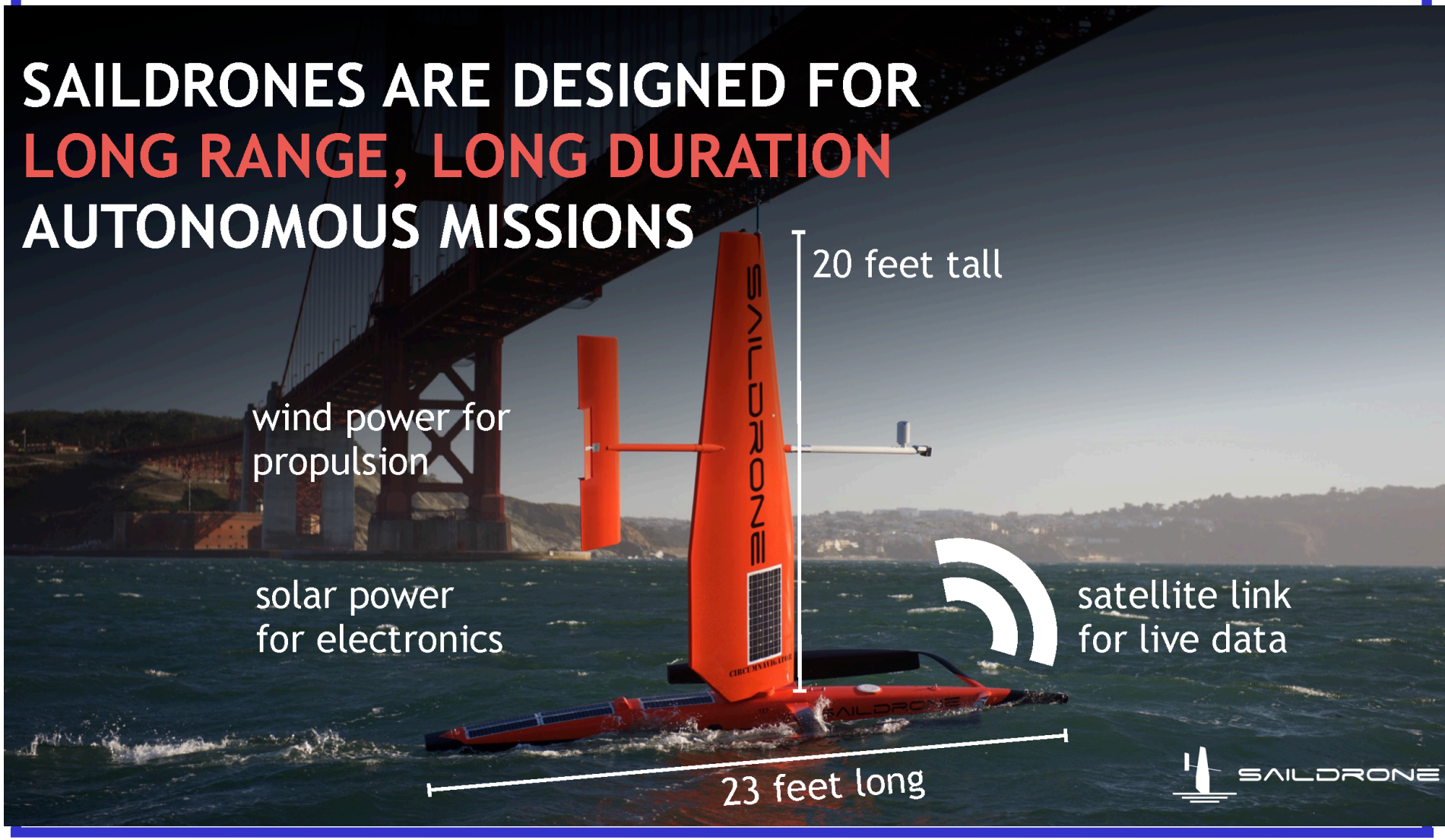
National Oceanographic Partnership Program

Using Saildrone autonomous in situ data for satellite validation and research into upper ocean physics and ecology

Chelle Gentemann


SAILDRONES ARE DESIGNED FOR
LONG RANGE, LONG DURATION
AUTONOMOUS MISSIONS
20 feet tall
wind power for propulsion
solar power for electronics
satellite link for live data
23 feet long
SAILDRONE


SAILDRONE

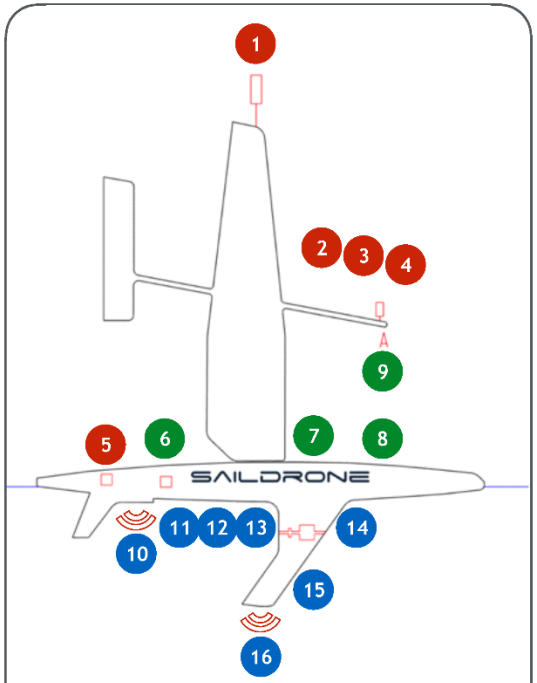
SAILDRONE GEN 4 SPECIFICATIONS AND SENSOR SUITE

Atmospheric Measurements

- Wind Speed, Wind Direction — **1** Anemometer @ +4.5m, Gill Windmaster 3D ultrasonic 20H
- Sunlight — **2** Sunshine Pyranometer @ +2.2m, Delta-T Devices SPN1
- Sunlight — **3** Pyranometer @ +2.2m, Eppley PSP & PIR
- Air Temperature, Humidity — **4** Meteorological Probe @ +2.2m, Rotronic HC2 - S3 with rad shield
- Air Pressure — **5** Digital Barometer @ +0.2m, Vaisala BAROCAP PTB210

Oceanic Surface Measurements

- Wave Height & Period — **6** Dual GPS & IMU, Vectornav / KVH
- pCO_2 — **7** CO_2 System @ +0.3m, PMEL ASVCO$_2$
- Magnetic Field — **8** Magnetometer @ 0m, Barrington MAG 648
- Skin Temperature — **9** SST IR Pyrometer @ +2.2m, Heitronics KT15 II



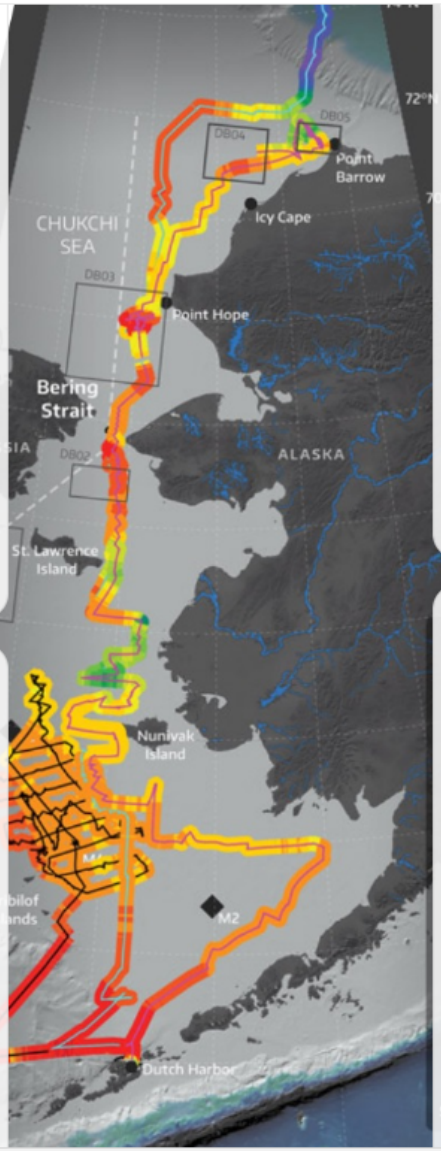
Length: 23 ft
Height: 15 ft
Depth: 7 ft
Weight: 1200 lbs, loaded
Speed: Transit ~ 3 Kt, Max ~ 8 Kt
Payload Power: 30w Steady state
Payload Capacity: 250 lbs
Max deployed duration; 12 months
Longest voyage: 10,000 miles

Oceanic Sub-Surface Measurements

- Ocean Currents — **10** ADCP @ -0.2m, Teledyne RDI Workhorse 300 kHz
- Chl*a*, CDOM Concentration, Red Backscatter — **11** Fluorometer @ -0.2m, Sea-bird Scientific WET labs Eco Triplet
- Dissolved Oxygen — **12** Oxygen Optode @ -0.5m, Aanderaa 4831
- pCO_2 — **13** CO_2 System @ -0.5m, PMEL ASVCO$_2$, Sea-Bird Scientific SBE Prawler, Honeywell Durafet
- Water Temperature, Salinity — **14** Thermosalinograph @ -0.5m, Teledyne RDI Citadel TS-NH
- Marine Mammal Presence — **15** Passive Acoustic Recorder, Greenridge Sciences Inc. Acousonde
- Fish Biomass, Bathymetry — **16** WBAT @ -2.5m, SIMRAD EK 80; Multi-beam Sonar @ -2.5m, Norbit iWBMS

A UNIQUE PLATFORM

Saildrones are Unmanned Surface Vehicles (USVs) designed for long range long duration ocean data collection missions of up to 12 months. Launched and retrieved from a dock, the Saildrone fleet navigates to a chosen study area using wind power for propulsion, transiting at 3-5 knots. Each drone then starts collecting high resolution data, either holding station or following a survey pattern as required by the specific mission objectives. Saildrone USVs operate around the world, in any ocean conditions. By augmenting expensive ship observations with a fleet of Saildrones, science-grade data can cost-effectively and autonomously be gathered over large ocean areas.



PRECISE MEASUREMENTS

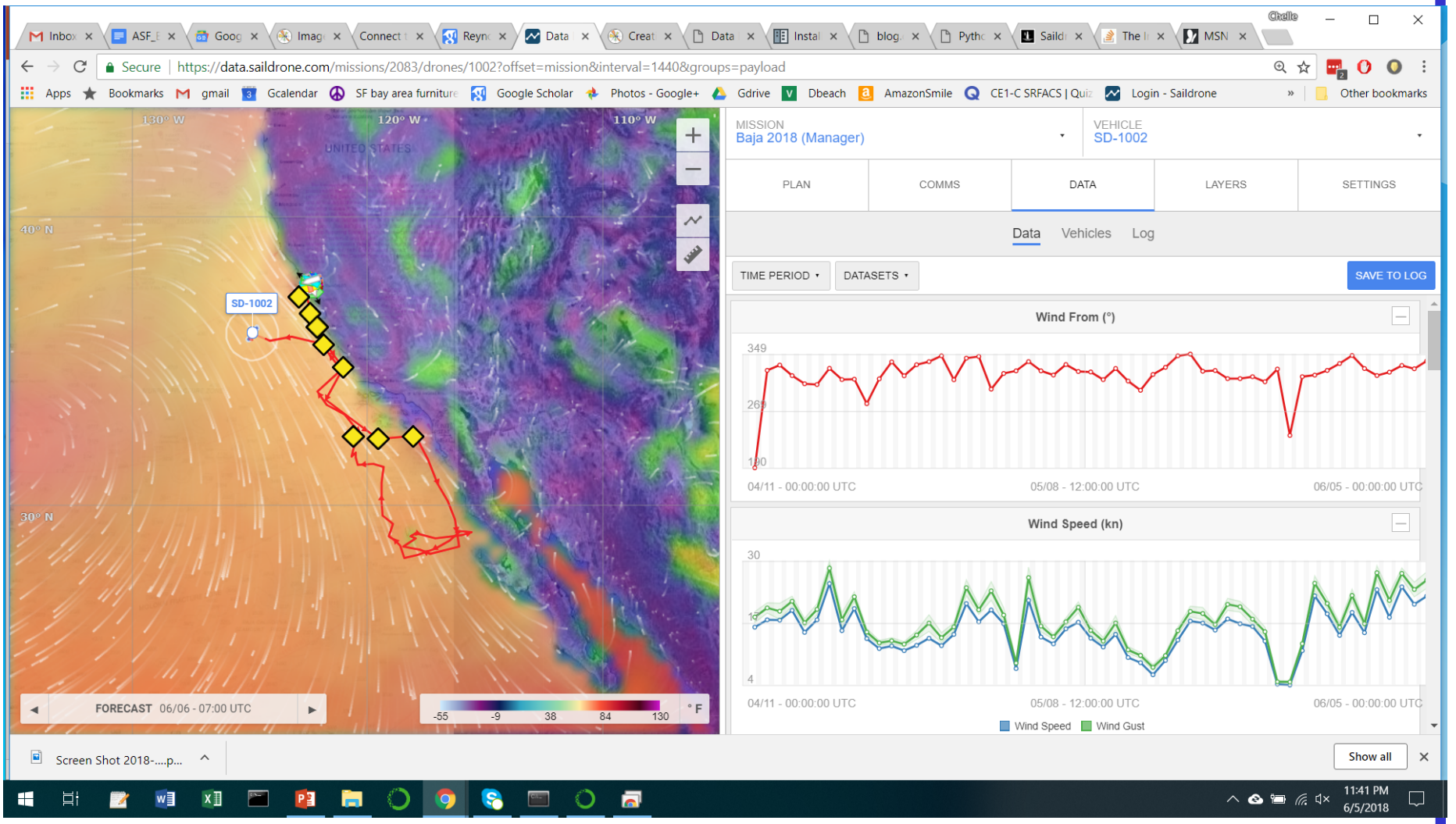
The Saildrone USV carries a comprehensive scientific sensor suite measuring key environmental variables, from atmospheric to surface and sub-surface. Measurements for each variable have been validated by NOAA through extensive comparison with ship and buoy measurements and recognized as climate-grade quality. In addition to our standard met/ocean sensor suite, Saildrone USVs can also carry a pCO2 sensor for carbon applications, an ADCP for current profiling and a specialized echo sounder for fish stock assessment and survey grade depth.

MISSION-AS-A-SERVICE

Saildrone handles all operational mission execution to deliver high quality, high resolution ocean data to your desktop or mobile. Found something interesting? The Saildrone USVs can be re-tasked, in real time to measure interesting features in greater detail. Welcome to adaptive sampling. We take care of all live operations, from launch & retrieval of the drones to piloting the fleet in busy waterways, so you can focus on the data, yet remain in control.

REAL TIME DATA

The in situ data collected by the Saildrone fleet is transmitted back to shore in real-time via satellite. This data is delivered to you seamlessly through a user-friendly web portal, which can be accessed on any computer or smart phone for live data manipulation and visualization. This includes real-time ADCP and echo sounder data. We deliver raw data from calibrated sensors, as well as quality controlled and processed data according to the latest scientific conventions and best practices. All of our data is also accessible via a modern API for seamless ingestion.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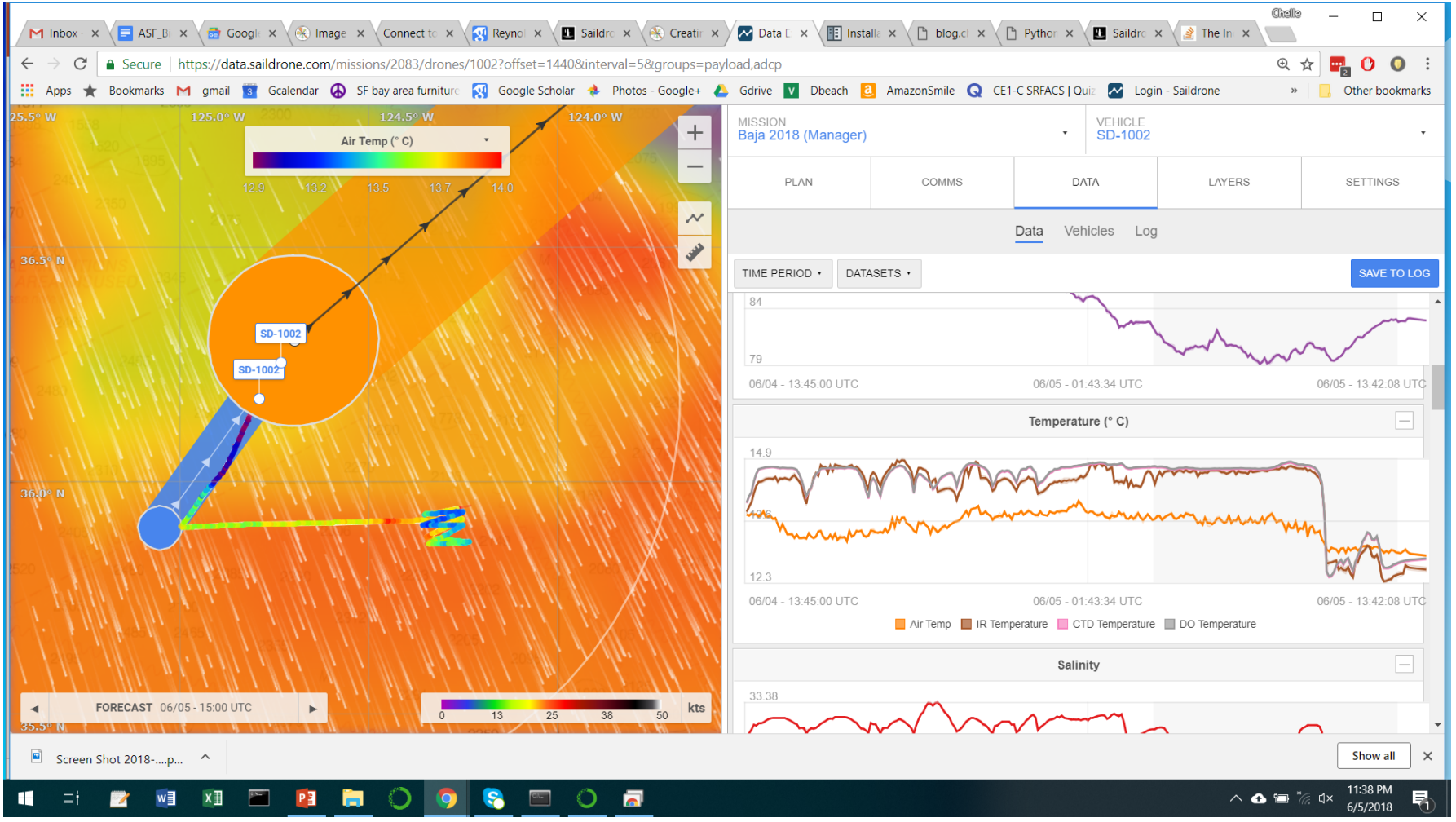
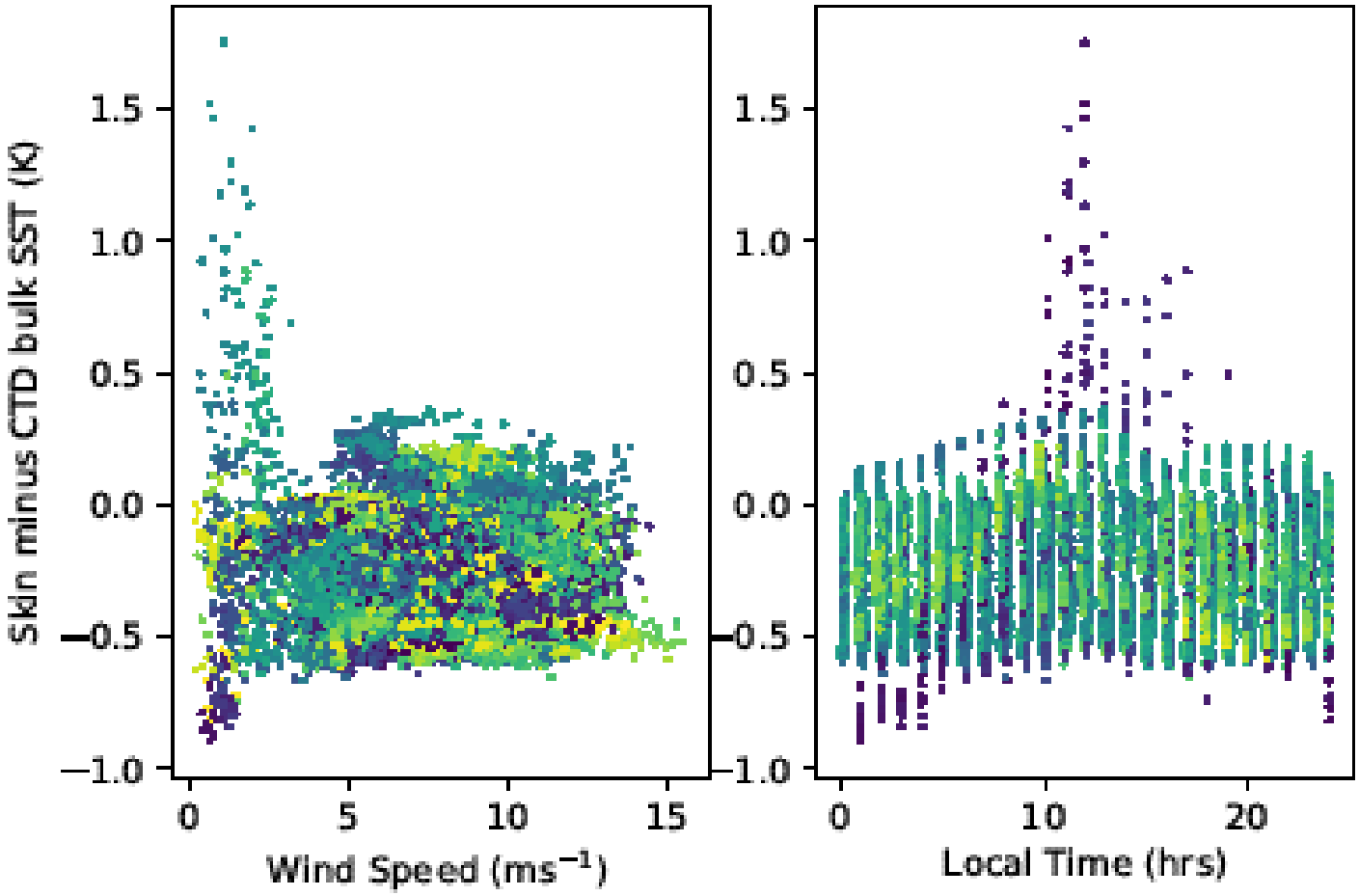
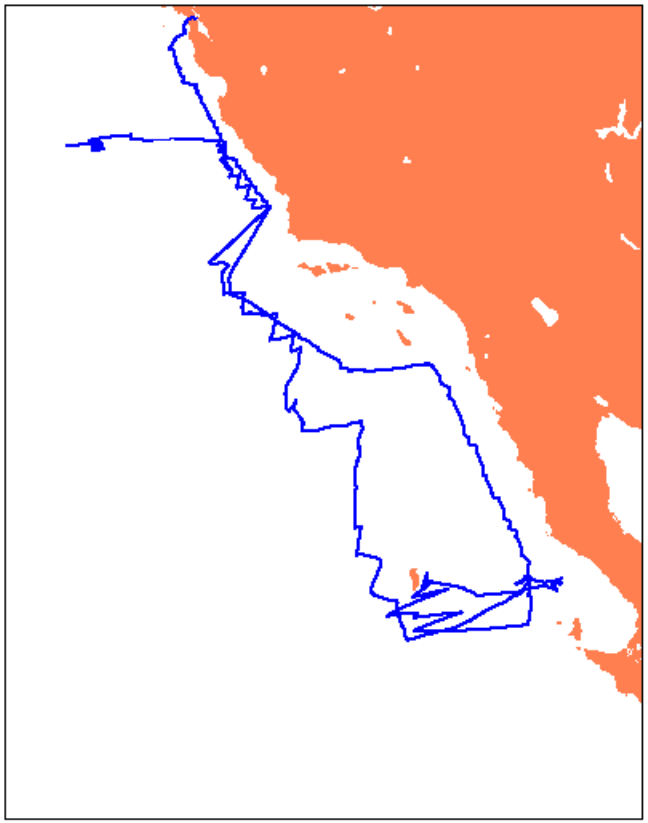
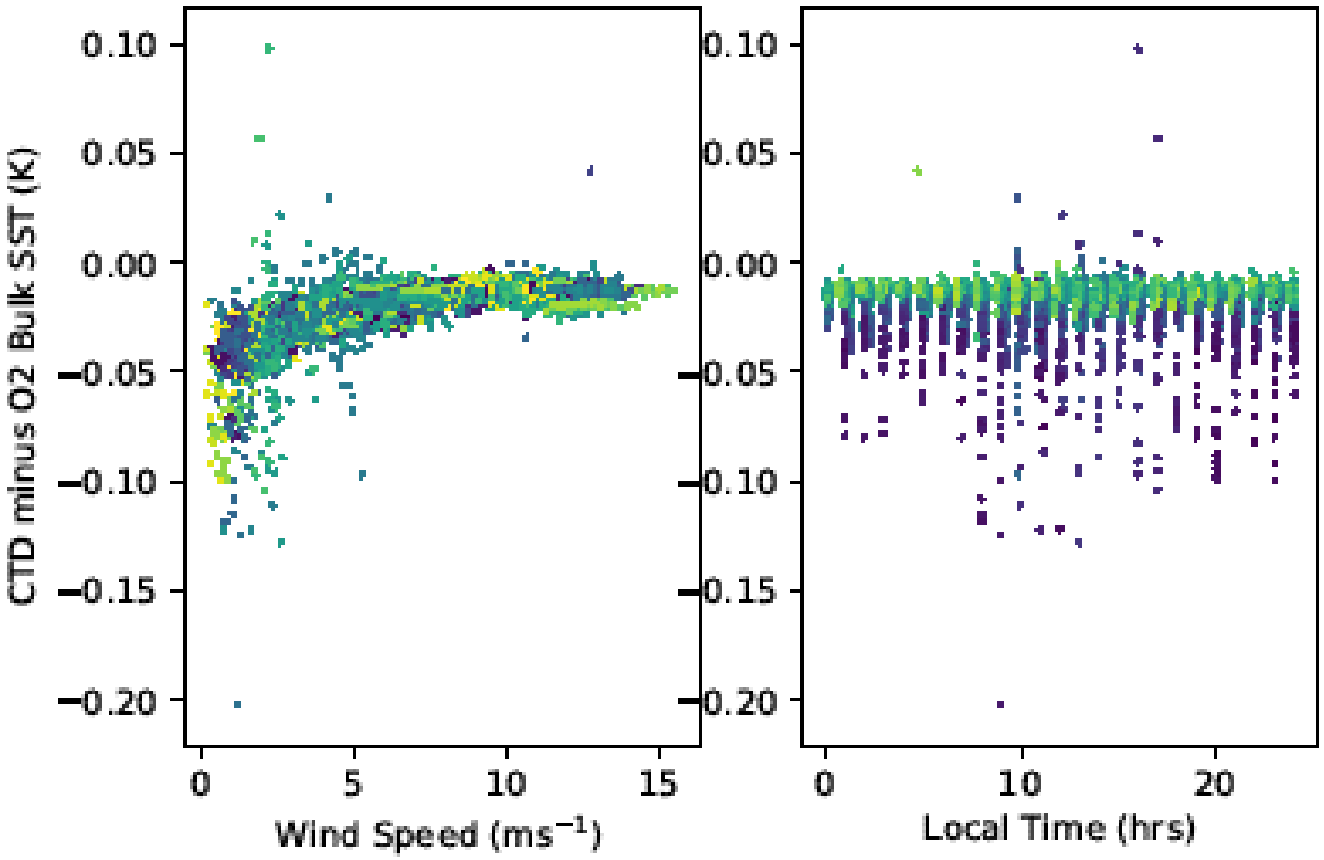
130° W
120° W
110° W
40° N
30° N
SD-1002
FORECAST 06/06 - 07:00 UTC
-55 -9 38 84 130 °F
MISSION
Baja 2018 (Manager)
VEHICLE
SD-1002
PLAN
COMMS
DATA
LAYERS
SETTINGS
Data
Vehicles
Log
TIME PERIOD
DATASETS
SAVE TO LOG
Wind From (°)
349
269
190
04/11 - 00:00:00 UTC
05/08 - 12:00:00 UTC
06/05 - 00:00:00 UTC
Wind Speed (kn)
30
17
4
04/11 - 00:00:00 UTC
05/08 - 12:00:00 UTC
06/05 - 00:00:00 UTC
Wind Speed
Wind Gust
Screen Shot 2018-....p...
Show all
11:41 PM
6/5/2018


https://data.saildrone.com/missions/2083/drones/1002?offset=1440&interval=5&groups=payload,adcp
Air Temp (° C)
12.9
13.2
13.5
13.7
14.0
SD-1002
SD-1002
FORECAST 06/05 - 15:00 UTC
0
13
25
38
50
kts
MISSION
Baja 2018 (Manager)
VEHICLE
SD-1002
PLAN
COMMS
DATA
LAYERS
SETTINGS
Data
Vehicles
Log
TIME PERIOD
DATASETS
SAVE TO LOG
84
79
06/04 - 13:45:00 UTC
06/05 - 01:43:34 UTC
06/05 - 13:42:08 UTC
Temperature (° C)
14.9
12.3
06/04 - 13:45:00 UTC
06/05 - 01:43:34 UTC
06/05 - 13:42:08 UTC
Air Temp
IR Temperature
CTD Temperature
DO Temperature
Salinity
33.38
Screen Shot 2018-....p...
Show all
11:38 PM
6/5/2018


Skin minus CTD bulk SST (K)
1.5
1.0
0.5
0.0
−0.5
−1.0
0
5
10
15
Wind Speed (ms^{-1})
0
10
20
Local Time (hrs)




CTD minus O2 Bulk SST (K)
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
0
5
10
15
Wind Speed (ms^{-1})
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.20
0
10
20
Local Time (hrs)

Sea Ice Remnant Svalbard July 17, 2008
Image credit: Camille Seaman

5 Arctic Cruises

Five 90-day cruises to Arctic
Additional SST profile obs
Improved SST skin

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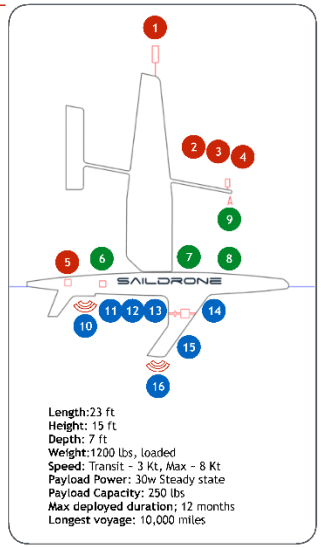

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