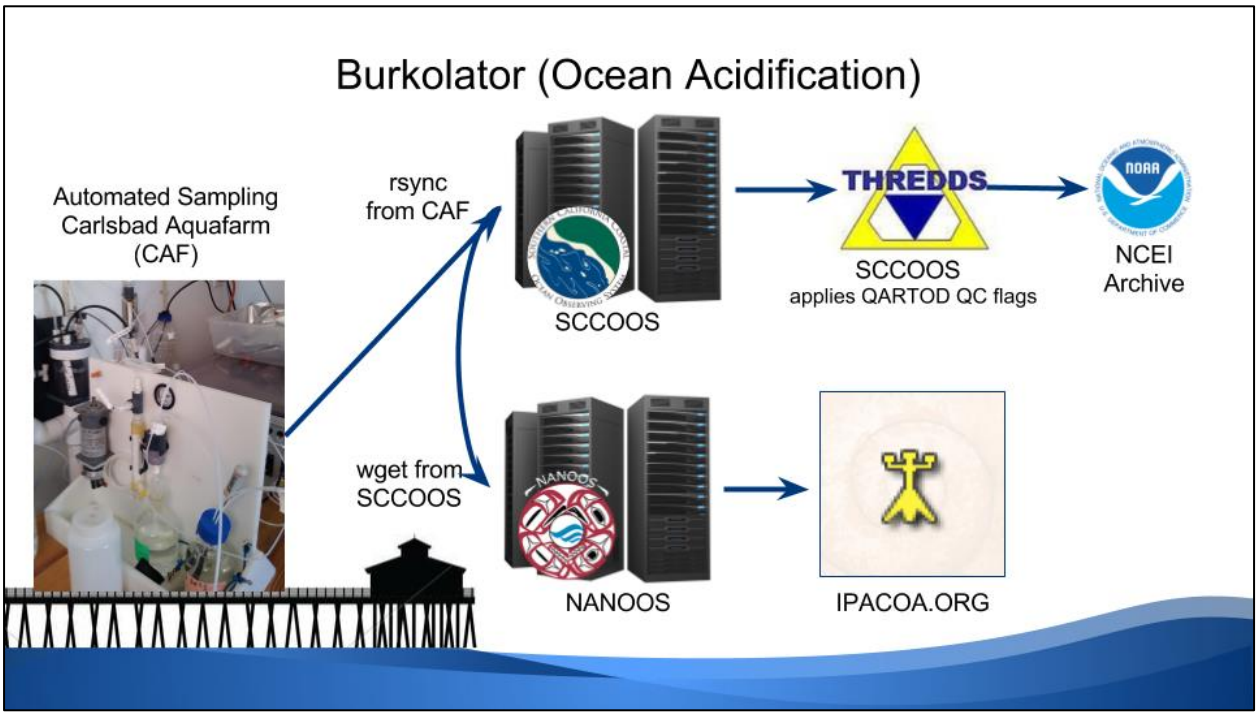
Burkolator Sensor Plan
May 8, 17

Background
Measurements pertaining to ocean acidification monitoring at the Carlsbad Aquafarm.

Measured Variables: CO2 Water (-3ft), Dissolved Inorganic Carbon (total) (-3ft), Salinity, Water Temperature
Derived Variables: Alkalinity (total), Omega Aragonite Saturation

Data Ingestion
Data are ingested by SCCOOS from the Burkolator instrumentation in real-time. This instrument



samples every 15 seconds however, data files are updated every 10 minutes.
Burkolator data are sent from the Carlsbad Aquafarm Burkolator instrument to SCCOOS using the Unix Rsync command over SSH every 10 minutes. From SCCOOS, these data go in two separate directions; 1. To NANOOS which is distributed through the IPACOA.org portal, 2. Through SCCOOS. These data are developed into NetCDF files that have OARTOD QC applied and are then made available on SCCOOS THREDDS and ERDDAP servers. The NetCDF files are then ready for NCEI archival.

Data Management
1. Raw Data files from the Burkolator are stored on SCCOOS servers and have the naming scheme CAF_RTproc_YYYYMMDDHHMM. These non-public RTproc files contain real-time processed data including pCO2, TCO2, T, S. The median is recorded over a 15

second processing interval. These files also contain all the calculated variables (such as omega, TA, etc). Each file contains approximately 1 day of data.

2. NANOOS accesses these data via a wget process from http://sccoos.org/data_src/caf/
3. The IPACOA website, which is a collaborative web portal between NANOOS, CeNCOOS, and SCCOOS, hosts ocean acidification measurements. This data portal is managed by NANOOSs' Data Manager, Emilio Mayorga.
4. NetCDF files are created with the appropriate implementation of metadata and quality control. These files conform with current National Centers for Environmental Information (NCEI) NetCDF Template v2.0 conventions.

Data Distribution

NetCDF files are be available in a variety of formats through the SCCOOS THREDDS and ERDDAP servers. Data are updated every 10 minutes.

SCCOOS THREDDS server: http://sccoos.org/thredds/
SCCOOS ERDDAP server: http://sccoos.org/erddap/

Quality Control

Automated quality control tests are based on QARTOD guidelines. The following tests are performed on the Burkolator data 1.) syntax, 2.) gross range, 3.) spike, 4.) climatology, and 5.) flat line.

These tests and thresholds are described on http://sccoos.org/about/dmac/oaqc/

QC SETTINGS	Temperature	pCO2_atm	Salinity	TCO2_mol_kg	Notes
Timing/Gap					Samples recorded every 15 seconds
Syntax	Yes	Yes	Yes	Yes	
Location					Does not apply to fixed deployments
Gross Range	10 to 30 C Suspect 0 to 120 C Bad	250 to 800 Suspect 200 to 1500 Bad	20 to 35 psu Suspect 20 to 40 psu Bad	1900 to 2300 Suspect 1900 to 2300 dbar Bad	
Spike	0.5 C Suspect 1 C Bad	25 Suspect 50 Bad	0.5 psu Suspect 1.0 psu Bad	None	
Climatology	0 to 30 C	0 to 1500	10 to 35 psu	0 to 2500 dbar	Applied in gross range
Rate of Change / Current Gradient					TBD
Flat Line	50 reps Suspect 120 reps Bad eps 0.01C	20 reps Suspect 120 reps Bad eps 0.01	20 reps Suspect 120 reps Bad eps 0.0001 (1ppm)	2 reps Suspect 3 reps Bad eps 0.01	

The table below has been reproduced with descriptions of the QC tests.
Timing/Gap Test – Check for arrival of data. (Samples recorded every 15 seconds)

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Syntax Test – Check to ensure that the message is structured properly.
Location Test – Check for reasonable geographic location. (Does not apply to fixed deployments)
Gross Range Test – Data point exceeds sensor or operator – selected min/max.
Spike Test – Data point n-1 exceeds a selected threshold relative to adjacent data points.
Climatology Test – Test that data point falls within seasonal expectations. (Applied in gross range)
Range of Change Test – Excessive rise/fall test. (Not implemented)
Flat Line Test – Invariant value.

Quality Control tests are implemented with code developed at IOOS https://github.com/ioos/qartod

Daily raw files are run through quality control and appended with quality control flags to yearly NetCDF files. These NetCDF files are available from http://sccoos.org/thredds/ and http://sccoos.org/erddap/

Archiving

SCCOOS Burkolator data are maintained, curated and backed up at SIO and the University of California, San Diego Supercomputer Center.

Beginning April 28, 2017, SCCOOS now archives the Carlsbad Aquafarm Burkolator NetCDF files at the National Centers for Environmental Information (NCEI). These files are setup for yearly archival. Our files meet the established requirements set up for SCCOOS Automated Shore stations and will be ingested into the archive under the same ATRAC agreement and ingest procedure.

SCCOOS maintains a manifest with a hash and location of data which NCEI will archive. http://sccoos.org/dr/metadata/ncei/autoss_archive_manifest_sha256.txt NCEI compares this hash with their records to determine if the data are to be archived.
NCEI harvests Burkolator data directly from our THREDDS server http://sccoos.org/thredds/catalog/caf/catalog.html.

Metadata documentation are submitted alongside the data or created on deposit/ transformation in order to make the data reusable. The metadata are available in multiple formats, ASCII FGDC, XML FGDC. ISO 19115-2 metadata are available, on the following link: http://sccoos.org/thredds/catalog/caf/catalog.html

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Permission Restrictions
Current funding is provided by the National Oceanic and Atmospheric Administration (NOAA). When used for web displays and online resources, please provide a link to the SCCOOS homepage. For instance, in standard html:

Data courtesy of SCCOOS

For offline references, please choose the appropriate form from the recommended acknowledgements below.

- Short form (figure captions, etc.)

"... data from SCCOOS"

- Longer form (in text)

"...data were furnished by the Southern California Coastal Ocean Observing System."

- Full form (acknowledgements at conclusion of papers, etc.)

"...data were furnished by the Southern California Coastal Ocean Observing System (SCCOOS), a regional partner of the United States Integrated Ocean Observing System (IOOS®)."

Intellectual Property Rights
The funding agency & the University of California, San Diego through a contractual agreement.

The IPACOA portal was funded by U.S. IOOS, with data streams contributed by regional IOOS observing systems in Alaska (AOOS), Washington and Oregon (NANOOS), Central and Northern California (CeNCOOS), Southern California (SCCOOS), and the Pacific Islands (PacIOOS) as well as through NOAA's Ocean Acidification Program (OAP) and Pacific Marine Environmental Laboratory (PMEL). Data presented here were funded through NOAA OAP, U.S. IOOS, or regional observing system collaborators.