

# UNOLS Webinar – Oct 19, 2020

## Instrumentation and Data Facilities

### UHDAS and ADCPs

Jules Hummon  
University of Hawaii

Instrument = “**ADCP**”:

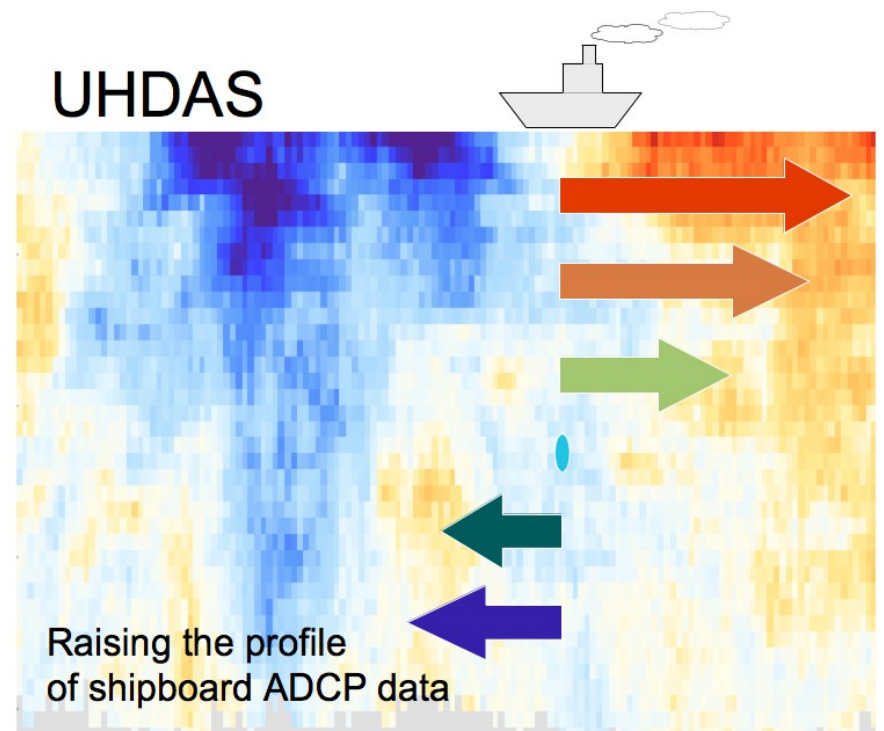
- **A**coustic **D**oppler **C**urrent **P**rofiler
- Uses Doppler frequency shift
- measure relative motion of the water past the ship
- Measurements at different depths: make a profile of currents

Acquisition System = “**UHDAS**”:

University of **H**awaii **D**ata **A**cquisition **S**ystem

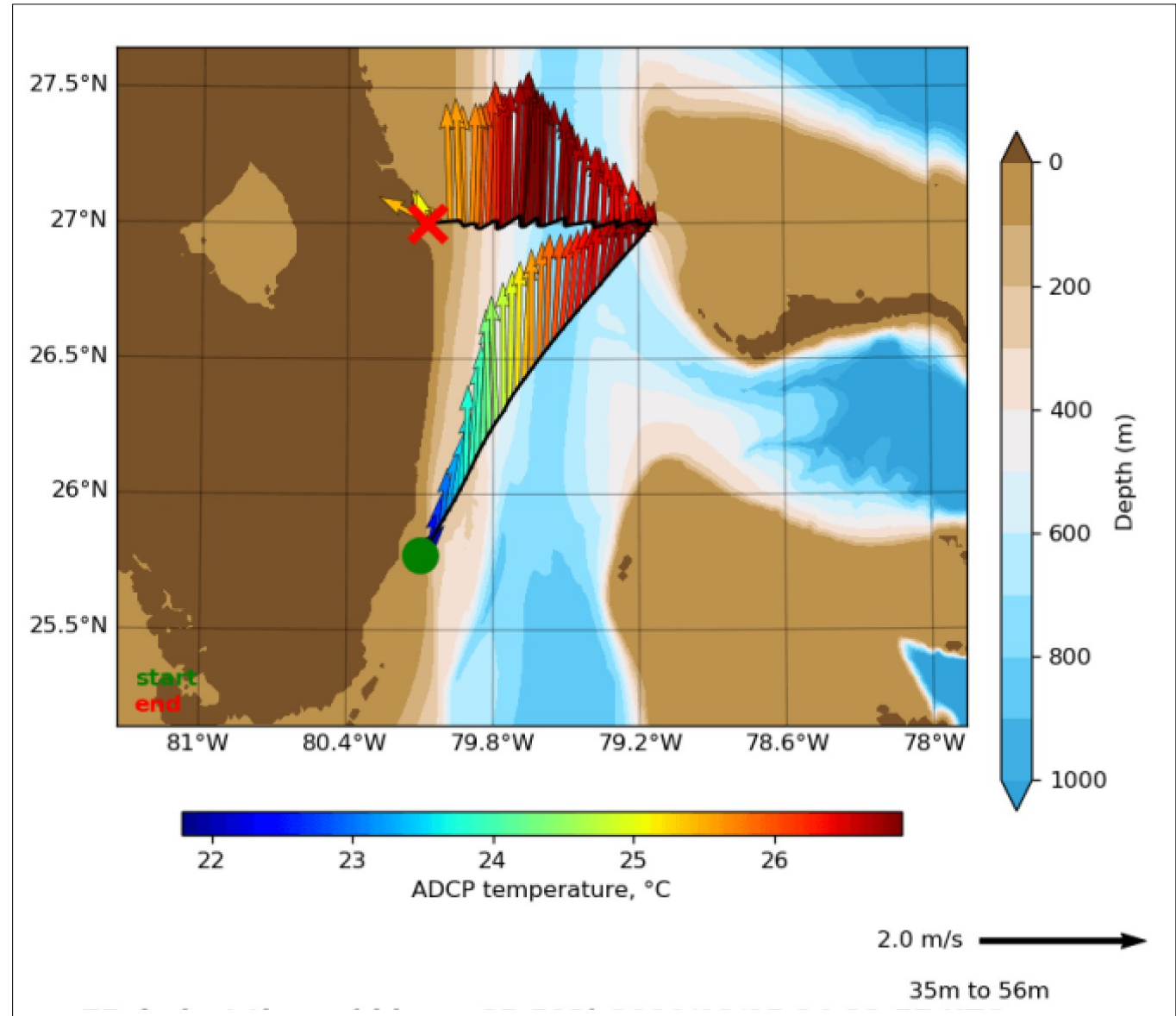
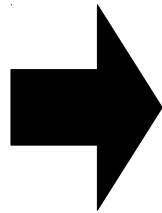
UHDAS Goals:

- reliable near real-time ocean currents at sea
- long-term utility of original and processed data



# UHDAS+ADCP: What does it do?

Time,  
ADCP  
Position  
Attitude



primitive data

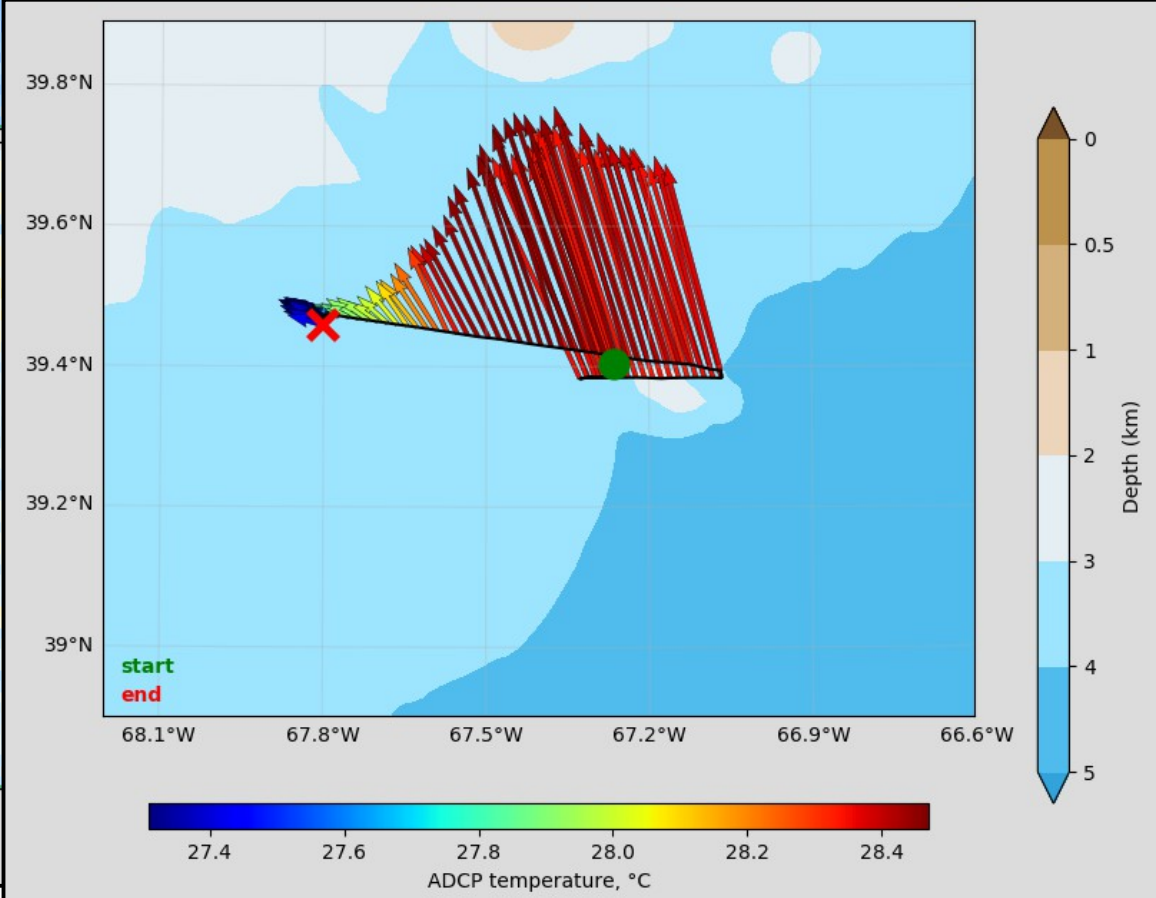
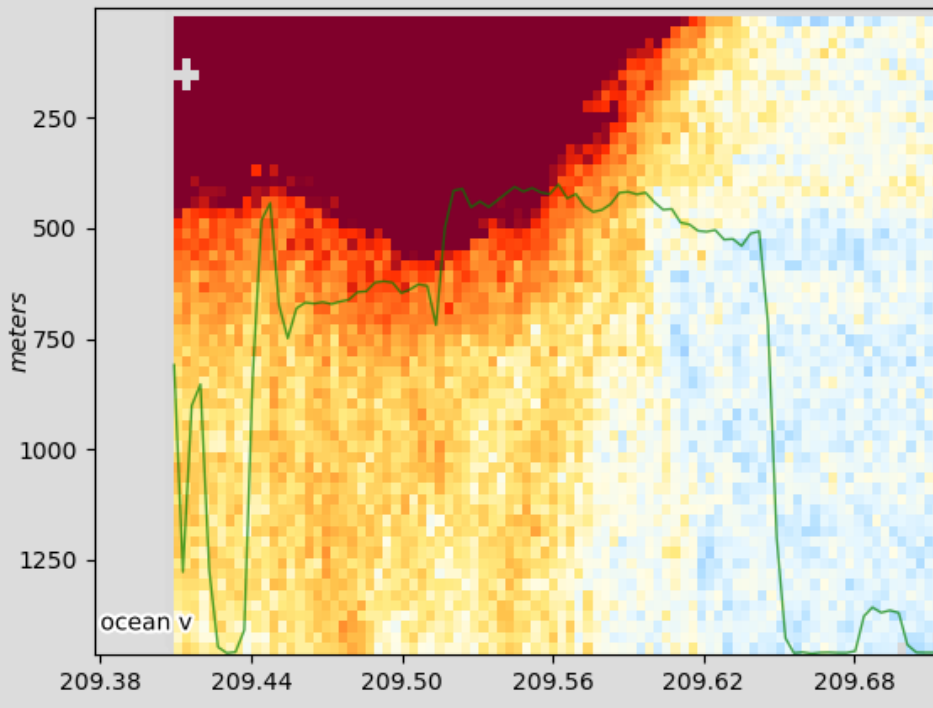
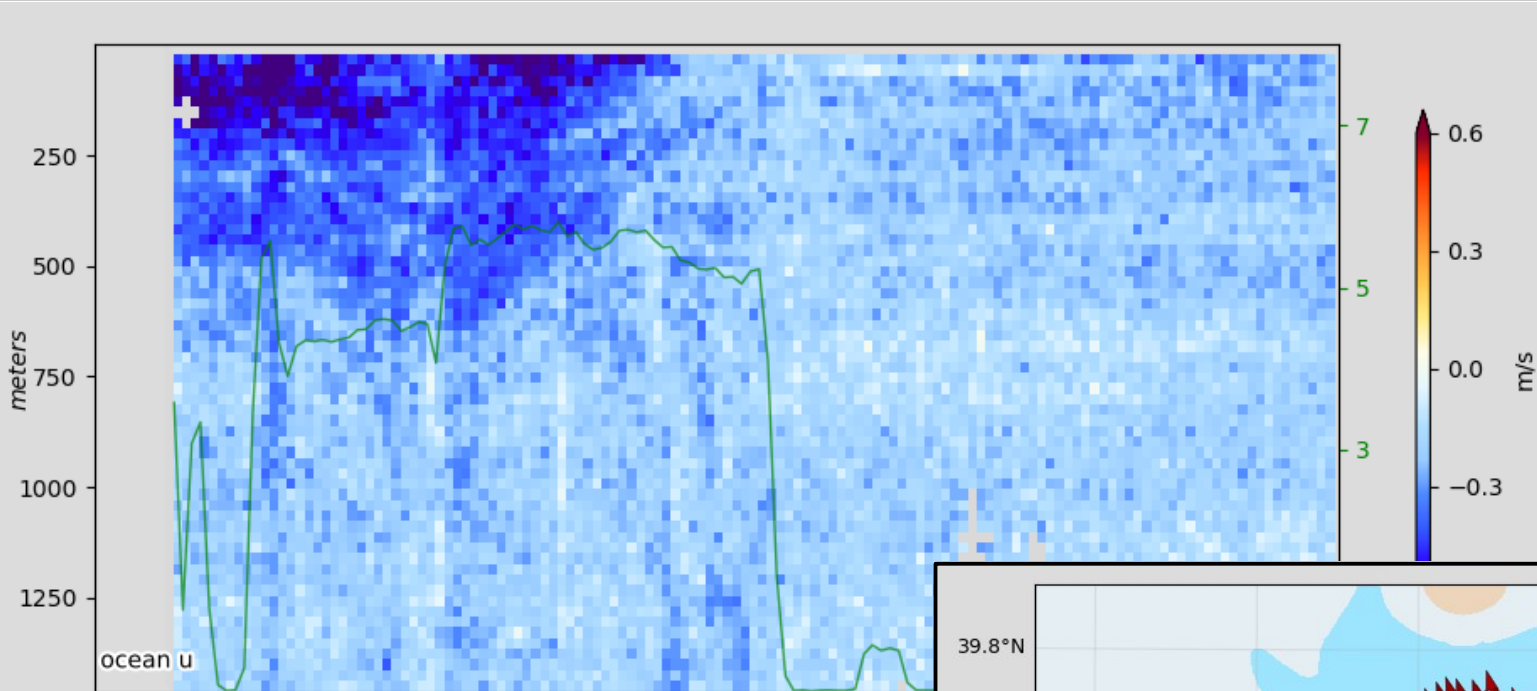
ocean  
velocities

# Who uses UHDAS?

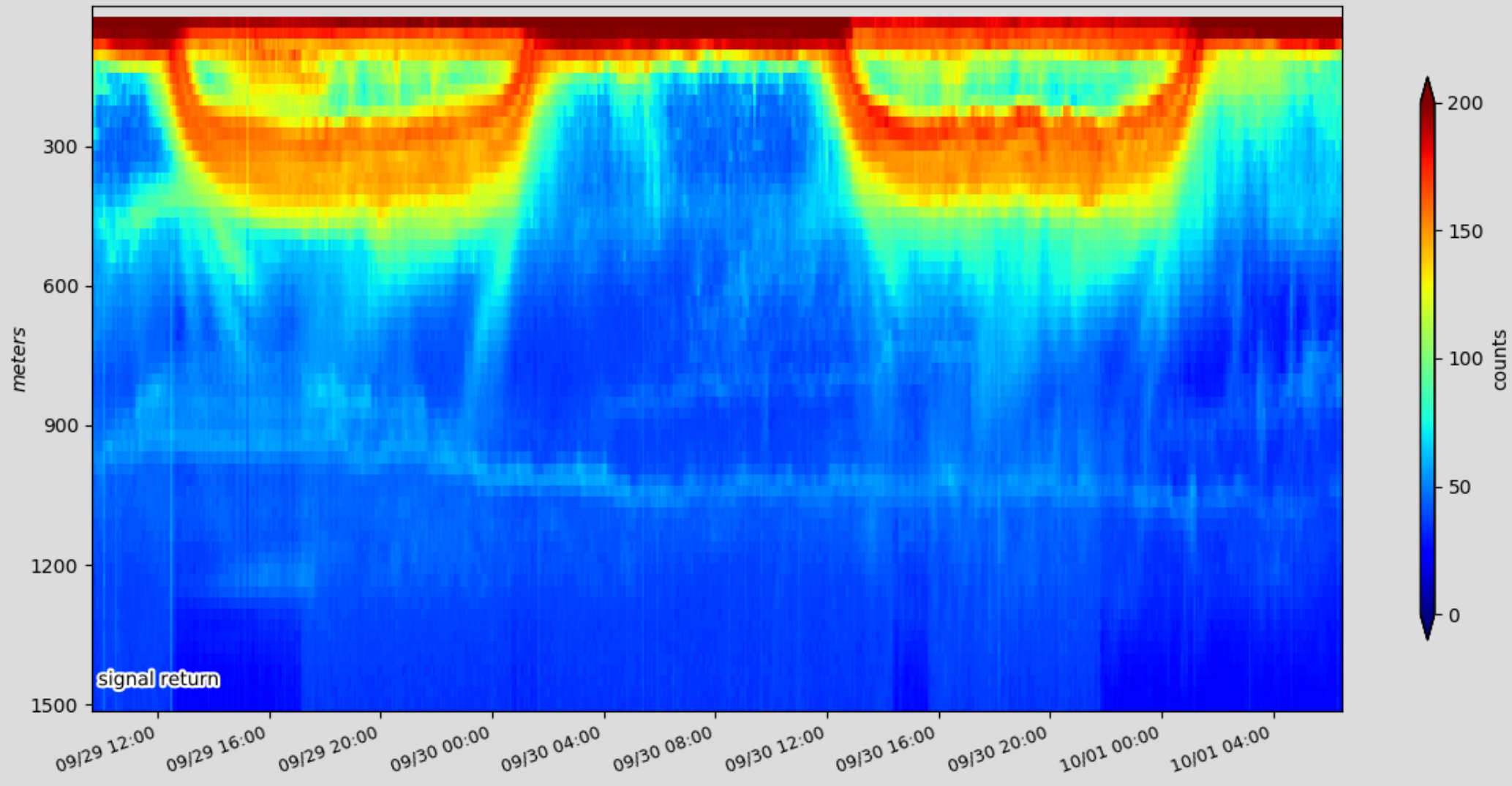
- At Sea:
  - Physical Oceanographers (currents, shear, moorings)
  - Biological Oceanographers (backscatter, context)
  - Operations
    - currents below the surface
      - over-the-side work
      - when towing
  - ROV operations
- Afterwards:
  - compare to satellites
  - timeseries (HOT, BATS, Oleander, Drake Passage)
  - backscatter (biological activity)

# Example use: Sampling location, location of a front, ROV dives

- deploy floats, drifters, neutrally buoyant samplers,
- over-the-side work



# Kilo Moana: 38kHz ADCP backscatter (tropical eastern pacific)



# UHDAS+ADCP: what does it do?

- **Acquisition:** Start by collecting the data well
  - reliable, robust, duplicate feeds (ADCP, GPS, accurate heading)
- **Monitoring:** Keep it working well
  - daily scrutiny by UHDAS Team and people on shore (email)
  - at-sea web site has diagnostic plots
- **Processing:** provide access to data and plots at sea
  - Balance real-time output and post-cruise recovery
  - data access and figures in [at-sea web site](#)
  - Portable code and [documentation](#)
- **Stewardship:**
  - improve QA, accessibility, visibility, understanding
  - rely on R2R and NCEI for conduit and archiving



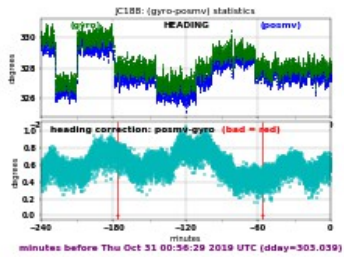
# At-sea web site overview

[HOME](#)

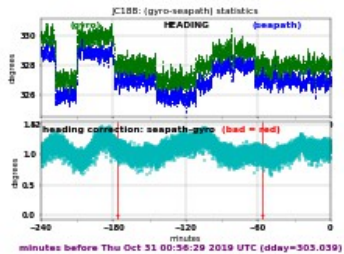
Monitoring: click opens a new figure

## Attitude Devices

- posmv-gyro comparison ([thumbnail](#))



- seapath-gyro comparison ([thumbnail](#))

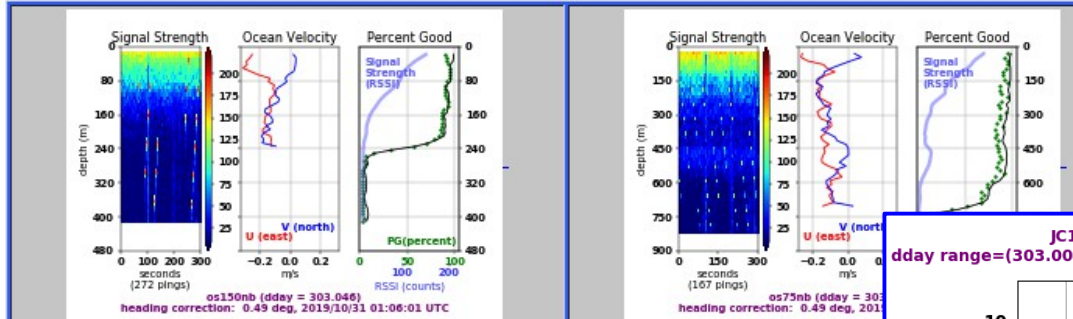


## Bridge plots:

- surface vector :
  - [day](#)
  - [night](#)
- kts and direction profile:
  - [day](#)
  - [night](#)
- kts E/N + scattering [profile](#)

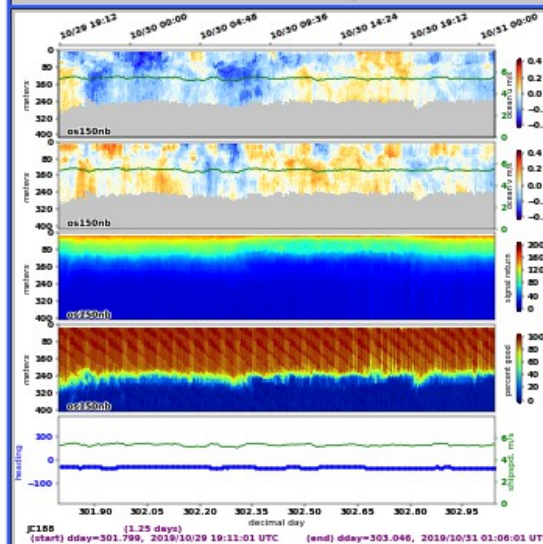
Diagnostic Plots

## ADCP Thumbnails

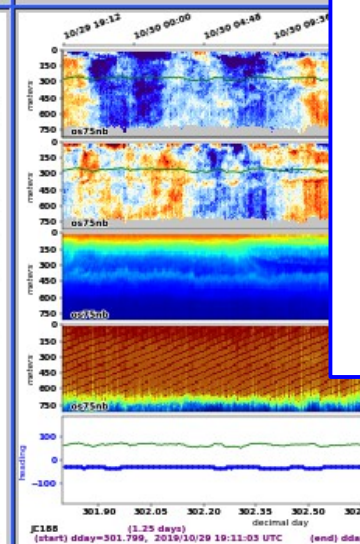


os150nb 5-minute profile

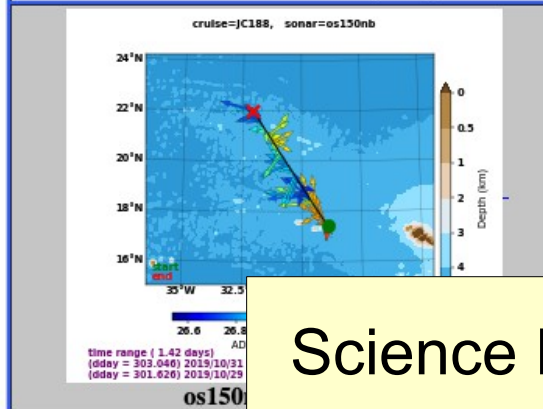
os75nb 5-minute profile



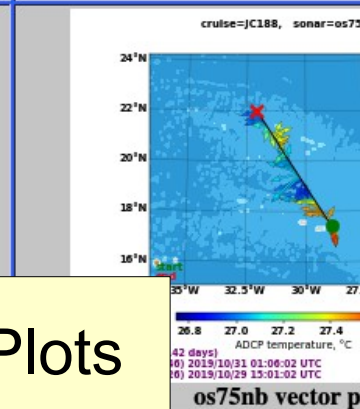
os150nb hi-resolution (time)



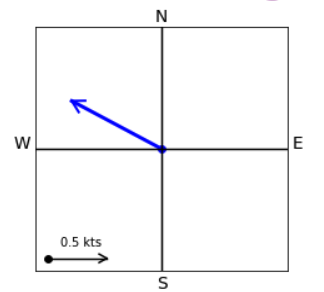
os75nb hi-resolution



Science Plots

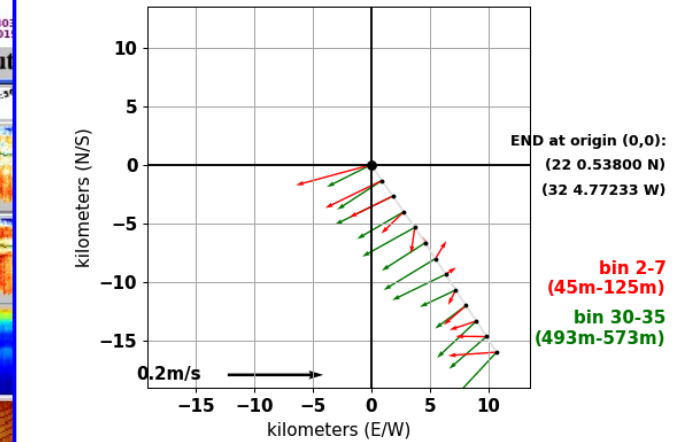


0.9 kts, 298 degT

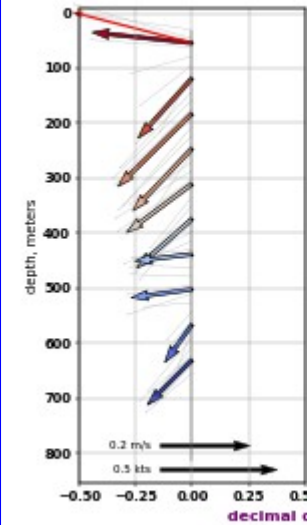


os150nb Ocean Velocity (26-34 m) 2019/10/31 01:06:01 UTC

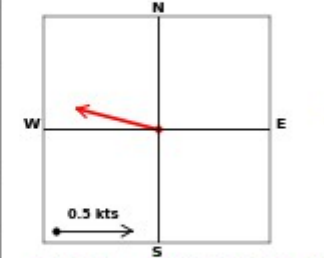
JC188 os75nb (duration = 1.0 hours); dday range=(303.00419, 303.04586), last UTC time=2019/10/31 01:06:02



Vector profile: each depth has speed and direction. Colors have no quantitative meaning; North is "up"



0.5 kts, 284 degT



os75nb Ocean Velocity (46-62 m)

Operations

# Documentation

A self-contained web site:

- on the web
- on the ship
- on your computer

UHDAS+CODAS 2020.04.25-python3 documentation »

next | index

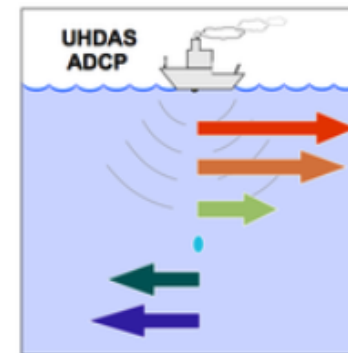
## CODAS+UHDAS Documentation

This web site contains documentation about CODAS processing of Teledyne RDI ADCP data, and the UHDAS system written to acquire those data.

An **ADCP** (Acoustic Doppler Current Profiler) is a device made by [Teledyne RD Instruments](#) that uses the Doppler frequency shift of an acoustic ping to infer water velocity. It is a registered trade name. ADCPs are attached to moorings, lowered on CTD rosette packages, and mounted on ship hulls. This web site deals with shipboard ADCPs.

If you are unfamiliar with how and ADCP works, please visit the Teledyne R.D.Instruments website and download the [ADCP \(BroadBand\) Practical Primer](#). They will ask you to create an account, but there is no cost. This outlines the underlying concepts behind how an ADCP works.

A **CODAS** (Common Ocean Data Access System) database is a way to store and access oceanographic data. CODAS was developed in the late 1980's as a portable, self-describing format for oceanographic data, with emphasis on processed ADCP data.



### Home

1. CODAS ADCP Processing
2. CODAS Installation
3. UHDAS Operations
4. ADCP Data: Examples
5. Appendix
6. Glossary

### Next topic

1. CODAS ADCP Processing



# UHDAS Systems Installed (2020)

- **17 UNOLS ships:** Atlantic Explorer, Neil Armstrong, Atlantis, Blue Heron, Endeavor, Hugh Sharp, Kilo Moana, Langseth, Oceanus, Pelican, R.Revelle, Sally Ride, Savannah, Sikuliaq, R.G.Sproul, T.G.Thompson, F.G.Walton Smith
- **3 polar ships:** Healy, L.M.Gould, N.B.Palmer
- **11 (+/-) NOAA ships:** Okeanos Explorer, F.Hassler, G.Gunter, H.Bigelow, N.Foster, Pisces, R.Brown, R.Lasker, Sette, B.Shimada, Dyson
- **6 (+) “other” research ships:** Falkor, Pt Sur, Investigator, Kristine Bonnevie, Discovery, James Cook
- **2 (-) Volunteer Observing Ship:** Oleander, Norrona, (RCCL Adventure of the Seas, RCCL Celebrity Flora)

# Who are we?

**Eric Firing:** Physical Oceanography faculty

- late 1980's (ADCPs were new): writing tools to analyze the data
- publicly accessible (software, documentation)

**Jules Hummon:** Physical Oceanography PhD-turned-tech

- joined mid 1990's

Late 1990's: UHDAS development started, first deployed 2003

2006: officially started putting it on UNOLS ships

2015: grant from NOAA to put it on Fisheries ships.

**Toby Martin:** hired for the NOAA ships – OSU tech (Wecoma, Oceanus)

- joined in 2015

**Uggo Pinho** and **Thomas Roc** joined in 2017

- both left in Aug 2020 (H1B visas – too hard to stay here)

**Joseph Gum** (2020) was HOT program, then ODF at Scripps

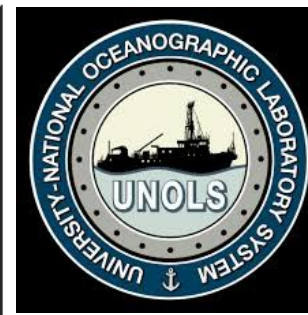
(June 2020: Eric retired, but is still involved. Jules is Team Leader; need one more)

# What do we do?

- **read daily emails** sent from UHDAS computers
  - automated, with diagnostic information and figures
  - follow up on flags raised by our ticketing system
  - communicate with techs on the ship (ADCP, GPS, heading)
  - [UHDAS monitoring dashboard: figures, diagnostics](#)
- **Answer questions** from scientists and techs (uhdas@hawaii.edu)
- **Provide advice** to scientists+techs about settings
- **Software development/maintenance**
  - Work to improve diagnostics, figures, processing algorithms
  - Keep up with external software changes: (Python, Matplotlib, Linux operating system)
- **Test and add new instruments to UHDAS** - every 5-10 yrs
  - Sentinel V, Pinnacle45 (two new RDI ADCPs)

### UNOLS ships

letters	ship name	figures	last email	cruise name	status	daily report	daily email	OS	last update
ae	Atlantic Explorer	<a href="#">figs</a>	6hr	Pierside_PostAE2016	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Apr-23
ar	Neil Armstrong	<a href="#">figs</a>	6hr	ar47	(not logging)	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
at	Atlantis	<a href="#">figs</a>	210d	(not set)		<a href="#">dir</a>	<a href="#">email</a>	16.04	2018-Aug-02
bh	Blue Heron	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
en	Endeavor	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
hly	Healy	<a href="#">figs</a>	43d	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
hs	Hugh Sharp	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
km	Kilo Moana	<a href="#">figs</a>	6hr	km2012	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-25
lg	L.M.Gould	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2018-Dec-23
mgl	M.G.Langseth	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	16.04	2017-Aug-15
np	N.B.Palmer	<a href="#">figs</a>	1d 6hr	nbp2010a	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2018-Dec-19
oc	Oceanus	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Apr-23
pe	Pelican	<a href="#">figs</a>	6hr	PE21_06_Fugro_ADCP	(not logging)	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
rr	Roger Revelle	<a href="#">figs</a>	0hr	RR2002a	(not logging)	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
skq	Sikuliaq	<a href="#">figs</a>	6hr	SKQ202014S	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-02
sp	R.G.Sproul	<a href="#">figs</a>	3hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	14.04	2015-Mar-25
sr	Sally Ride	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
sv	Savannah	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
tt	Thomas G. Thompson	<a href="#">figs</a>	17d	TN384	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Apr-25
ws	Walton Smith	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01



NSF funds the UNOLS ships  
NOAA funds the NOAA ships  
Various institutions or projects fund the “other” ships

### NOAA ships

letters	ship name	figures	last email	cruise name	status	daily report	daily email	OS	last update
dy	Oscar Dyson	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
ex	Okeanos Explorer	<a href="#">figs</a>	205d	EX-Transit-2020-03-23	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Jan-14
fh	Ferdinand Hassler	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	14.04	2017-Jan-17
gu	Gordon Gunter	<a href="#">figs</a>	35d	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
hb	Henry Bigelow	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
nf	Nancy Foster	<a href="#">figs</a>	3d	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
pc	Pisces	<a href="#">figs</a>	6hr	PC2020_atpier_october	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
rb	Ron Brown	<a href="#">figs</a>	6hr	RB2006	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
ri	Reuben Lasker	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
se	Oscar Elton Sette	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
sh	Bell Shimada	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01



We also have some science funding to process ADCP data, eg. GOSHIP

### other UHDAS ships

letters	ship name	figures	last email	cruise name	status	daily report	daily email	OS	last update
fk	Falkor	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-25
inv	Investigator	<a href="#">figs</a>	6hr	in2020_v06	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
kb	Kristine Bonnevie	<a href="#">figs</a>	6hr	KB2020620	logging	<a href="#">dir</a>	<a href="#">email</a>	14.04	2017-Mar-09
nor	Norrone	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	16.04	2018-Jul-05
olr	Oleander	<a href="#">figs</a>	6d	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
ps	Point Sur	<a href="#">figs</a>	6hr	(not set)		<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-May-30
ukdy	Discovery	<a href="#">figs</a>	8hr	DY120	logging	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01
ukjc	James Cook	<a href="#">figs</a>	8hr	JC209	(not logging)	<a href="#">dir</a>	<a href="#">email</a>	18.04	2020-Aug-01



National Oceanography Centre



THE OLEANDER Project

# UHDAS: recap of 2020

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- new on Revelle: UHDAS running on a virtual computer

COVID-19: no travel after March 1 ➡ opportunity for updates

- ships were in port
- good power+internet
- reliable schedule (pierside for months)

Usually Operating System upgrades are done in person, must do it without travel.

- Complete upgrade of 21 systems on (16 ships)
  - shipping disks
  - ship computers
  - remote install using ship's tech support
- Additionally, touched up the UHDAS code on 27 computers (20 ships)



# Coming up in 2020/2021

- test Sentinel V (on loan from Blue Heron)
- test Pinnacle45 (Sally Ride, early December)
- switch to the next Operating System, test
  - start upgrading computers
- Hire one more person
- Continue documentation improvements, software development