casts with all files: 100

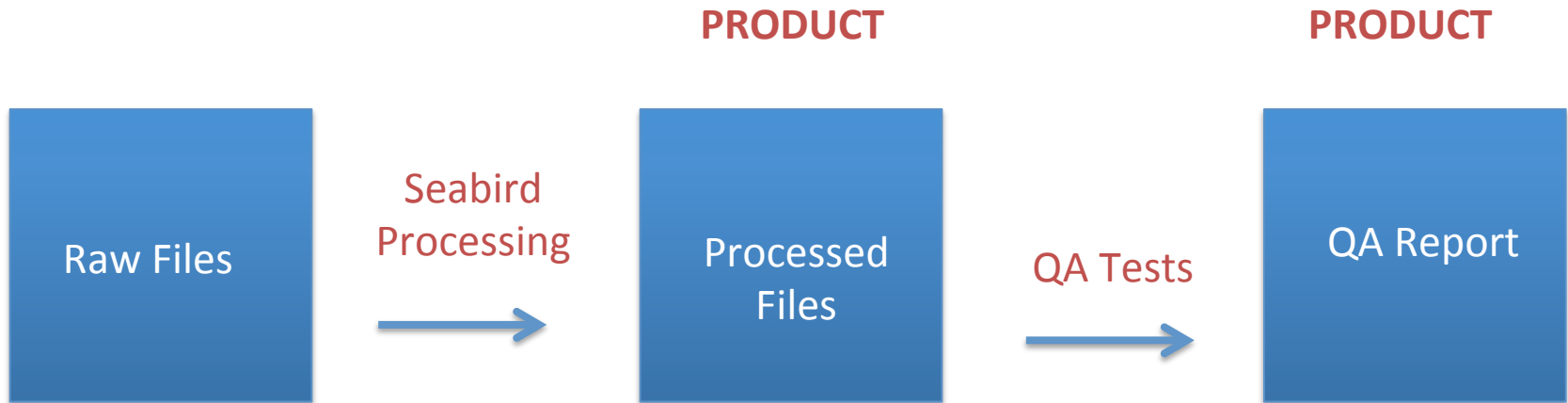
Redundant T and Cond Sensors
GREEN if all casts have dual T and Cond sensors; else YELLOW

Has Latitude and Longitude
GREEN if 100% of the profiles have latitude and longitude data; else RED

Minimum Cast Depth
GREEN if all casts have a maximum pressure > 5m; else RED

Sensor Data Ranges
GREEN if T and Cond data ranges fall within manufacturer spec; else RED

CTD QA Workflow



Raw Files -> Seabird Processing -> Processed CTD

■ Raw Files

- .hex/.dat
- .con/.xmlcon
- .hdr
- .bl
- .NAV
- ...

• Seabird Modules

- datcnv
- wildedit
- Celltm
- filter
- loopedit
- Binavg (2db)
- Split

• Parameters Extracted

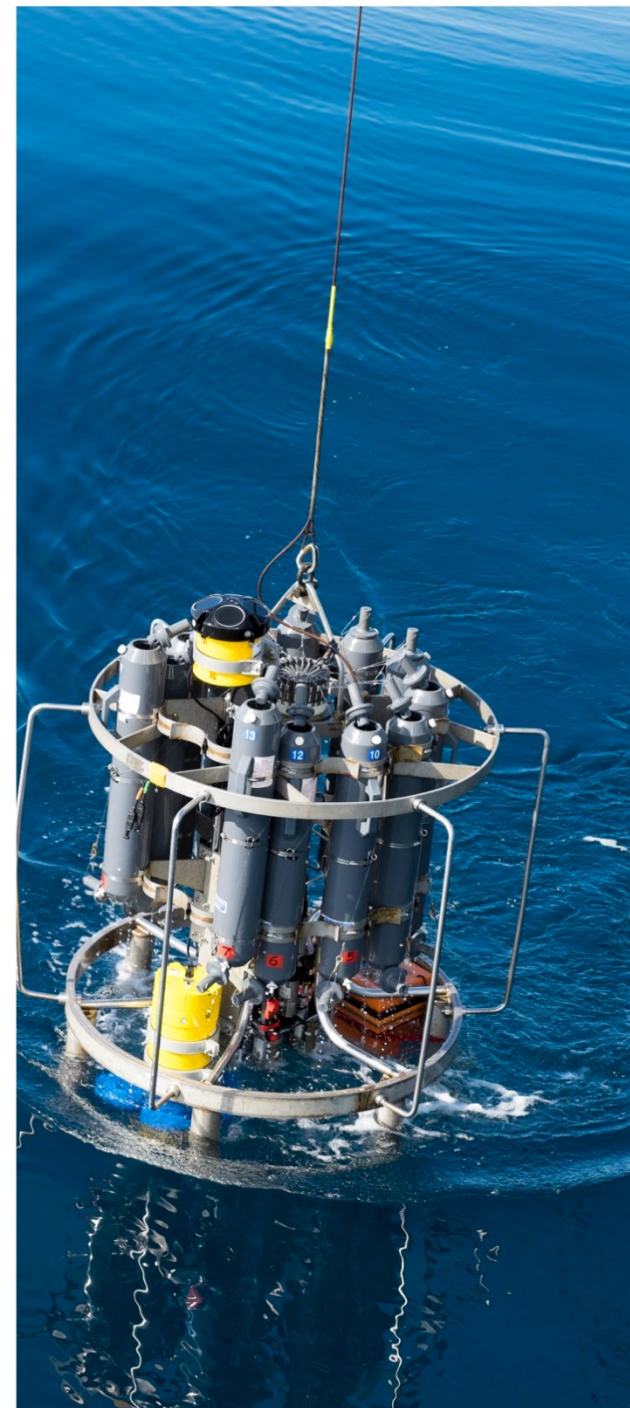
- Temperature
- Conductivity
- Oxygen
- Altimeter
- ...

■ .cnv Files

- No. of Stations
- Bottles Fired
- Max/min cast depth
- Sensor Configuration

QA – Metadata, Sensors Data Coverage

- Cruise metadata
 - Validity of the GPS data
 - Presence of all expected raw SeaBird files
 - Presence/validity of date/time entries
- Sensors:
 - Presence of Redundant Sensors
 - Data Ranges (comparison with manufacturer specs for each sensor)
 - Sensor List and Calibration Dates
- Data Coverage:
 - Number of stations detected
 - Detection of bottles fired
 - Minimum pressure test (casts went below 5m)



QA Process Steps

Process has evolved over several years; informed by feedback from Chris Paver (NCEI), shipboard techs, R2R partners, WHOI PO scientists and data managers

- Ability to handle different versions SeaBird SeaSoft
- Ability to modify/create .psa files and insert them into batch processing (SeaSave software setup for Windows)
- Added seabird modules (Wildedit, LoopEdit, BinAvg, Split) to generate processed CTD profile data product (2 decibar, bin-averaged, down/up cast files)

QA Process Steps

- R2R Nav processing validates temporal bounds (start/end dates) and fills in spatial bounds (WESN box)
- CTD QA process checks against those spatial and temporal cruise bounds, and identifies outlier casts in the XML report
- R2R breakout process reads the CTD QA XML report and updates SQL database (if needed), and resubmits files to NCEI if necessary (new version)
- In addition to individual test results, CTD QA report info block includes which casts/files failed tests
- Both the Level 0 (original raw) and Level 1 (processed) will be submitted to NCEI (one QA report applies to both)

QA Process Steps

Create R2R Quality Assessment (QA) Rollup Report

- XML format, compliant with R2R v1.0 schema
- Basic provenance information (cruise, fileset ID)
- Info Results Summary:
 - Total Raw Files, Total Processed Files
 - Bottles Fired (True / False)
 - % of Casts with Bottles Fired
 - Number of Sensors Detected
 - Sensor Info list: Sensor Name, SensorID, Calibration Date
- Create suite of sensor-specific plots
- FileSet Info: basic cruise and instrument metadata
- File manifest: file name, ID and checksum values

CTD raw and processed data plus QA files submitted to NCEI

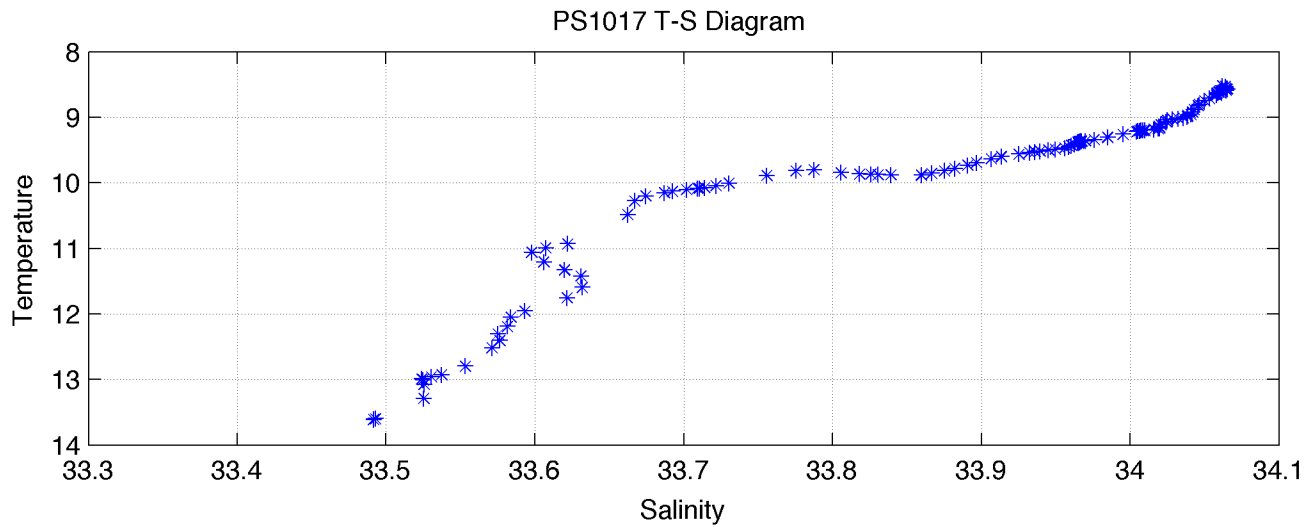
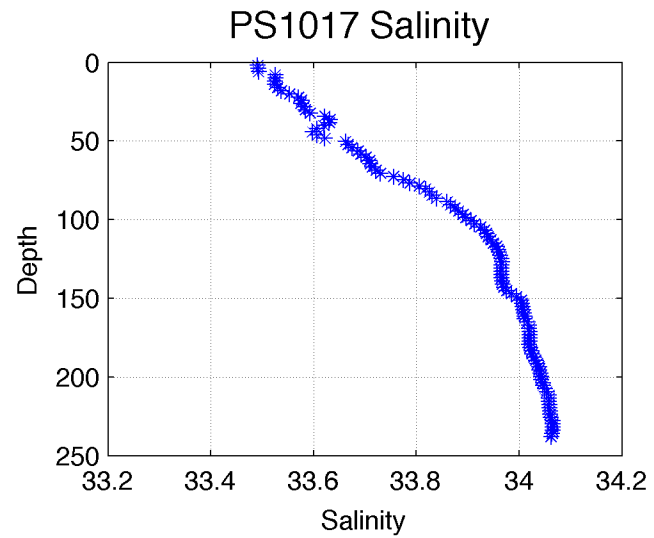
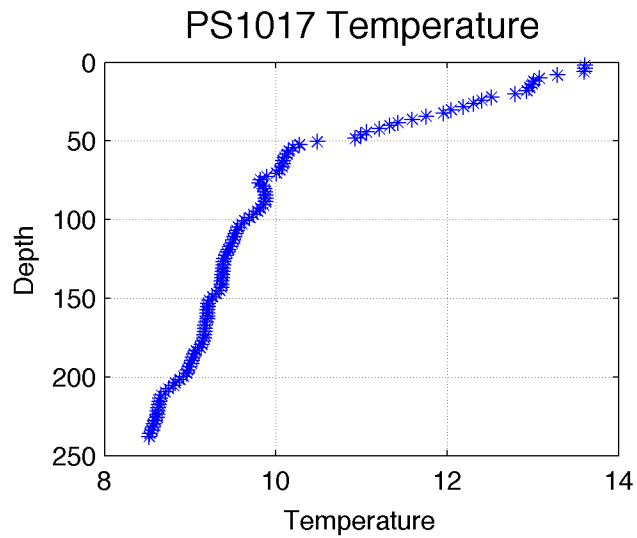
QA Process Sensor Tests

- Min/max range (sensor manufacturer specs)
- Gap
- Spike
- Constant Value
- Gradient Test
- Outlier Test
- Dual Sensor Presence Test (Temp and Cond)
- Dual Sensor Difference Test (Temp and Cond)

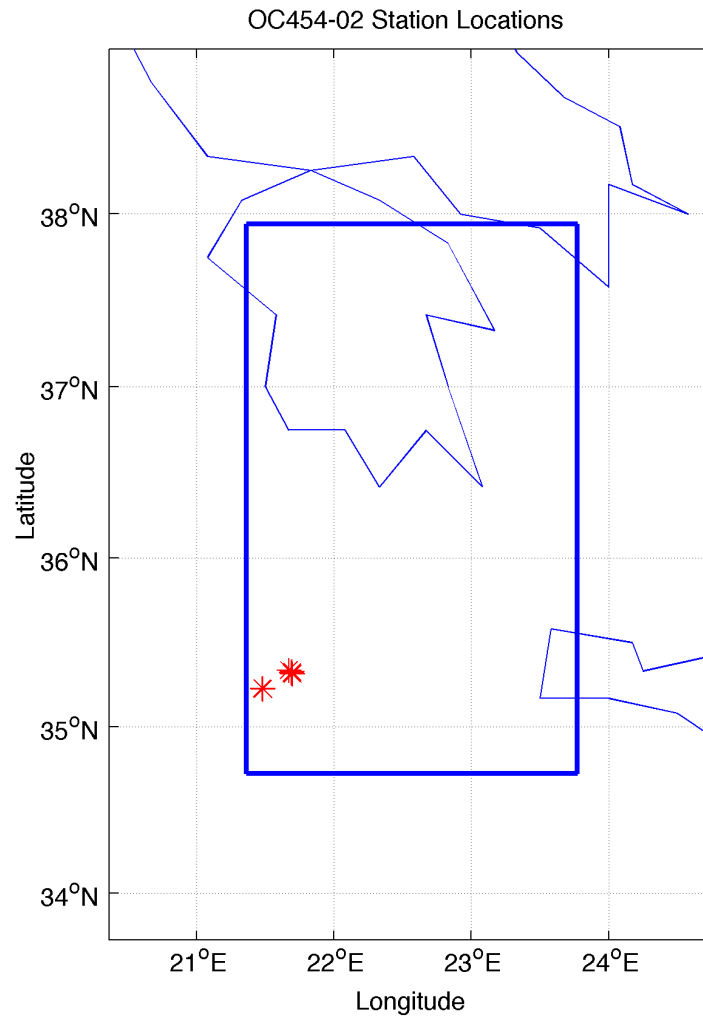
QA Process Results

- CTD QA report (XML)
- Sensor-specific QA plots
- QA dashboard display (access to QA results)
- Product: “Processed Seabird CTD files”
 - Consistent CTD data product from every cruise
 - Down and uptrace data file for each cast
 - .psa (processing file)
 - Con Reports (ASCII version with full instrument metadata, including all sensor info)

QA Plots



QA Plots



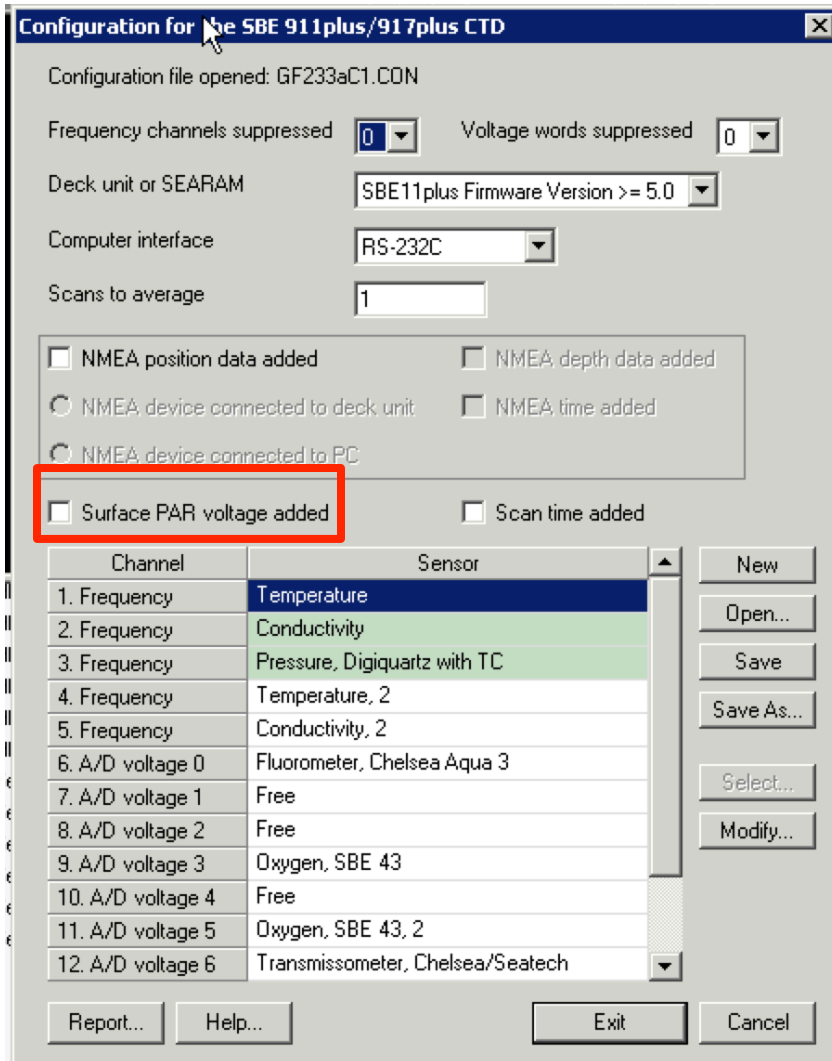
Future Enhancements

- Continue evaluating why some cruises are failing certain tests (adjust process)
- Review test results with domain experts
- Expose the CTD QA test results on the public dashboard view

Hurdles (and there have been a few...)

- Syntax of user supplied data
 - Example: `**Latitude: 3136.32`
- Mismatched File Names
- Deck Tests (missing files, empty files)
 - (missing files are red for example)
- PAR sensor inconsistency (details next slide)

PAR Sensor Issue

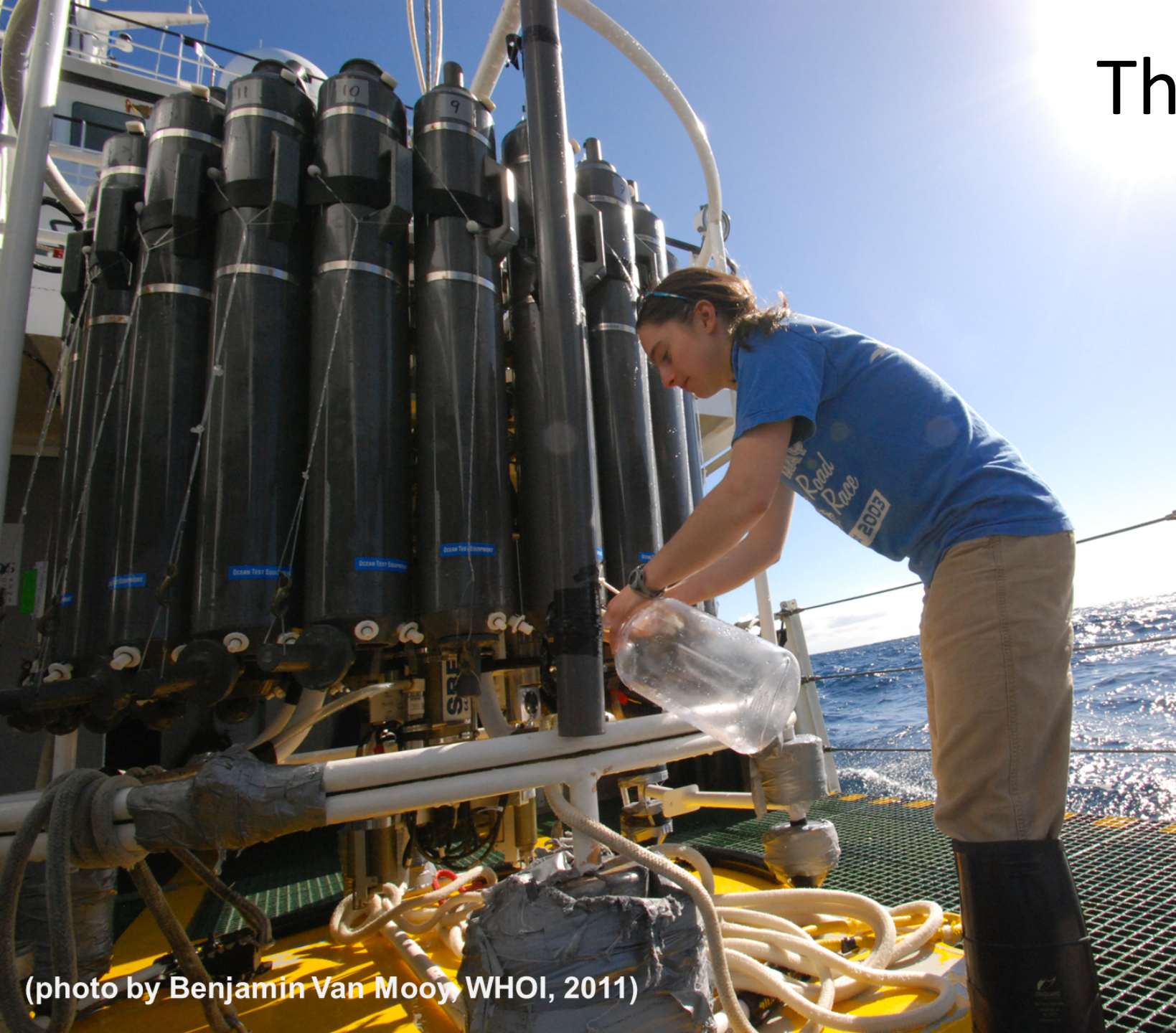


The ability to collect PAR data is determined by two separate 'switches', one on the deck unit and the other in the .con file

If the two don't match (switch for PAR data is on in the con file but not on the deck box, or vice versa) you end up with either no PAR data or bad data.

Thanks!

QUESTIONS ?



(photo by Benjamin Van Mooy, WHOI, 2011)