Shipboard ADCP processing workshop
Feb 18, 2018
University of Alaska, Fairbanks

UHDAS ADCP data Acquisition and CODAS processing

UHDAS + CODAS Documentation

http://currents.soest.hawaii.edu/docs/adcp_doc/index.html

Outline

Day 1: Morning: Presentation

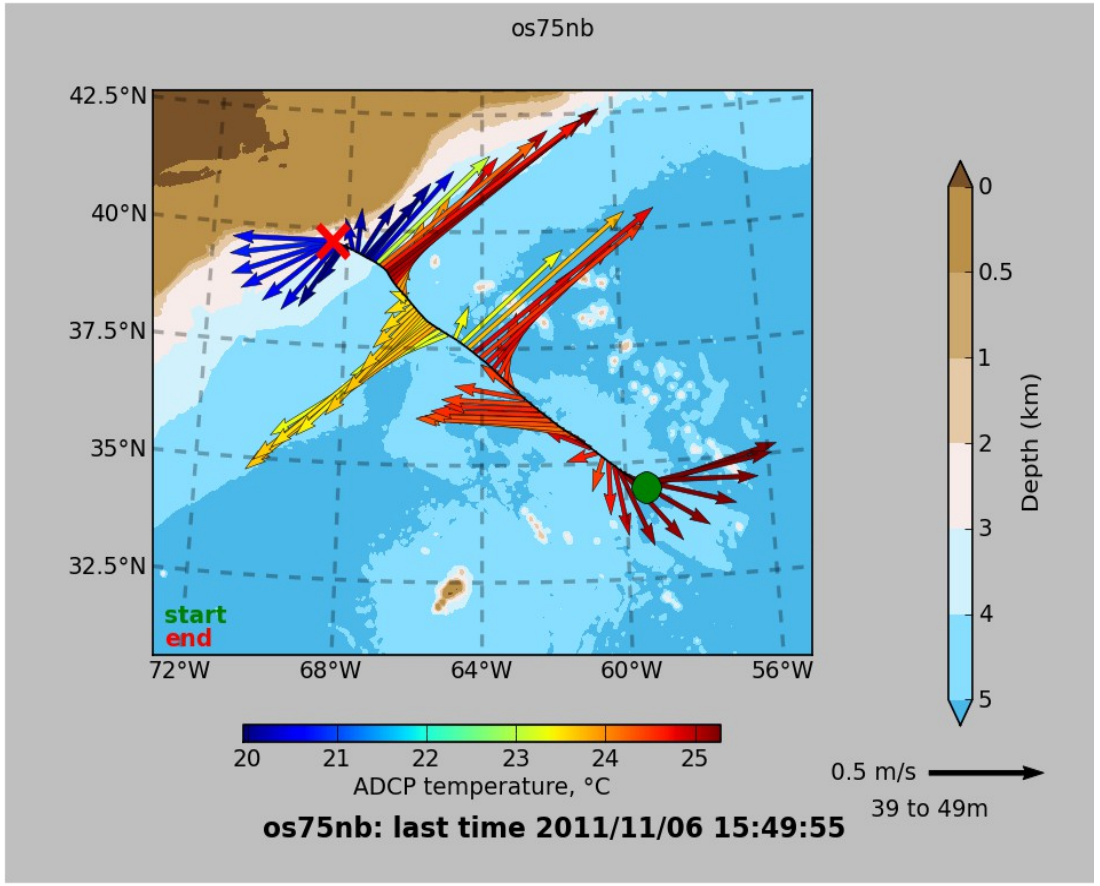
1. ADCP: components to currents
2. ADCP Data Acquisition
   - compare: VmDAS⬌UHDAS
3. CODAS Processing
4. Data Stewardship

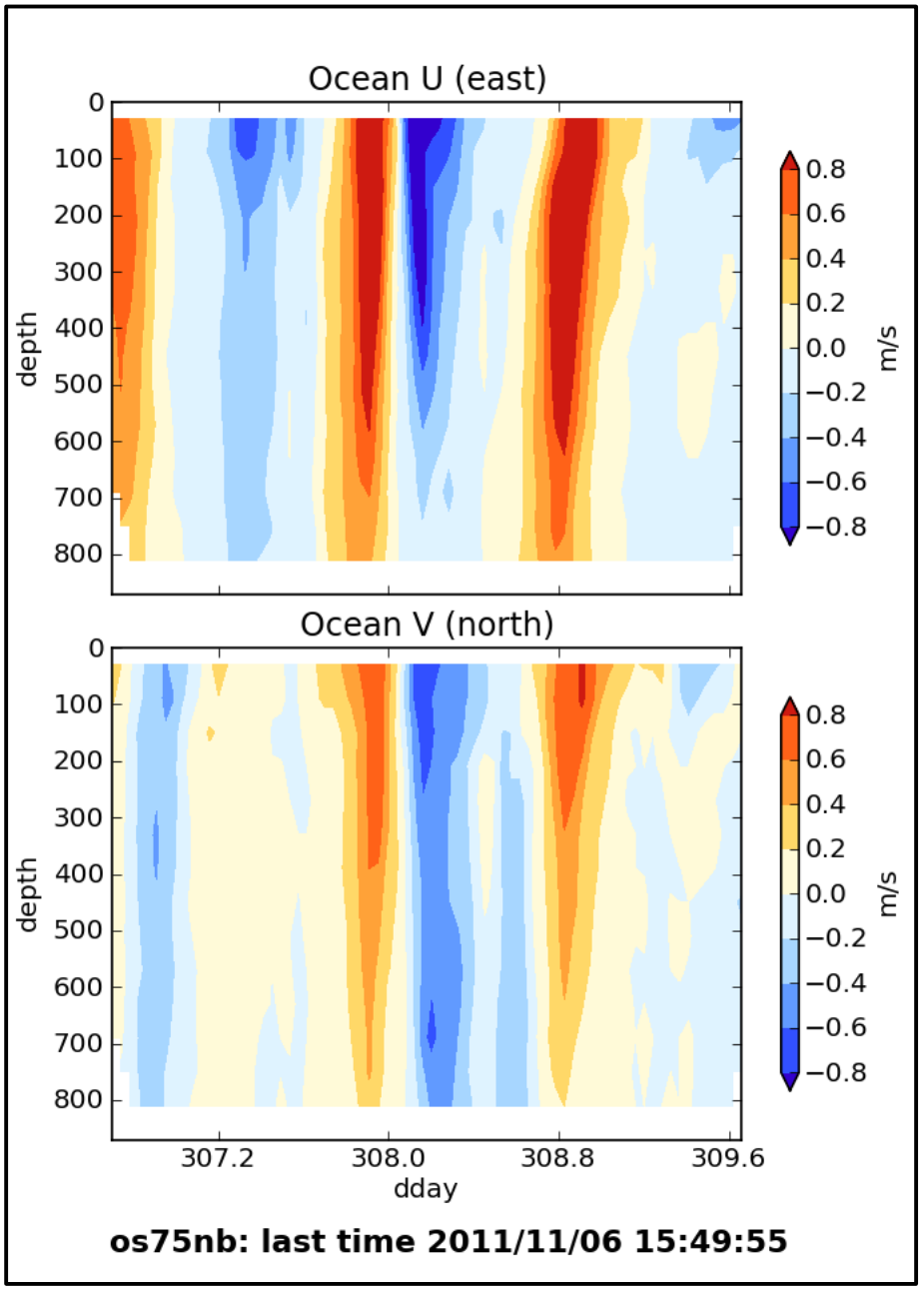
After: Practice

CODAS Processing

Time, ADCP, Position, Attitude

primitive (raw) data





UHDAS - What it does (follow the data)

(1) Acquisition ⟸ ADCP+position+heading

(2) Processing

(3) Data Access

- At Sea
- On Land (after the cruise)

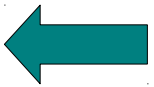
(4) Monitoring

At Sea

On Land

UHDAS - What it does (follow the data)

(1) Acquisition

(2) Processing  **CODAS**

(3) Data Access

- At Sea
- On Land (after the cruise)

(4) Monitoring

At Sea

On Land

UHDAS: What it does

- **(1) Data Acquisition**
  - communicate with ADCP
  - timestamp data, write to disk
  - keep log files about activities
- **(2) Processing**
  - parse NMEA messages
  - grid NMEA messages
  - all CODAS processing

UHDAS: What it does:

(3) Data Access...

- web site on ship with
  - plots for science and operations
  - full-resolution data (matlab, netcdf, CODAS)
- on land (in the cruise directory)
  - full-resolution data (matlab, netcdf, CODAS)
  - archive of figures from cruise

UHDAS: What it does

(4) Monitoring...

- **at sea:**
  - data acquisition (UHDAS GUI tool)
  - processing
  - health of accurate heading device
- **from shore: (uhdas.org)**
  - sends daily email with attachment for review
  - diagnostic files
  - data snippet for shore-based figures for review

green=good red=rubbish
web site figures
web site figures

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(I) ADCP: Getting Ocean Velocity

ADCP :

Acoustic (it pings along beams at a frequency)

Doppler (uses frequency shift to get velocity along the beam)

Current (include many more steps to get ocean velocity)

Profiler (listen for the return in small chunks of time to create a vertical profile)

ADCP introduction

- **A**coustic **D**oppler **C**urrent **P**rofiler (shipboard)
- 4-beams, Doppler shifted currents as ship moves
- To obtain ocean currents:

  (1) transform beam coordinates into instrument coordinates

  (2) rotate horizontal velocities into ship coordinates using transducer angle in the hull (EA command for VmDAS)

  (3) rotate velocities on ship to North (using heading)

  - yields measured velocities in Earth coordinates

  (4) remove ship's speed using positions

- link to diagrams

(I) ADCP: Getting Ocean Velocity

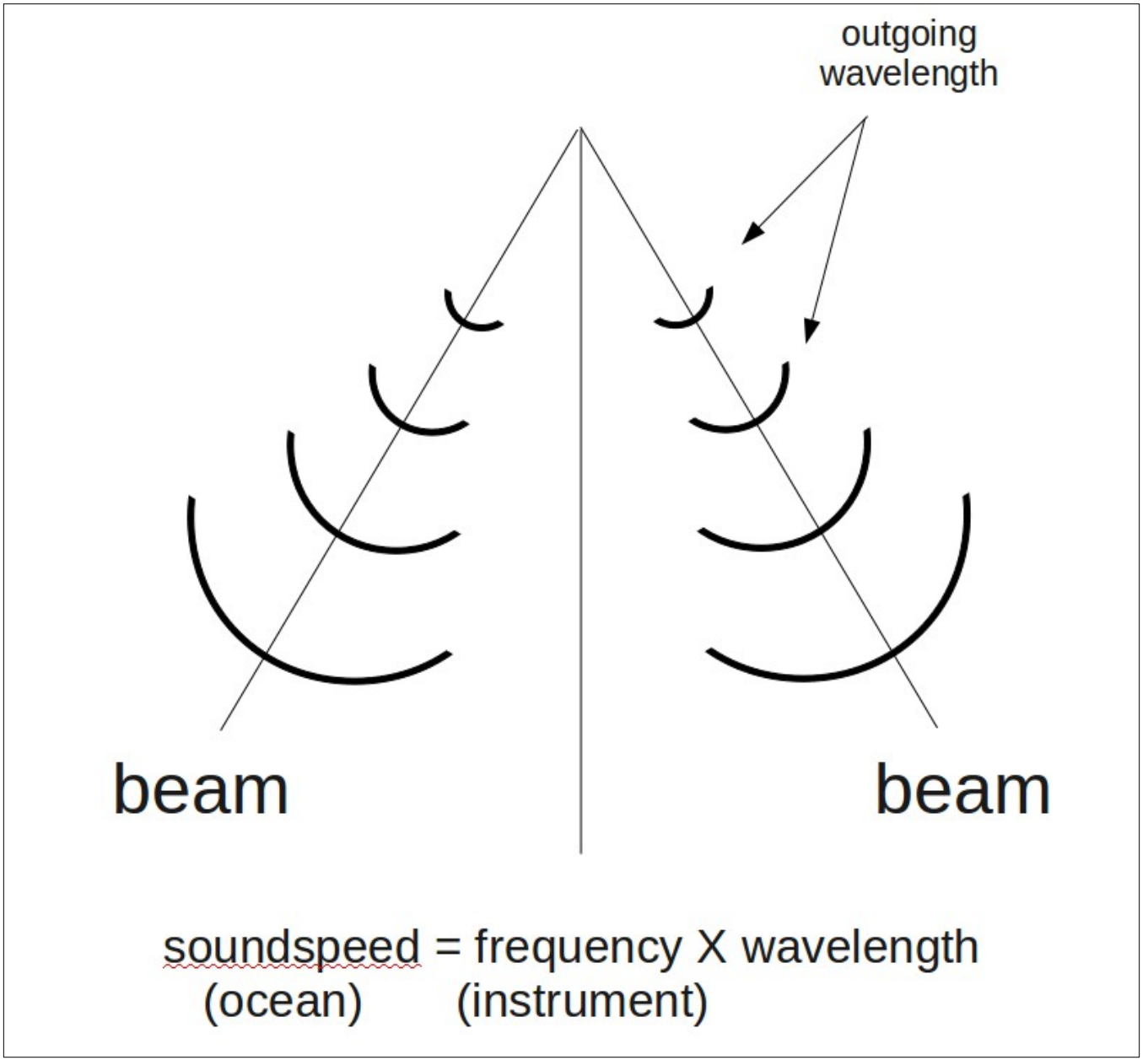
ADCP :

Acoustic

Doppler

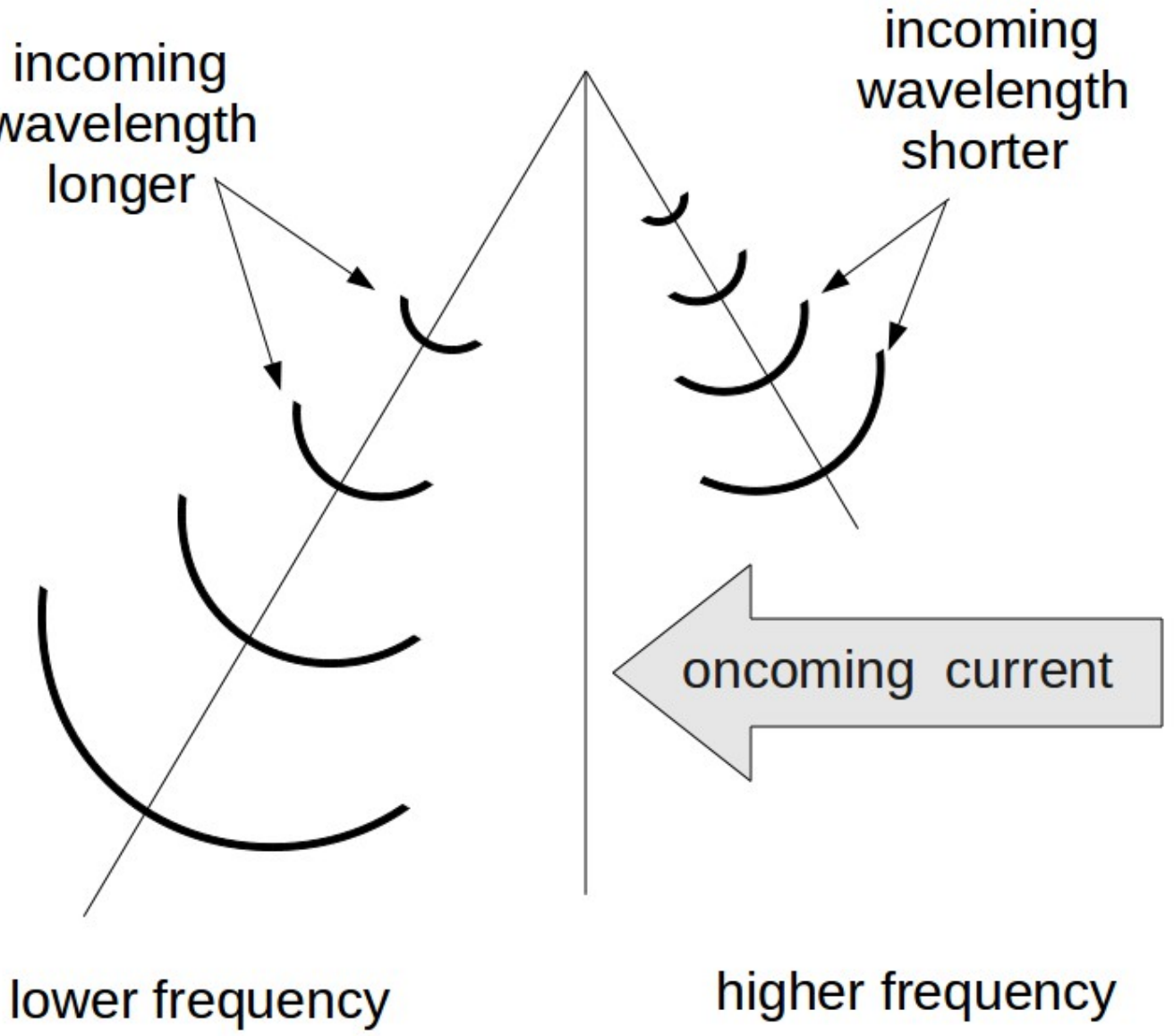
Current

Profiler



ADCP :

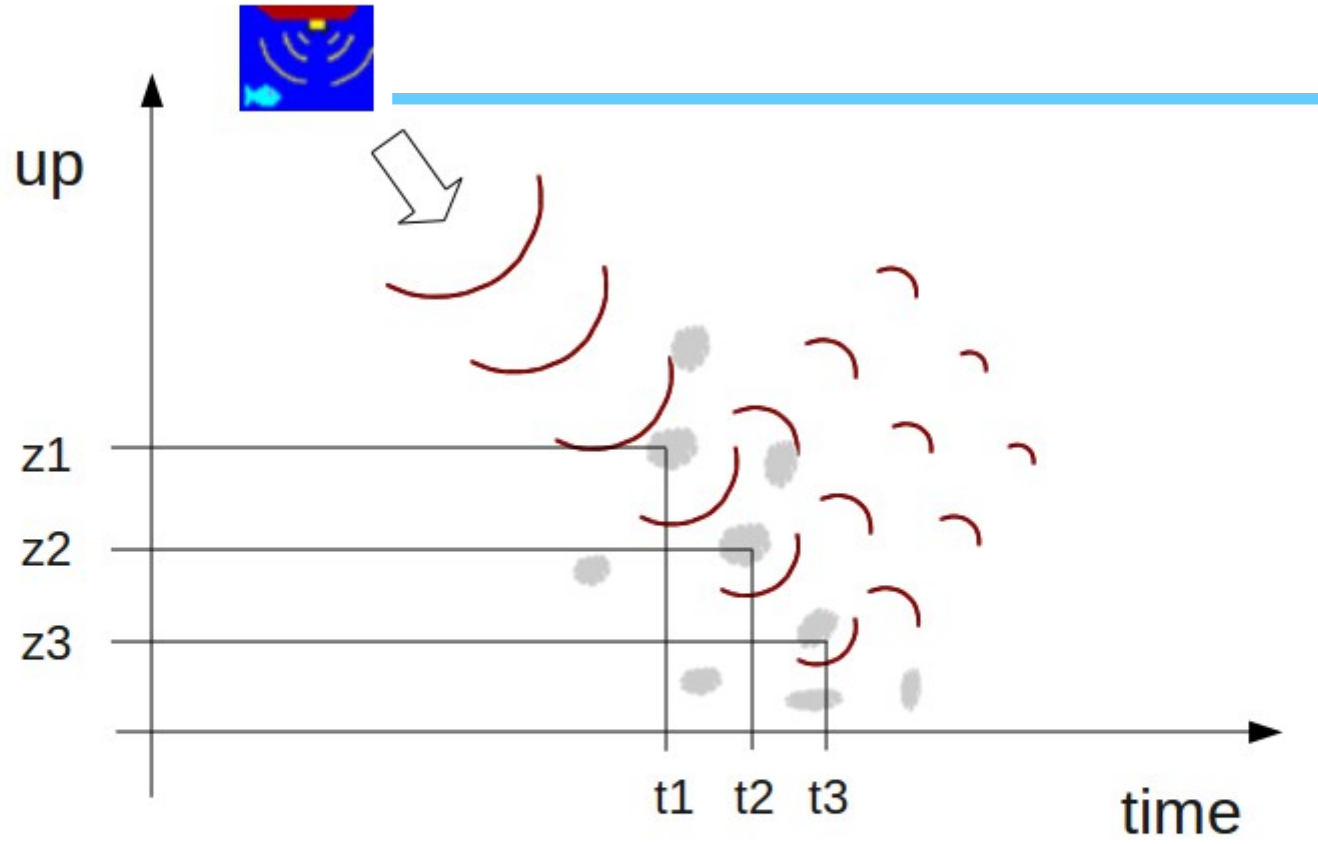
Acoustic
Doppler
Current
Profiler



soundspeed = frequency X wavelength
(ocean) (instrument)

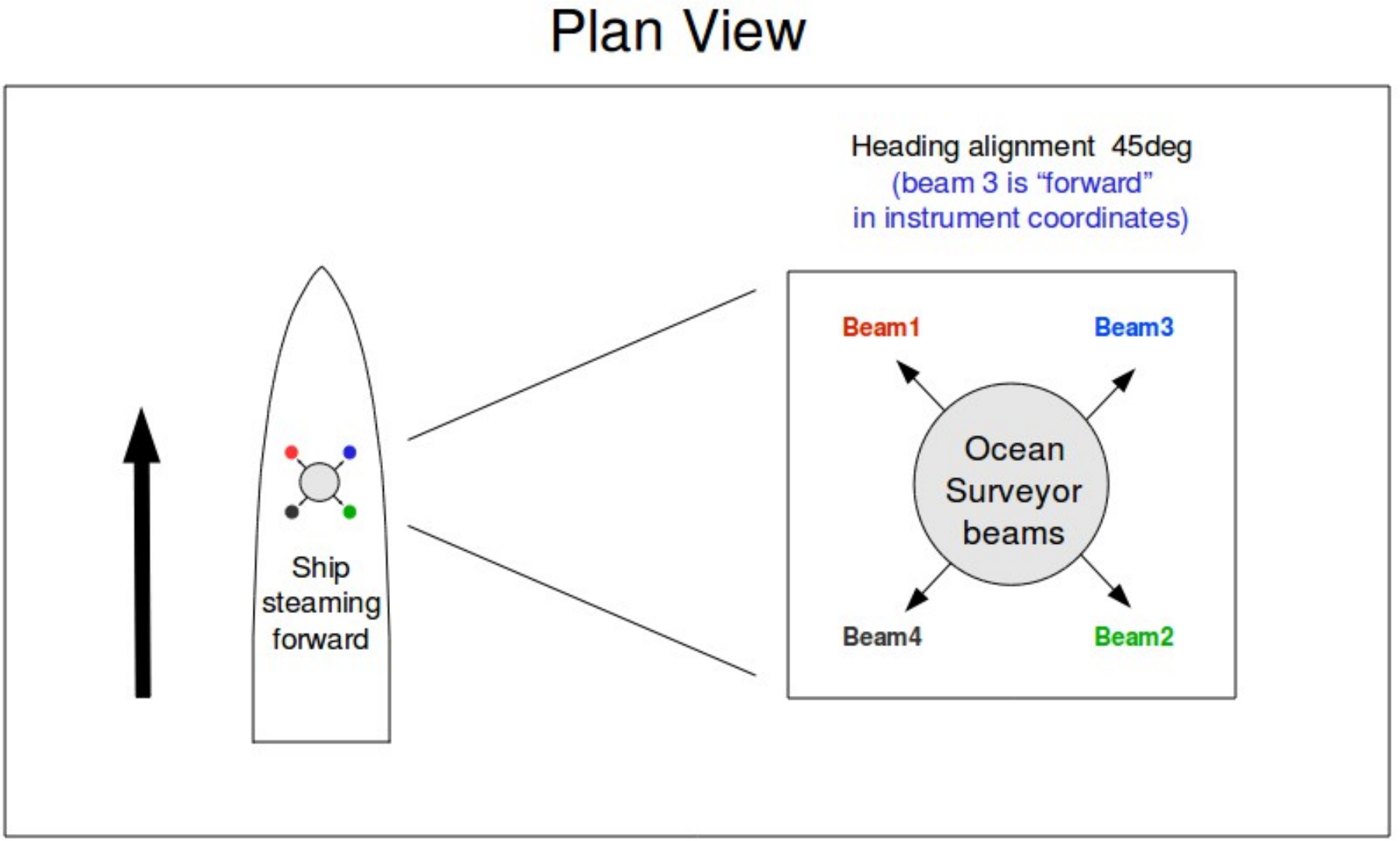
ADCP:

Acoustic
Doppler
Current
Profiler

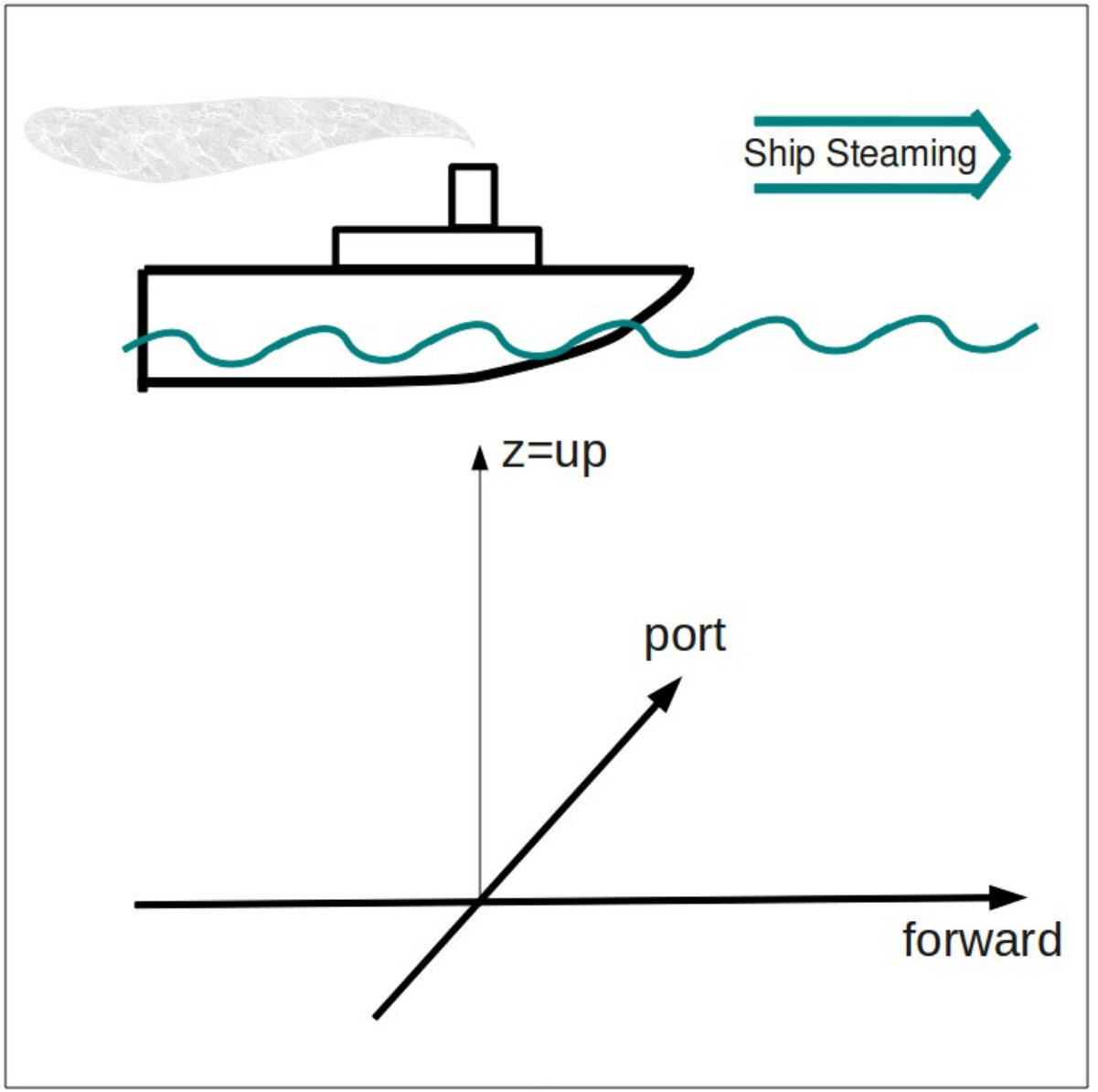


"Gating" the return over time results in "bins" in the vertical, creating a profile of information

ADCP : Getting Ocean **C**urrents



ADCP : Getting Ocean Currents

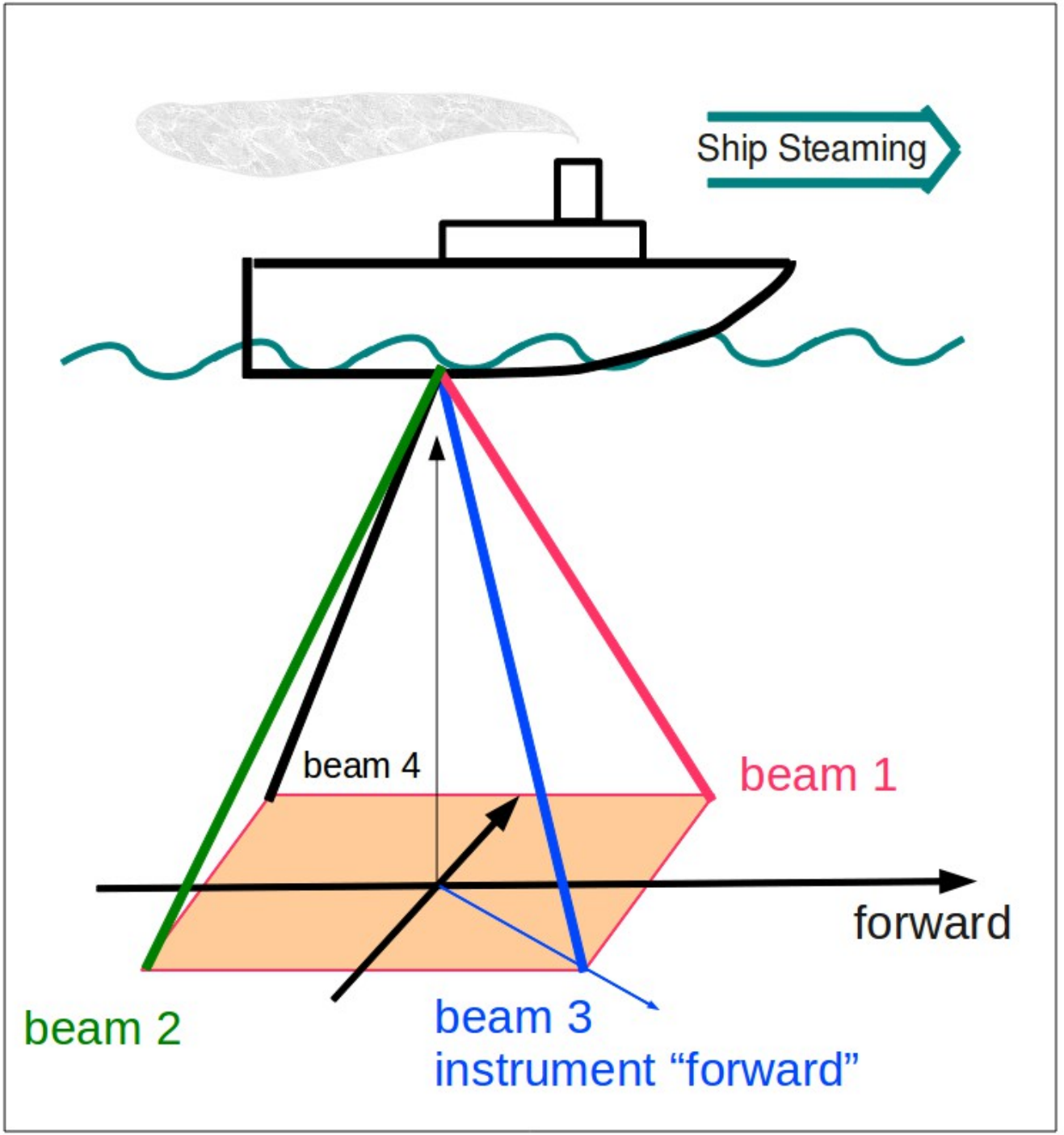


ADCP

Getting Ocean Currents

Four beams

- 90deg apart
- 30 (or 20)deg up from vertical
- “forward beam” is #3
- usually 45deg starboard of forward



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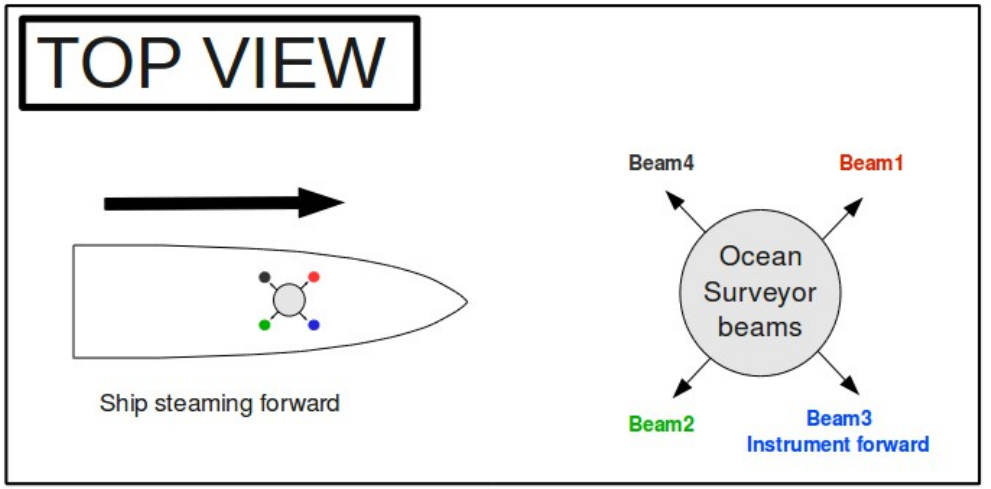
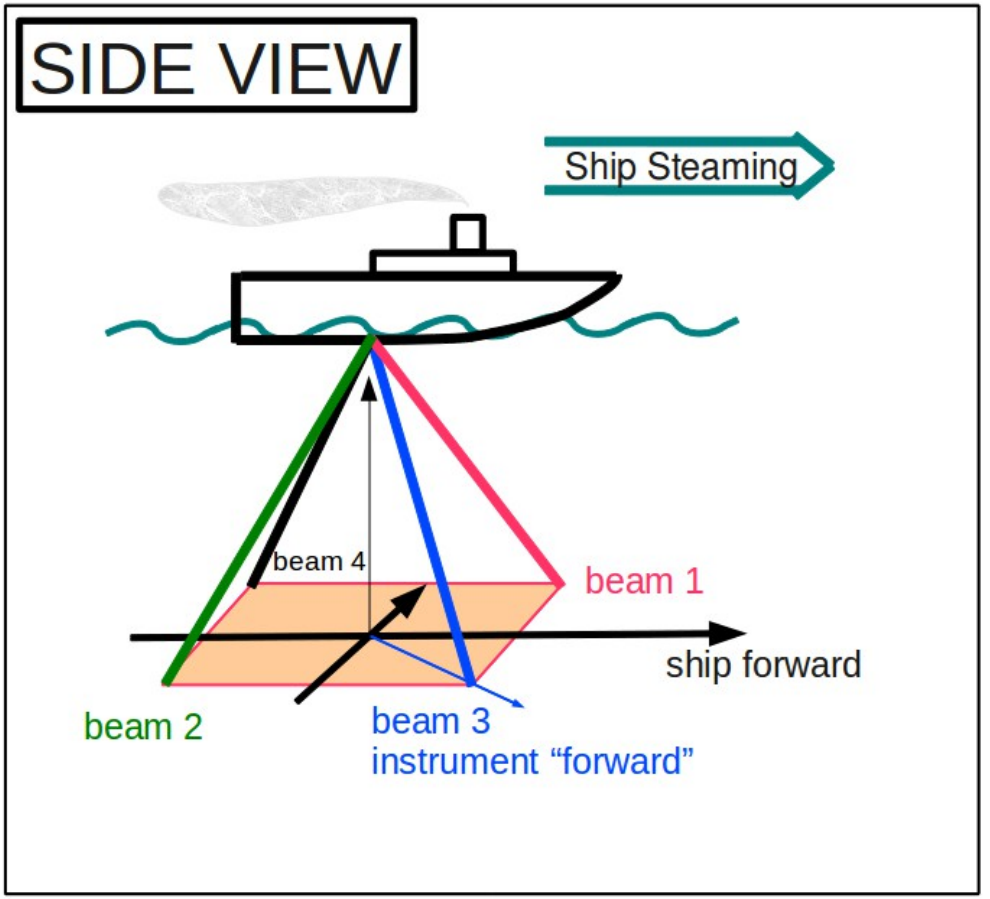
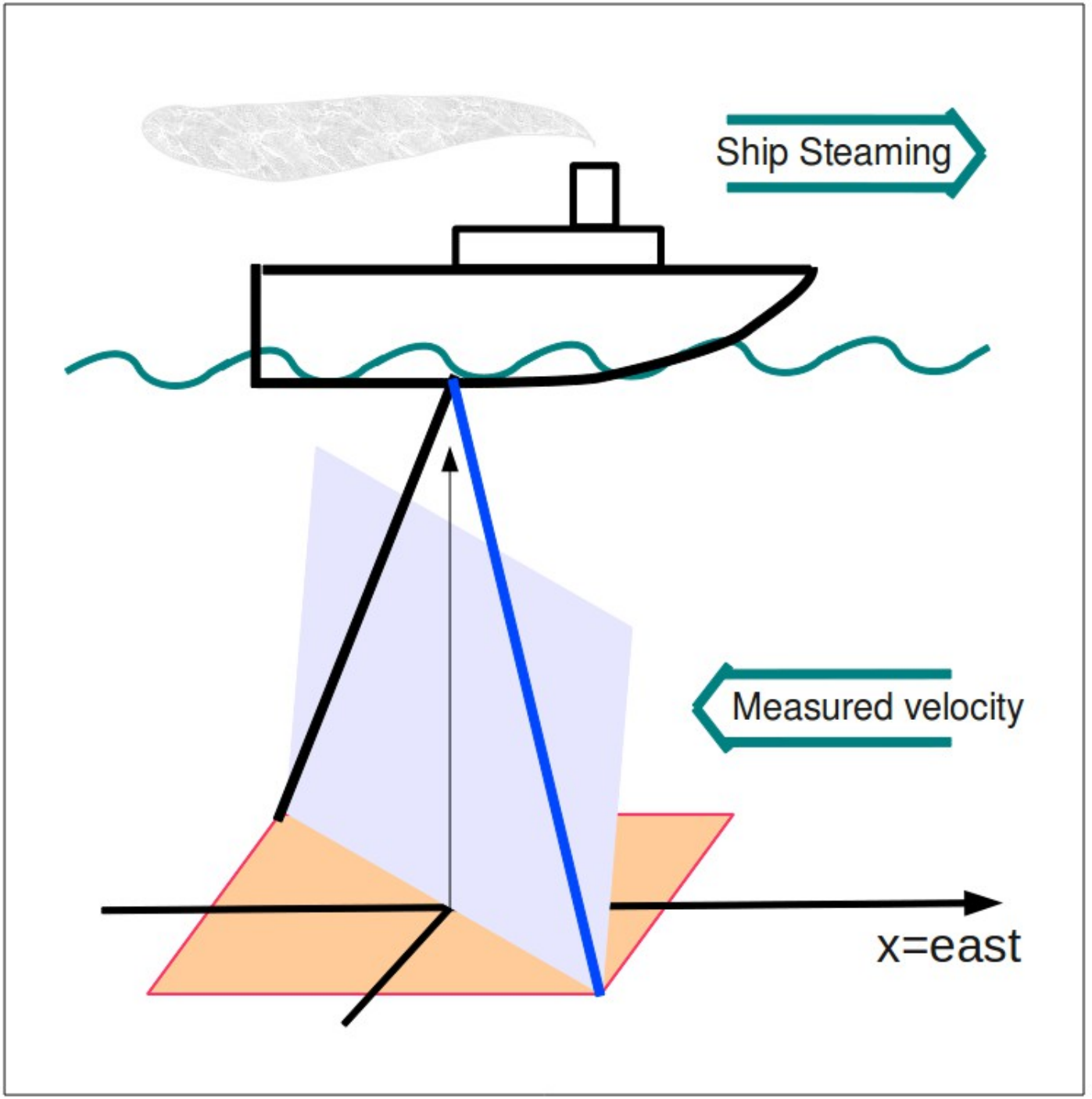




ADCP

Getting Ocean Currents

Two opposite beams make a vertical plane



ADCP

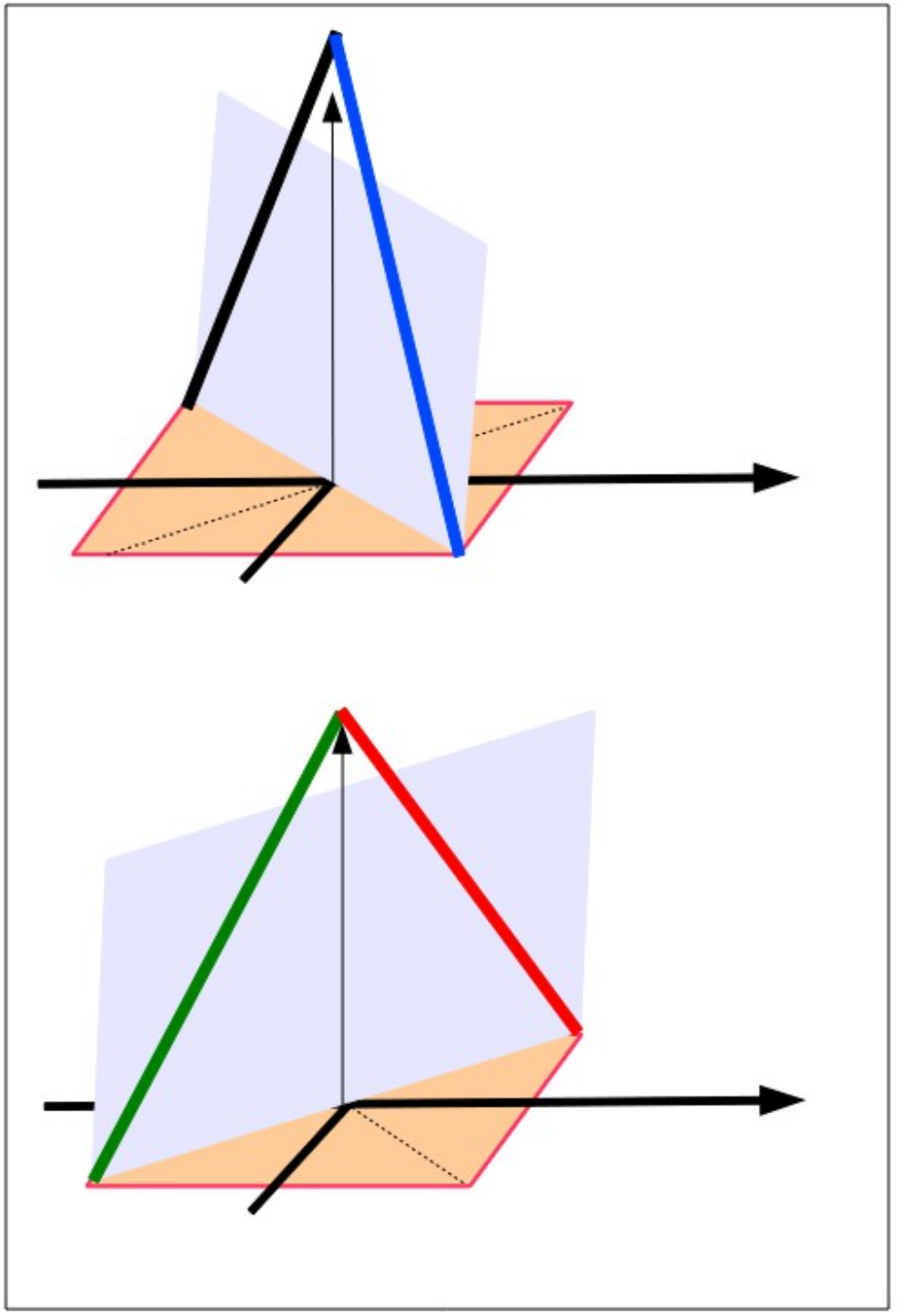
Getting Ocean Currents

Now we have two vertical planes at 90deg to each other

These are the basis of the horizontal and vertical velocities

Horizontal velocities will be used to get ocean velocities

Vertical velocities will be used for error-checking



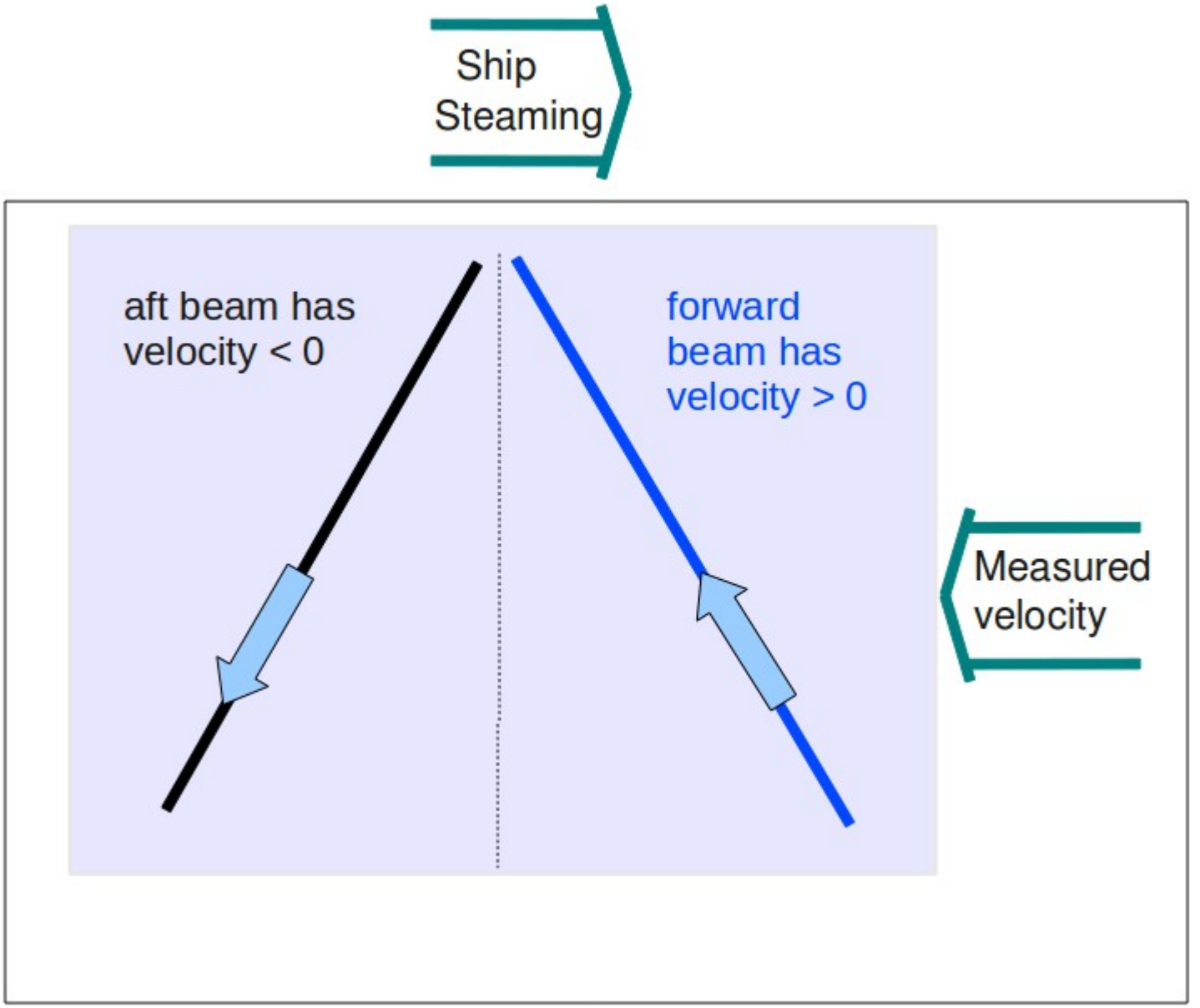
ADCP

Getting Ocean Currents

Two beams make one vertical plan

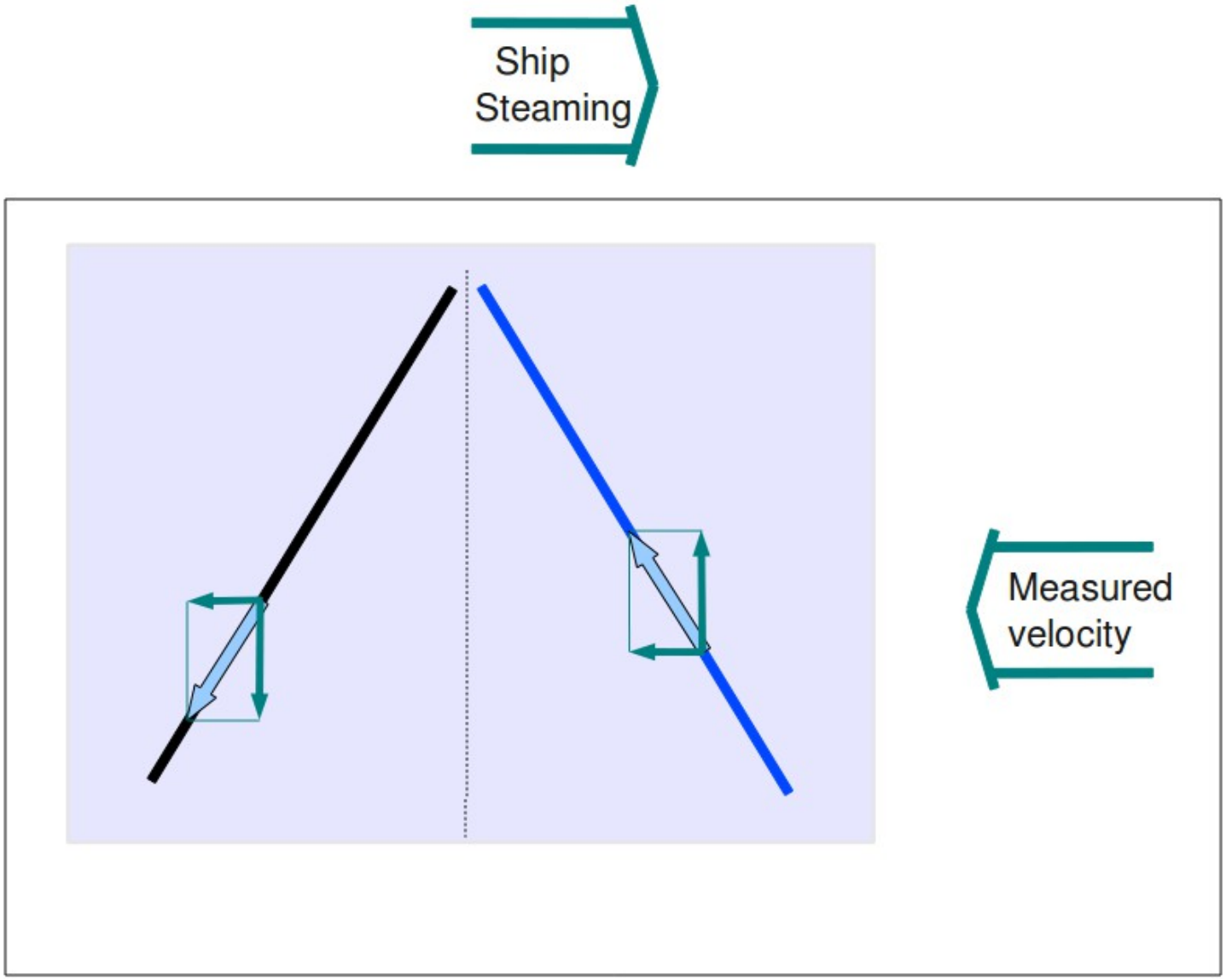
This shows the velocities determined by the Doppler shift;

“beam velocities”



ADCP: Getting Ocean Currents

Interpret the two beam velocities one horizontal and one vertical velocity

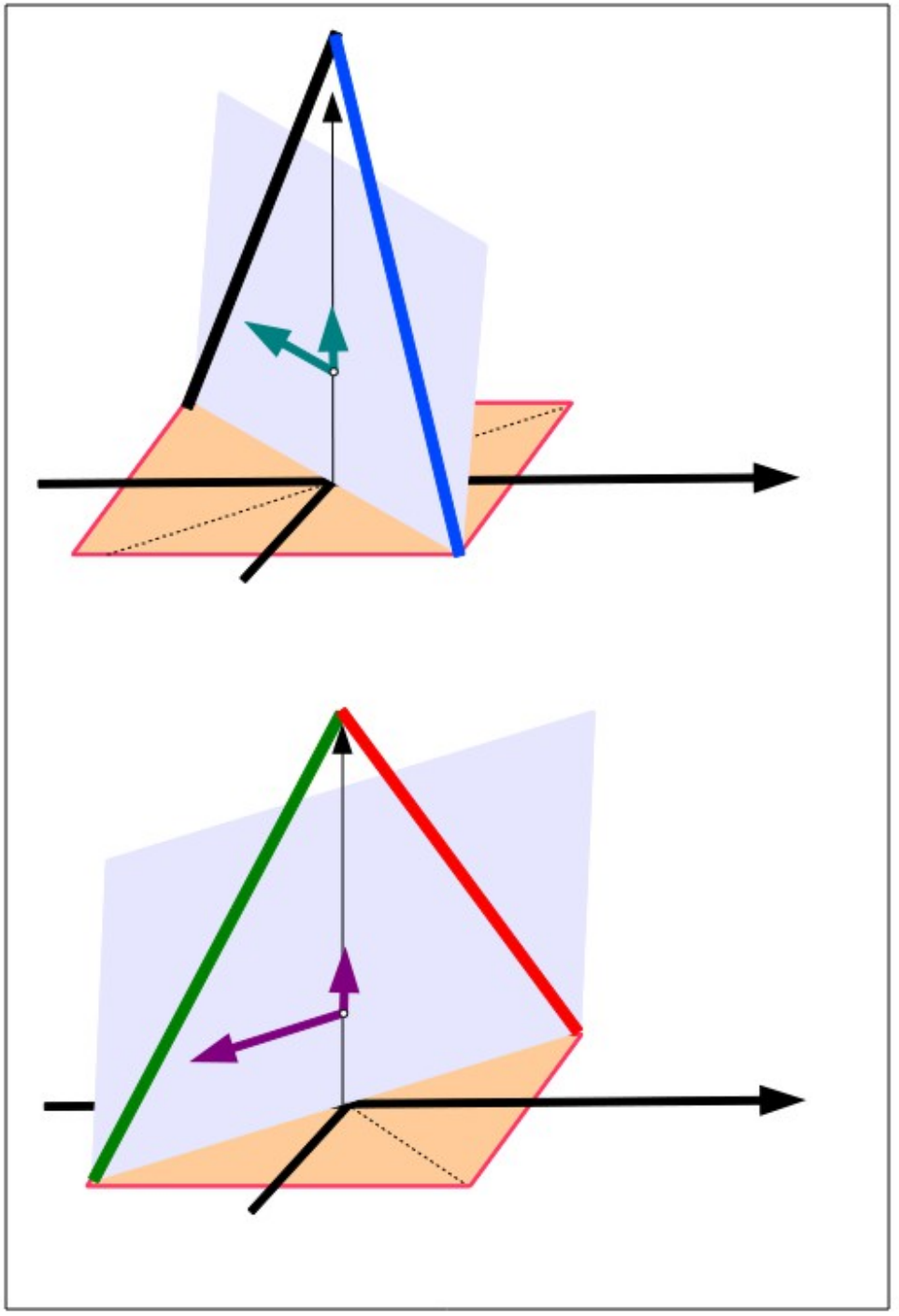


ADCP:

Getting Ocean Currents

Now we see the horizontal and vertical velocities on the two planes

Use the horizontal velocities for determining ocean velocities requires more steps.

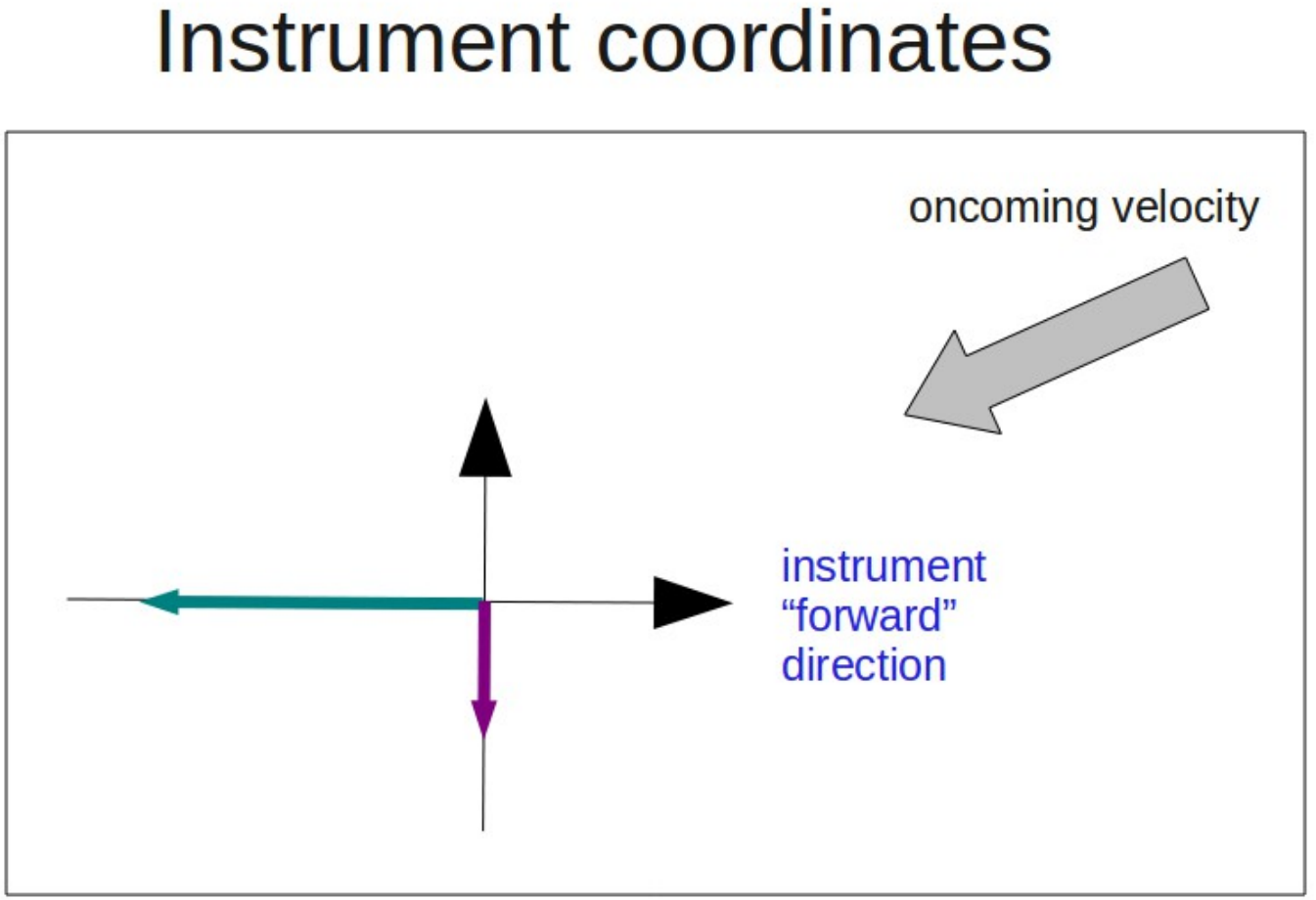


ADCP:

Getting Ocean Currents

This is a top-down view of the measured horizontal velocity in **instrument coordinates** (from the two planes made by the beams)

(determining ocean velocities requires more steps)



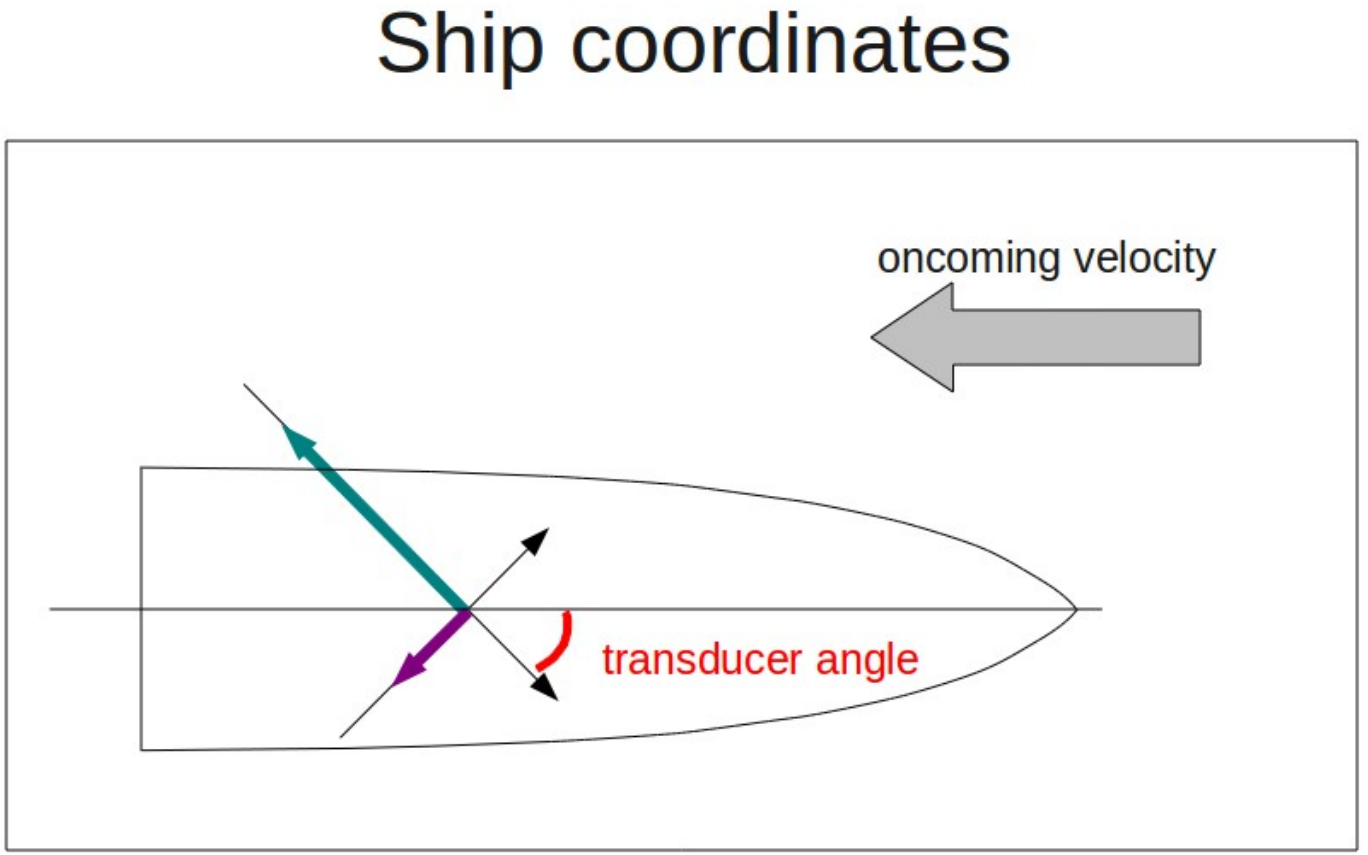
ADCP:

Getting Ocean Currents

This is a top-down view of the measured horizontal velocity in ship coordinates.

The instrument coordinates values are rotated by the **transducer angle**.

(determining ocean velocities requires more steps)



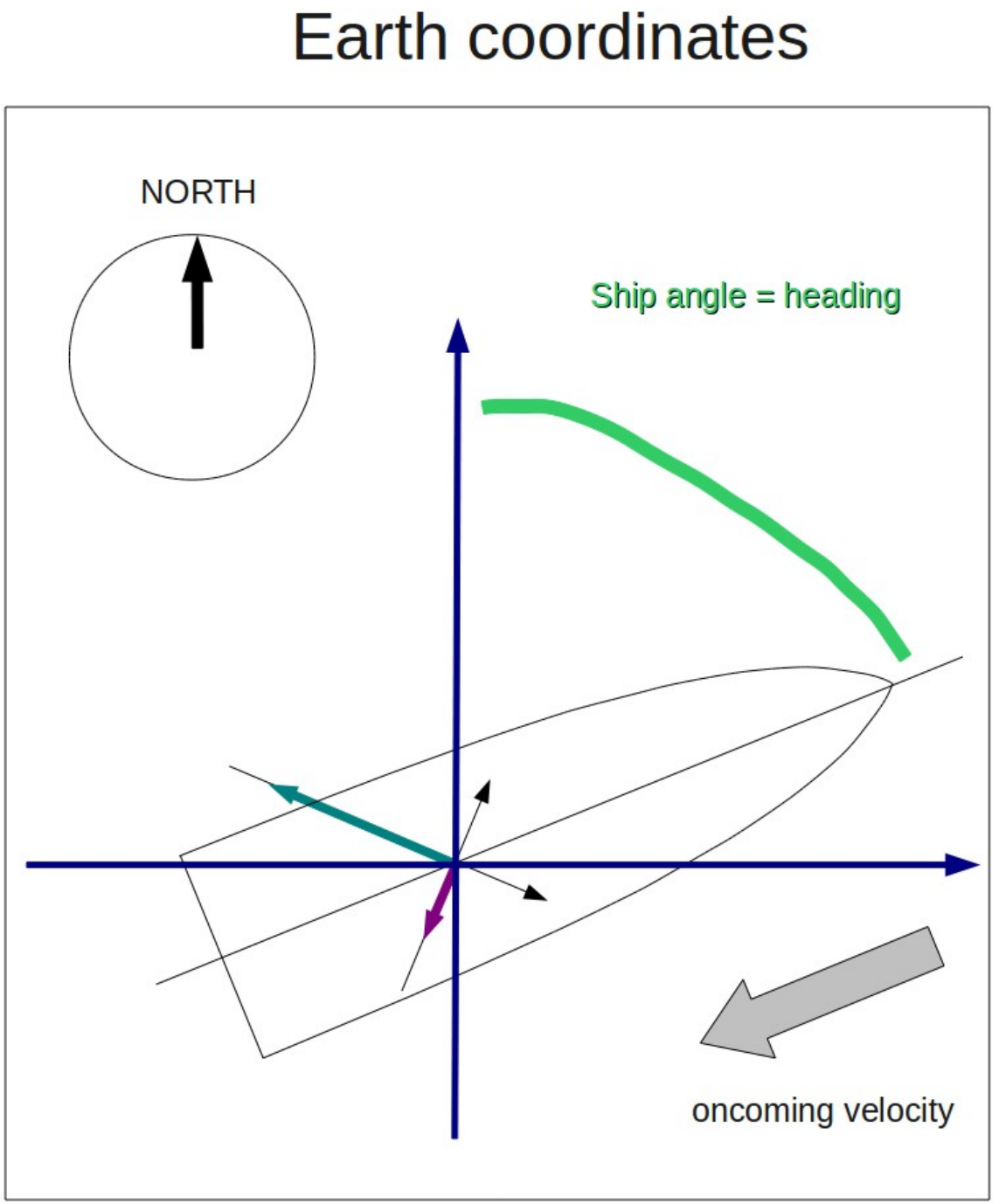
ADCP:

Getting Ocean Currents

This is a top-down view of the measured horizontal velocity in earth coordinates.

The instrument coordinates values are rotated by the **ship's heading**.

(determining ocean velocities requires more steps)



ADCP:

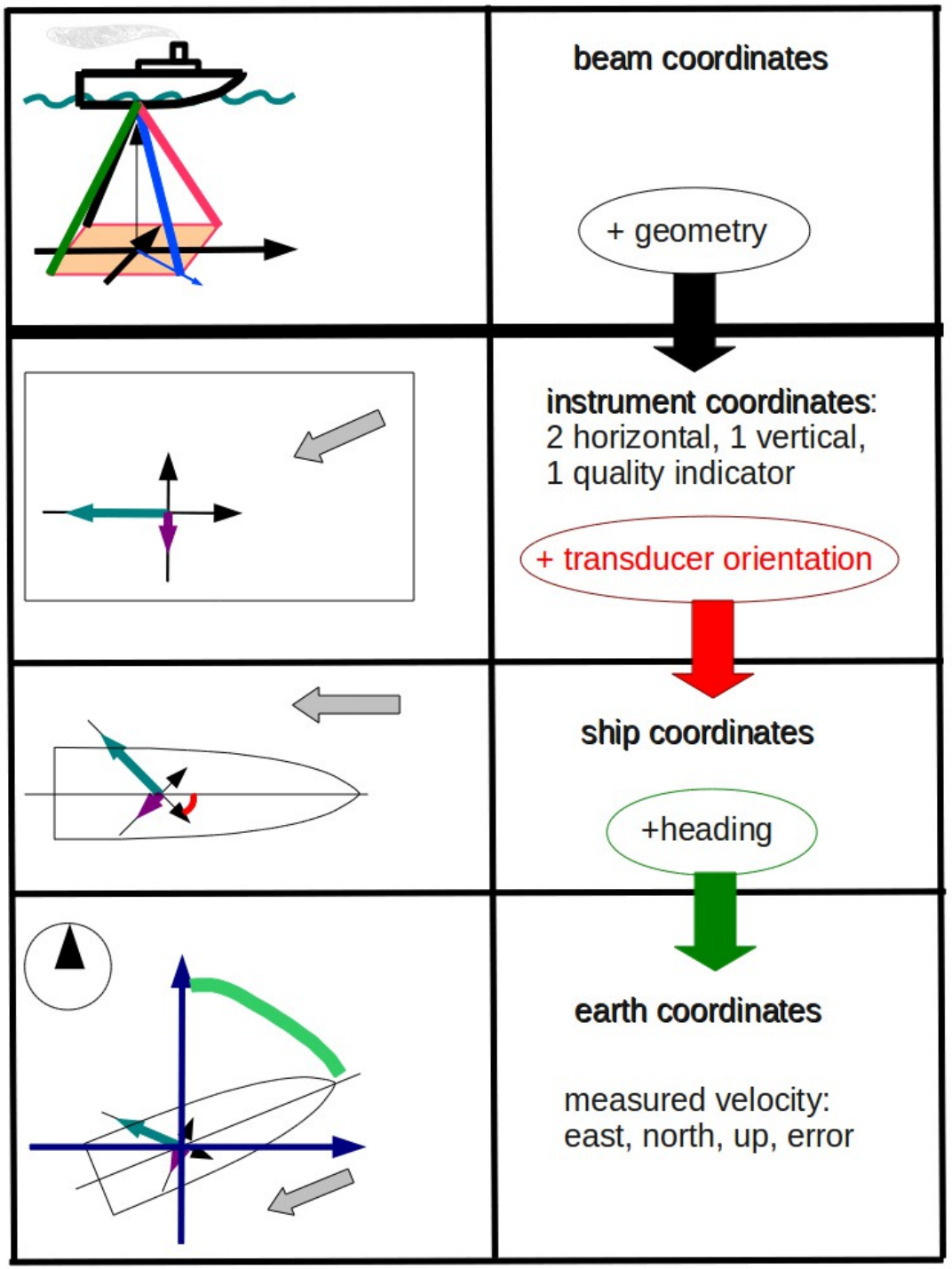
Getting Ocean Currents

Summary of steps:

Doppler to beam
(not shown)

<u>below here: horizontal+vertical</u>

- beam to instrument
- instrument to ship
- ship to earth



ADCP:

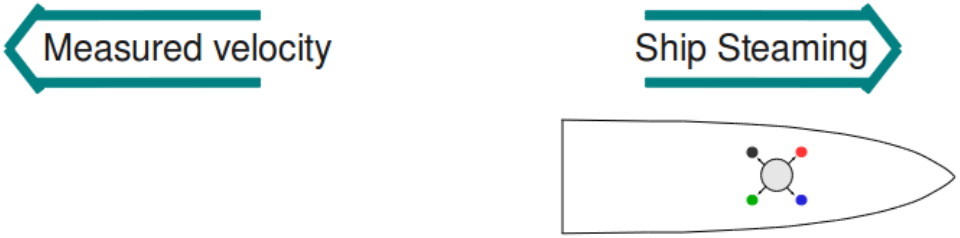
Getting Ocean Currents

Earth coordinates + **GPS** gives ship speed

add ship speed to measured velocity to get ocean velocity

Earth coordinates

If no ocean currents:



$$U_{meas} = -U_{ship}$$

With Ocean current

$$U_{meas} = -U_{ship} + U_{ocean}$$

$$U_{meas} + U_{ship} = U_{ocean}$$

ADCP:

Getting Ocean Currents

Complete summary:

beam velocities

+

transducer orientation
+
heading

+

gps

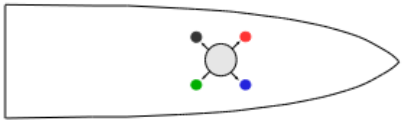
ocean velocities

Earth coordinates

With Ocean current

Measured velocity

Ship Steaming



$U_{meas} = -U_{ship} + U_{ocean}$

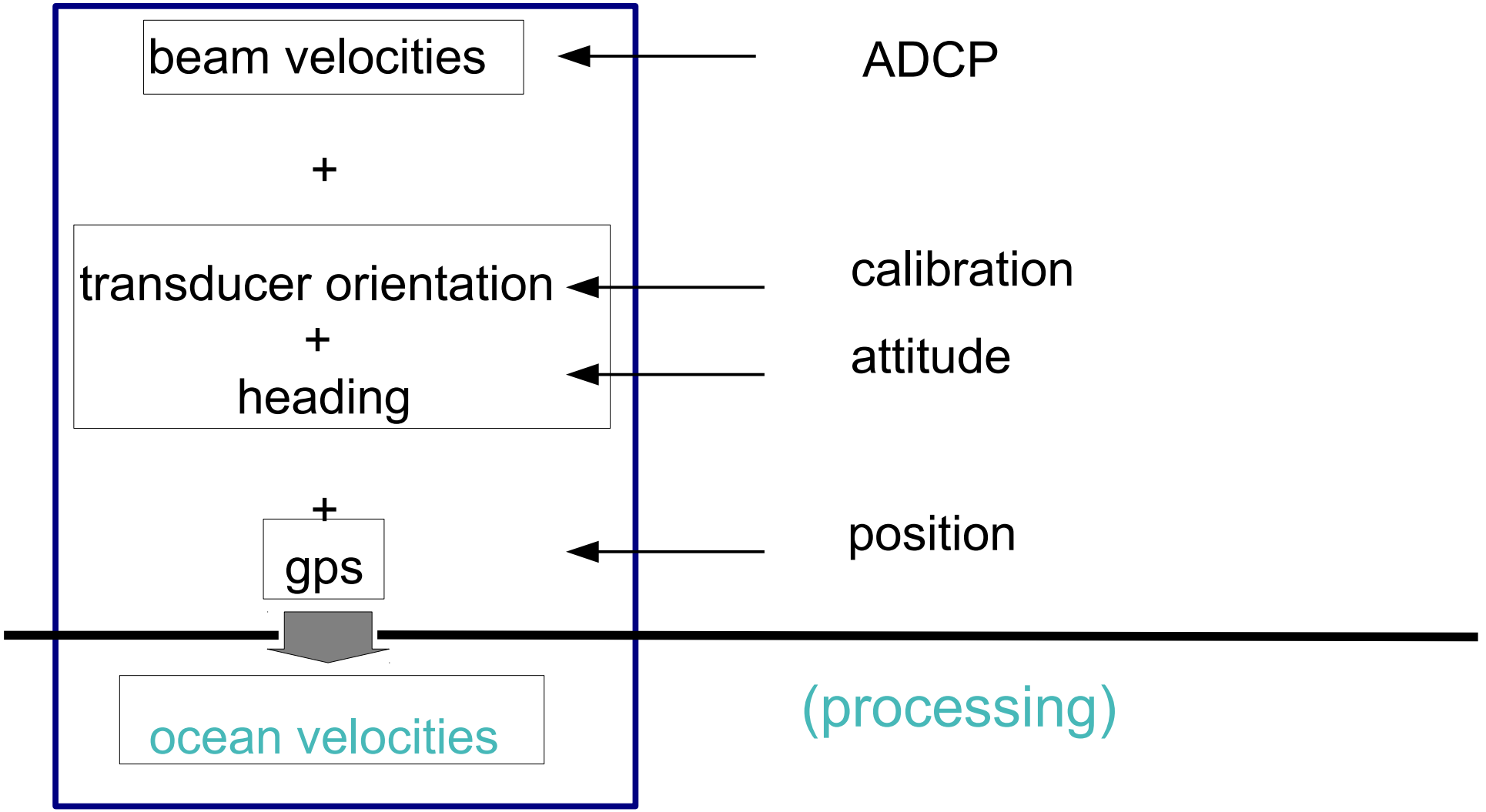
$U_{meas} + U_{ship} = U_{ocean}$

beam velocities
geometry
transducer orientation
heading

+ gps

$= U_{ocean}$

ADCP: Data components



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After: Practice

DATA ACQUISITION

Time, ADCP, Position, Attitude

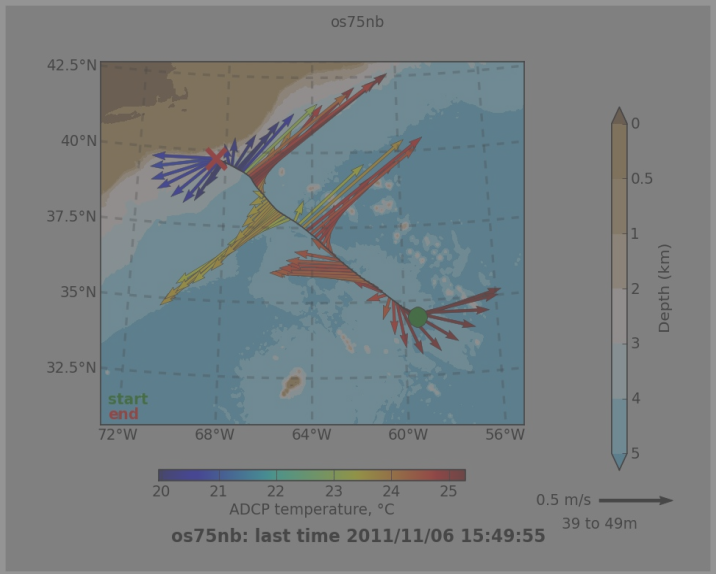
primitive (raw) data

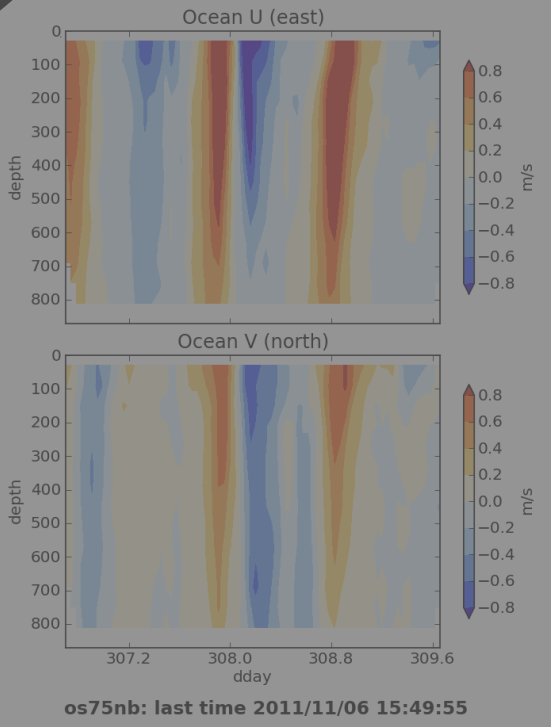
Time
ADCP
Position
Heading

Timestamp, Write to disk

DATA PROCESSING

(Data Products) (Visualization)





ADCP Acquisition Systems

There are two acquisition systems for vessel-mounted ADCPs:

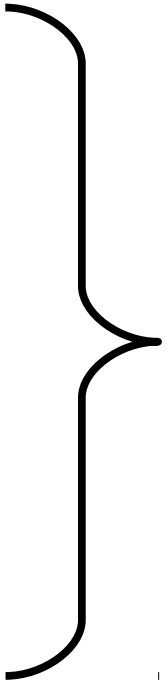
- VmDAS (provided with purchase)
- UHDAS (developed at Univ Hawaii)
  - Installed on UNOLS ships, rolling out to NOAA ships
  - Link to **Table of ships**

Components – Overview:

- Basic requirements
- Processing
- Monitoring

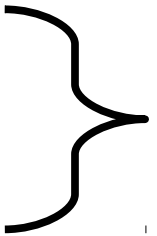
ADCP Acquisition Systems: Overview

- Basic requirements:
  - Control ADCP settings
  - Acquire ADCP data
  - Acquire ancillary data
    - Position
    - Attitude (heading)
  - Timestamp all



Core

- Processing
- Monitoring



Extra

ADCP Acquisition Systems: Overview

- Basic requirements

- Processing
  - Coordinate transformation
  - Editing
  - Averaging
  - Graphical Displays

- Monitoring

ADCP Acquisition Systems: Overview

- Basic requirements
- Processing

- Monitoring
  - Computer system
  - Data acquisition
  - Processing
  - Access to data

ADCP Acquisition systems: Details

- Basic requirements:
  - Overview
  - Serial setup
  - Data logging

Comparison (UHDAS/VmDAS)

- Processing
- Monitoring

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ADCP Acquisition Systems- Overview

	UHDAS	VmDAS
developer	Univ Hawaii	TRDI
style	linux system	windows application
source	open source	executable
purpose	seagoing oceanographers	all-purpose
goals	maximize - usefulness at sea - long-term value for research	off-the-shelf
evolution	continuous	incremental
setup	complex	confusing

ADCP Acquisition: Serial Setup

	UHDAS	VmDAS
ADCPs	multiple	one (per computer)
feeds	any number	3 (older version=2)
messages	many types can add more	fewer types
	subsample feed	record all
	choose messages	record all
GUI		
controls	instrument settings	everything
operation	simple	simple/confusing
protected	serial processing	nothing protected

Acquisition: Data Logging

	UHDAS	VmDAS
data logging	separate processes	one big program
time tagging	buffered tag every line	unbuffered tag ensemble
data formats	multiple	TRDI ADCP
data directory	heirarchical	flat
time range	match per file	match for one logging period
filenames sort (time=ascii)	always	one logging period
metadata	stored with data	text file elsewhere

ADCP Acquisition Systems: Comparison

- Basic requirements
  - Overview
  - Serial setup
  - Data logging
- Processing
  - Processing components
  - Accessing data products
- Monitoring

Processing: Comparison

	UHDAS	VmDAS
editing	CODAS	minimal
heading	reliable	primary
secondary heading	corrected to accurate	replaced by fallback
pings	interleaved	first
configure plots??	no	yes
plots	oceanographic: - profiles (E,N) - vector (+topo) - contour - bridge (mariner)	profile (speed, dir) vector WinADCP?

Accessing Data Products

	UHDAS	VmDAS
access plots	ship's web console	console only
data formats	TRDI Matlab netCDF	TRDI
access data	ship's web windows share NFS	acquisition PC windows share
documentation	ship's web www	acquisition PC www
speedlog out	yes	yes

ADCP Acquisition Systems: Comparison

- Basic requirements
  - Overview
  - Serial setup
  - Data logging
- Processing
  - Processing components

  - Accessing data products
- Monitoring

Monitoring

	UHDAS	VmDAS
computer	daily report	no
serial	daily_report	LOG and console messages configure tables
ADCP	beam plots	configure plots
Processing	daily_report plots calibration ping rate bottom track	configure plots no ? no
remotely	email to anyone	no

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Heading

Timestamp, Write to disk

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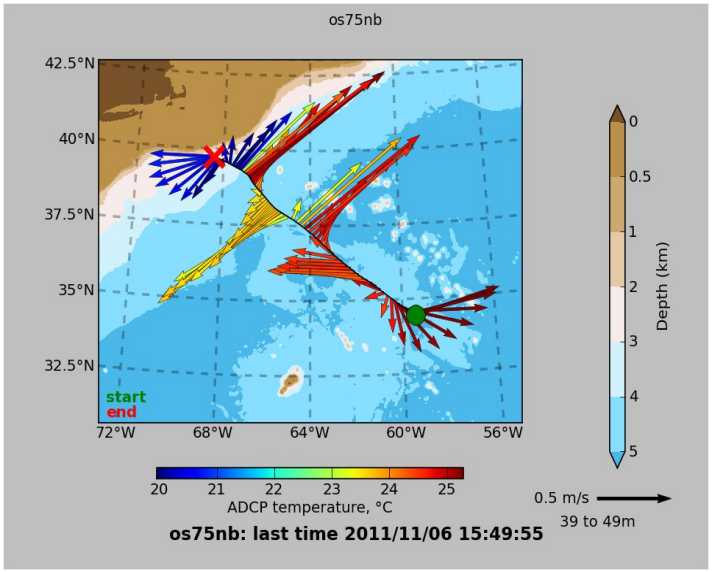

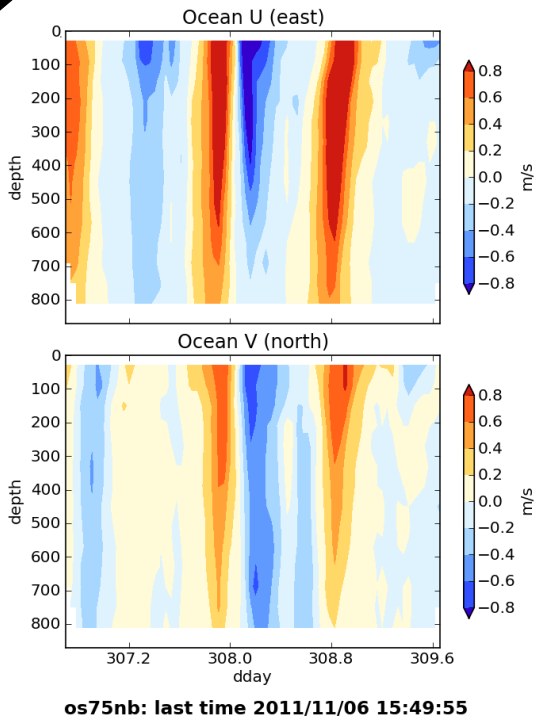

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Break now?
or in 10-15 min?

(information flow is better
if we hang on for one
more section...)

CODAS Processing

UHDAS:

- acquisition

Cruise directory structure

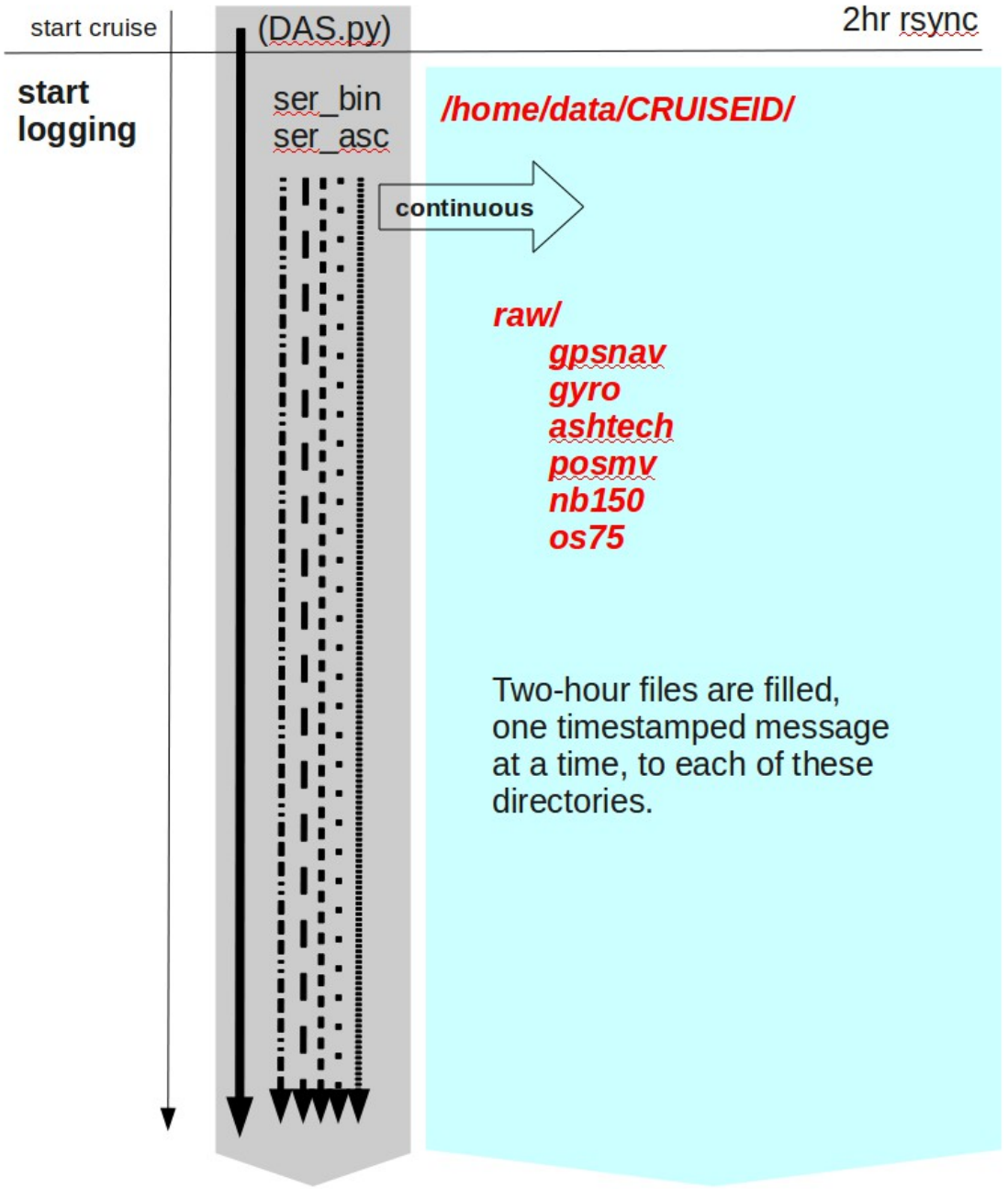
Gridding raw data before averaging

UHDAS cruise directory structure

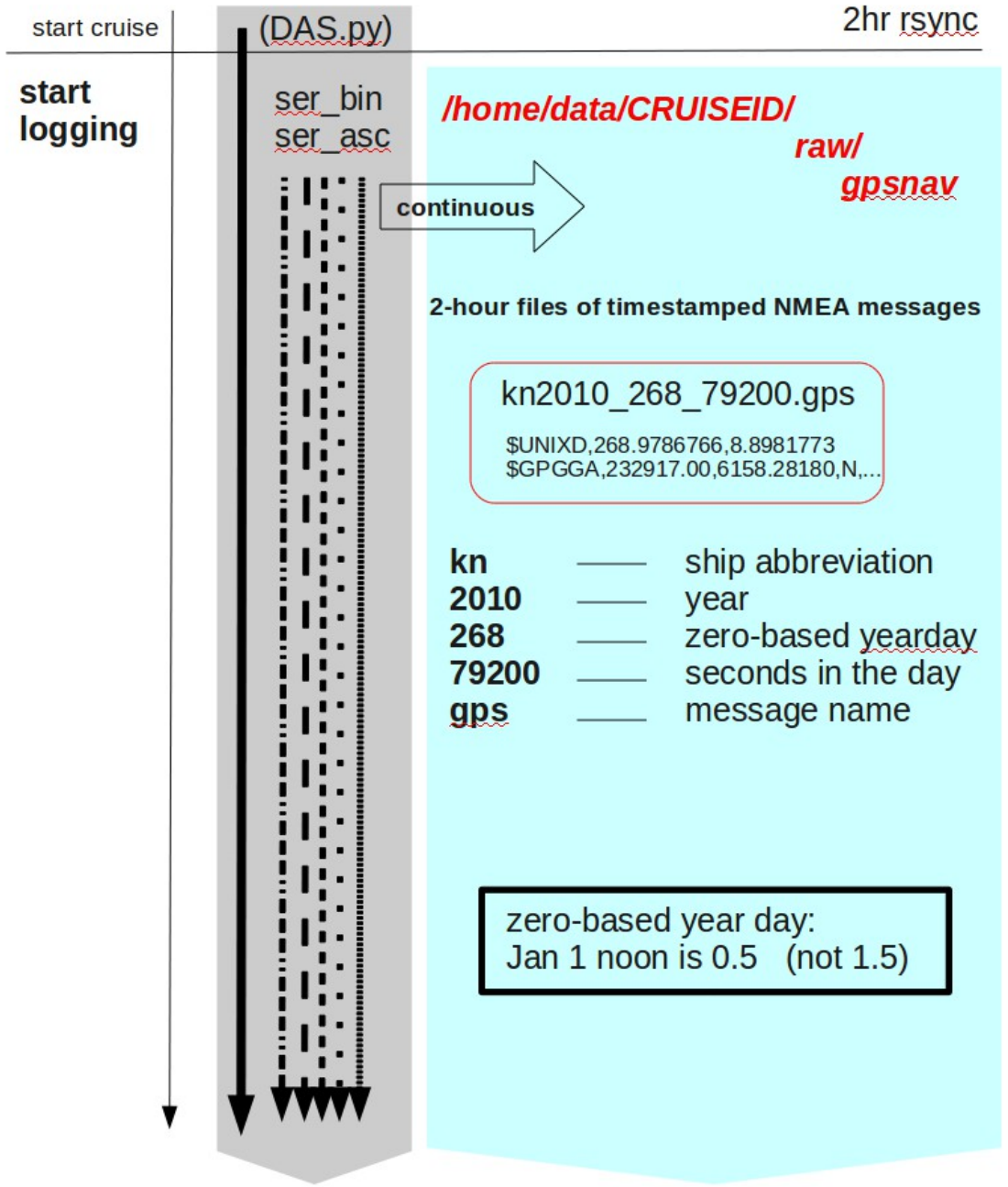
subdirectory	contents	importance	back up for ...
raw	all raw data	critical	archiving
rbin	intermediate files	nice to have	anyone who gets 'raw'
gbin	intermediate files	nice to have	anyone who gets 'raw'
proc	processed data • codas database • underway figure archive • matlab files	final at-sea product	science CD after cruise
reports	mini-webpage with metadata and overview of processed data	nice to have (only in modern cruise directories)	science CD after cruise

(link in documentation – [raw+rbin+gbin] directories)

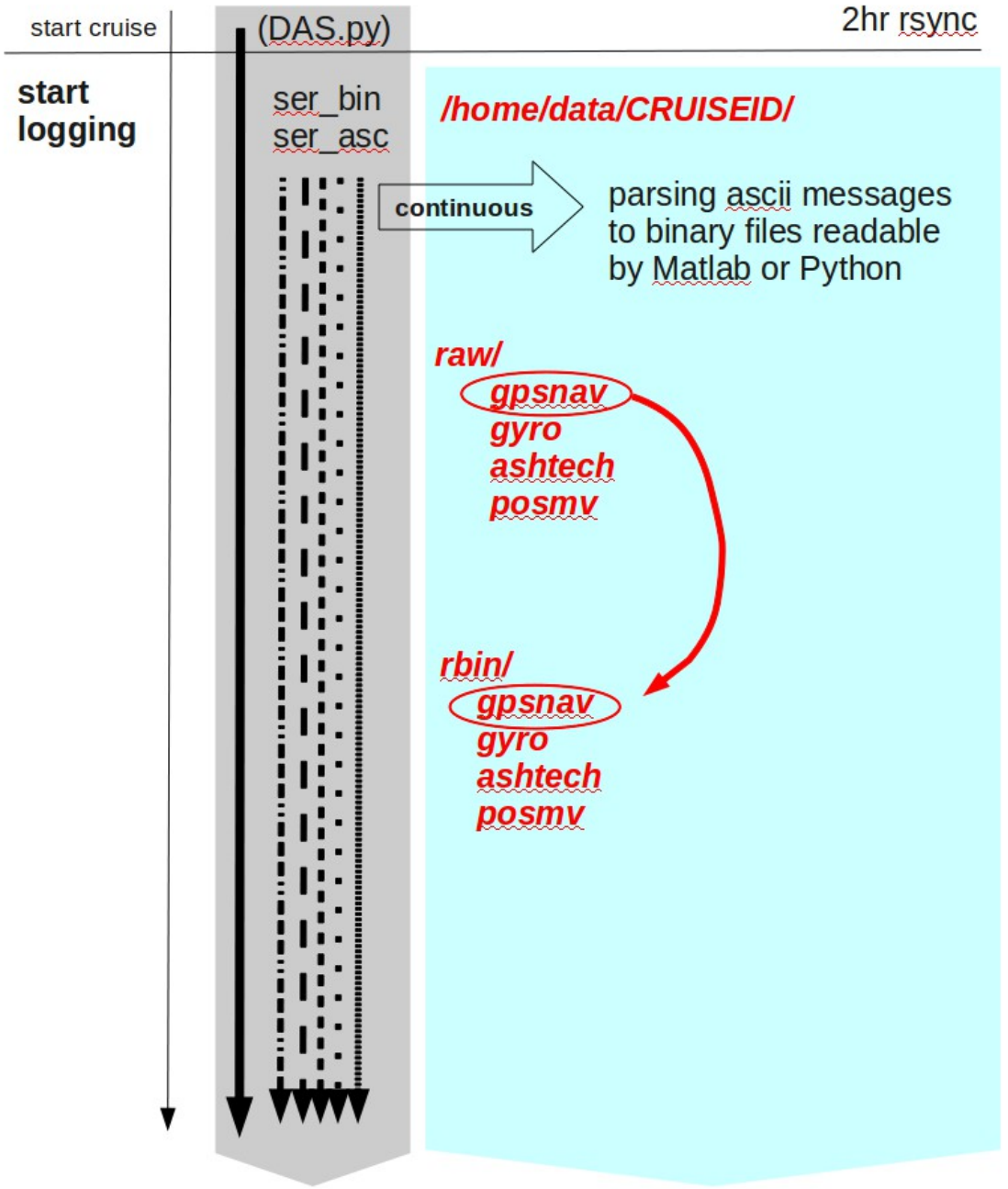
serial logging (raw files)



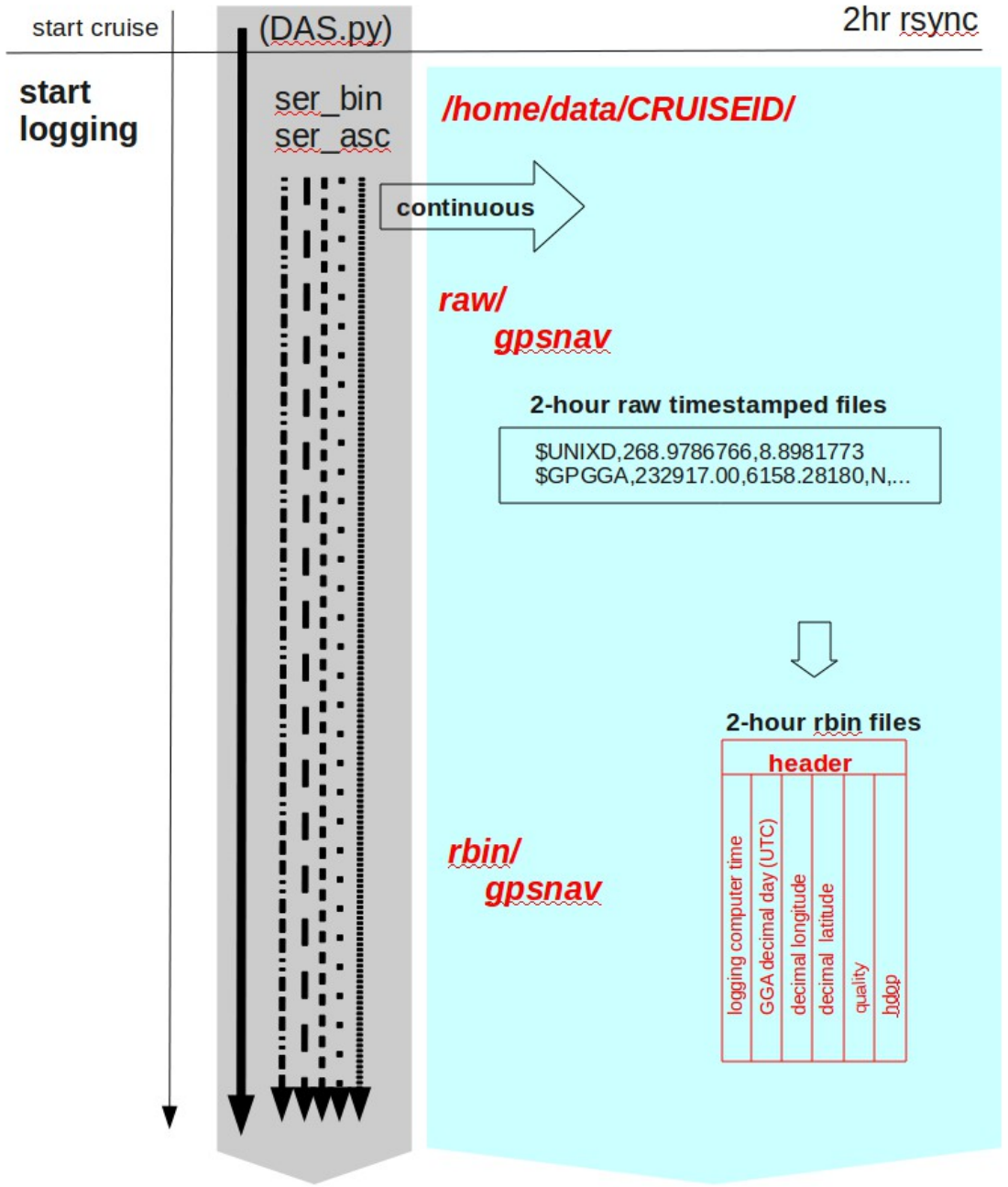
serial logging (write raw file)



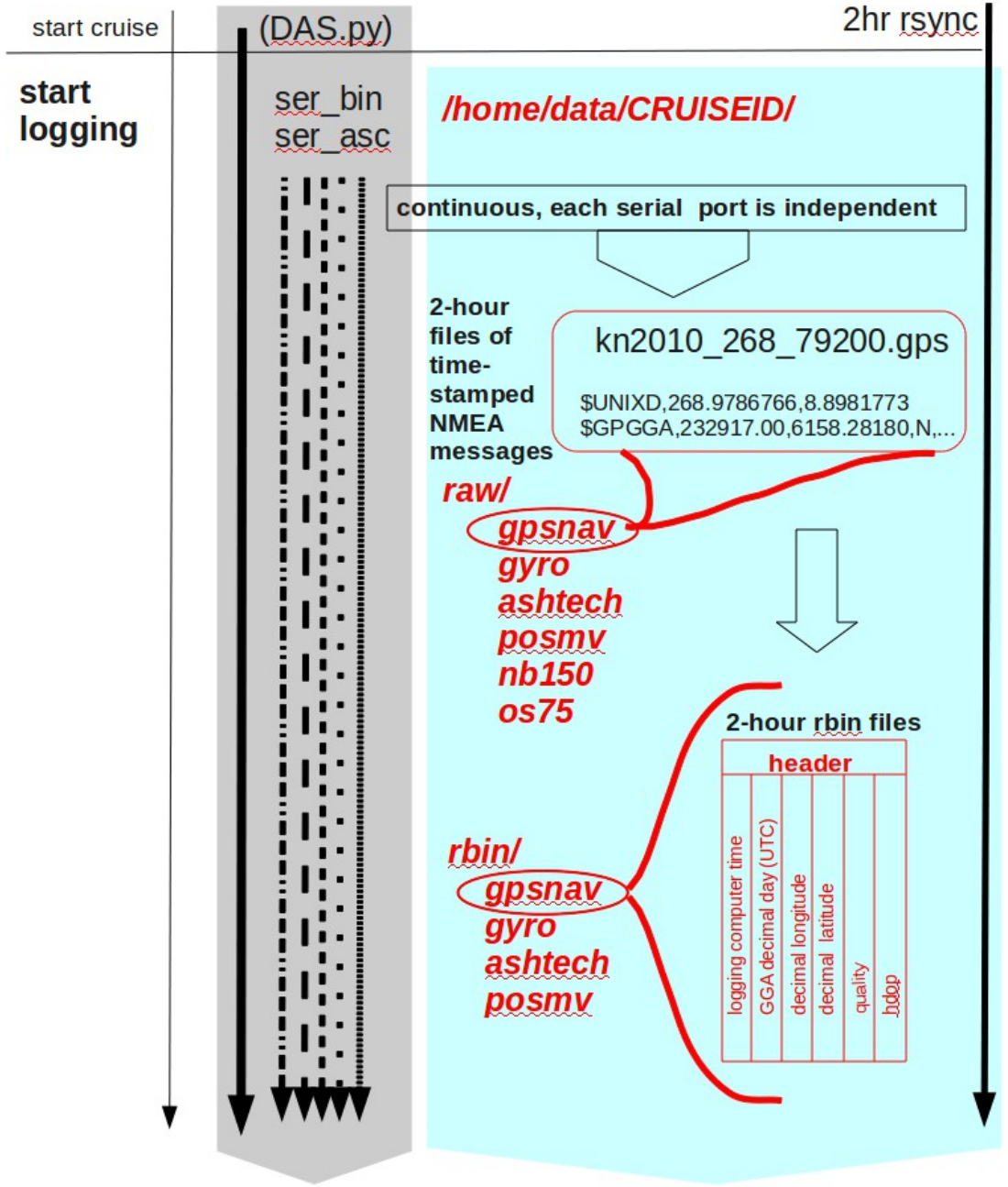
serial logging (raw ➡ rbin)



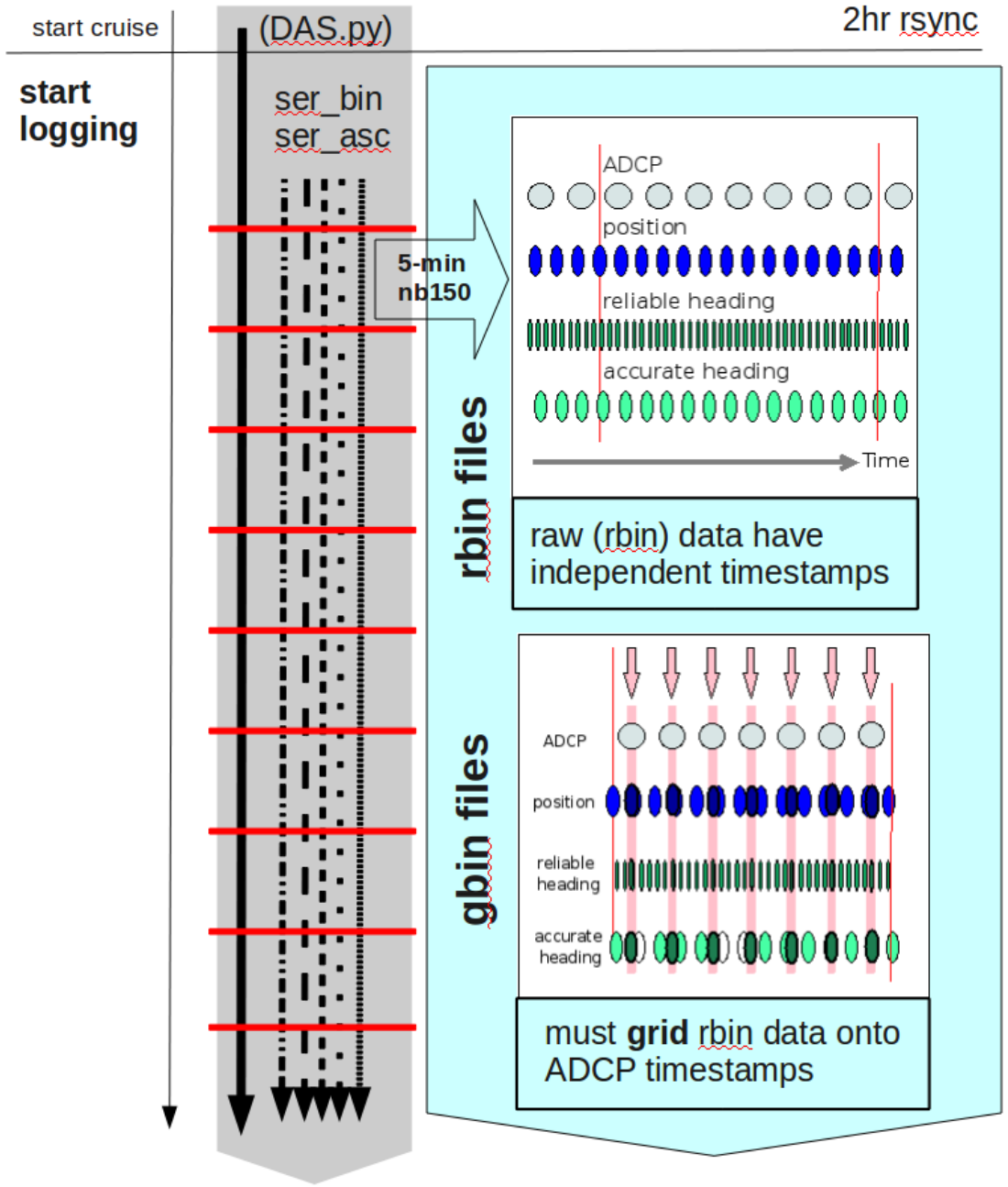
serial logging (rbin file contents)



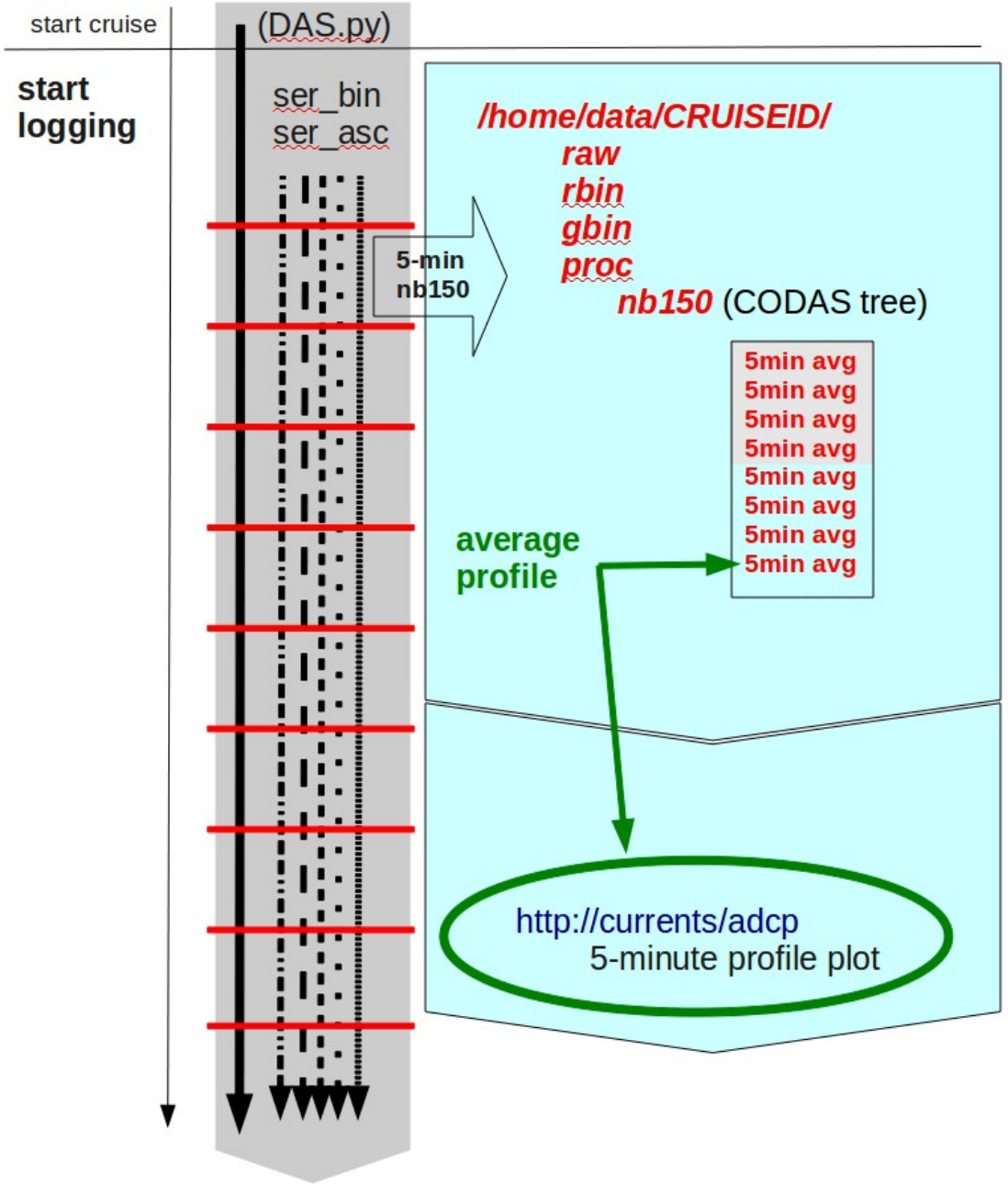
serial logging (raw, rbin)



UHDAS: 5min timer (make gbins)



UHDAS 5-minute timer: make profile



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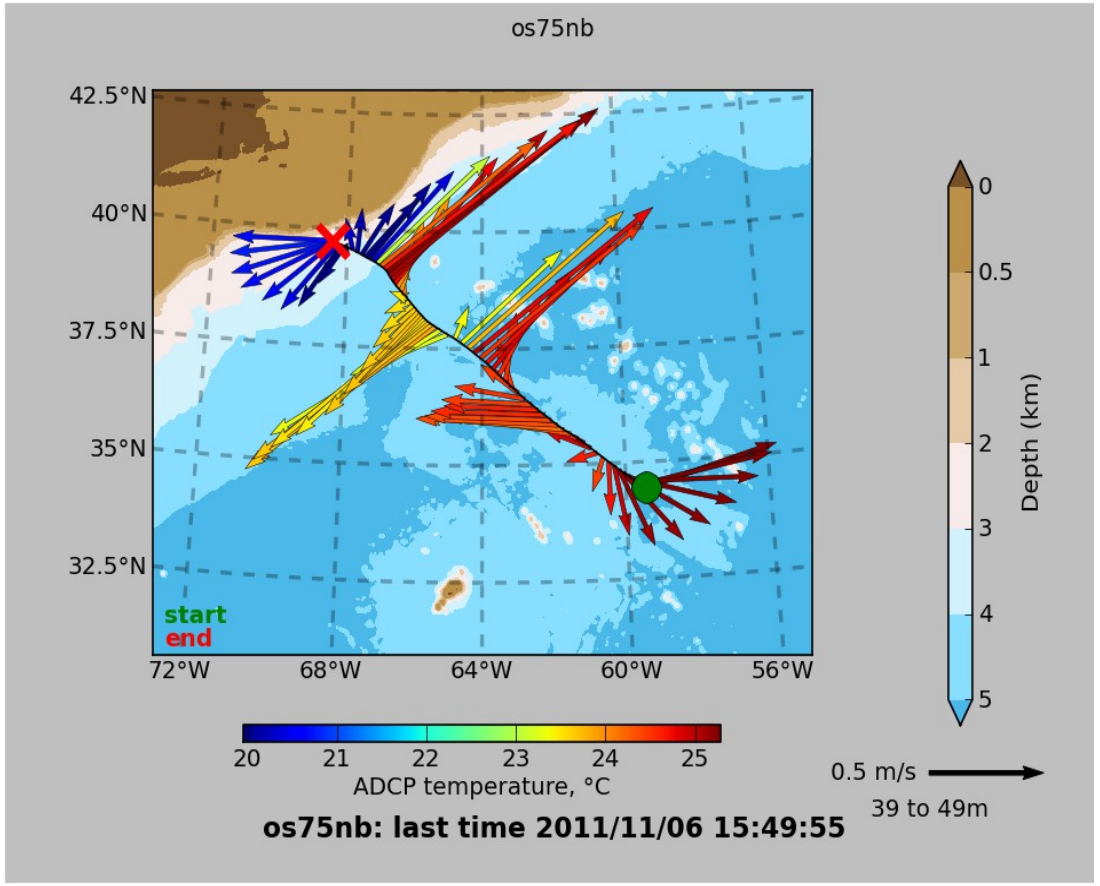
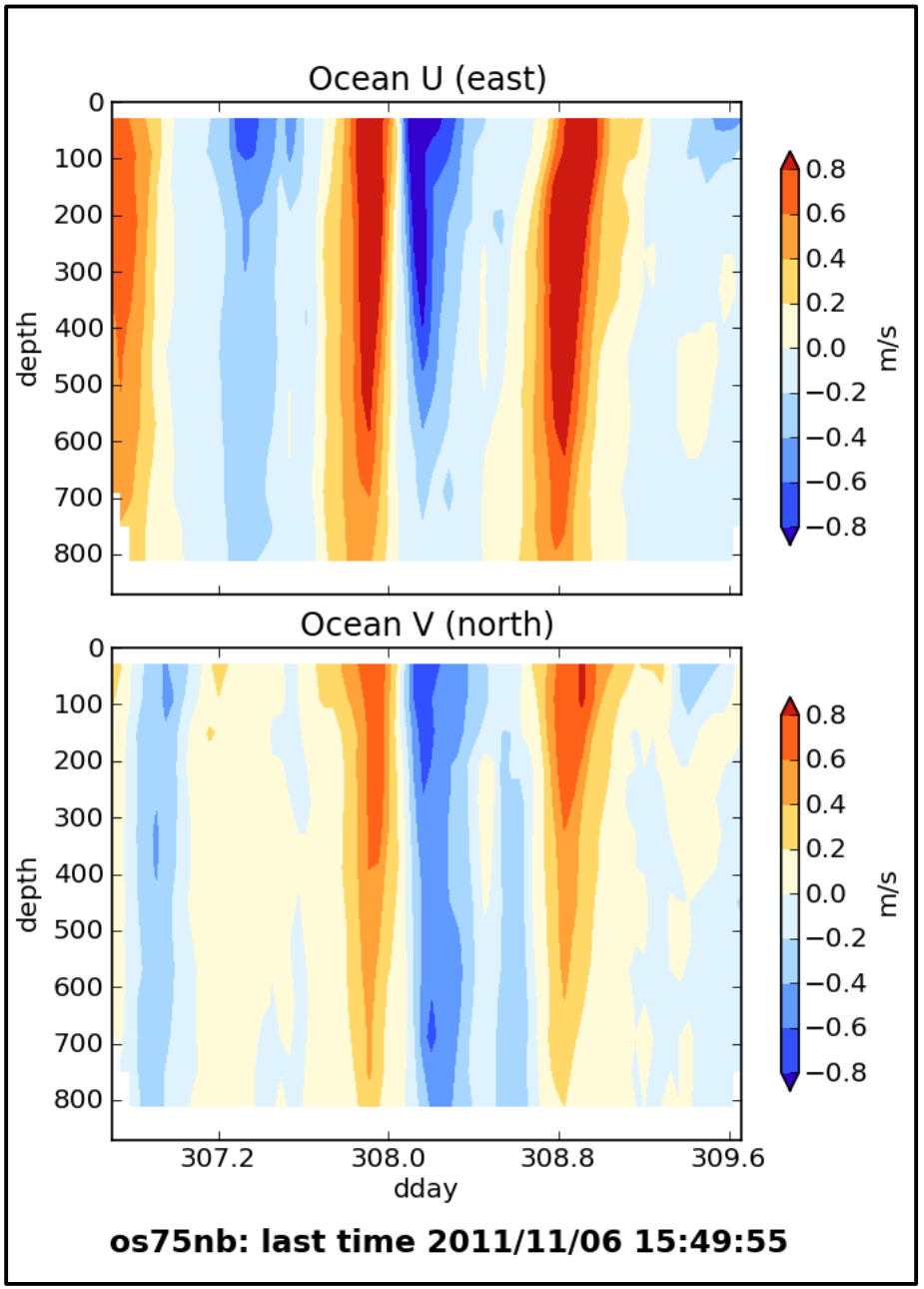
Time, ADCP, Position, Attitude

primitive (raw) data





CODAS Processing Overview

CODAS: **C**ommon **O**cean **D**ata **A**ccess **S**ystem

- Portable (multiple operating systems)
- Self-descriptive (like netCDF)
- Aggregated files (multiple files)
- Designed for ADCP data

"**CODAS Processing**" → produce ocean velocities

- Tools to access and modify CODAS files

“CODAS” ADCP Processing

Goals

- Run on multiple operating systems
  - (Windows, (*) OSX, Linux)
- Open source, free (Python)
- Flexible (tweak, tune, patch, augment)

Processing

- Written for ADCP data
- Works with most RDI ADCPs (link)
- Balance real-time product with recoverable dataset
- Single-ping (automated) and manual editing
- Calibration diagnostics and routines
- Documented

(*) via VirtualBox pre-configured Linux computer

CODAS = “**C**ommon **O**cean **D**ata **A**ccess **S**ystem”

CODAS Processing Supports...

Python CODAS support

Acquisition program	instrument	ping type	file type (suffix)	Averaged? or raw?
DAS2.48	Narrowband	nb	pingdata	avg
VmDAS	Broadband/ or Workhorse	bb	LTA, STA	avg
			ENR	raw
	Ocean Surveyor	nb	LTA, STA	avg
			ENR(N1R,N2R)	raw
		bb	LTA, STA	avg
			ENR(N1R,N2R)	raw
		nb bb	ENR(N1R,N2R)	raw
UHDAS	NB150,NB300	nb	raw	raw
	Ocean Surveyor	nb	raw	raw
		bb	raw	raw
		nb bb	raw	raw
	WH300	bb	raw	raw

CODAS processing: 2 modes

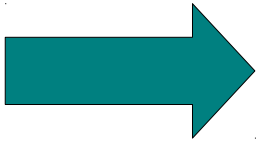
(1) **process single-ping data**

- beam-to-earth coordinates
- single-ping editing (acoustic interference, bottom)
- create averages; save to disk
- load averages into CODAS database

(2) **load averaged data** into CODAS database

- 1980's PINGDATA
- VmDAS: *.LTA, *.STA

} (no single-ping editing)



Next: "post-processing steps"

CODAS post-processing:

- View figures and logfiles
- Fix heading:
  - patch gappy but accurate heading correction (if relevant)
  - apply time-dependent heading correction
- Determine corrections/calibrations, then apply
  - remaining transducer offset
  - scale factor (if relevant)
  - transducer-GPS offset (in meters)
- Manually edit out bad data ("gee-autoedit" tutorial)
  - graphically select bins, profiles
  - using thresholds
- check calibrations
- make figures (web page); export data (matlab, netCDF)

CODAS software tools:

- **Tools for or raw (single-ping) ADCP data**:
- visualization of beam values
  - RSSI (signal return)
  - beam velocity
- estimate EA (transducer angle)

RDI ADCPs

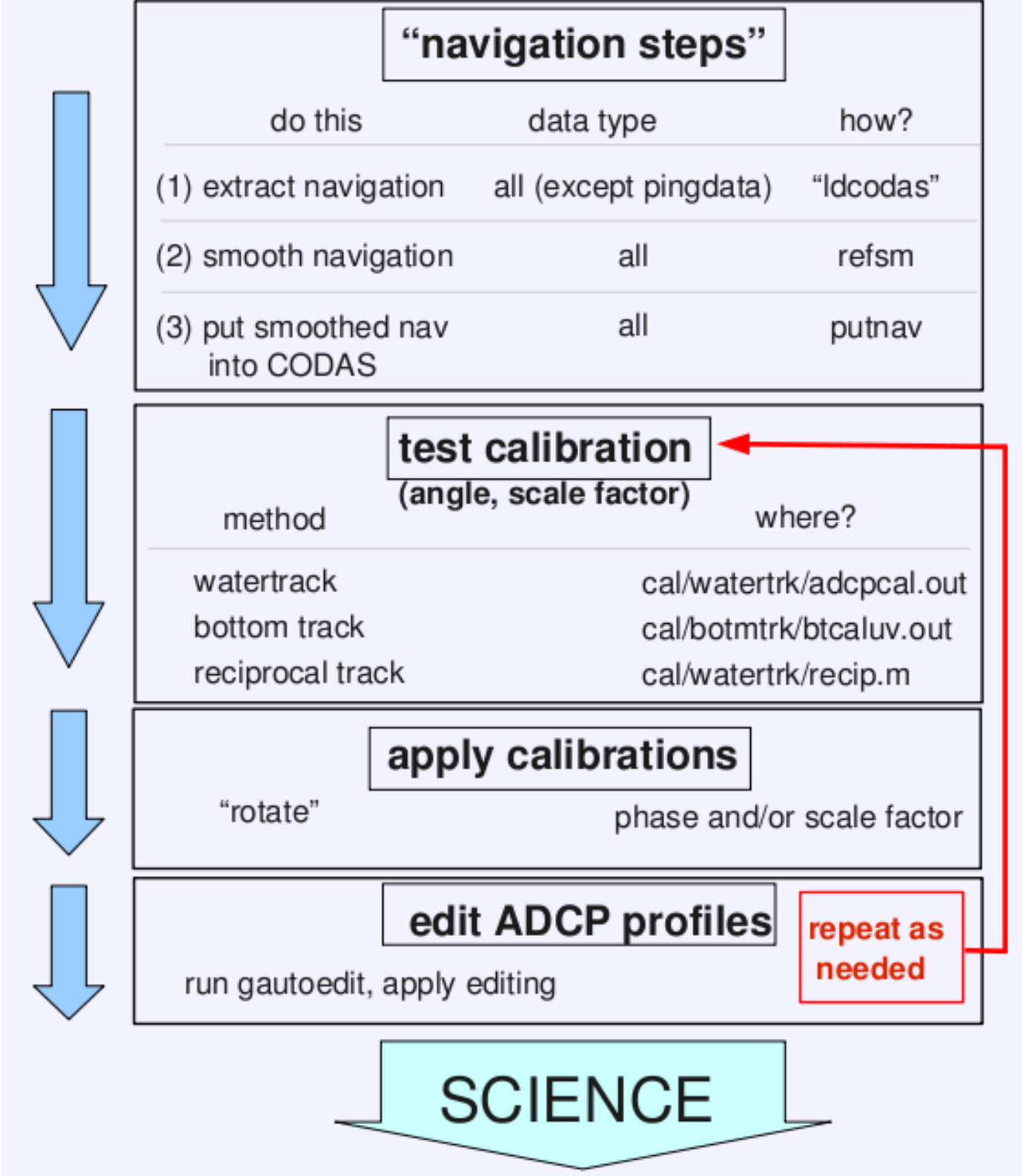
- conversion of NMEA strings to “rbin” data files
  - N1R, N2R, N3R (from VmDAS)
  - UHDAS raw serial data
- tools to plot rbin data:
  - plot POSMV quality
  - plot navigation over topography
  - plot one (or compare two) rbin data streams

UHDAS data products

Acquire the data, write to disk → **Fill the CODAS database**

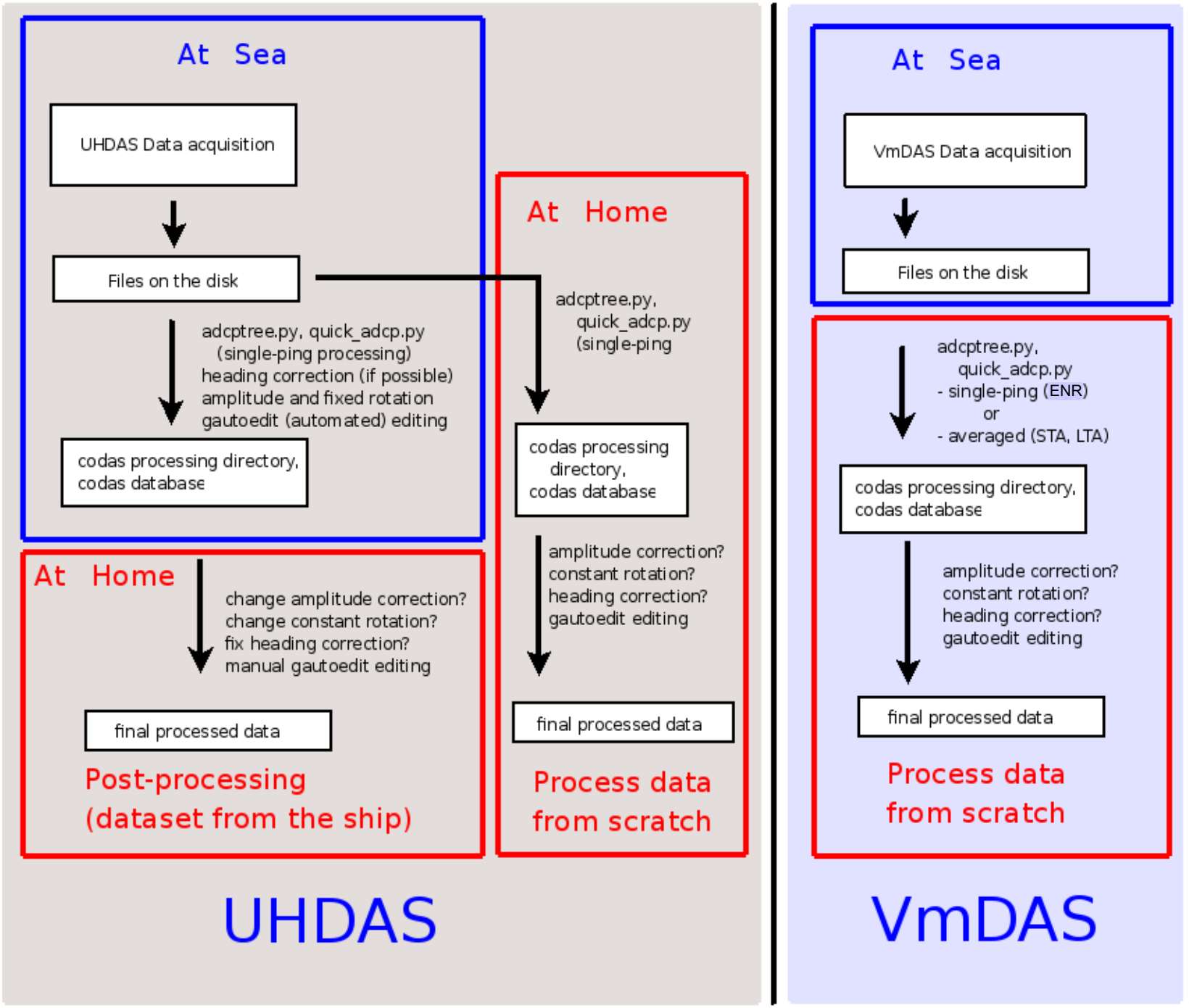
acquisition	data stored to disk		load the database	
program name	averaged	singleping	translate to *.bin + *.cmd	executable (to load)
DAS2.48	pingdata.*		(no)	loadping
VmDAS	*.STA *.LTA		load_lta.m	ldcodas
VmDAS		*.ENR *.ENS *.ENX	load_ens.m	ldcodas
UHDAS		*.raw	load_uhblk	ldcodas

These steps
use only the
CODAS files
so work on
any averaged
data, regardless
of the source
- single-ping editing
- LTA/STA
- PINGDATA



At Sea

At Home



CODAS Processing

- Editing (single-ping)
  - Acoustic interference
  - Bubbles
  - Below bottom
- Editing CODAS database averages "gee-autoedit"
- Interpolate missing heading correction
- Apply calibrations
  - Scale factor
  - Rotation
  - Transducer offset (new)

CODAS Processing

- Editing (single-ping)
  - Acoustic interference
  - Bubbles
  - Below bottom

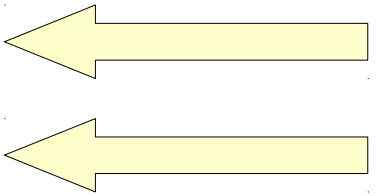
BEFORE AVERAGING

- Editing CODAS database averages "gee-autoedit"
- Interpolate missing heading correction
- Apply calibrations
  - Scale factor
  - Rotation
  - Transducer offset (uncommon/experimental)

ADCP Single-ping Editing

The most common causes of error
(addressed by single-ping editing)

- Acoustic Interference
- Bubbles
- Below bottom



Both tend to cause bias towards zero
in measured velocity

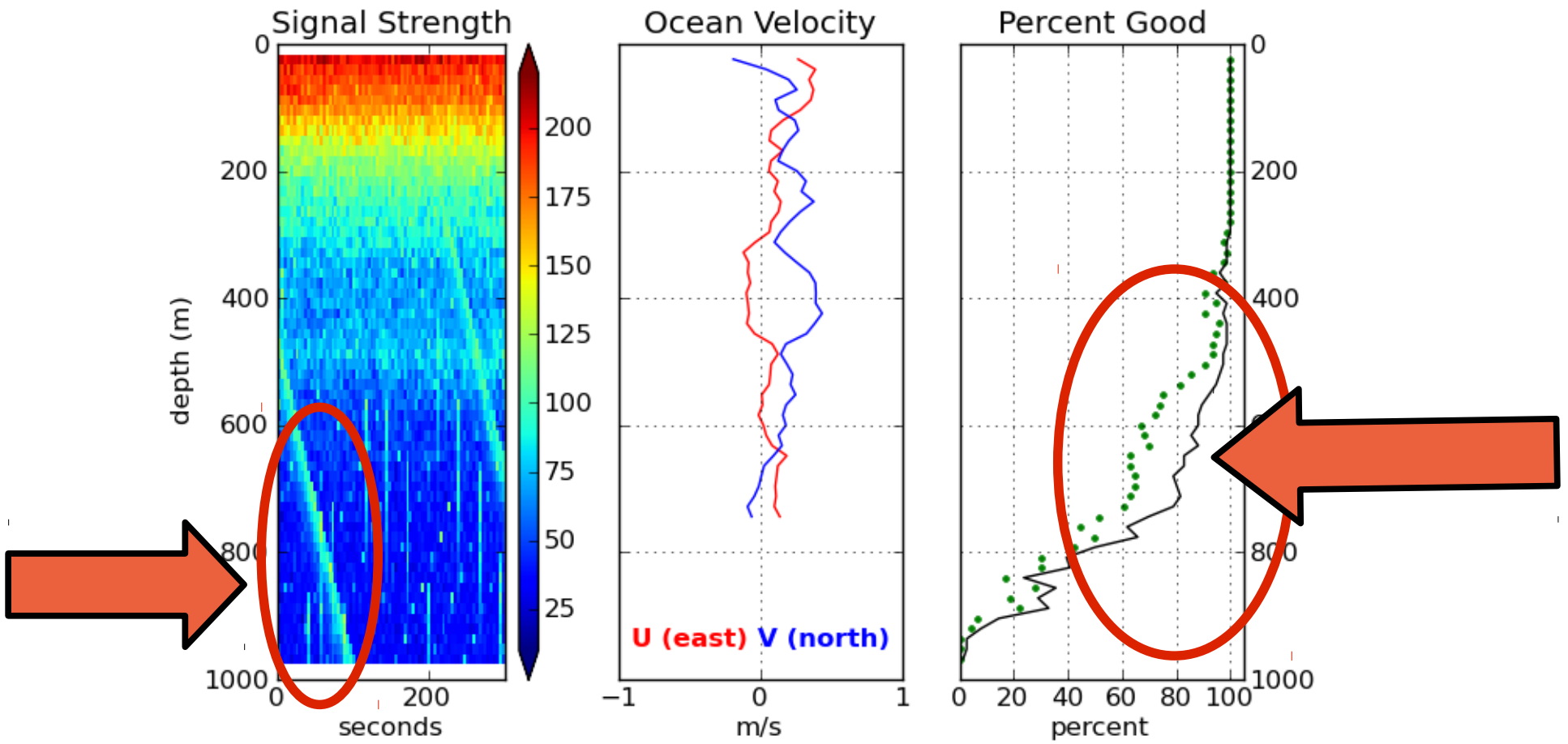
ADCP Single-ping Editing

The most common causes of error (addressed by single-ping editing)

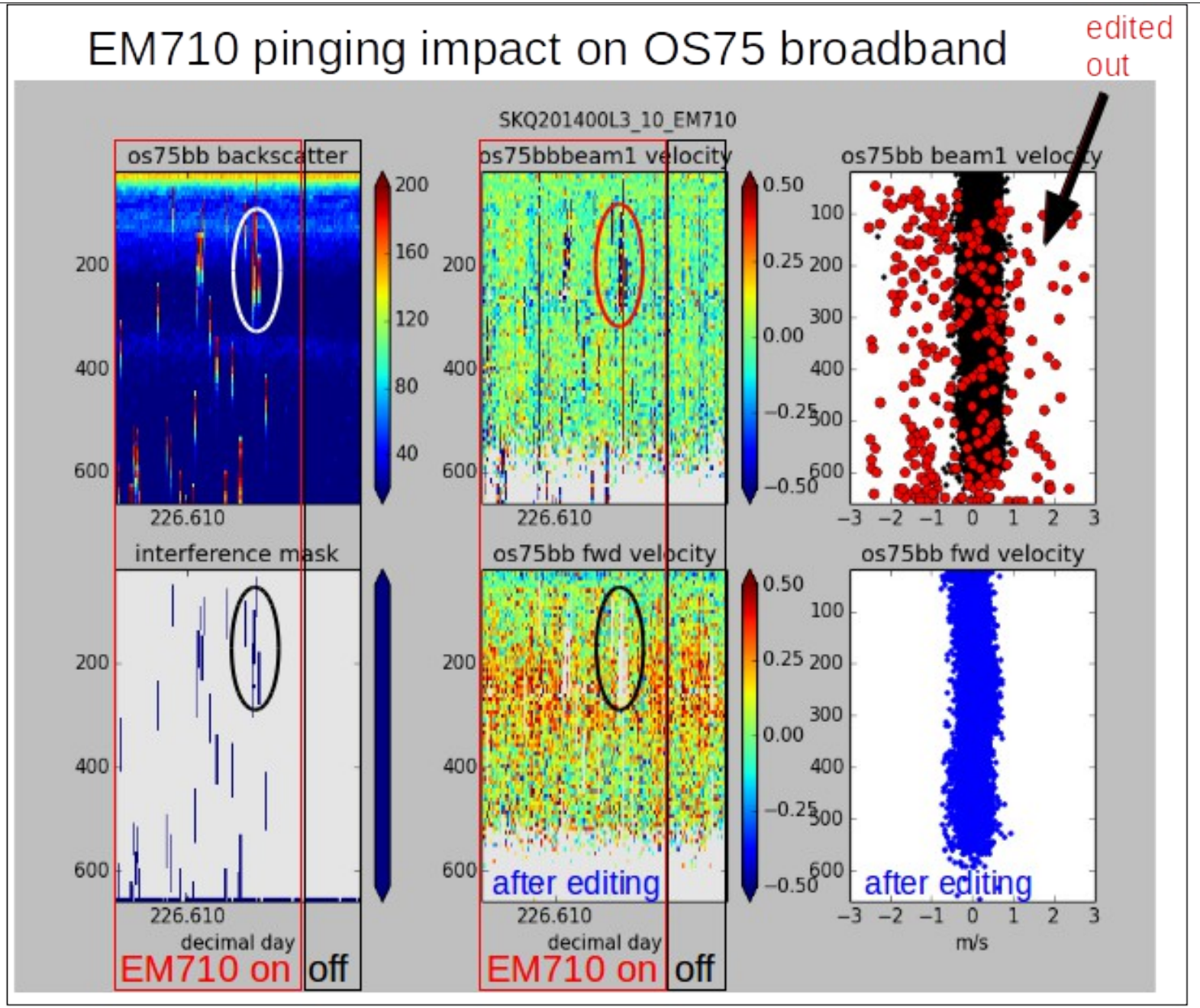
- Acoustic Interference
- Bubbles
- Below bottom

ADCP Processing

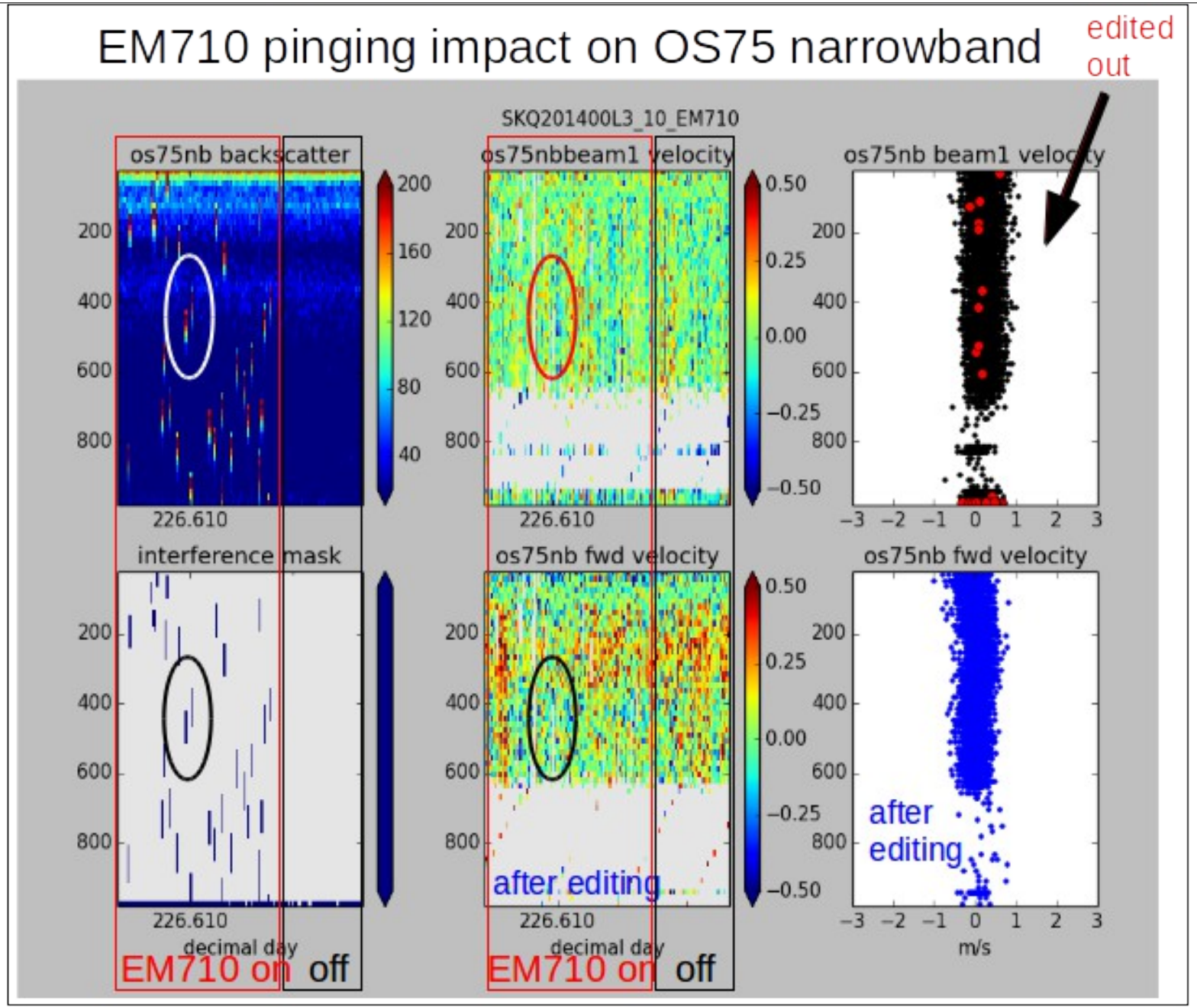
Singleping editing: acoustic interference



ADCP Processing: editing out interference



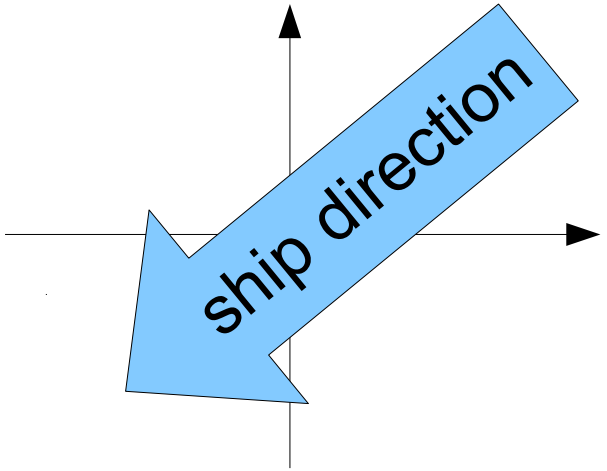
ADCP Processing: editing out interference

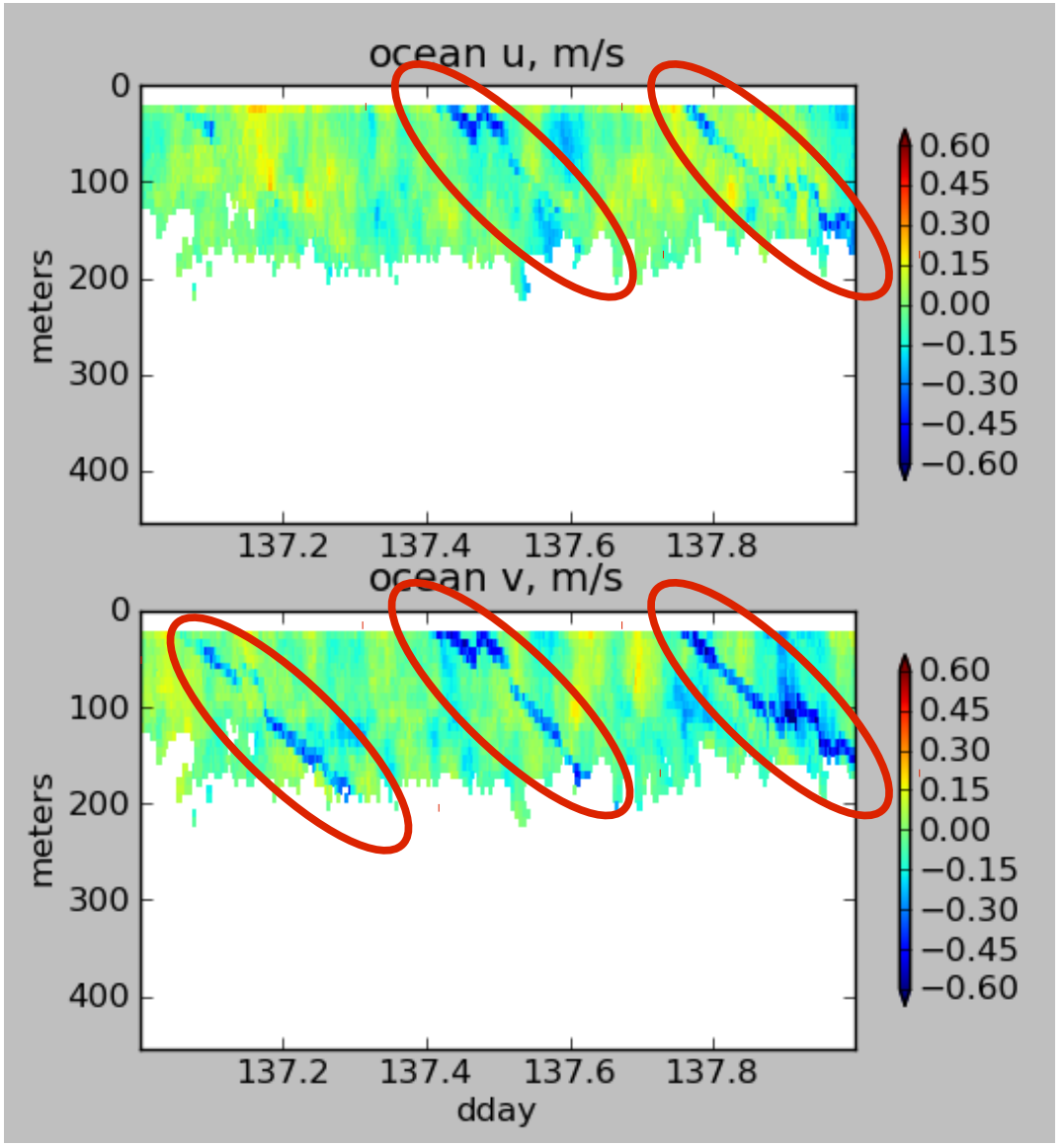


ADCP Processing **without** singleping editing

Averaged
ocean velocities

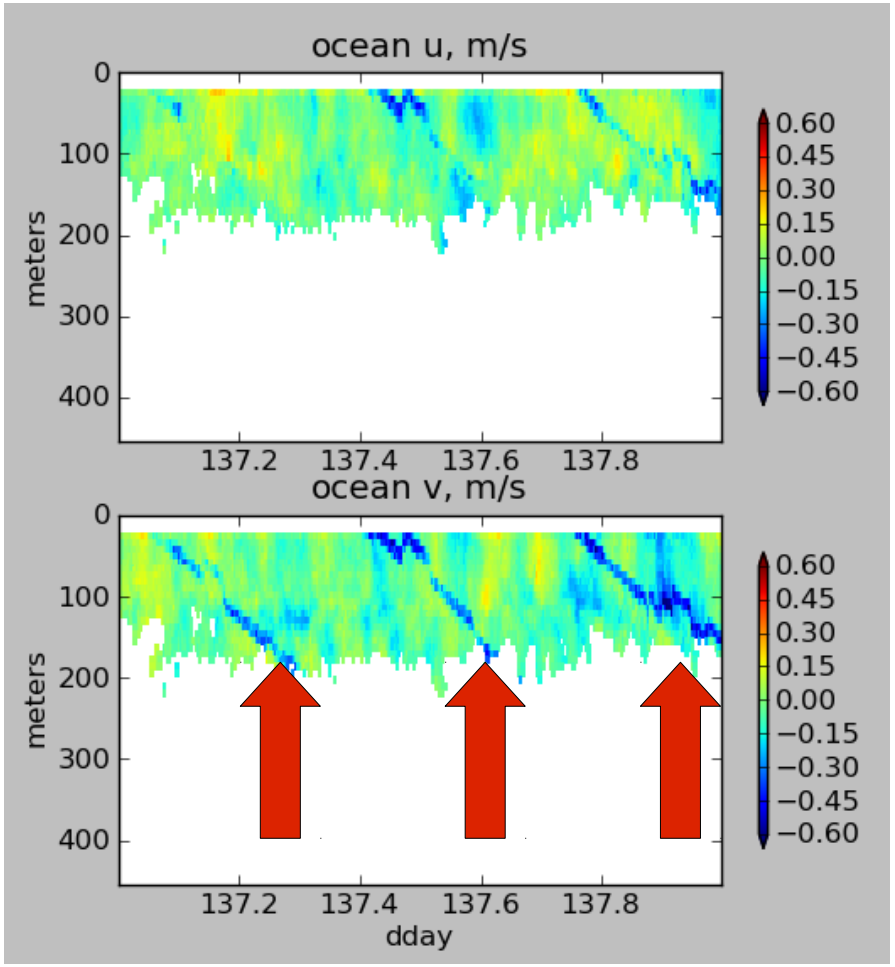
NOTE: along-track
direction bias



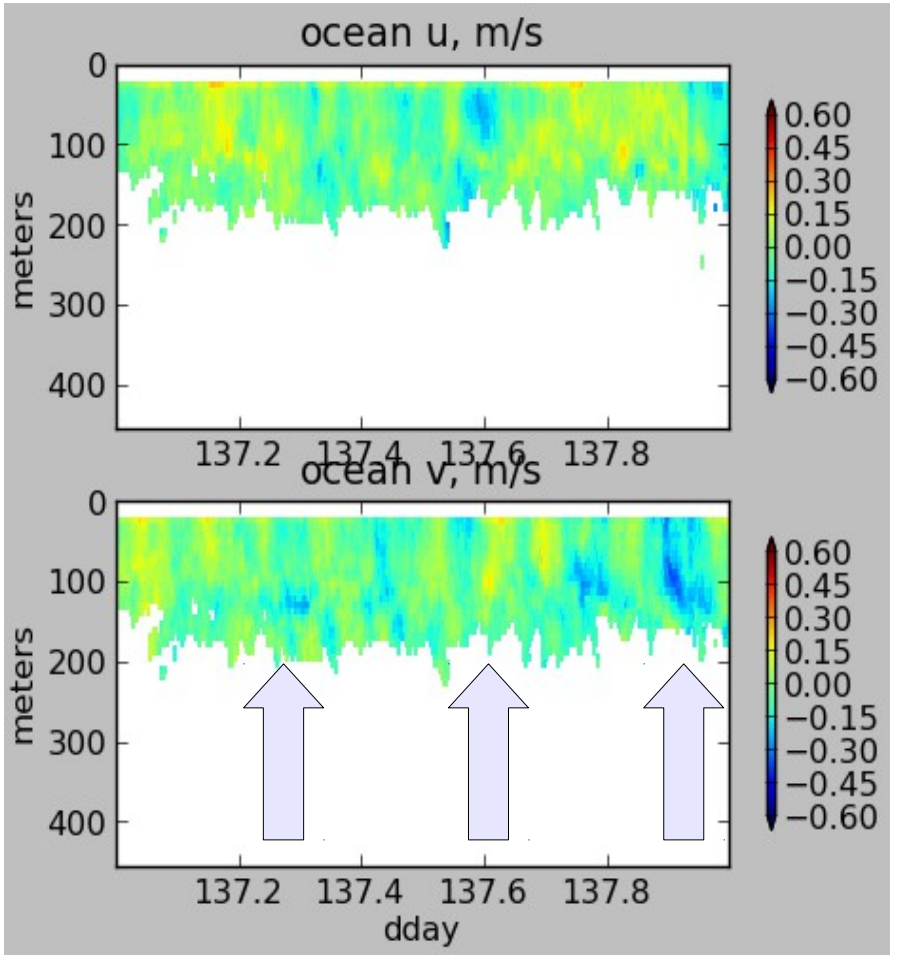


ADCP Processing: acoustic interference

WITHOUT
singleping editing



USING
singleping editing

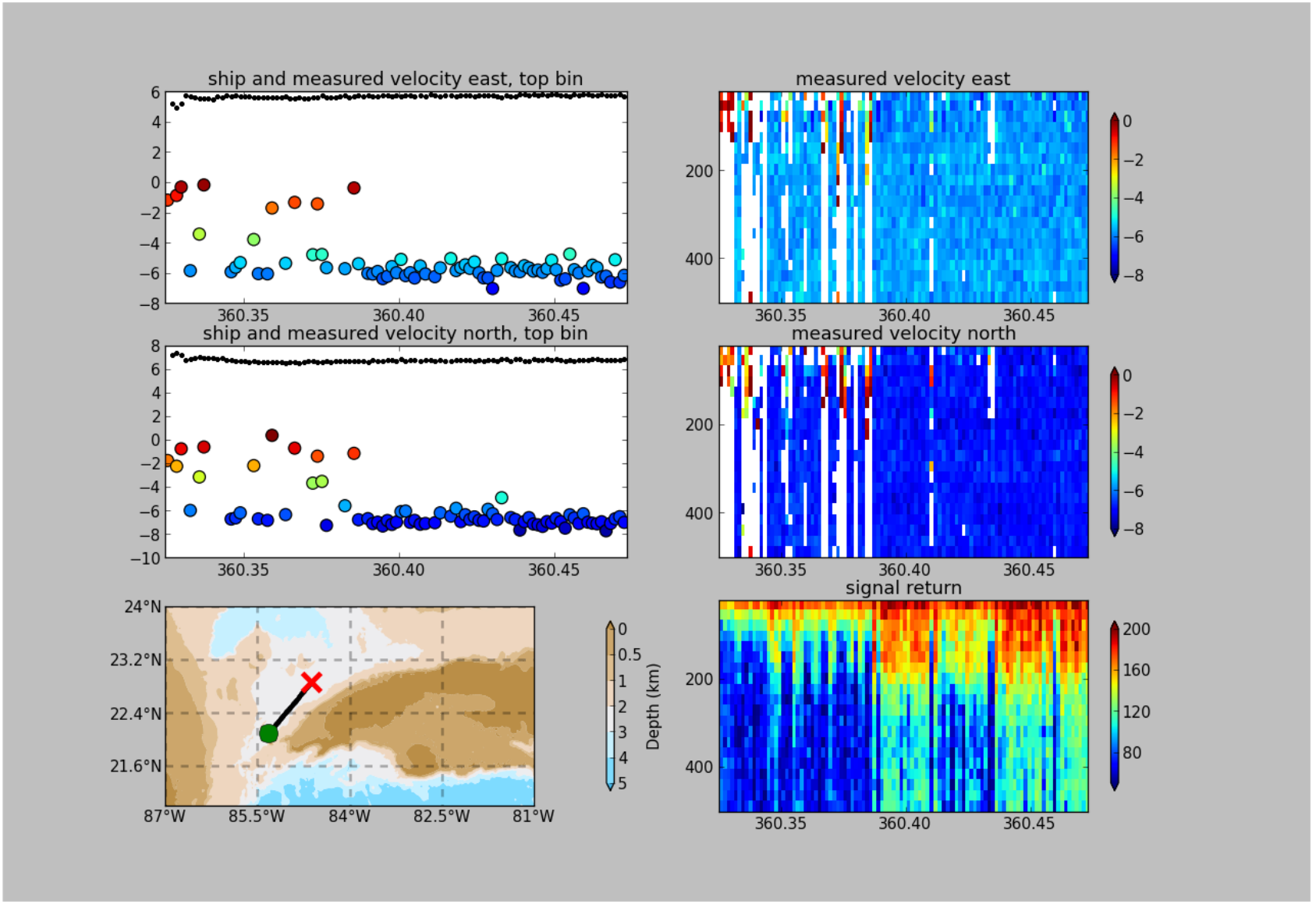


ADCP Single-ping Editing

The most common causes of error (addressed by single-ping editing)

- Acoustic Interference
- Bubbles
- Below bottom

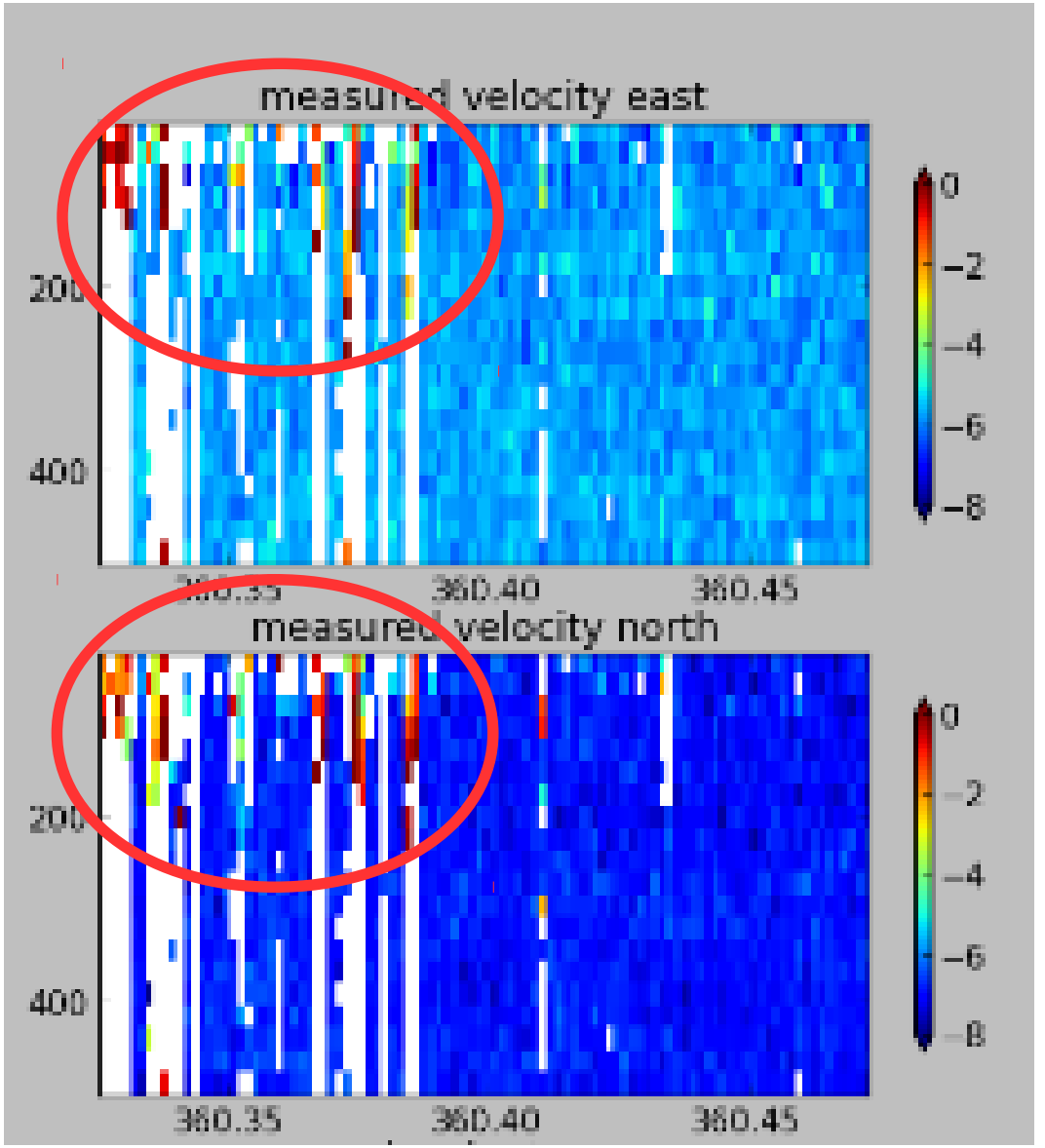
single-ping editing:underway bias



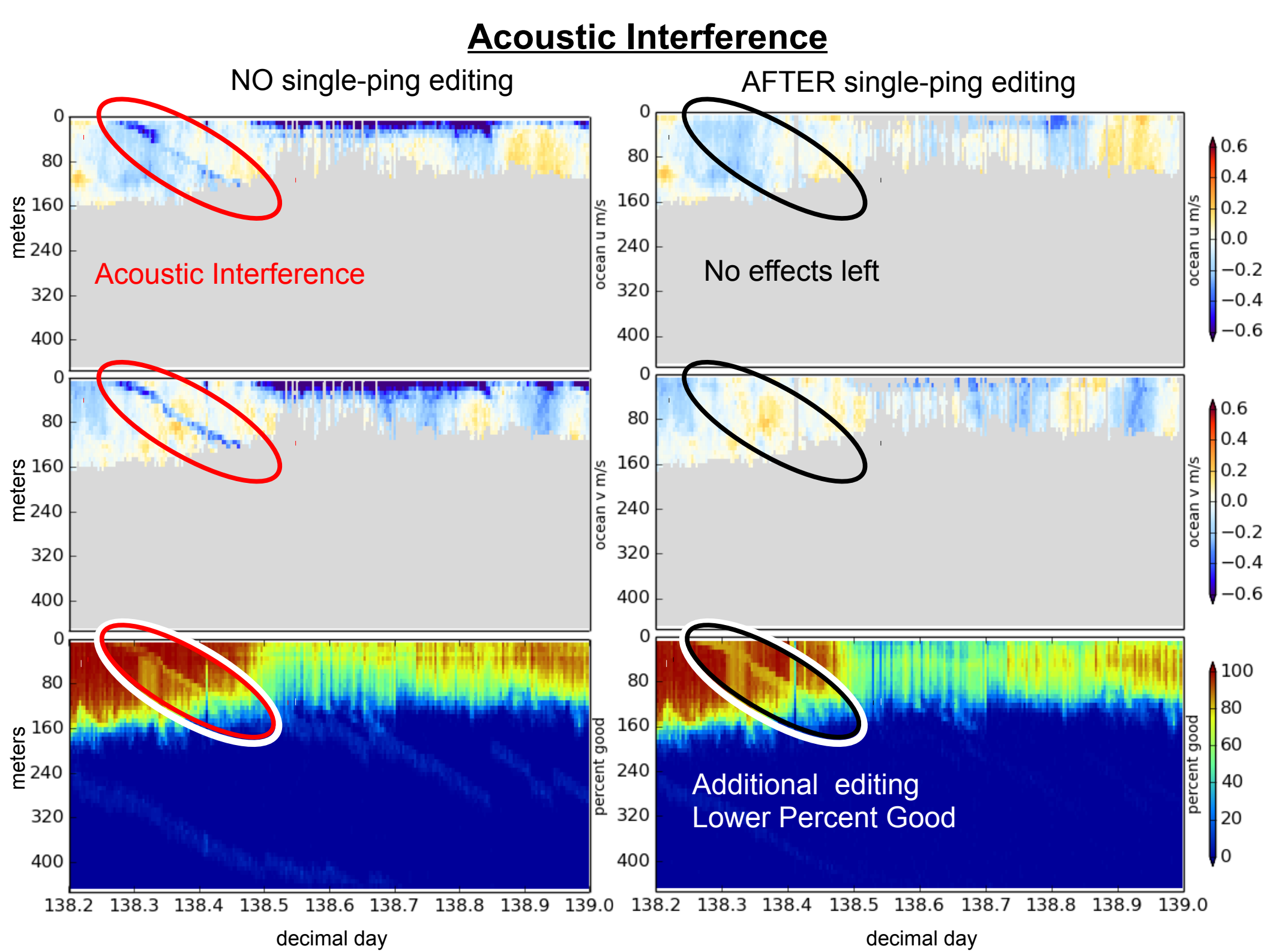
ADCP Data: effect of bubbles

Bubbles:
- short profiles
- strongly biased towards zero

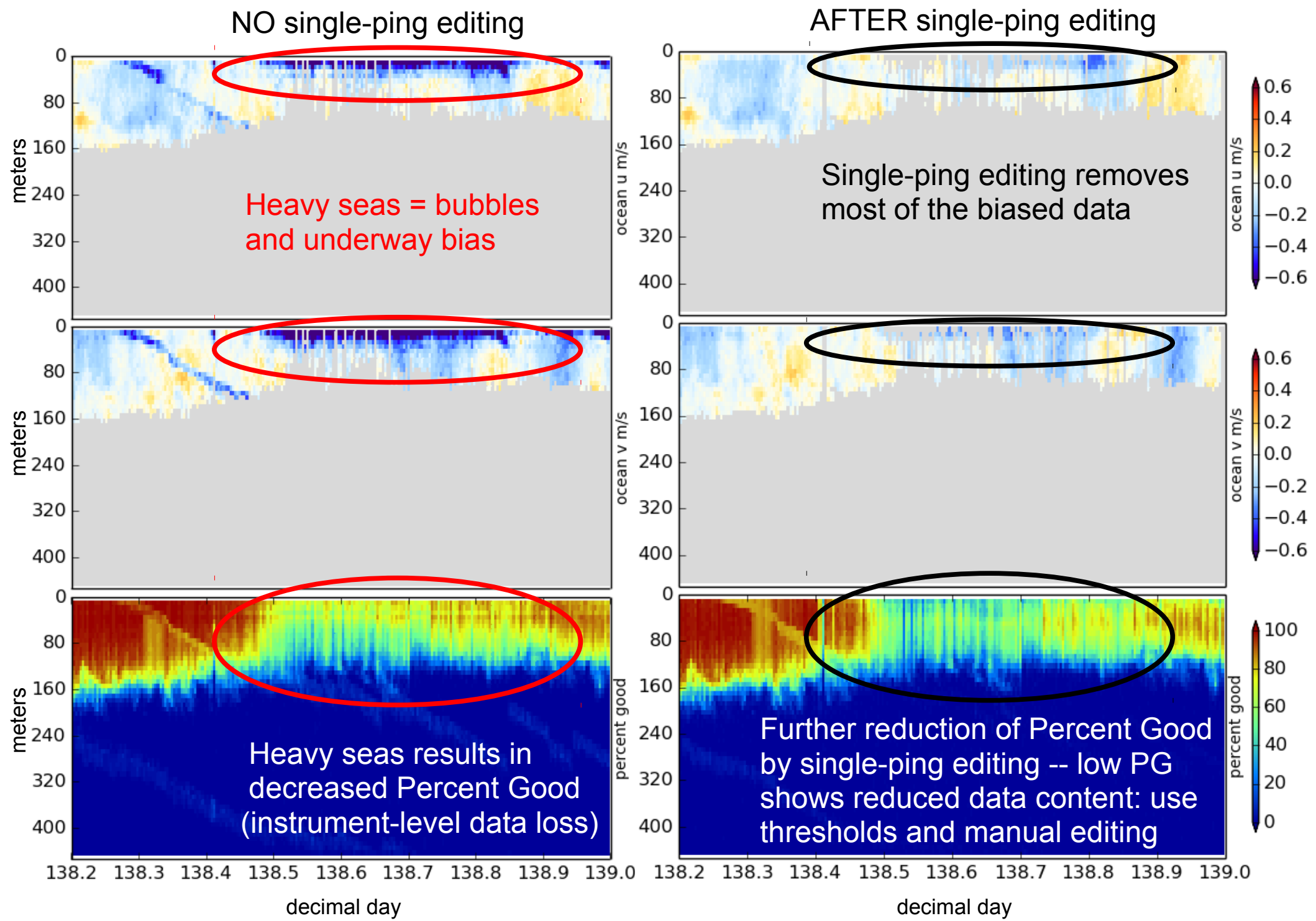
Untreated:
- biased ocean velocities



Acoustic Interference



Bubbles and alongtrack bias



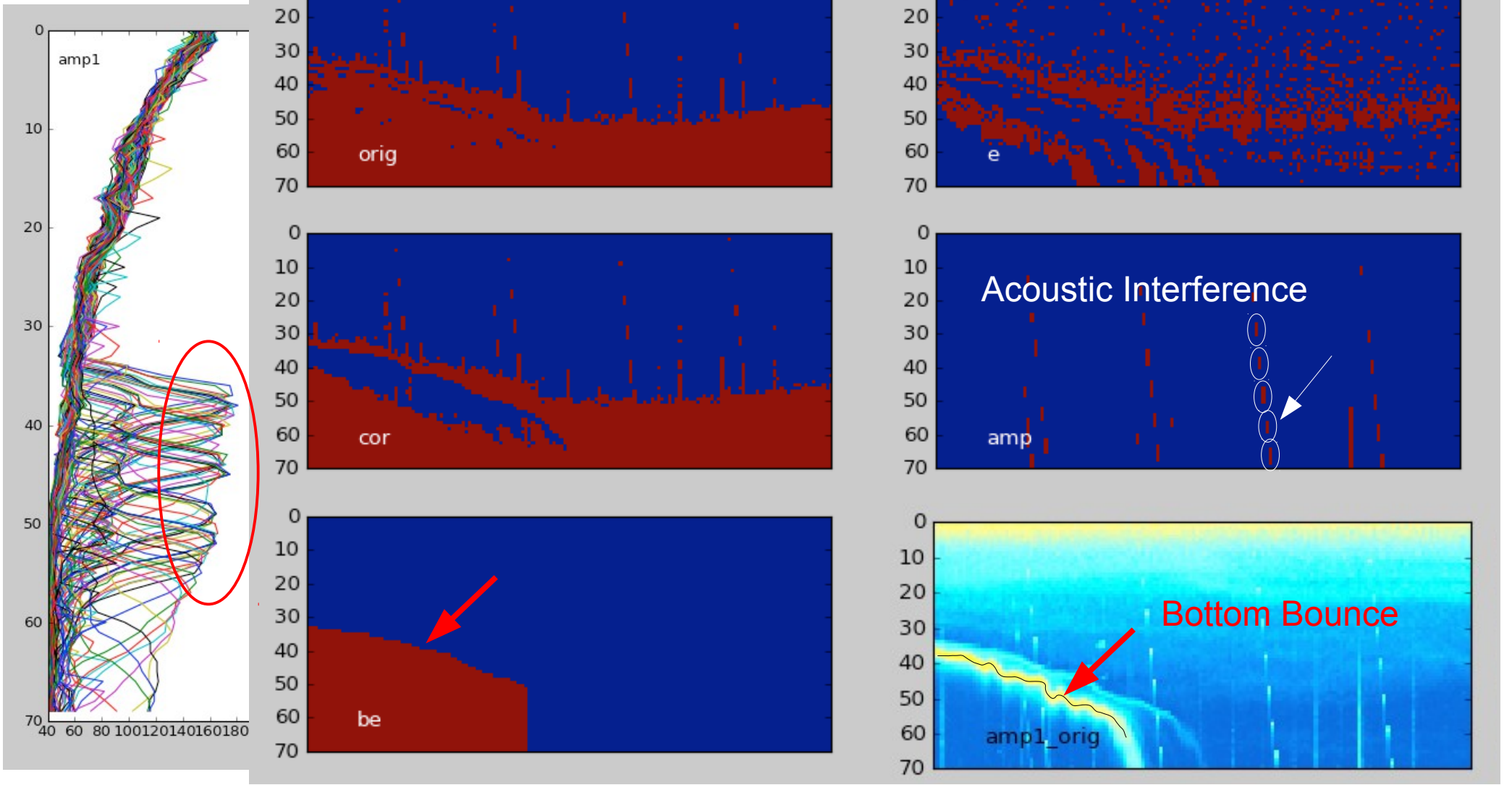
ADCP Single-ping Editing

The most common causes of error (addressed by single-ping editing)

- Acoustic Interference
- Bubbles
- Below bottom

Bottom Editing:

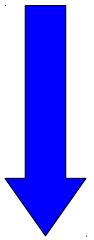
- remove acoustic interference, identify maximum amplitude
- calculate region of side-lobe interference
- flag as BAD all data below the bottom or with side-lobe interference



CODAS Postprocessing

- Editing (single-ping)
  - Acoustic interference
  - Bubbles
  - Below bottom

AFTER AVERAGING



- Interpolate missing heading correction
- Apply calibrations
  - Rotation
  - Scale factor
  - Transducer offset (new)
- Manually edit CODAS database averages "gee-autoedit"

CODAS Postprocessing

- Editing (single-ping)
  - Acoustic interference
  - Bubbles
  - Below bottom
- Interpolate missing heading correction
- Apply calibrations
  - Rotation
  - Scale factor
  - Transducer offset (new)
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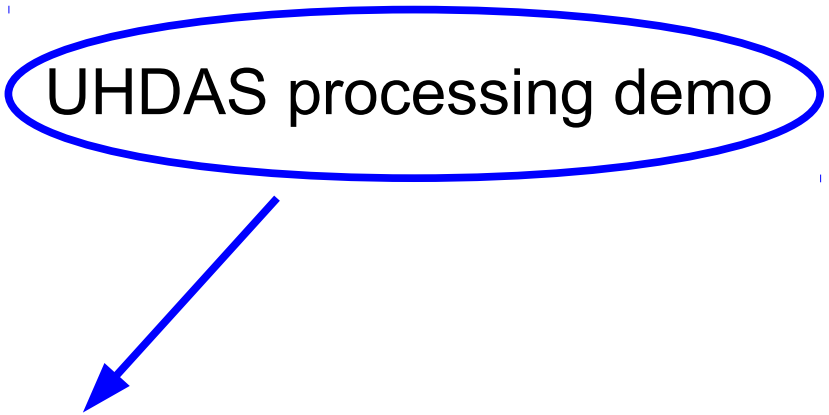


CODAS Postprocessing

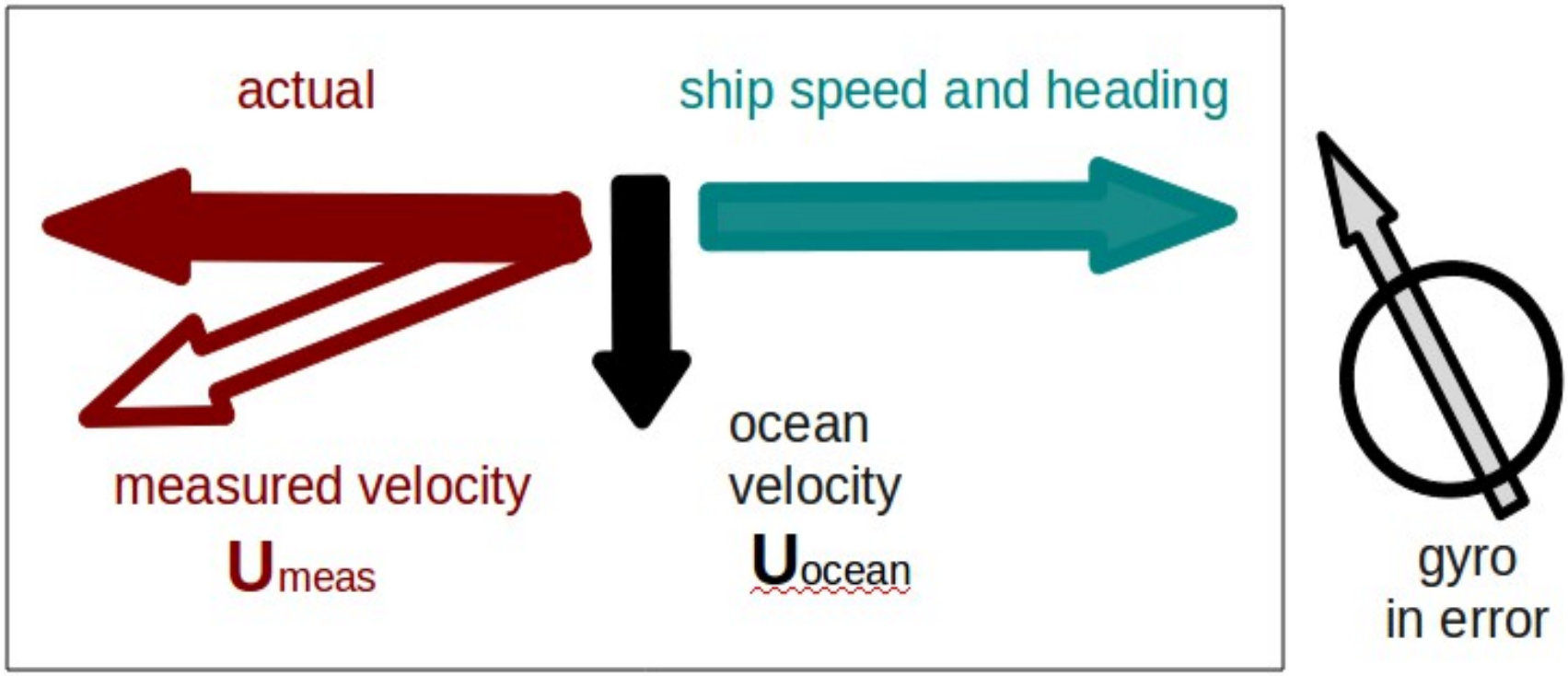
- Editing (single-ping)
  - Acoustic interference
  - Bubbles
  - Below bottom
- Interpolate missing heading correction
- Apply calibrations
  - Rotation
  - Scale factor
  - Transducer offset (new)
- Manually edit CODAS database averages “gee-autoedit”

CODAS Processing: Calibration

- Calibration of averaged data:
  - Cross-track error (angle error)
    - Incorrect transducer angle (constant)
    - Inaccurate heading (time-varying)
  - Alongtrack bias (scale factor)
    - Soundspeed (single-ceramic transducers only)
  - Transition Error
    - Horizontal offset between GPS and ADCP

Calibration: Angle Error

Cross-track bias in ocean velocity from angle error:
(heading + transducer angle)



Symptom = Cross-Track Error
Cause = incorrect **angle applied**

Angle applied comes from

- Transducer angle (beam “3” clockwise from bow)
- Heading of ship
  - **VmDAS**,
    - “Primary” heading, often no QC message
    - If “Primary” fails, replace with “Secondary”
  - **UHDAS**,
    - Reliable heading for each ping (eg gyro)
    - Heading correction for each averaging period
    - Calculated relative to devices such as Ashtech, POSMV, Seapath, Mahrs, Phins (hopefully with QC fields)

Symptom = Cross-Track Error
Cause = incorrect **angle applied**

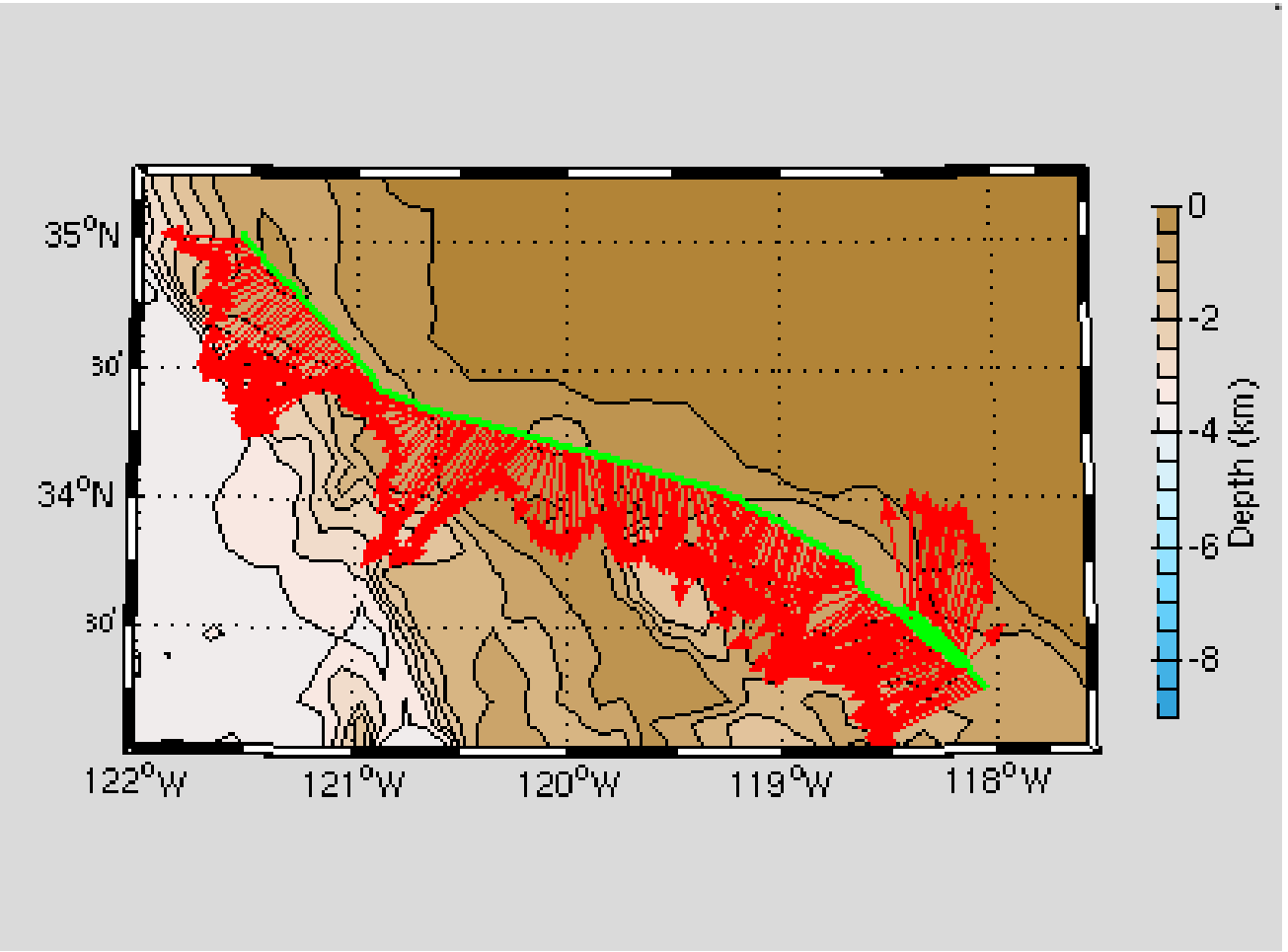
Angle applied comes from

- Transducer angle (beam “3” clockwise from bow)

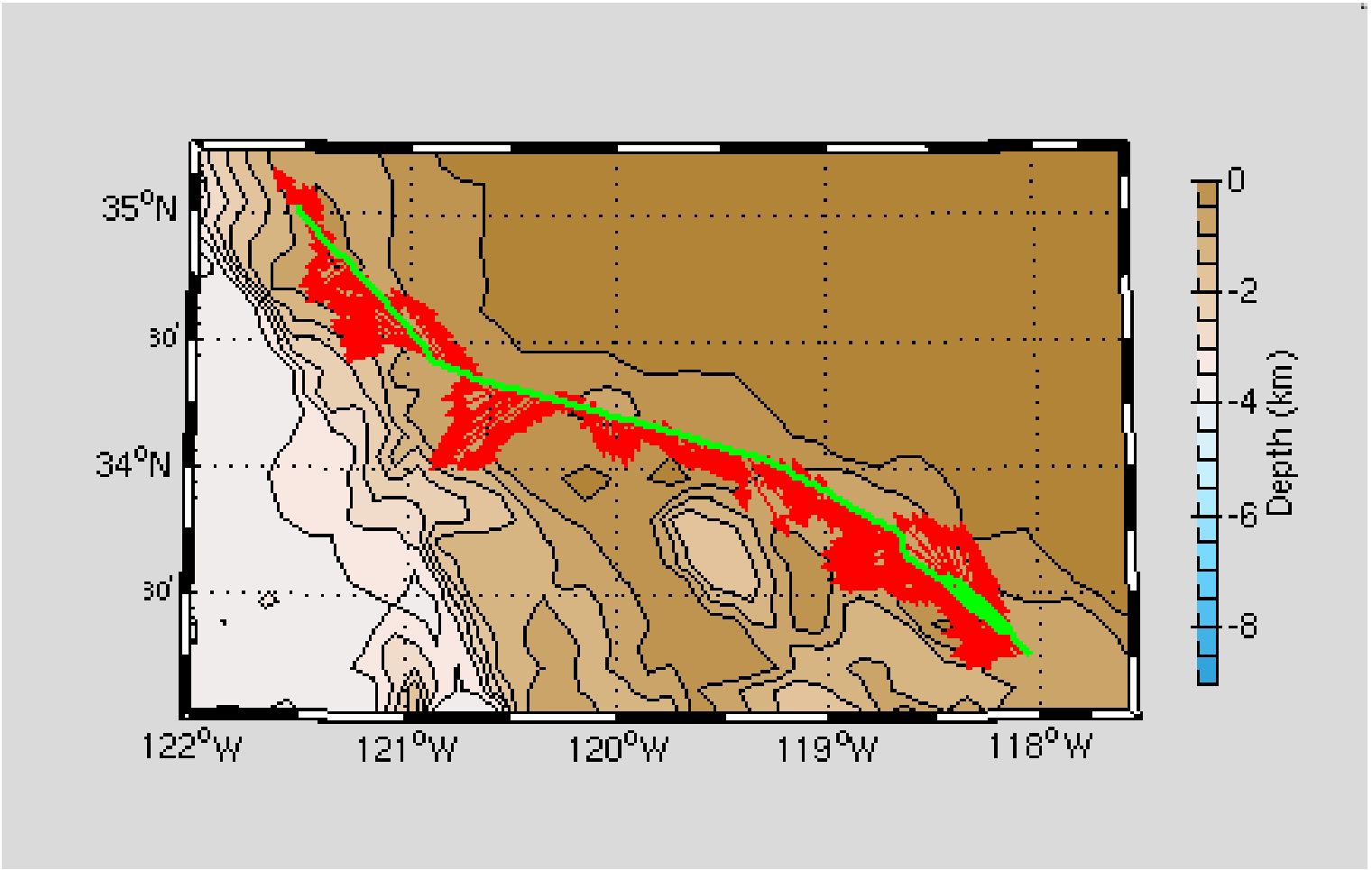
This is a **constant value** for the whole cruise

Examples of error in transducer angle follow...

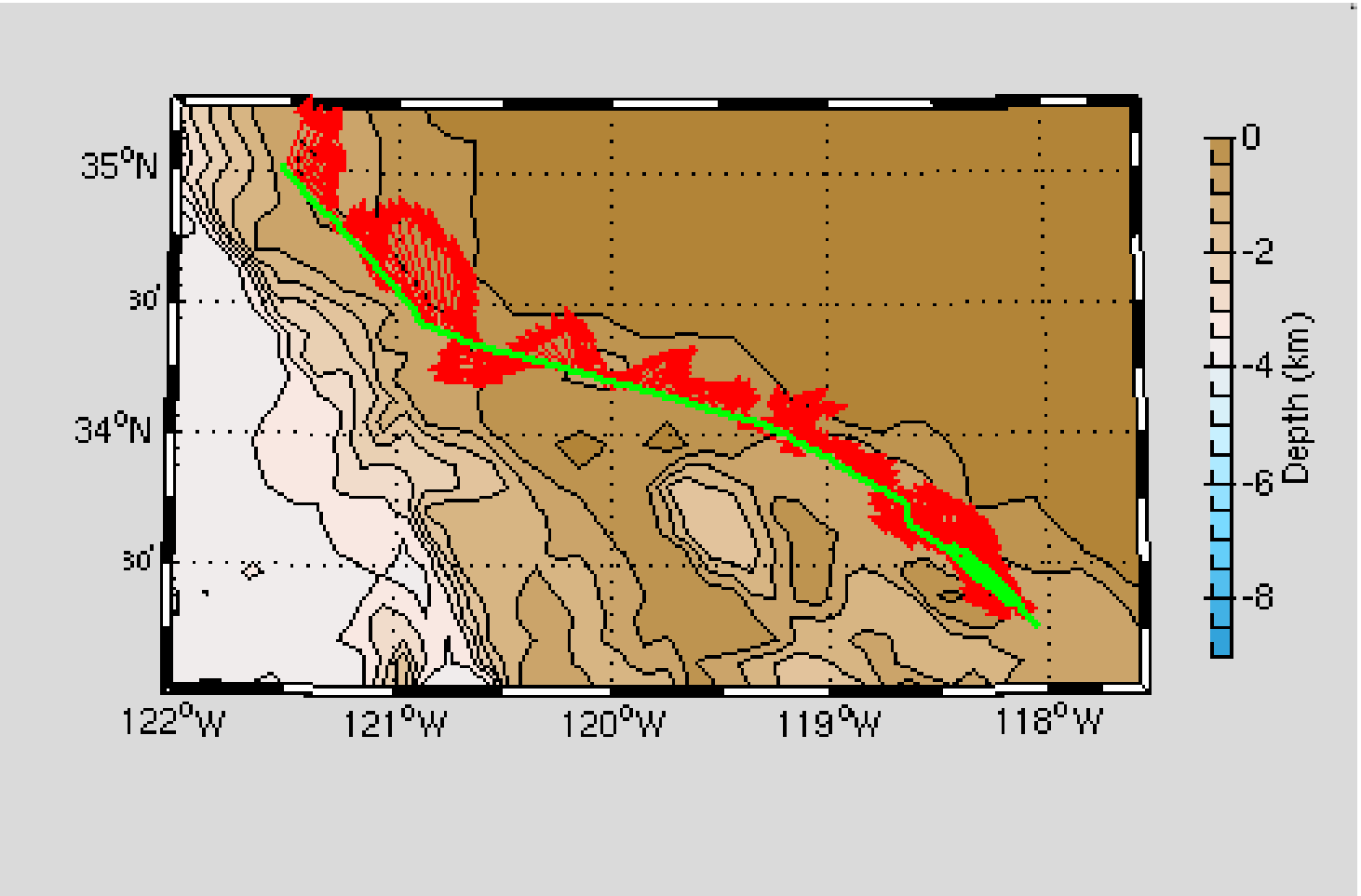
Calibration: angle error -3.6deg



Calibration: angle error -1.6



Calibration: angle error 0.4



Symptom = Cross-Track Error
Cause = incorrect **angle applied**

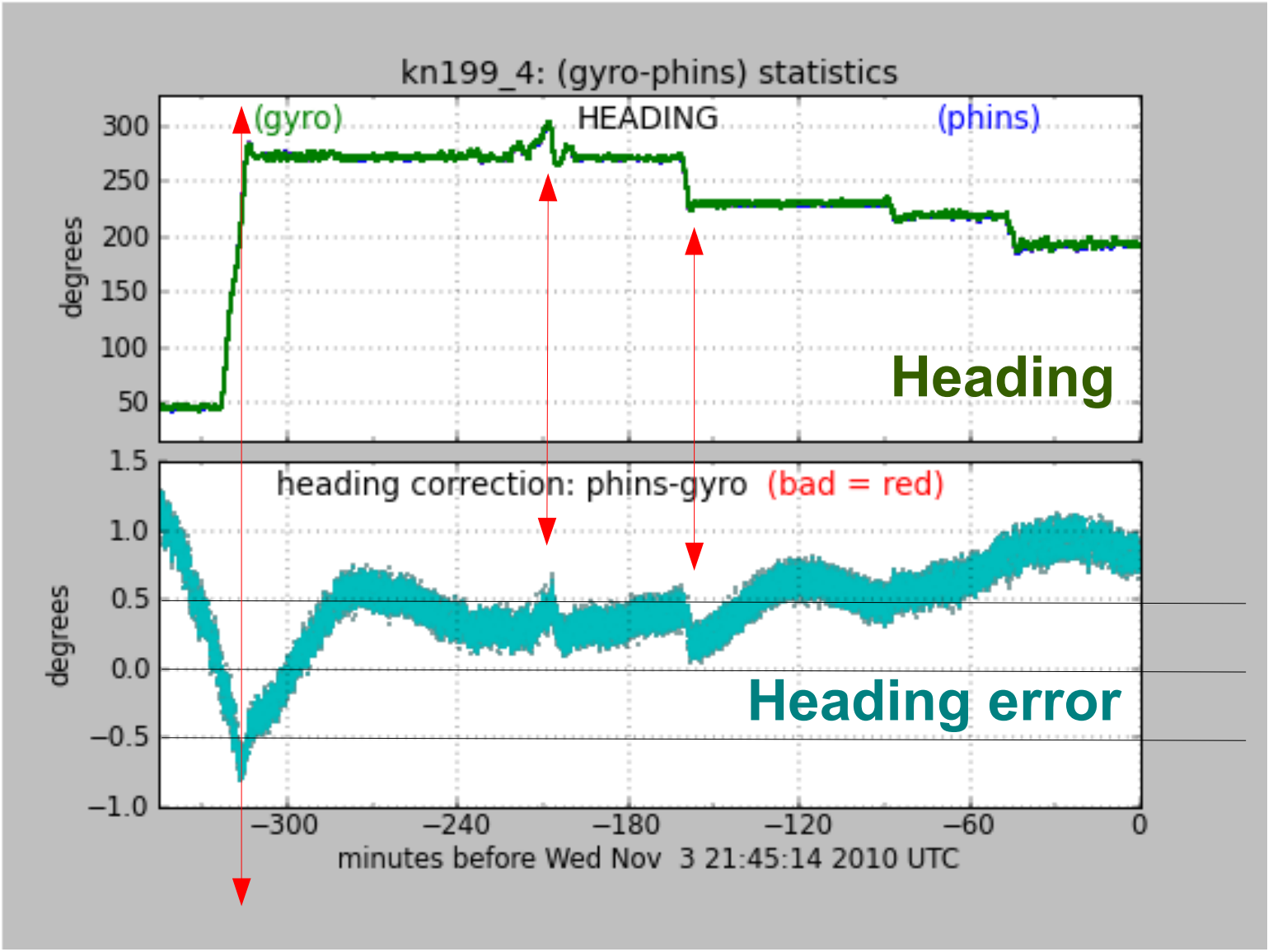
Angle applied comes from

Heading, which may be in error by

- A constant offset
- A **time-dependent offset**

Example follows ...

Phins-Gyro difference varies with time

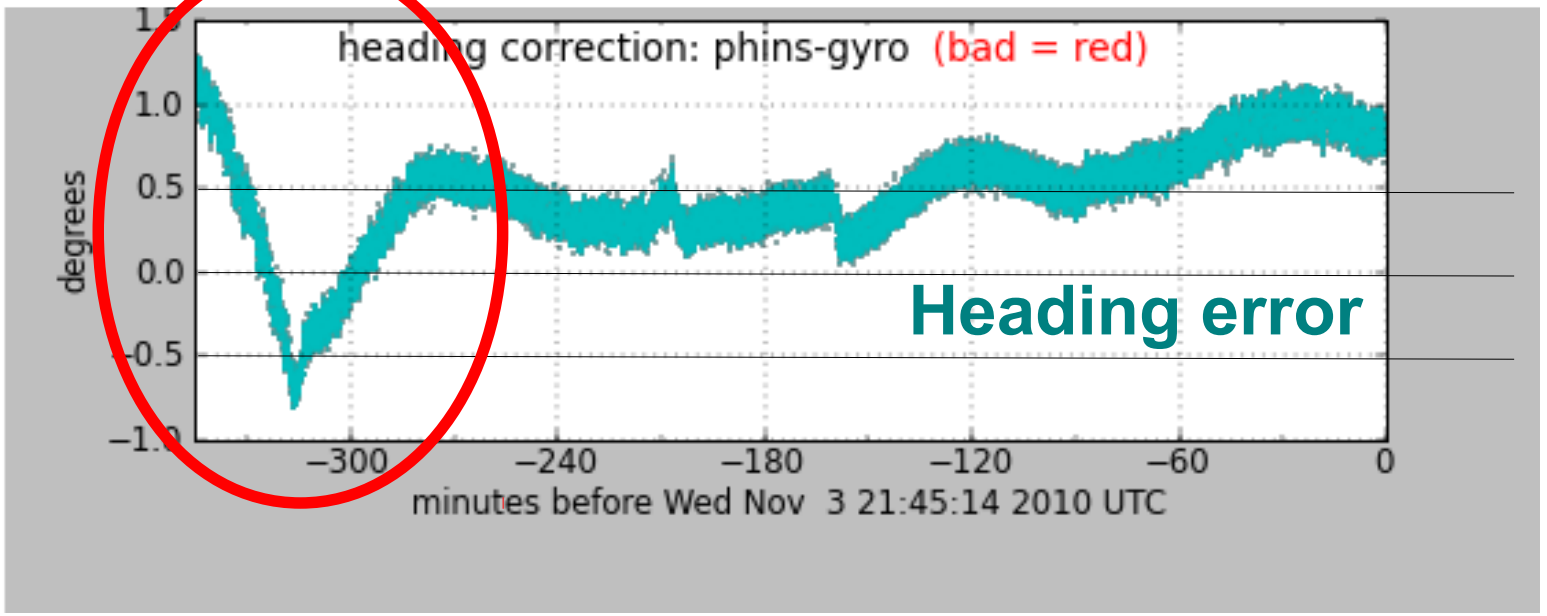


Changes in ship's heading affect heading error

Effect of Time-Dependent Heading Error on Ocean Velocties

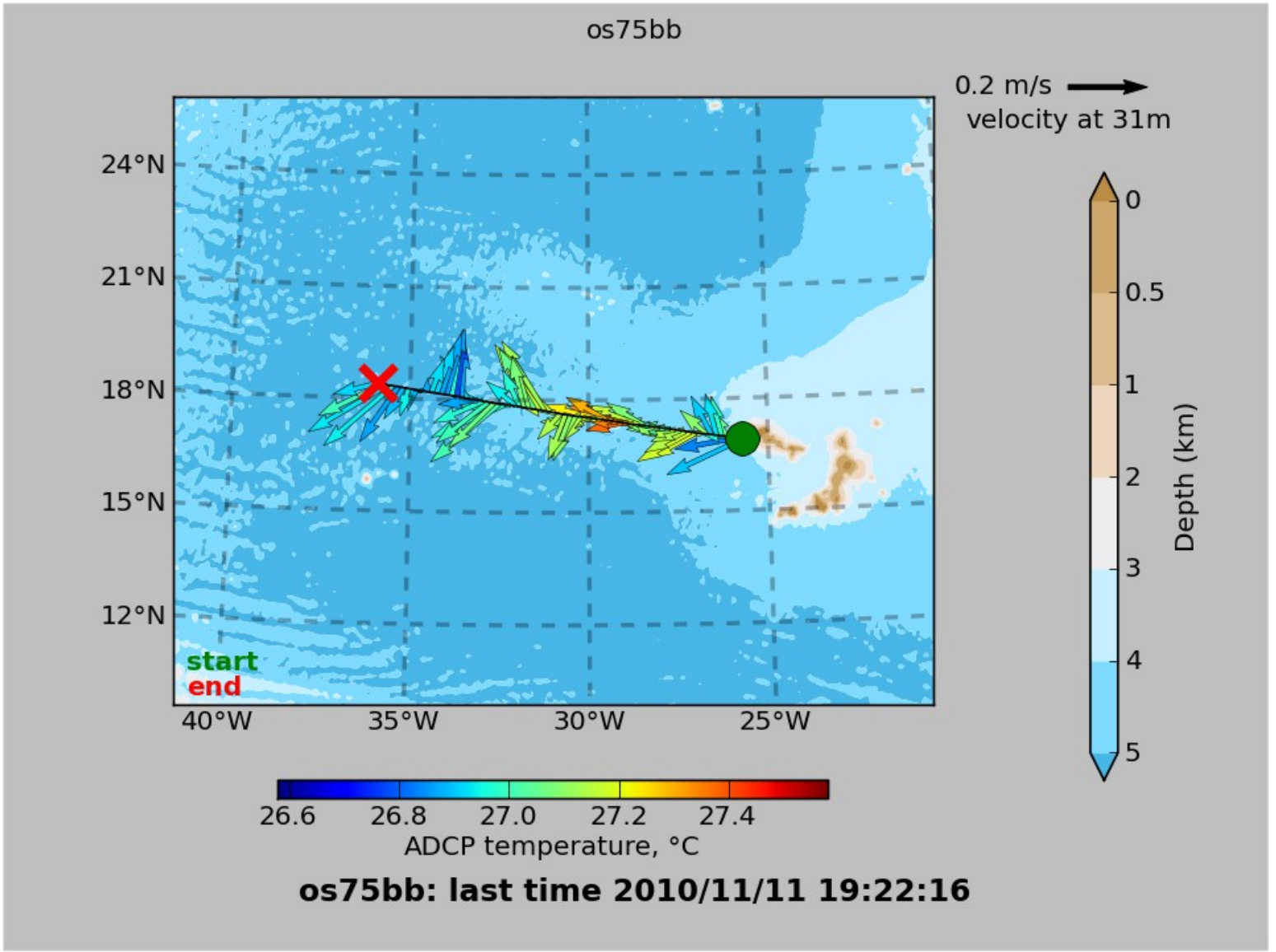
1 degree error in heading means:

- 0.1m/s error in ocean velocity
- in the cross-track direction



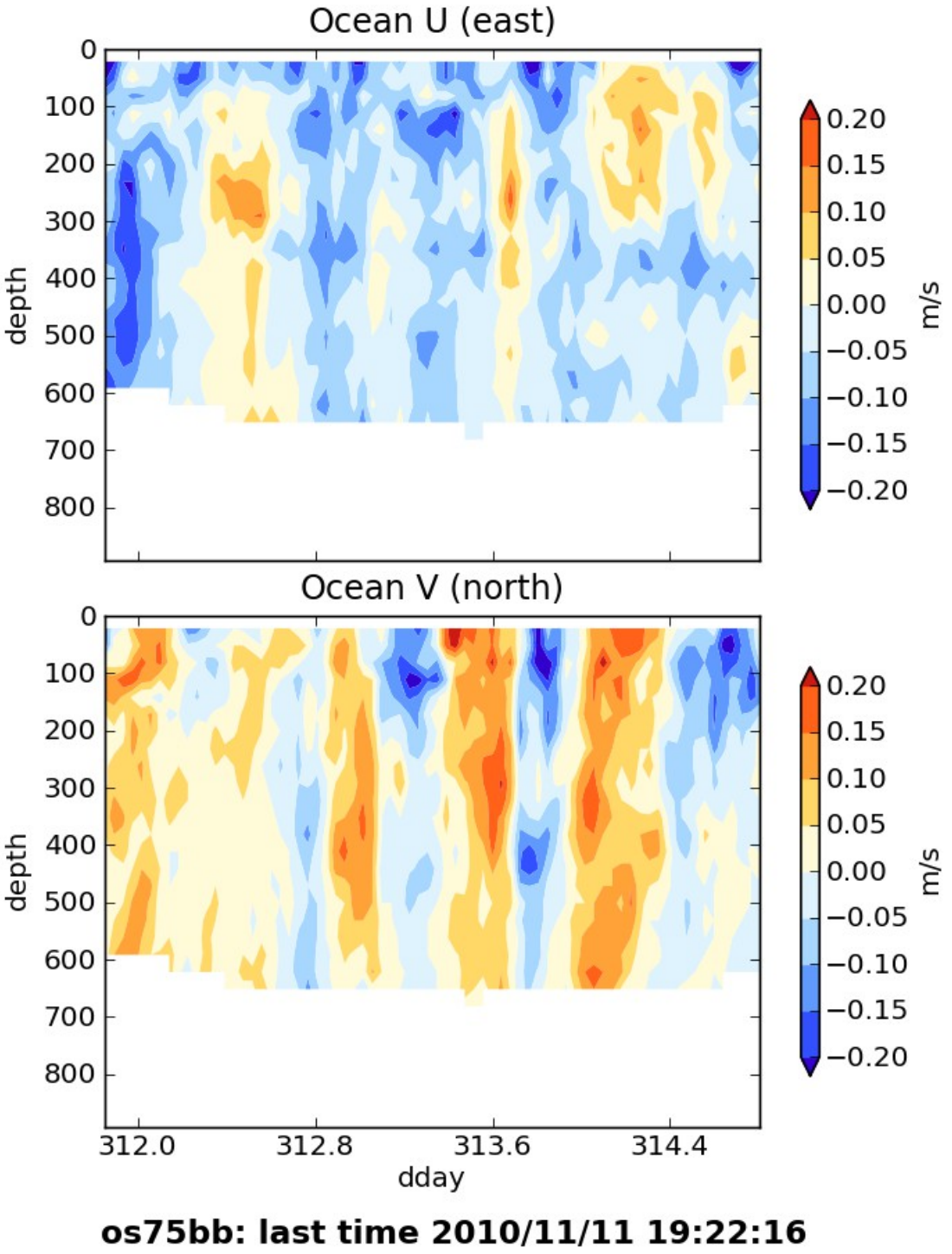
Changes in ship's heading affect heading error

Is this a heading error?



Contour plot:

Is this cross-track signal (stripes in N/S ocean velocity) due to a heading error?



Answer

Actually, it's really the ocean, but we can't tell without knowing the quality of the accurate heading device.

Examples of along-track error

Remove during single-ping editing

- Acoustic interference
- Bubbles (underway bias)

Correct after averaging:

- Scale factor (NB150 soundspeed correction)

Calibration: scale factor (alongtrack bias)

Ocean U (original)

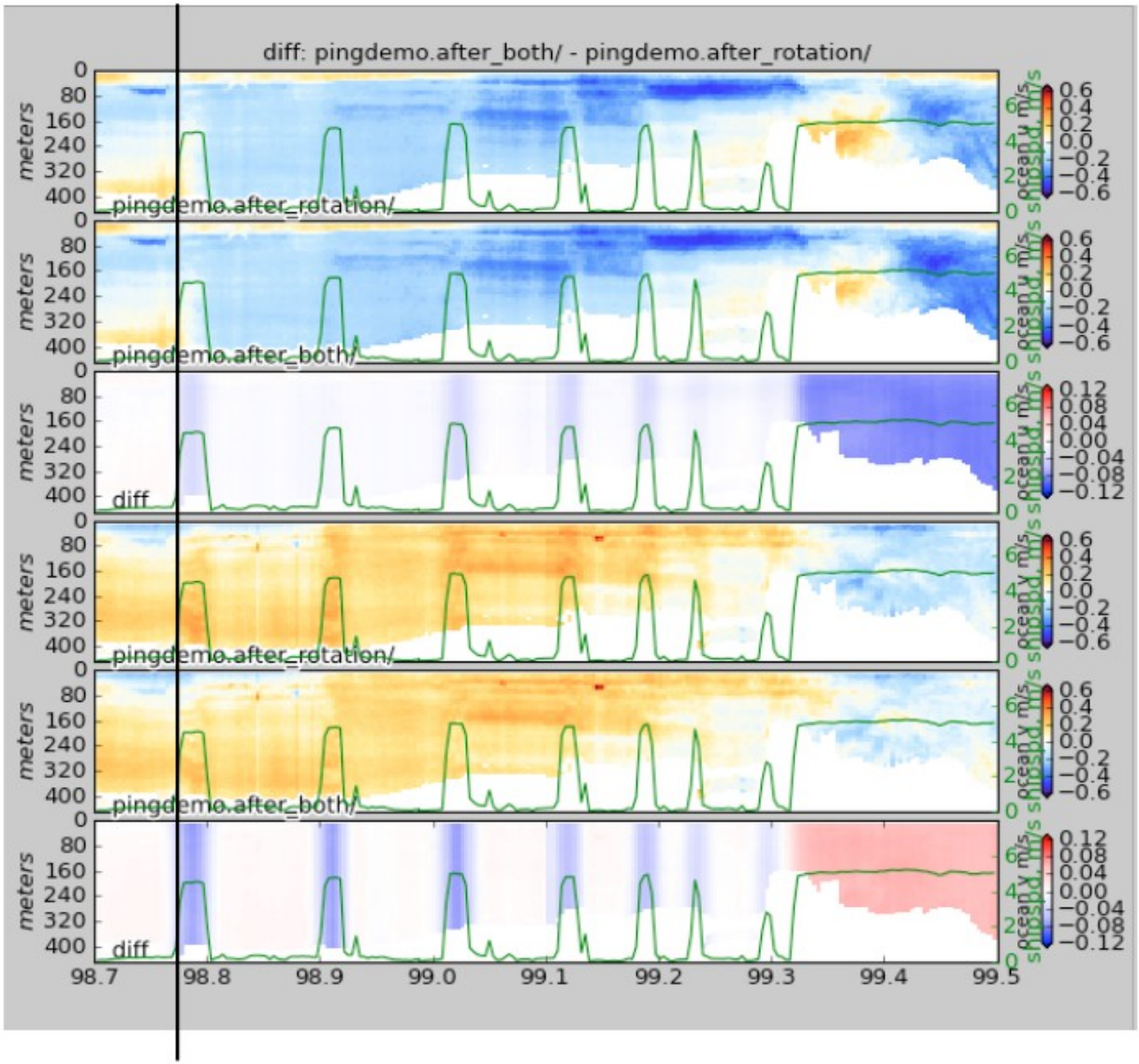
Ocean U (after scalefactor)

Diff: after-before

Ocean V (original)

Ocean V (after scalefactor)

Diff: after-before



Calibration: ADCP-GPS offset

(1) Cross-track error:

- recovery requires accurate heading

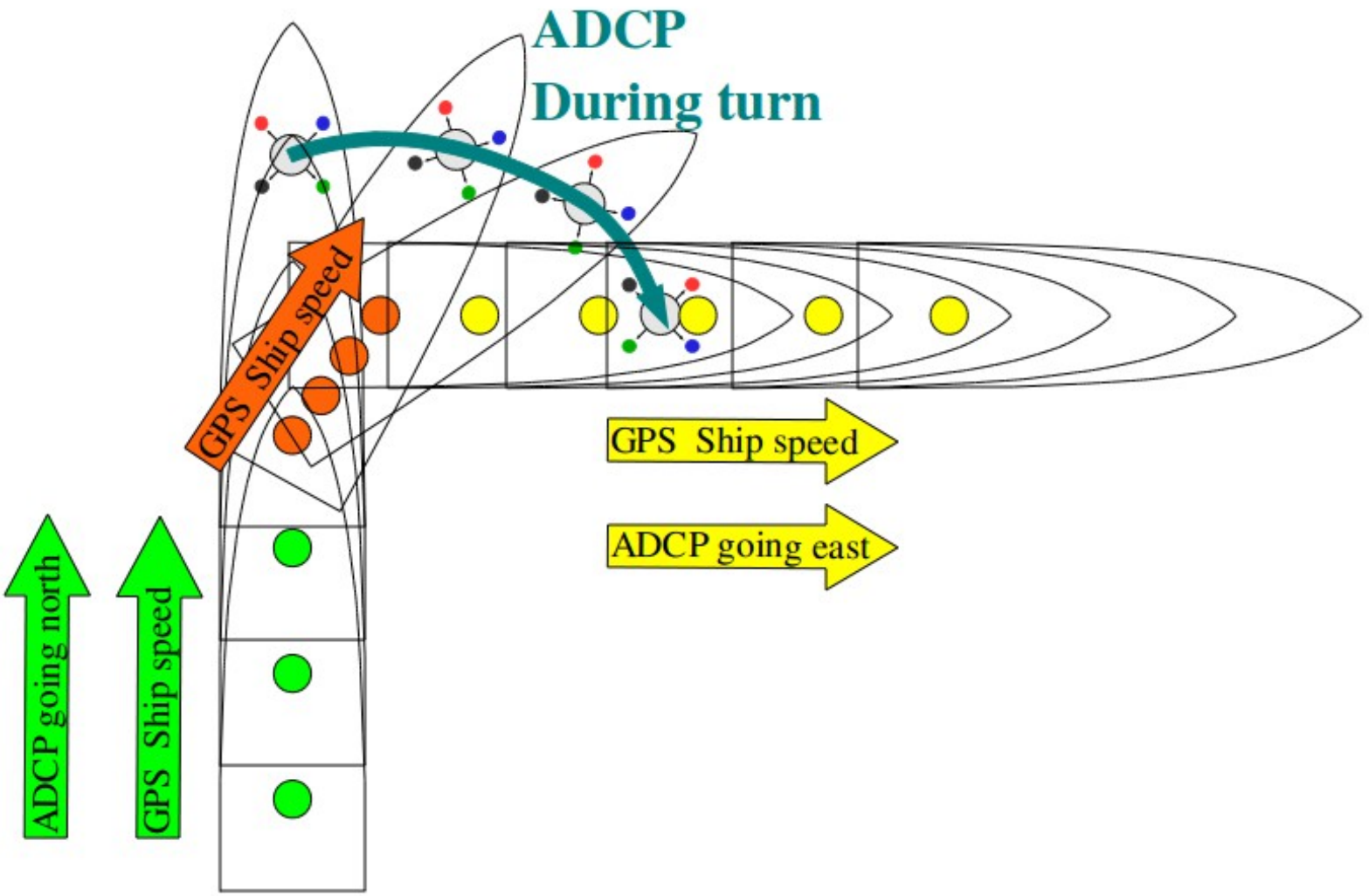
(2) Along-track error:

- may indicate a serious problem
- recovery may be possible, incomplete, ambiguous

(3) Transition/maneuvering error

- Lag or offset in time or space

Example: offset between ADCP and GPS creates an artifact during maneuvering

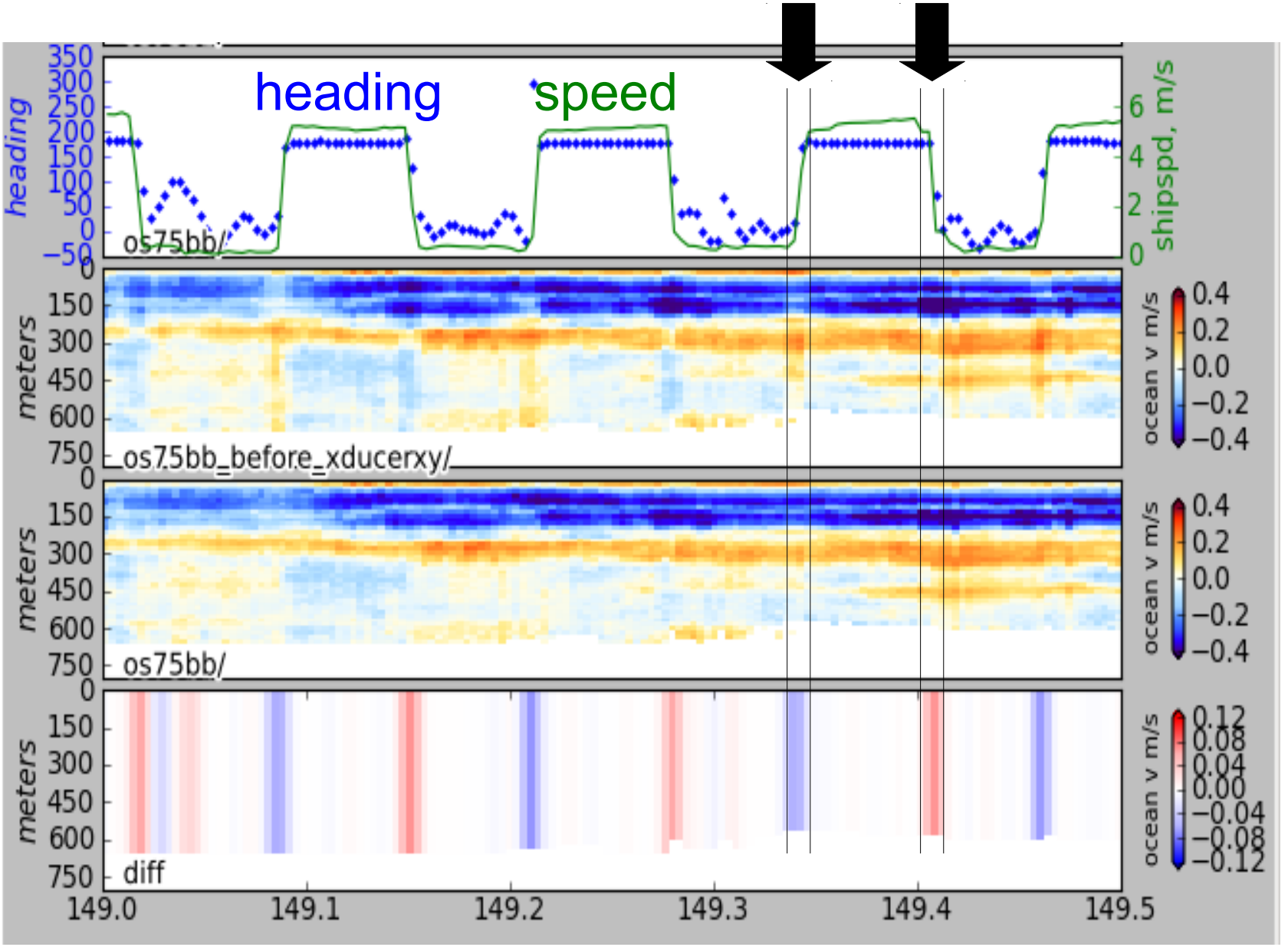


Transducer offset from GPS--error occurs: **transition** between on-station and underway

...using actual location

...using shifted GPS location

difference



Manual Editing

- Bottom interference
- Wire interference
- Scattering layers
- Ringing
- Bad shallow PG and underway bias

(see GeeAutoedit documentation)

Outline

Day 1: Morning: Presentation

1. ADCP: components to currents
2. ADCP Data Acquisition
   - compare: VmDAS⬌UHDAS
3. CODAS Processing
4. Data Stewardship

After: Practice

Another break?

UHDAS Shipboard ADCP Data

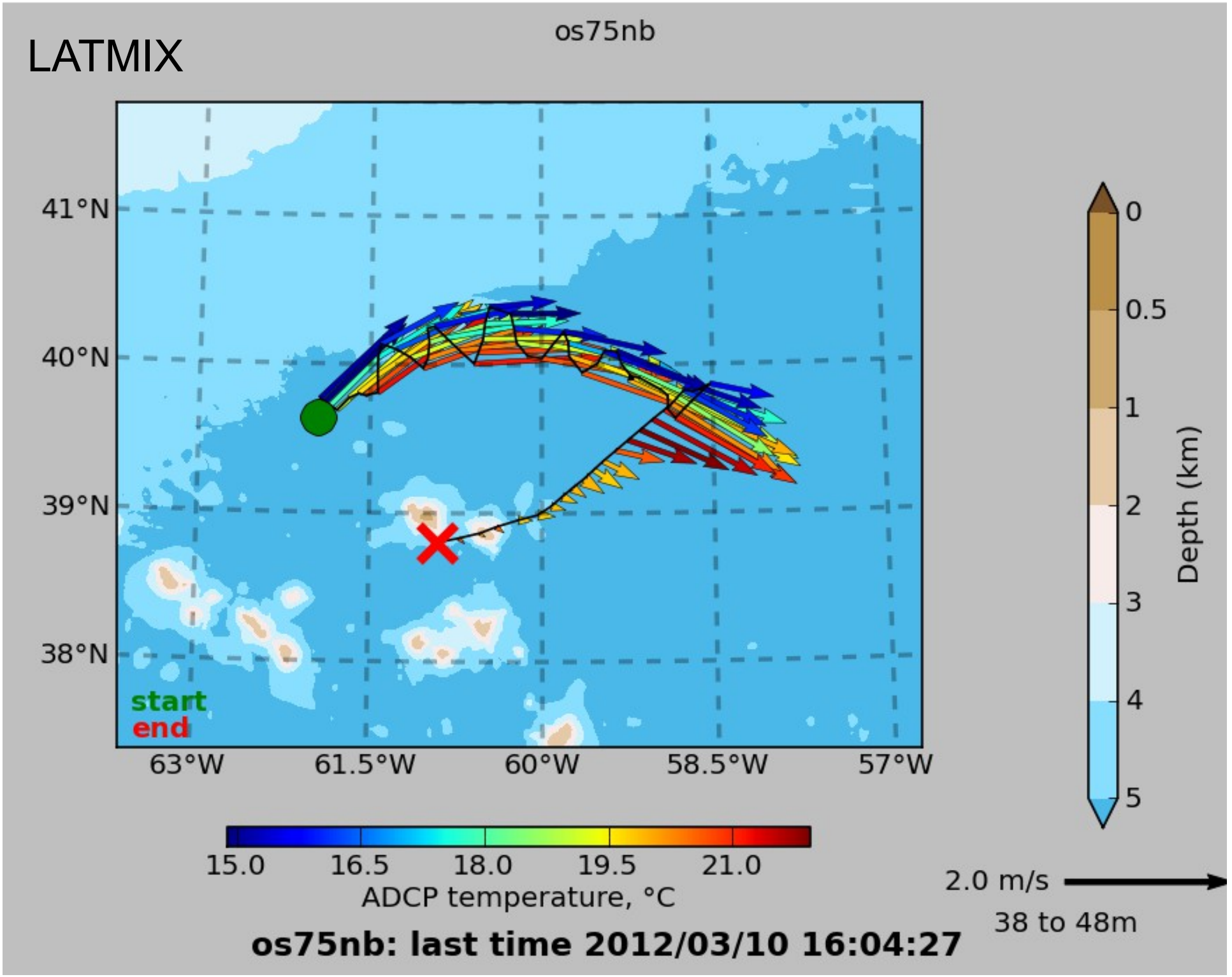
(Raising the Profile of Ocean Currents)

UHDAS Data Archiving and Stewardship

Who uses ocean currents from Shipboard ADCP?

At Sea:

- near-realtime guidance for sampling
  - “are we inside or outside the eddy”
  - “did we cross the front yet?”
  - “where do we find the zooplankton?”
- preliminary calculations for science
  - characterize data based on flow regime
- operationally
  - aid in dynamic sampling strategy
  - predict trajectory of drifting objects
  - towing, over-the-side work, dive operations


LATMIX
os75nb
41°N
40°N
39°N
38°N
start
end
63°W
61.5°W
60°W
58.5°W
57°W
0
0.5
1
2
3
4
5
Depth (km)
15.0
16.5
18.0
19.5
21.0
ADCP temperature, °C
2.0 m/s
38 to 48m
os75nb: last time 2012/03/10 16:04:27

Who uses ocean currents from Shipboard ADCP?

Post-Cruise Analysis:

- Look in detail (calculations or context) for one cruise
  - apply calibrations, edit; reprocess if problems are found
- Climatology/Time-series using multiple cruises
  - requires multiple datasets that are already finalized
  - project-based example:
    - instrumented Volunteer Observing Ship (eg. Oleander)
    - Drake Passage crossings to Antarctica (L.M.Gould)
  - opportunistic example:
    - Pacific Equatorial currents (many ships, eg TAO buoy service)

(2) What does UHDAS do?

Performs these tasks:

- Data acquisition
- Data processing (create ocean currents)
- Generates data products (multiple formats)
- Generates tools and components for monitoring (at sea and on shore)

What are our data goals?

- Data should be as close to "final" as possible (for an automated system)
- Data should be useful for science and operations at sea
- Require minimal post-processing for science
- Enhance the utility and visibility of ADCP data
- Open Source code, clear documentation
- Reprocessing on multiple operating systems (Linux, Mac, Windows)

(3) Data benefits of UHDAS

- Remote monitoring by ADCP guru:
  - ensure good configurations, reasonable settings
  - catch problems early
- Long-term usefulness:
  - Open source software
  - Existing path to NCEI
- Open communication with scientists and techs

Typical UHDAS dataset sizes

- Full at-sea directory (eg. month-long cruise) **5Gb**
- Subset necessary to completely reprocess **4Gb**
- Final averaged data product for scientists **25Mb**

ADCP data submission from a cruise

plots: diagnostic, science
logs: evaluation, calibration
data: ocean currents

} nuggets for science use/evaluation

(4) Archiving, Serving, Stewardship

PAST and PRESENT

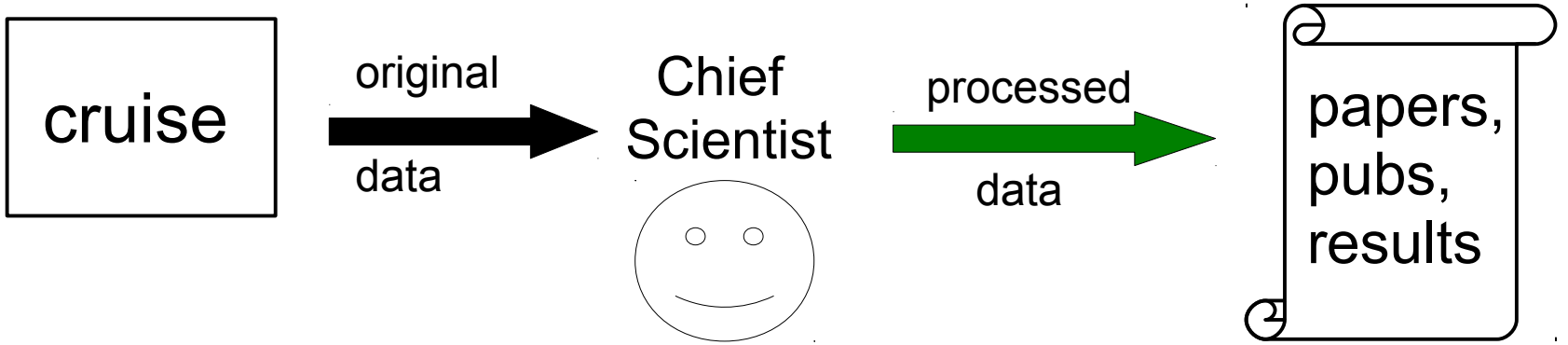
- diagram of information flow
- JASADCP – long-term archive for finalized shipboard ADCP data

PRESENT and FUTURE

- UHDAS, R2R, and NEIC
  - historical data to JASADCP
  - mine historical data for low-hanging fruit, other uses

Flow of information

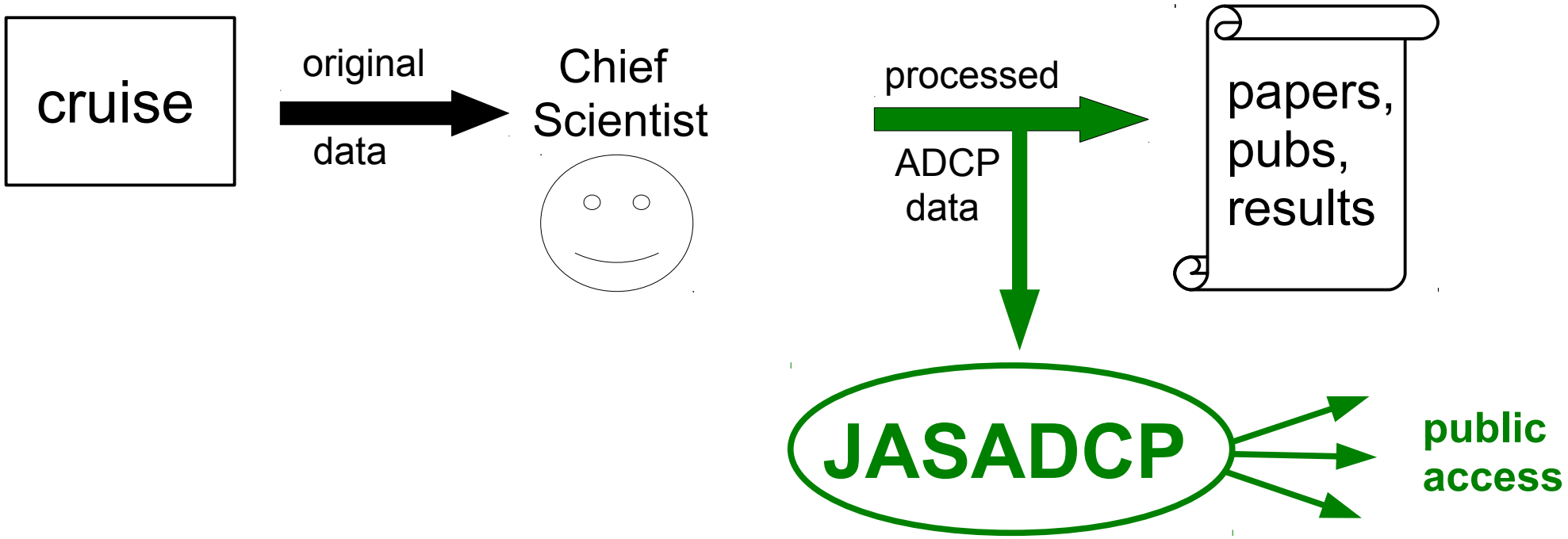
Old Model



Other people
- can read about the results
- cannot use the data (or must get it from Chief Scientist)

Flow of information

Past and Present



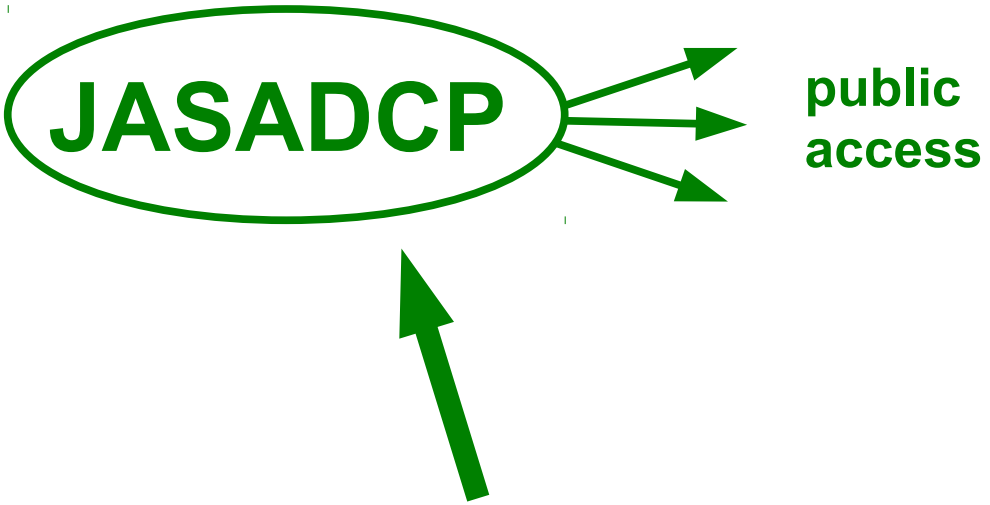
created 1992: **J**oint **A**rchive for **S**hipboard **ADCP**

- centralized dissemination center processed (finalized) shipboard ADCP data
- anyone can access standardized, science-ready data

Joint **A**rchive for **S**hipboard **ADCP**

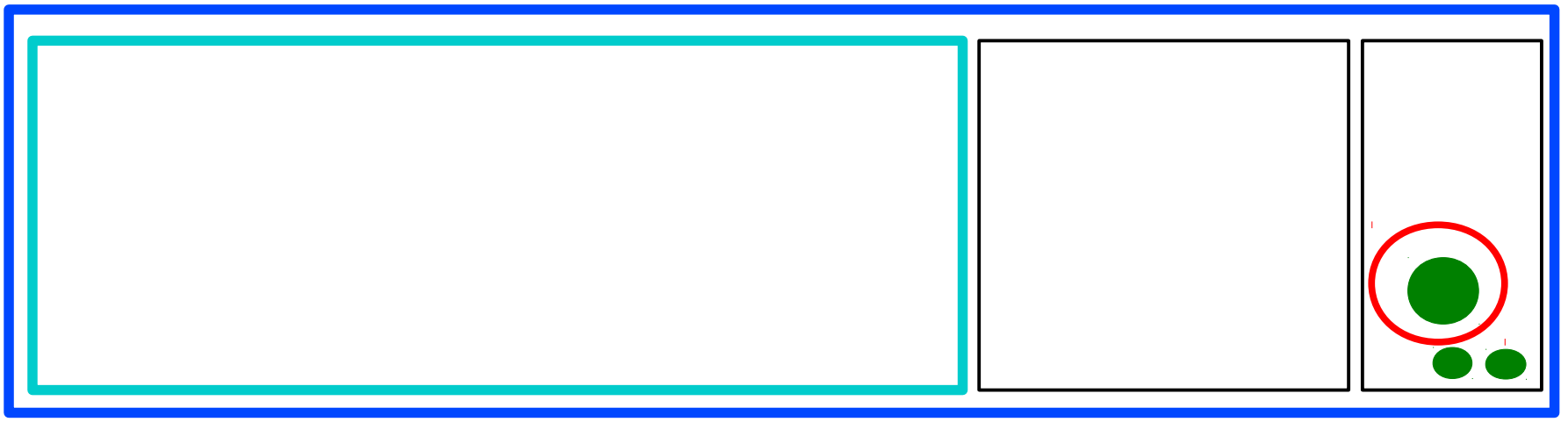
- accepts science-ready ocean current data
  - over 800 cruises (multiple instruments on some ships)
  - from multiple countries, multiple acquisition systems
  - this represents only a small fraction of historical data
- regularly used by scientists from 1992 - present
- (new) higher-resolution data available now/soon

JASDCP and UHDAS



Finalize processing then submit to JASADCP

UHDAS data directory from a cruise

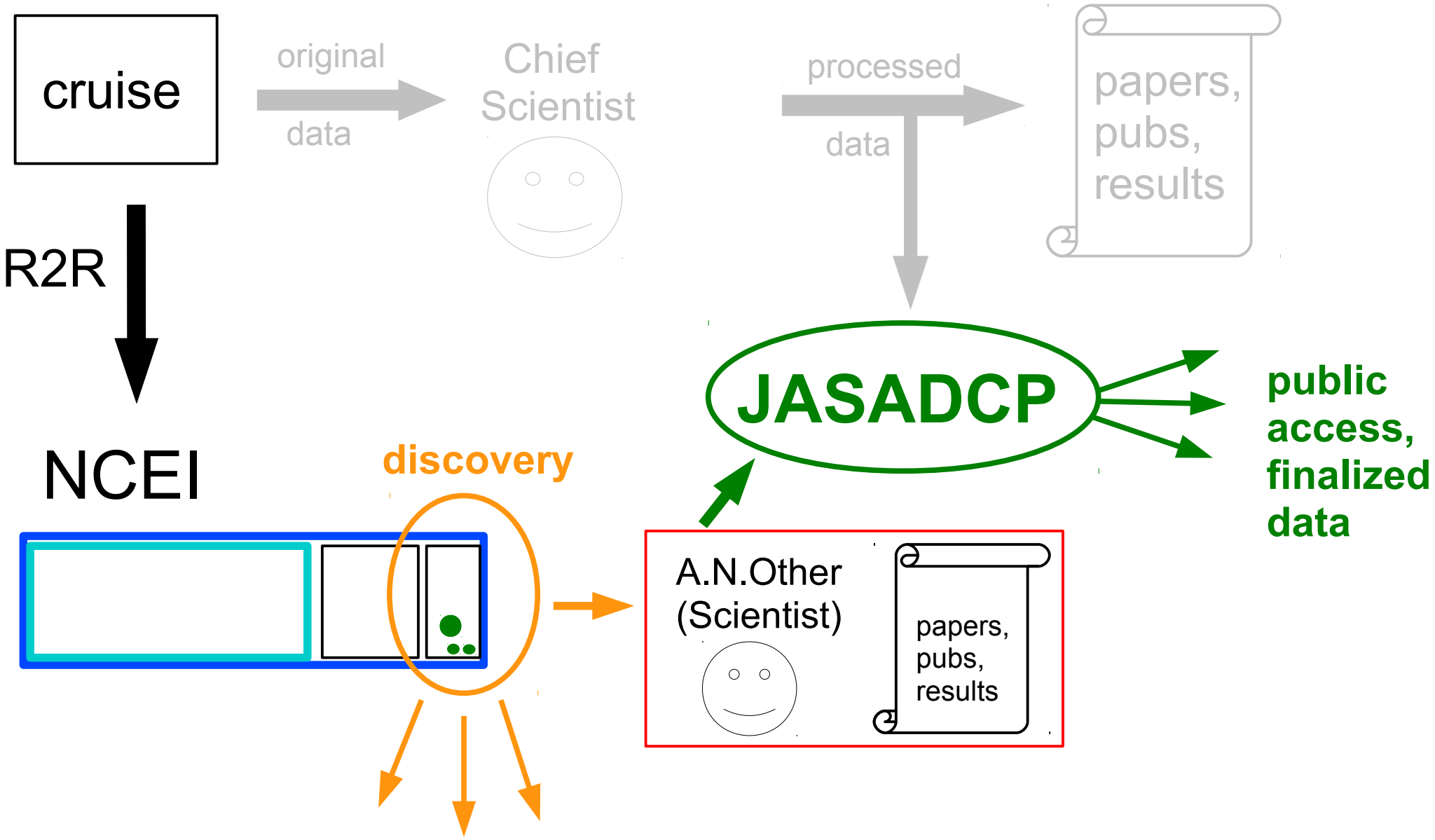


NCEI: archiving UHDAS datasets

- UNOLS cruises
  - ship submits to R2R (http://www.rvdata.us/catalog)
  - R2R adds value, pushes to archive to NCEI
- NCEI creates data accession
- cruises under NCEI
  Global Ocean Currents Database
- "originator data" R2R shipboard ADCP (507 cruises)
- UHDAS group: work with NOAA to
  - get UHDAS ADCP data from NOAA ships into NCEI
  - improve discovery and use of archived datasets

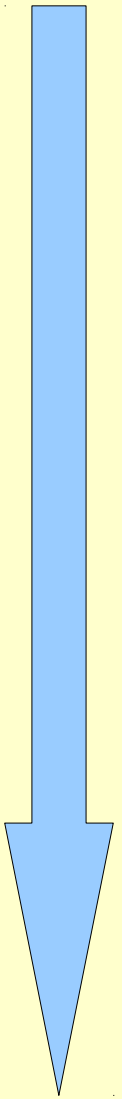
Present and Future:

- two paths to finalized public data
- more opportunities for original data to be used



Summary: What We Did

1. ADCP instrument
   - What it is; getting ocean velocities
2. ADCP Data Acquisition
   - Acquisition, processing, monitoring
   - Comparison: UHDAS⬌VmDAS
   - UHDAS data details
3. CODAS Processing
   - Single-ping editing
   - Postprocessing
     - Calibration
     - Editing
4. Data Stewardship (more discovery, more recovery)



ADCP:

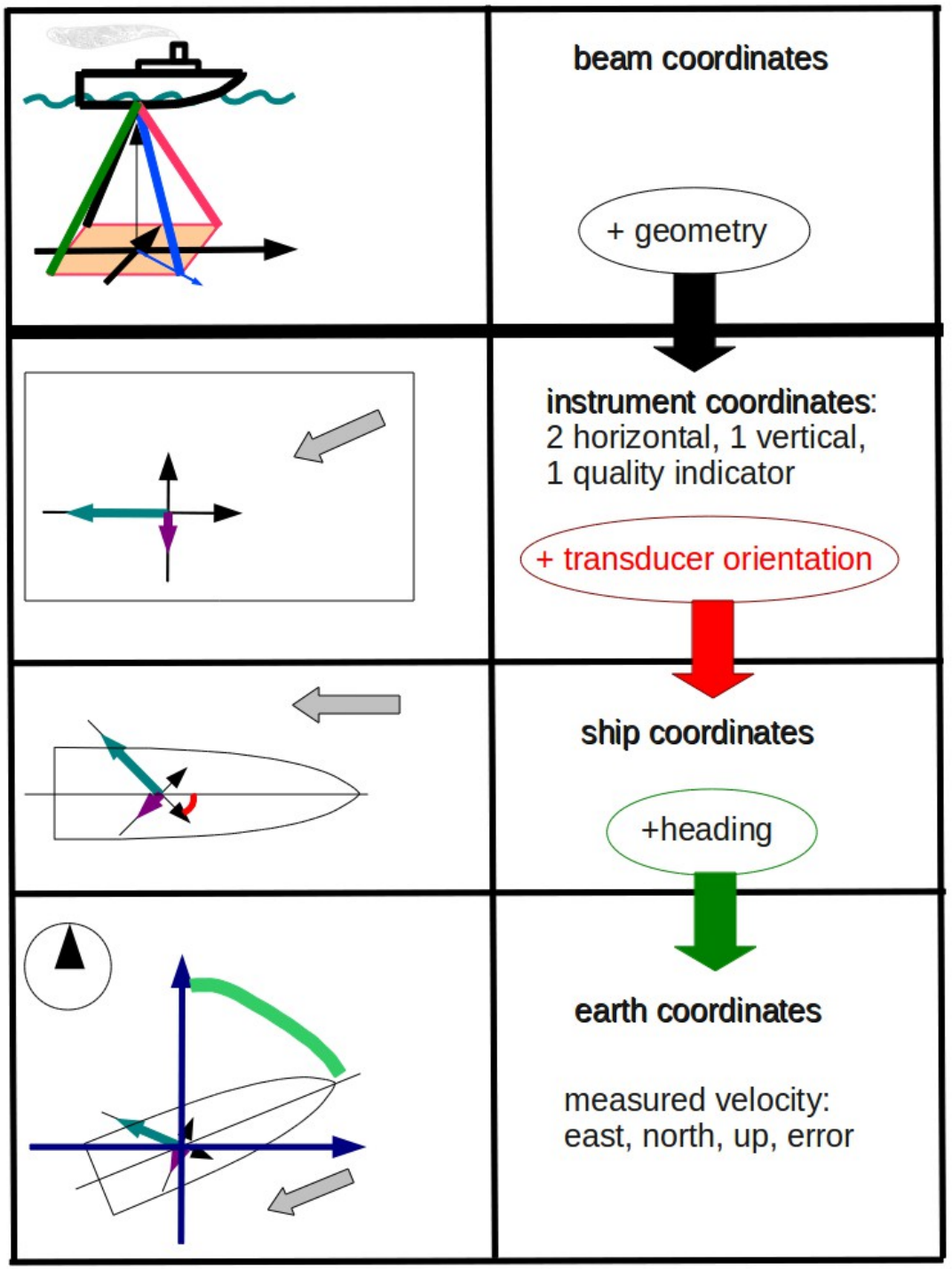
Getting Ocean Currents

Summary of steps:

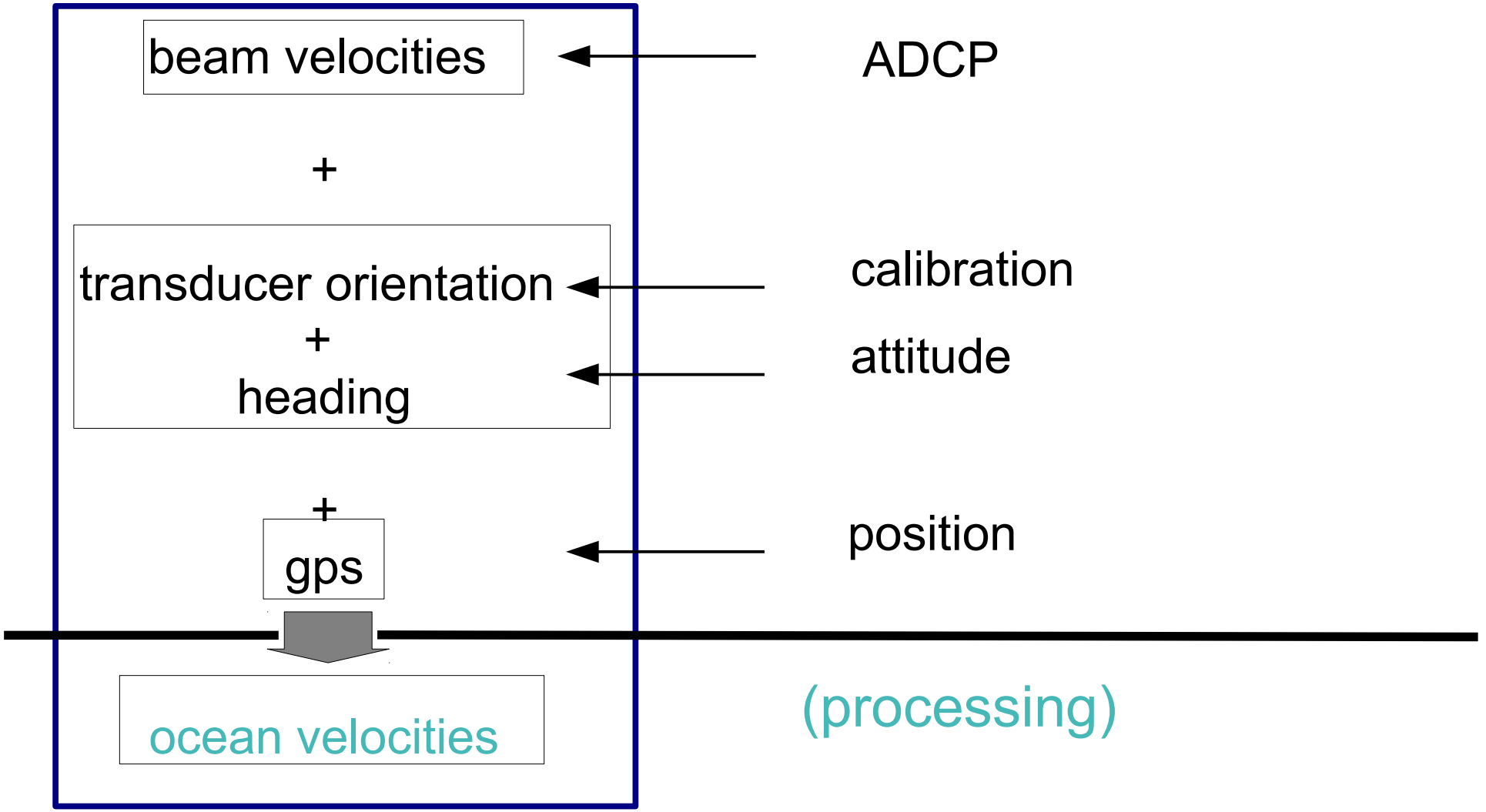
Doppler to beam
(not shown)

<u>below here: horizontal+vertical</u>

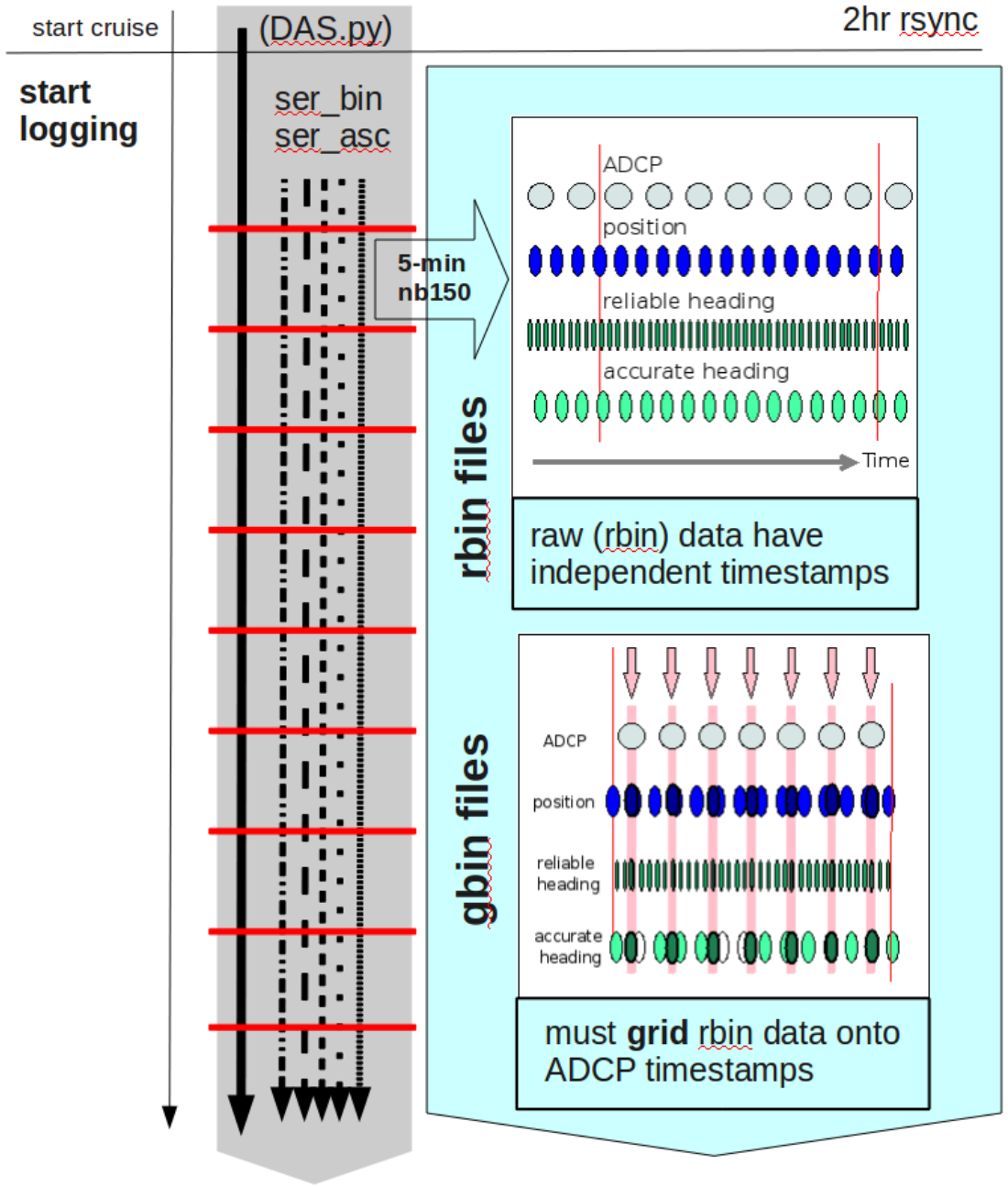
- beam to instrument
- instrument to ship
- ship to earth



ADCP: Data components



UHDAS: 5min timer (make gbins)



UHDAS cruise directory structure

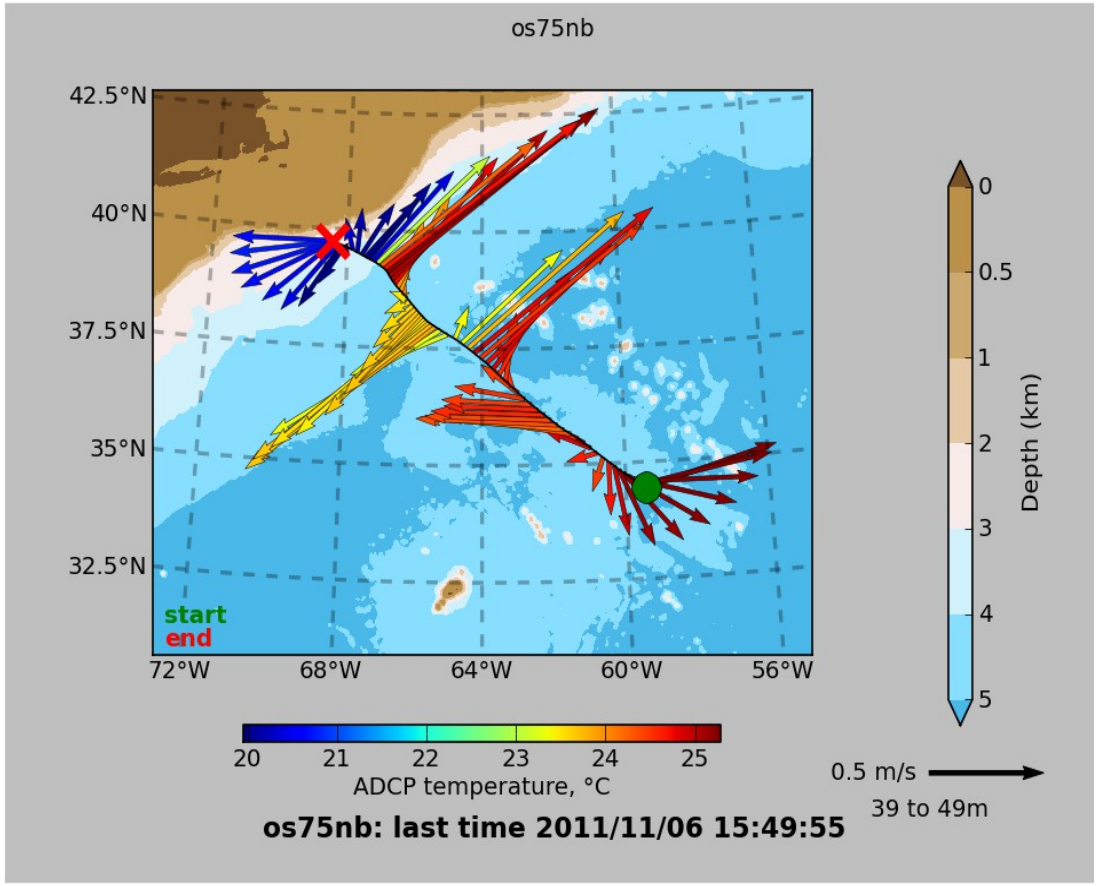
subdirectory	contents	importance	back up for ...
raw	all raw data	critical	archiving
rbin	intermediate files	nice to have	anyone who gets 'raw'
gbin	intermediate files	nice to have	anyone who gets 'raw'
proc	processed data • codas database • underway figure archive • matlab files	final at-sea product CODAS PROCESSING	science CD after cruise
reports	mini-webpage with metadata and overview of processed data	nice to have (only in modern cruise directories)	science CD after cruise

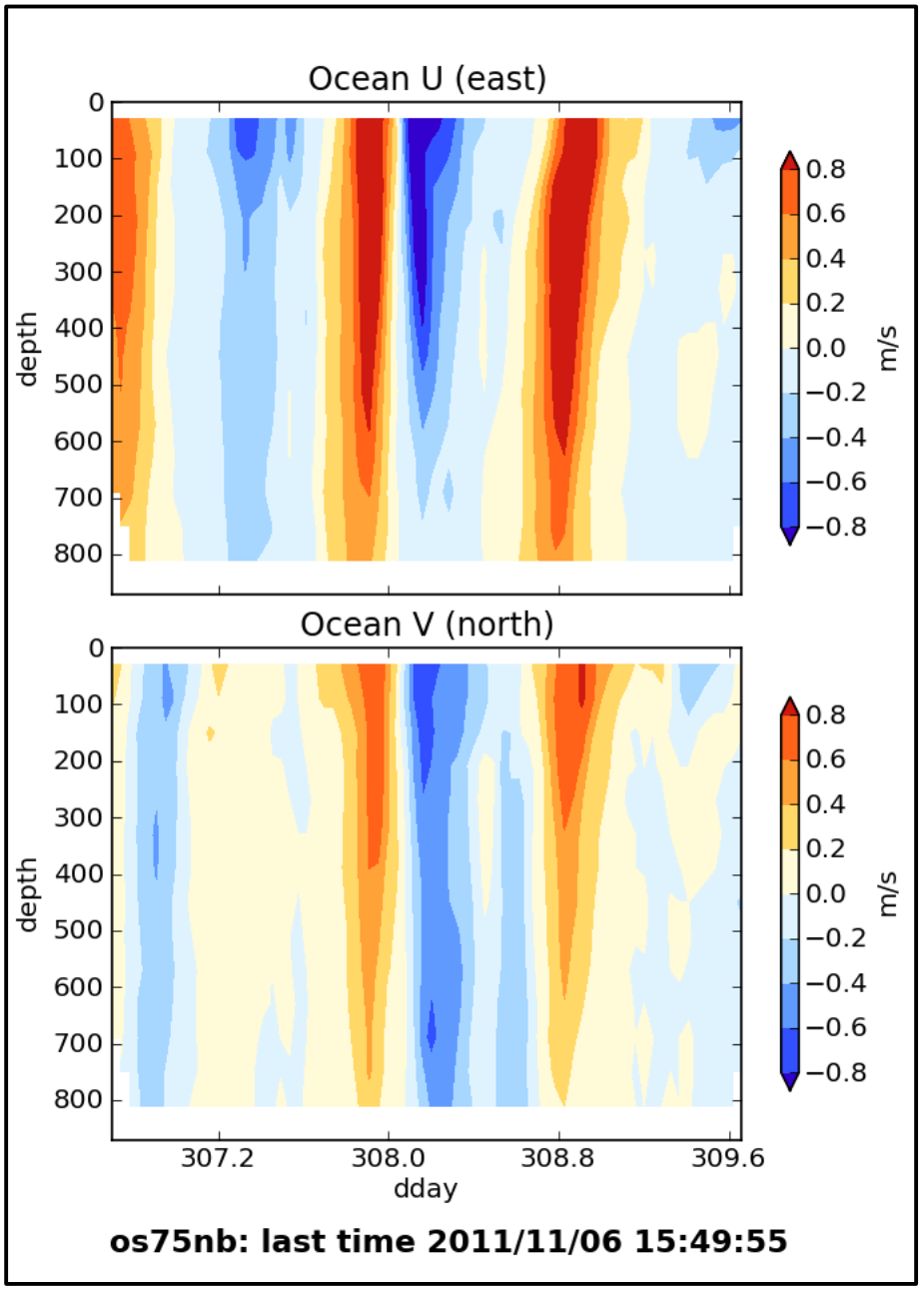
(link in documentation – [raw+rbin+gbin] directories)

CODAS Processing

Time, ADCP, Position, Attitude

primitive (raw) data





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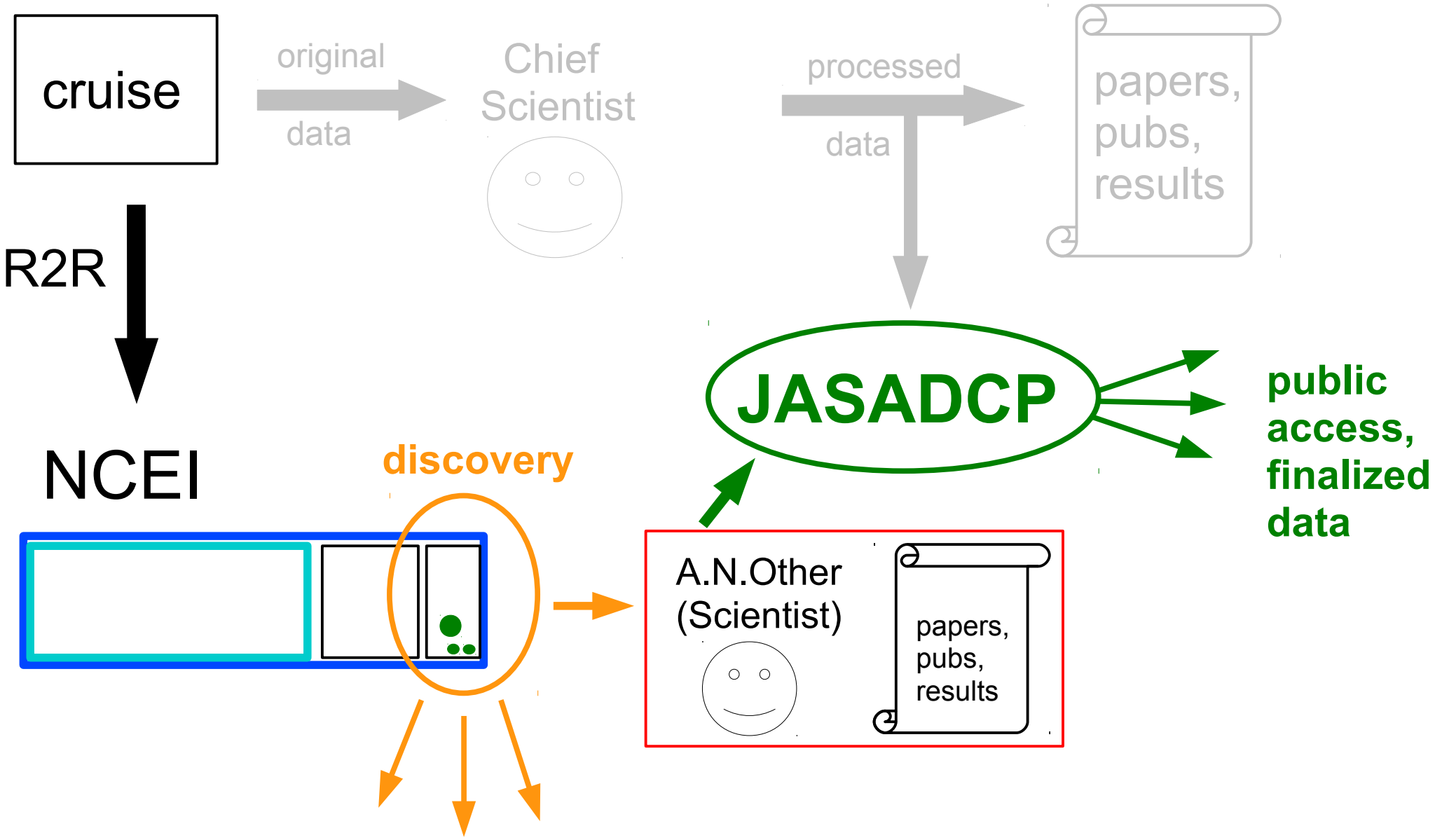

Workshop: What We Will Do

1. ADCP instrument
   - What it is; getting ocean velocities
2. ADCP Data Acquisition
   - Acquisition, processing, monitoring

- Comparison: UHDAS ⬌ VmDAS

Day 3

- UHDAS data details

3. CODAS Processing

Day 2

- Single-ping editing
- Postprocessing
  - Calibration
  - Editing

Day 1 afternoon

4. **Data Stewardship**