What is the U.S. Marine Rock and Sediment Sampling (MARSSAM) Facility?

- Prior to 1997 National Science Foundation (NSF) ***investigators responsible on an individual basis*** for requesting all funding necessary for sediment coring

- However, all sediment cores collected with NSF funding become available to the broad scientific community after brief moratorium

- At 1997 Future of Marine Geoscience (FUMAGEGS) meeting, it was decided that ***a central facility should exist*** to support coring for all NSF-supported PIs

- Now a 25-year-old national facility based at Oregon State University supporting operations on NSF Academic Research Fleet

- As of 2022 offers equal support of ARF dredging

The MARSSAM Mandate: Sea Change 2015-2025

CONTRIBUTORS:

Committee on Guidance for NSF on National Ocean Science Research Priorities

Decadal Survey of Ocean Sciences

Ocean Studies Board

Division on Earth and Life Studies

National Research Council

Sea Change “Priority Science Questions” (8)

1. What are the rates, mechanisms, impacts, and geographic variability of sea level change?
2. How are the coastal and estuarine ocean and their ecosystems influenced by the global hydrologic cycle, land use, and upwelling from the deep ocean?
3. How have ocean biogeochemical and physical processes contributed to today’s climate and its variability, and how will this system change over the next century?
4. What is the role of biodiversity in the resilience of marine ecosystems and how will it be affected by natural and anthropogenic changes?

Sea Change “Priority Science Questions” (8)

5. How different will marine food webs be at midcentury? In the next 100 years?
6. What are the processes that control the formation and evolution of ocean basins?
7. How can risk be better characterized and the ability to forecast geohazards like mega-earthquakes, tsunamis, undersea landslides, and volcanic eruptions be improved?
8. What is the geophysical, chemical, and biological character of the subseafloor environment and how does it affect global elemental cycles and understanding of the origin and evolution of life?

Implications for science:

AR64-02 PR05 PC03: 1901 m

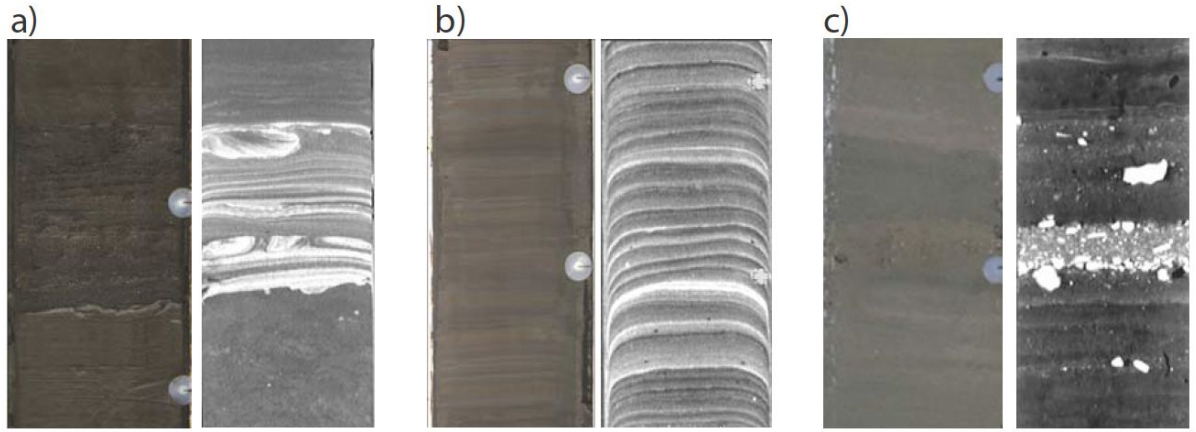
AR64-02 PR06 PC03: 5359 m

AR64-02 PR07 PC01: 8360 m

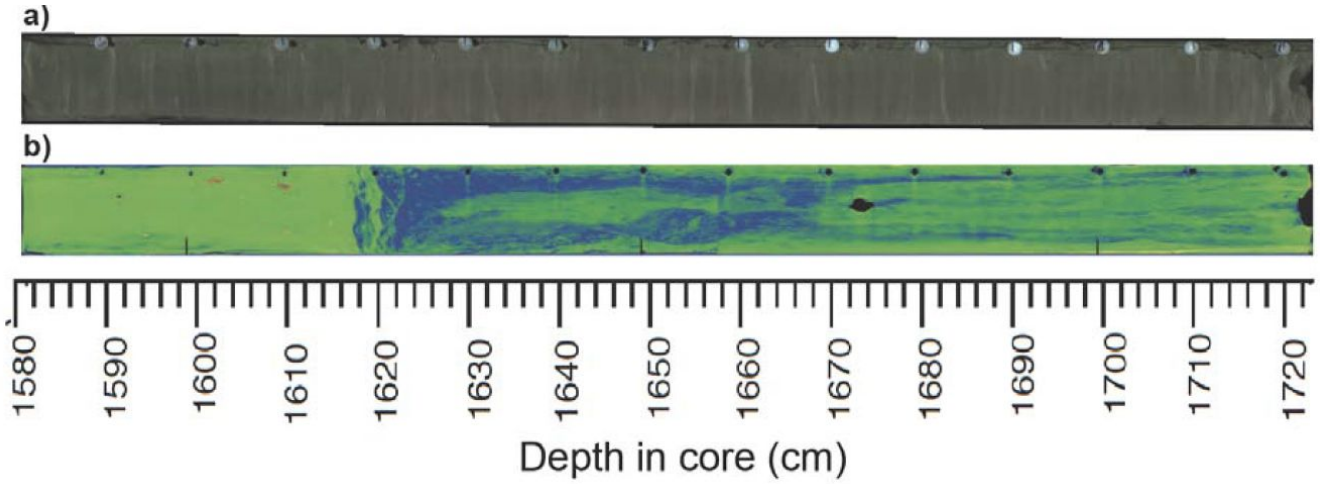
Earthquakes

Productivity/Climate

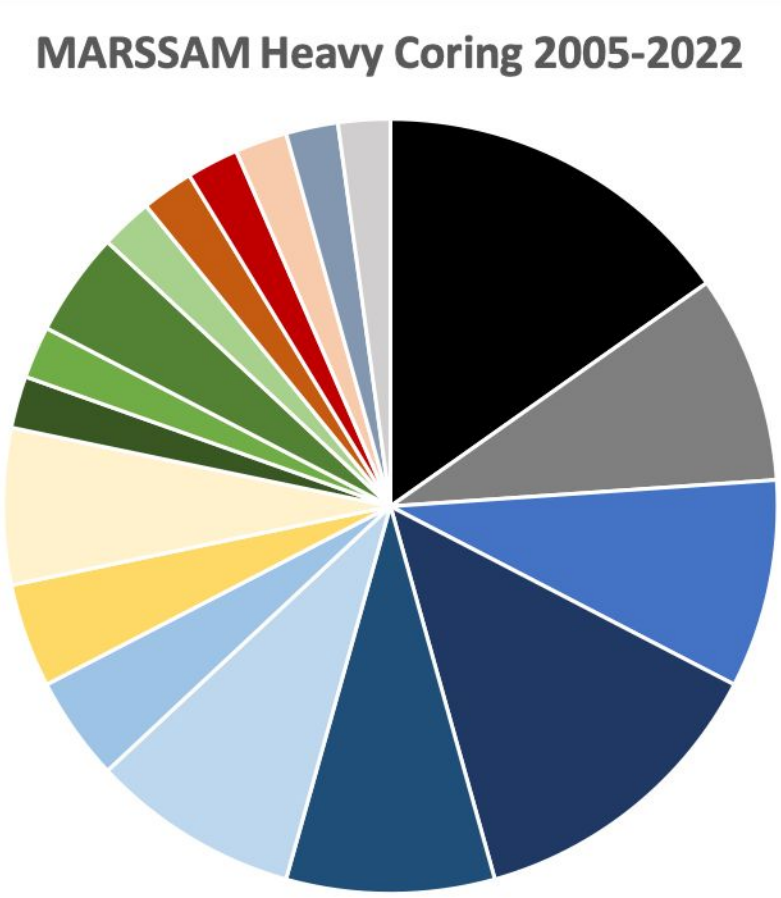
Glacial dynamics

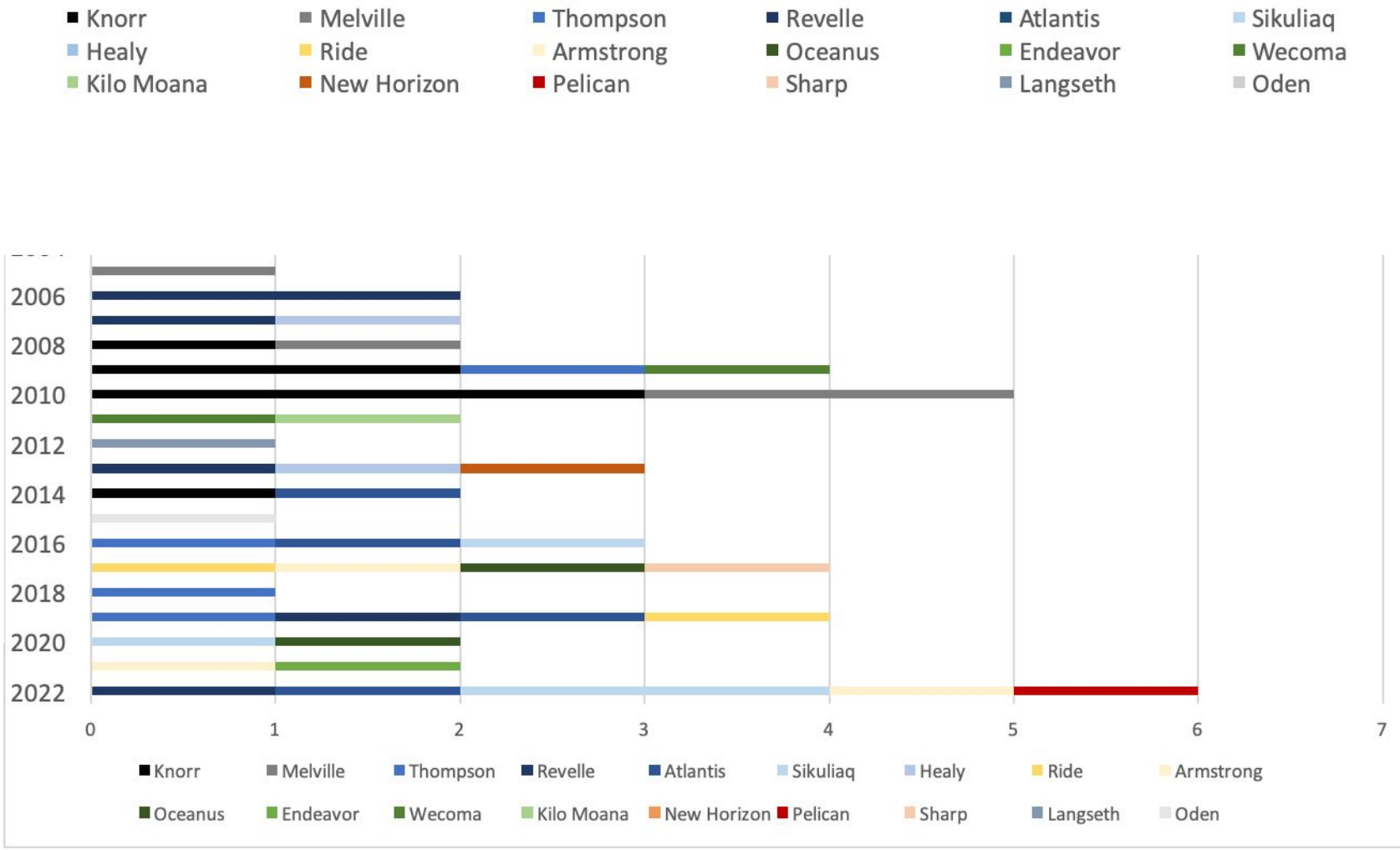


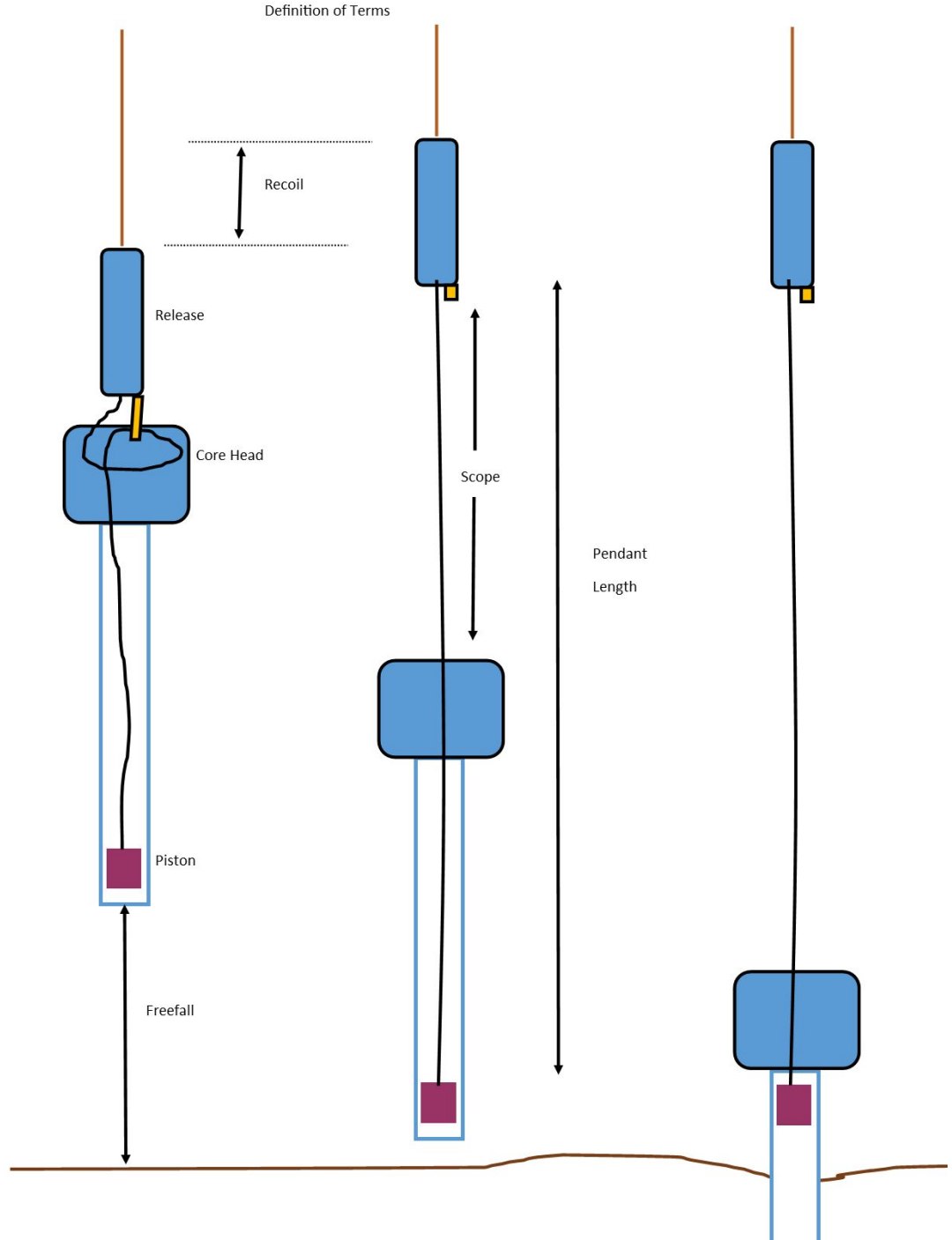
Sometimes it's worse than it looks…



What ships are used the most (2005-2022)?



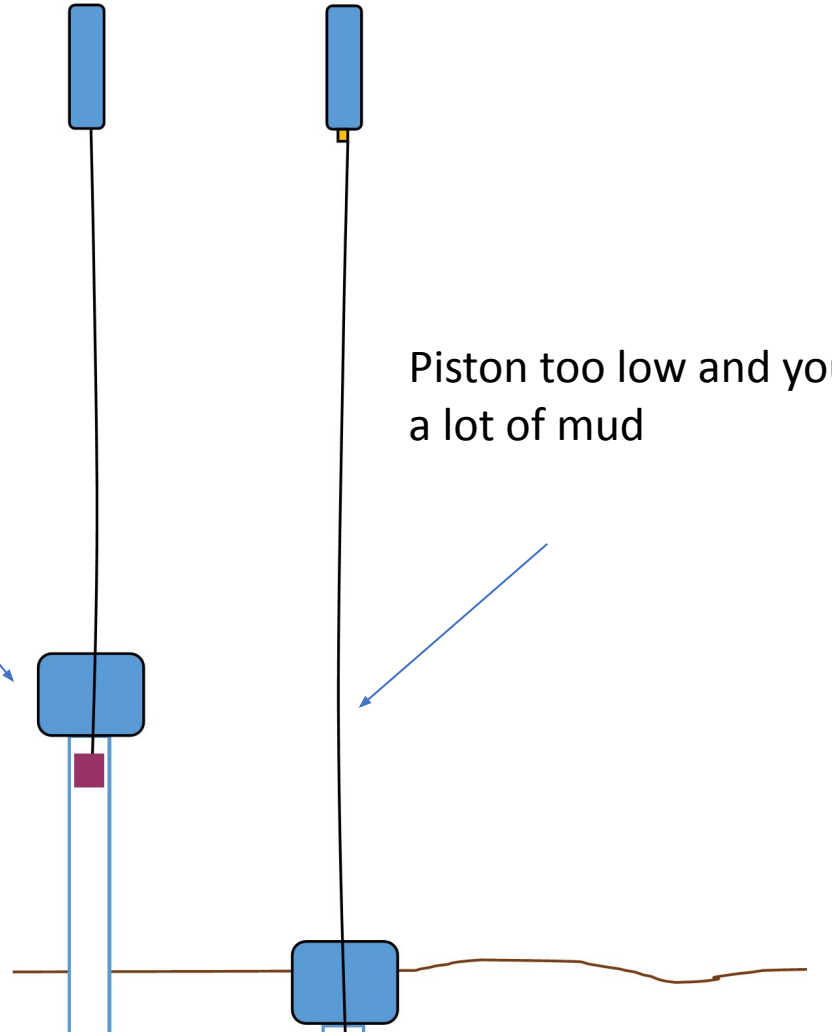


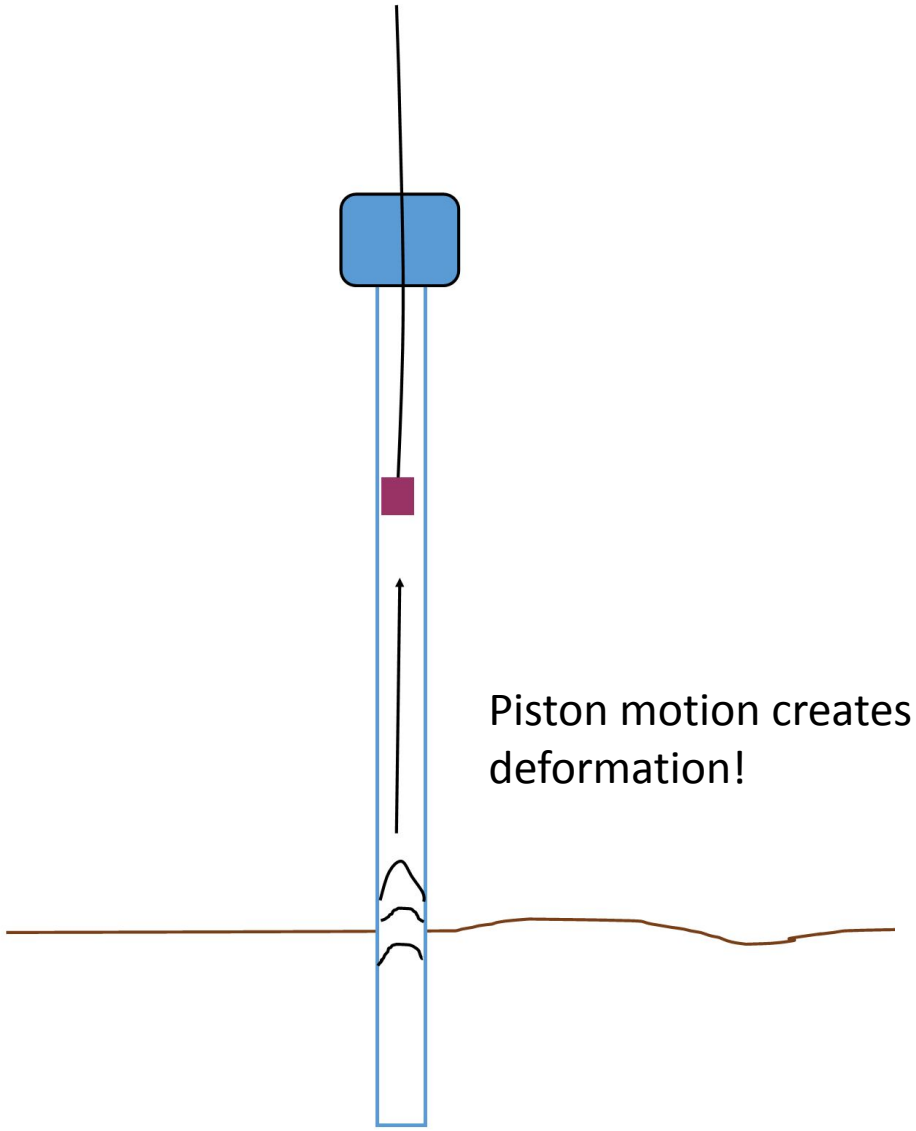

Definition of Terms
Recoil
Release
Core Head
Piston
Freefall
Scope
Pendant
Length

Piston action and placement determines core quality!

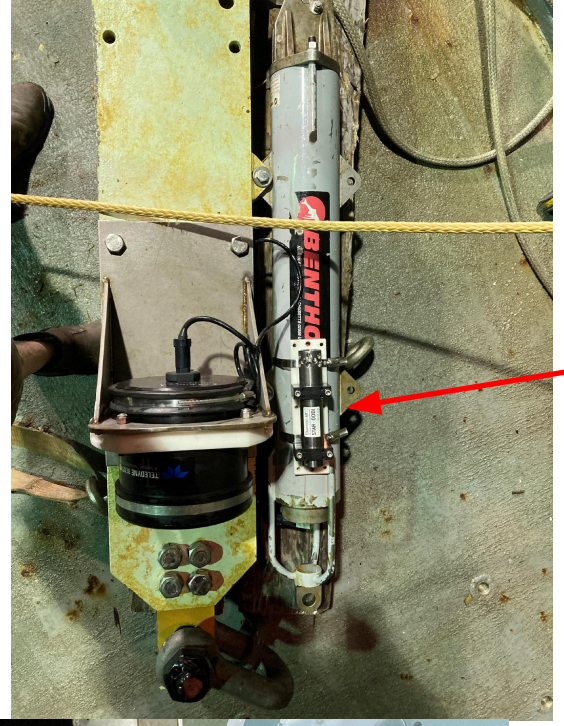
Piston too high and you're sampling water

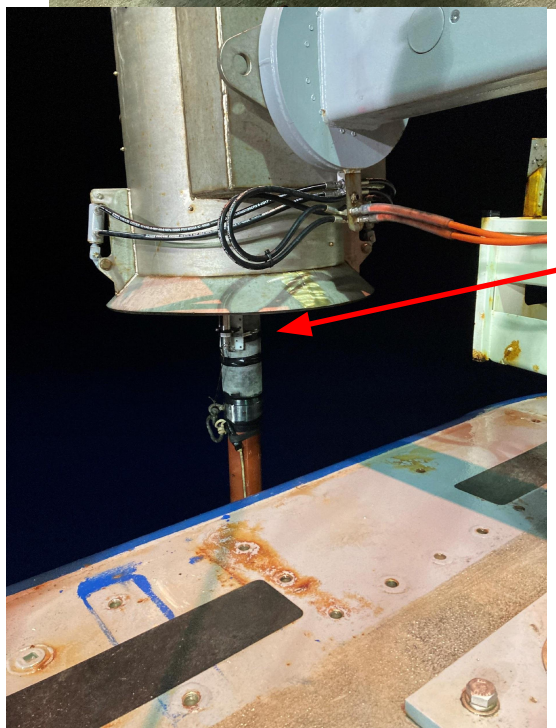
Piston too low and you're missing a lot of mud





Piston motion creates deformation!

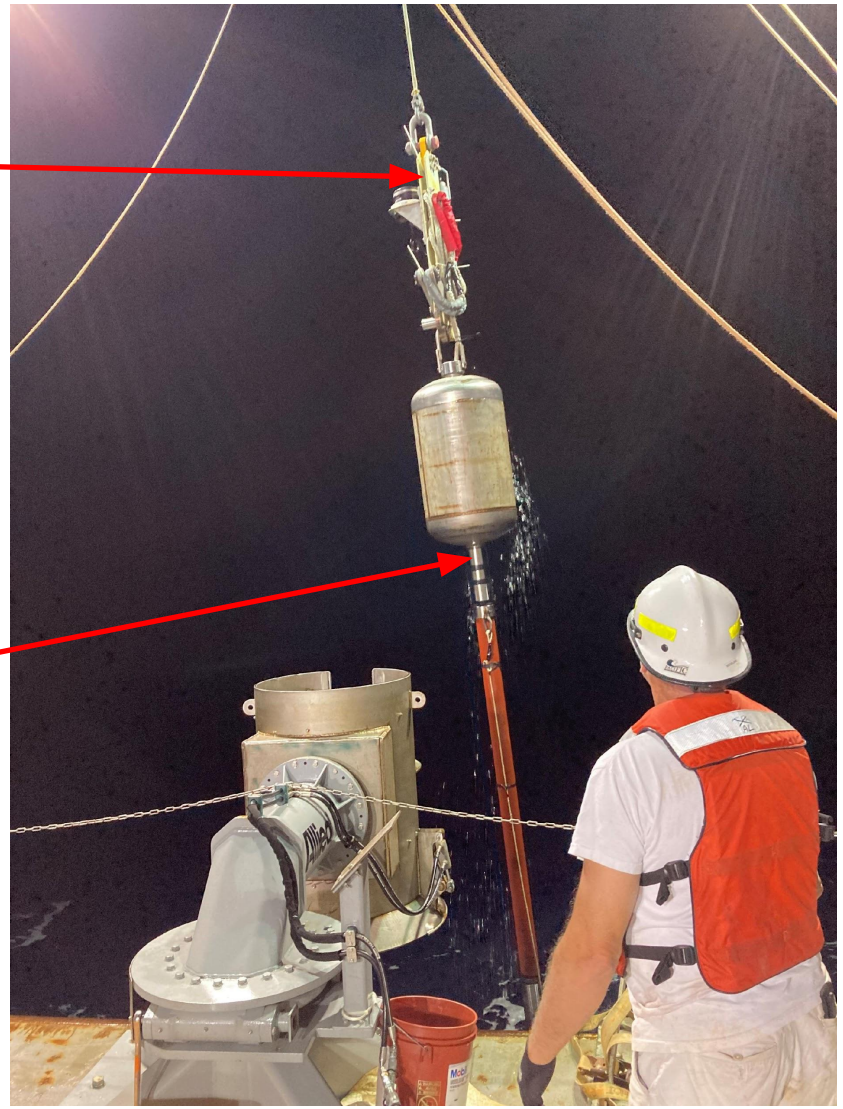




Sensors measure:
3-d acceleration
Depth
Temperature

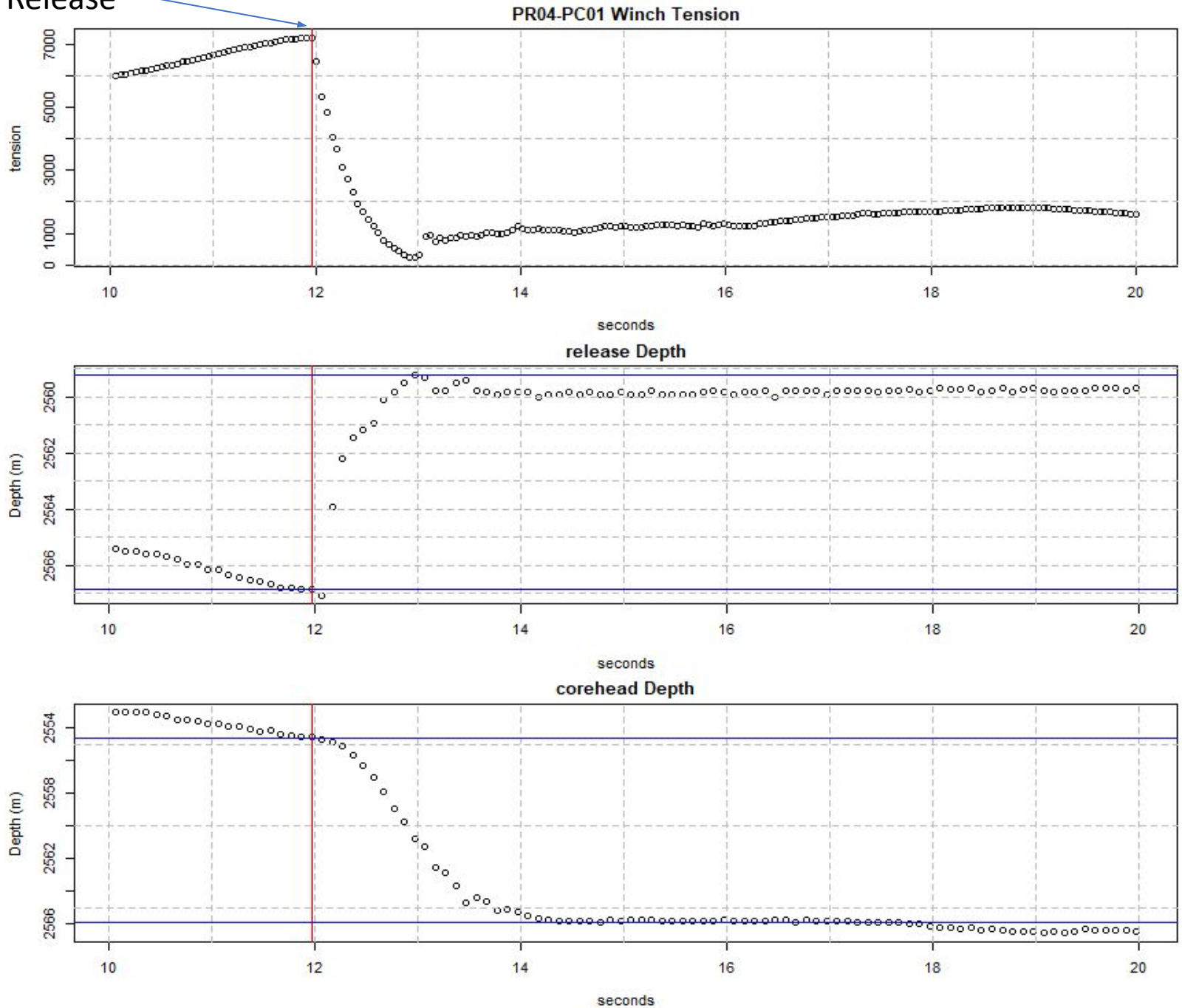
Release Sensor

Corehead Sensor

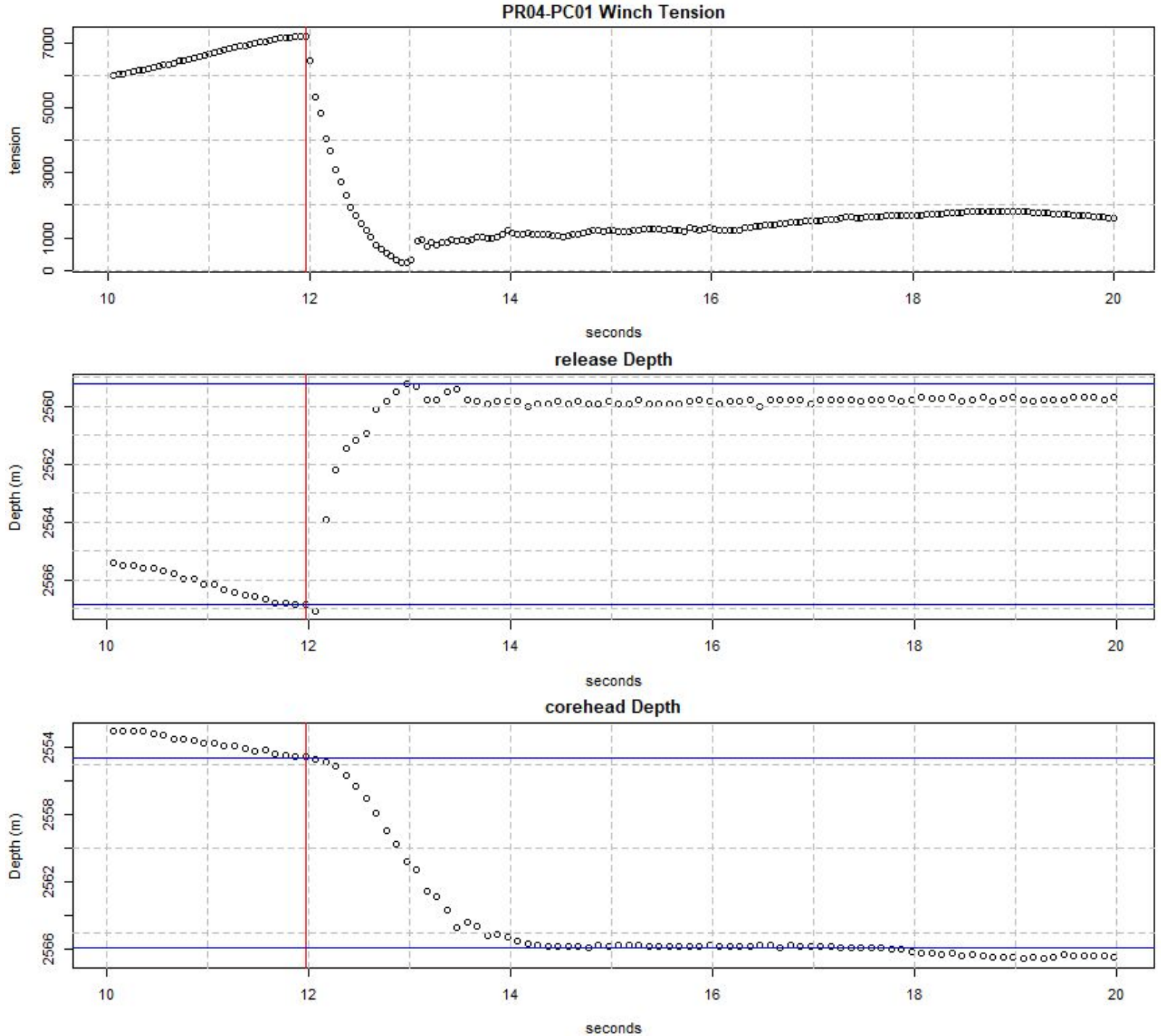


Moment of Release

Sensor Data



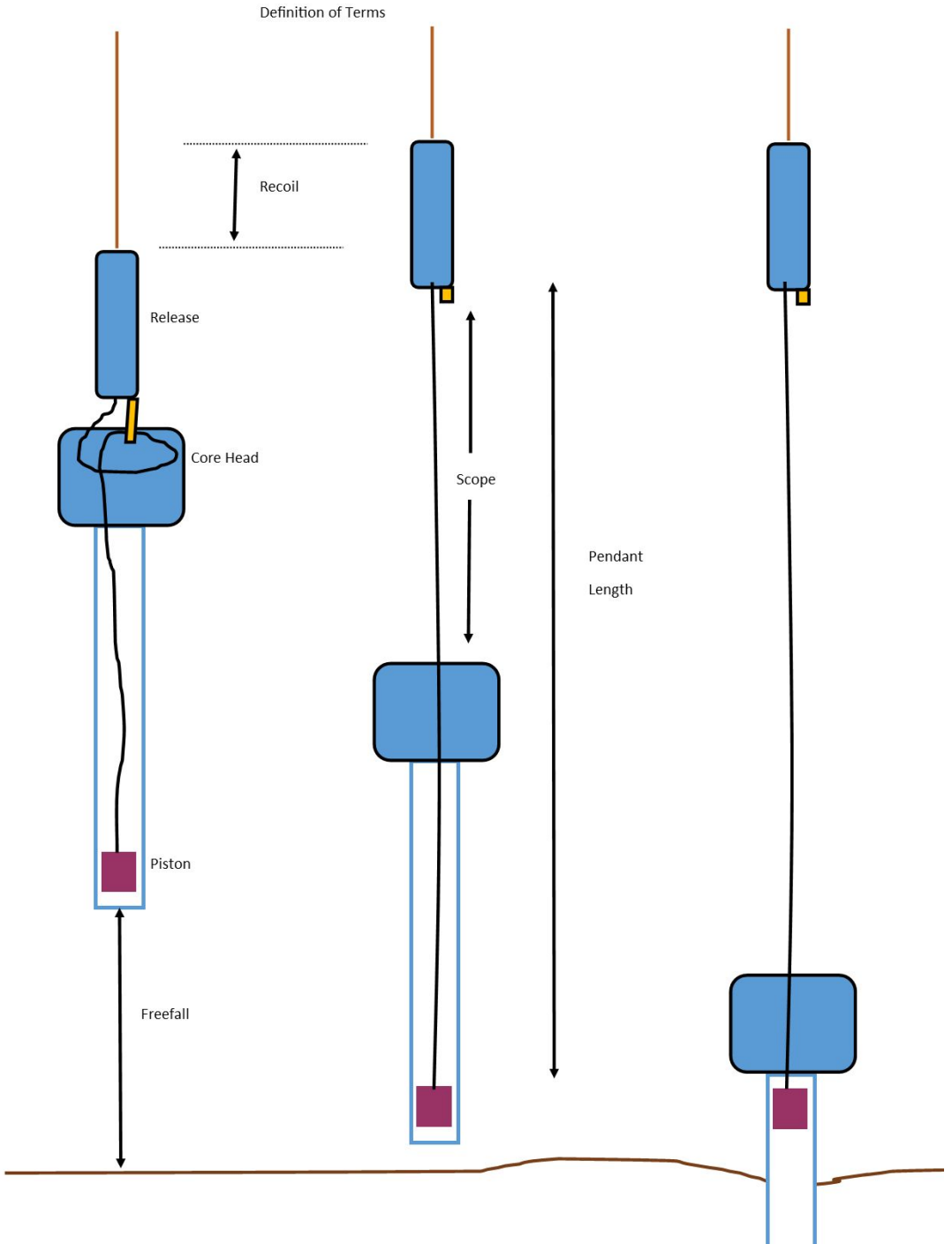
Change in Release Depth after release = “Recoil”

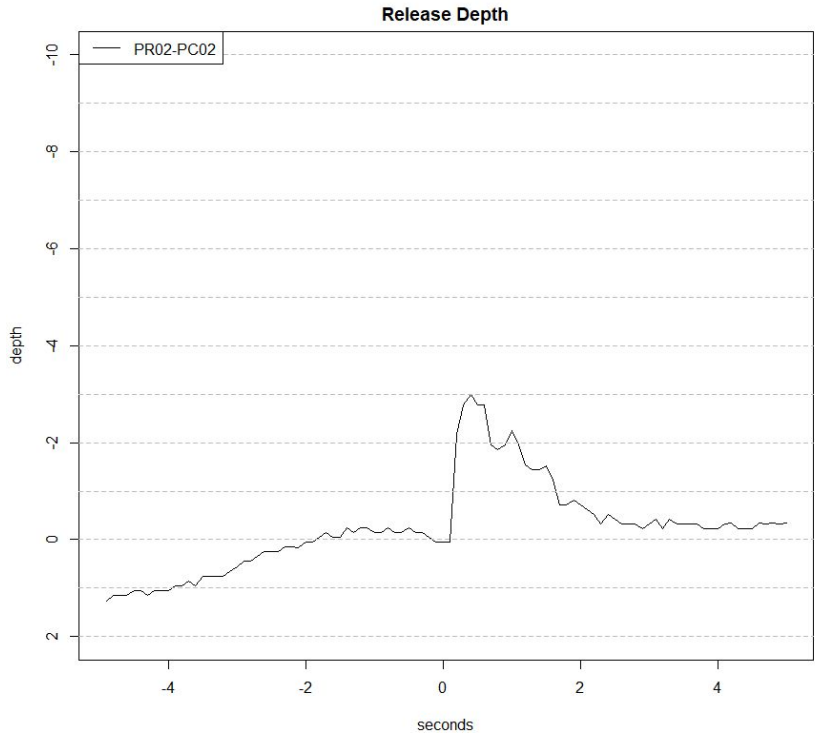


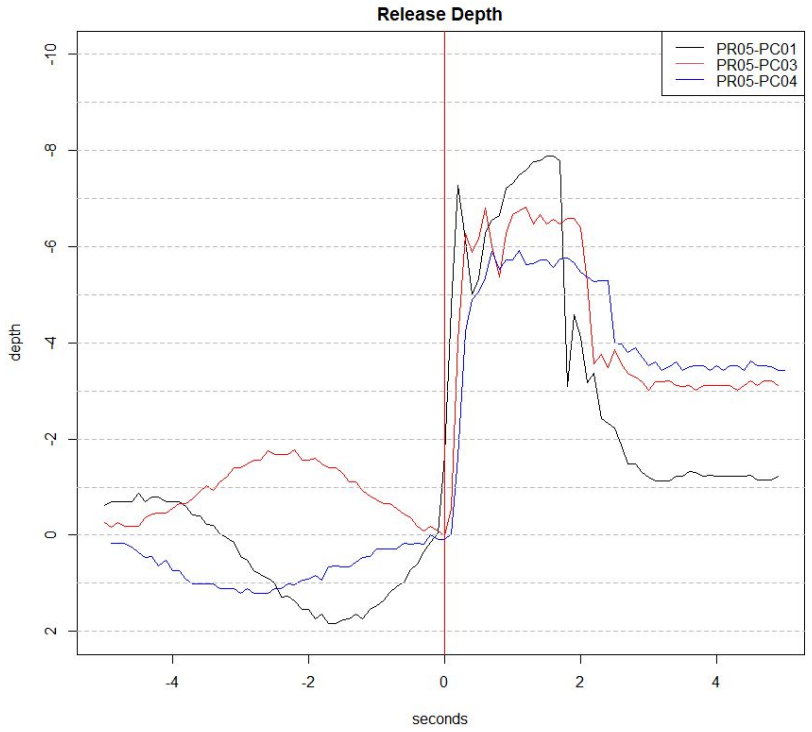
Scope = FreeFall + Recoil

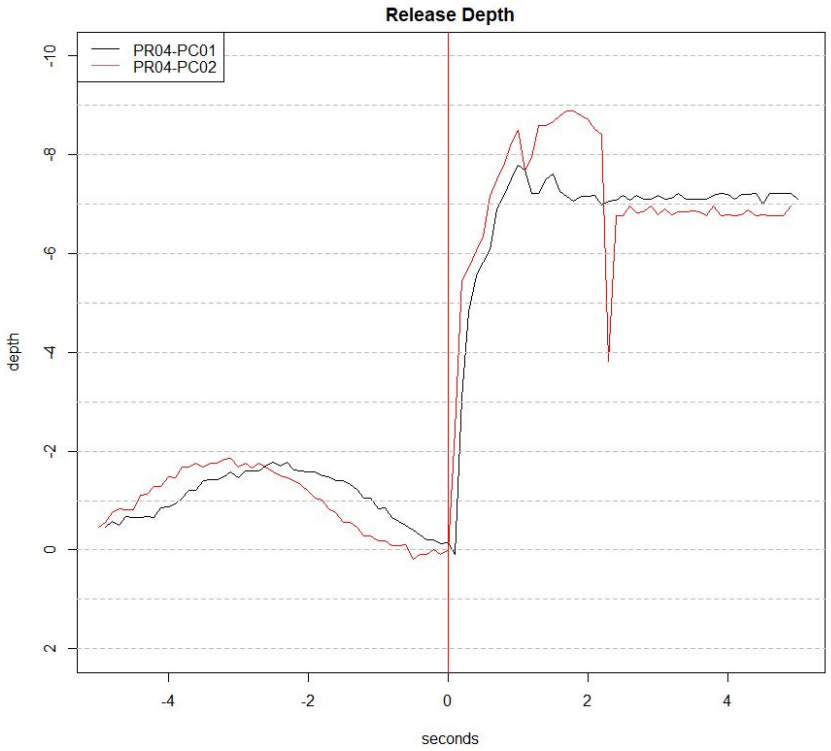
For 9/16 3x19 Trawl wire we increase scope by 6” for every 500m over 2000m to account for increasing recoil with depth

How much recoil is there with synthetic? A lot more!









3 m at 500m depth

5 – 8 m at 1900m depth

7- 9 m at 2600m depth

Core	Depth	rebound distance	% elongation
PR02-PC02	492	3.04	0.62%
PR05-PC01	1900	7.89	0.42%
PR05-PC03	1900	6.73	0.35%
PR05-PC04	1900	5.92	0.31%
PR04-PC01	2600	7.64	0.29%
PR04-PC02	2600	8.93	0.34%

Elongation and therefore recoil is a function of the load/line strength

Core	Depth	recoil	% elongation
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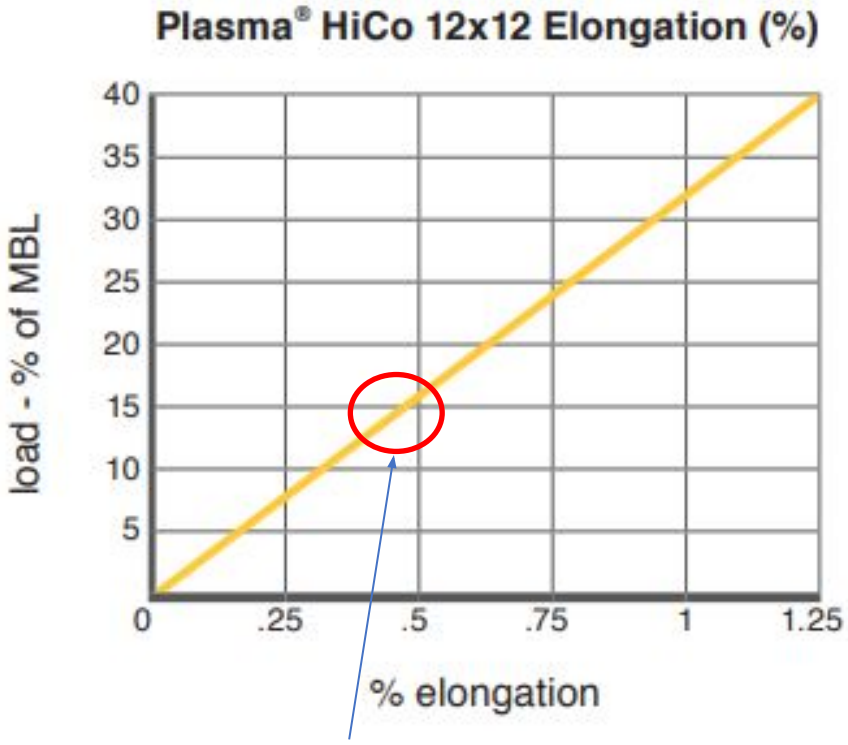
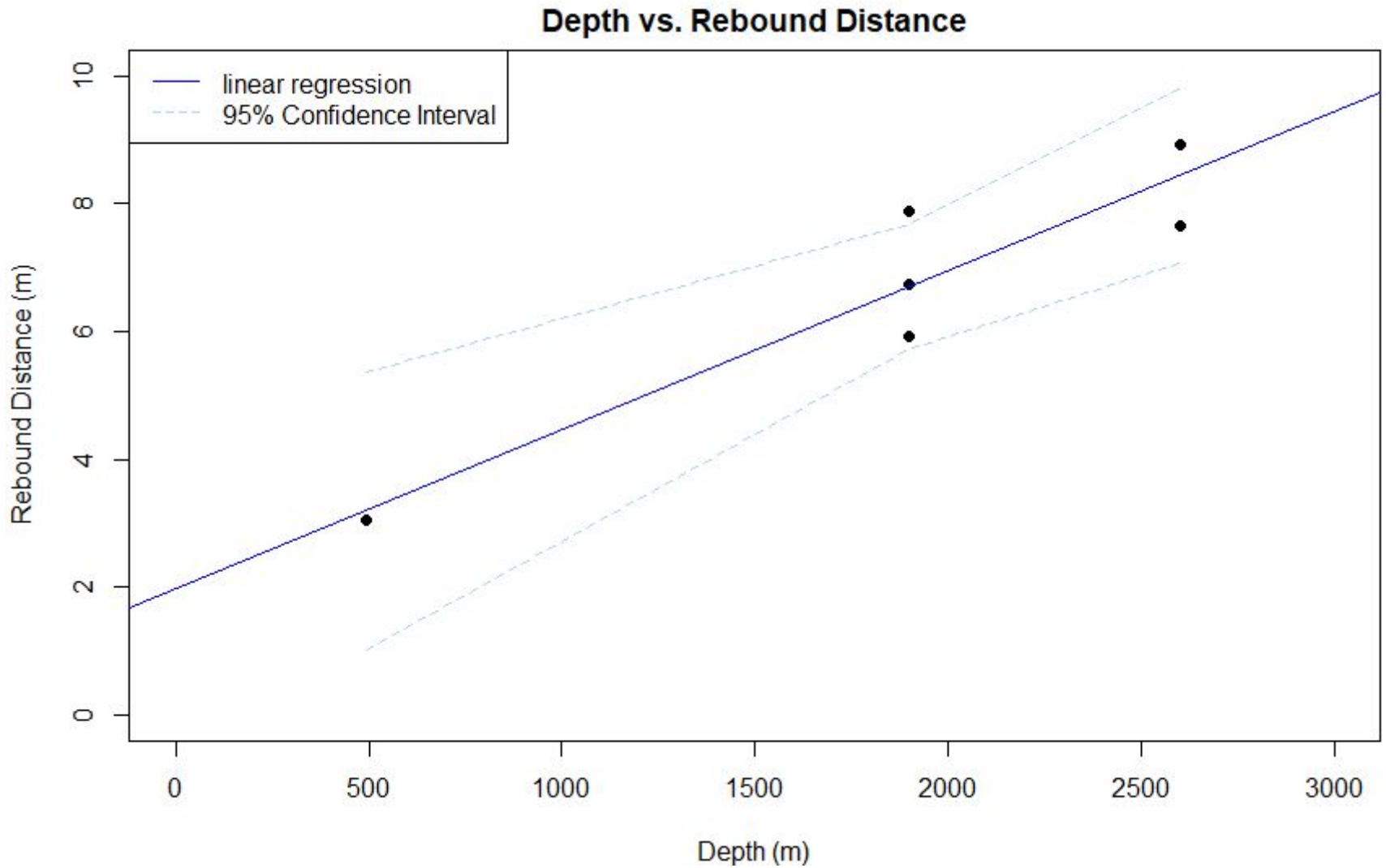
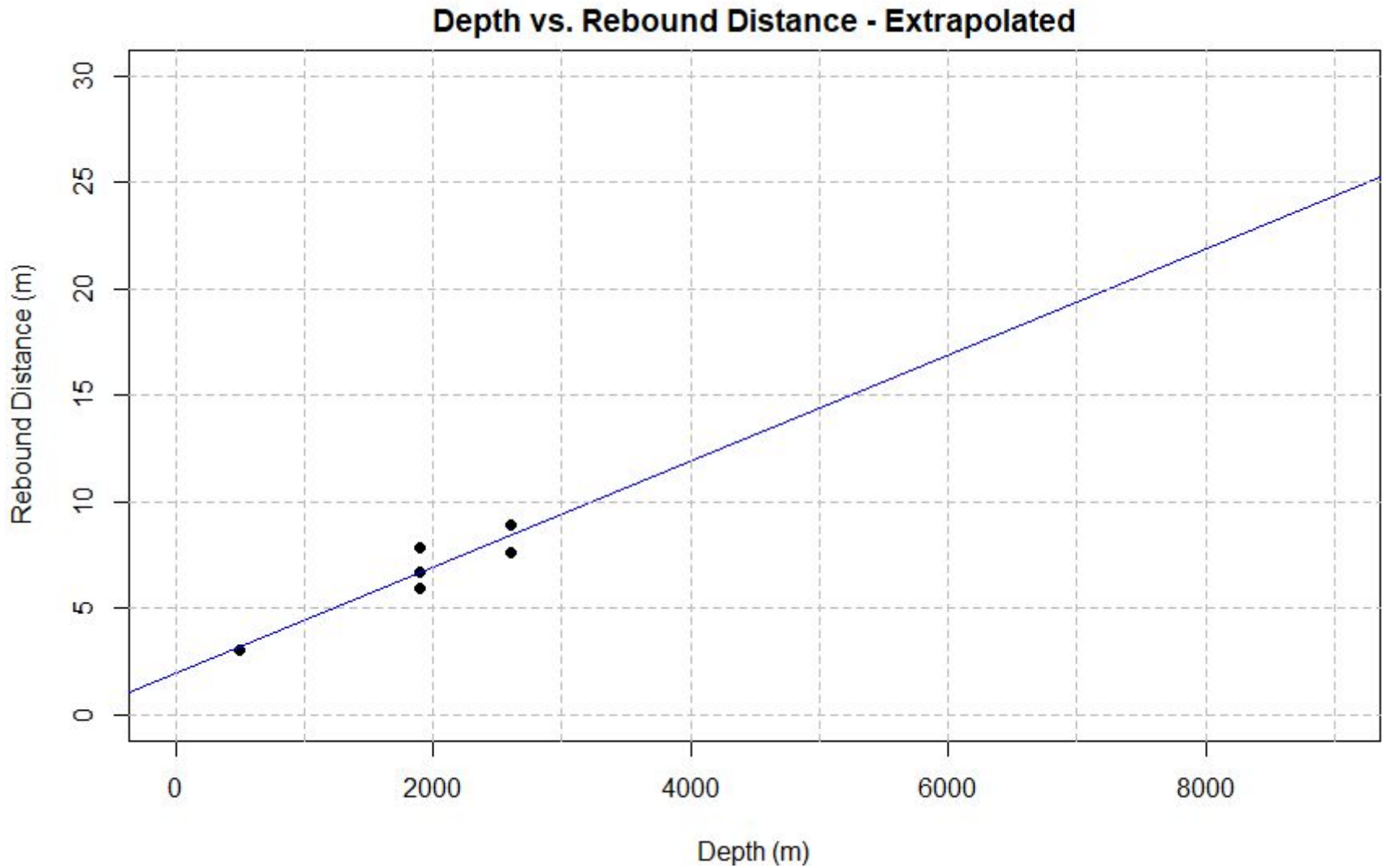
PR04-PC01	2600	7.64	0.29%
PR04-PC02	2600	8.93	0.34%
		Average	0.40%

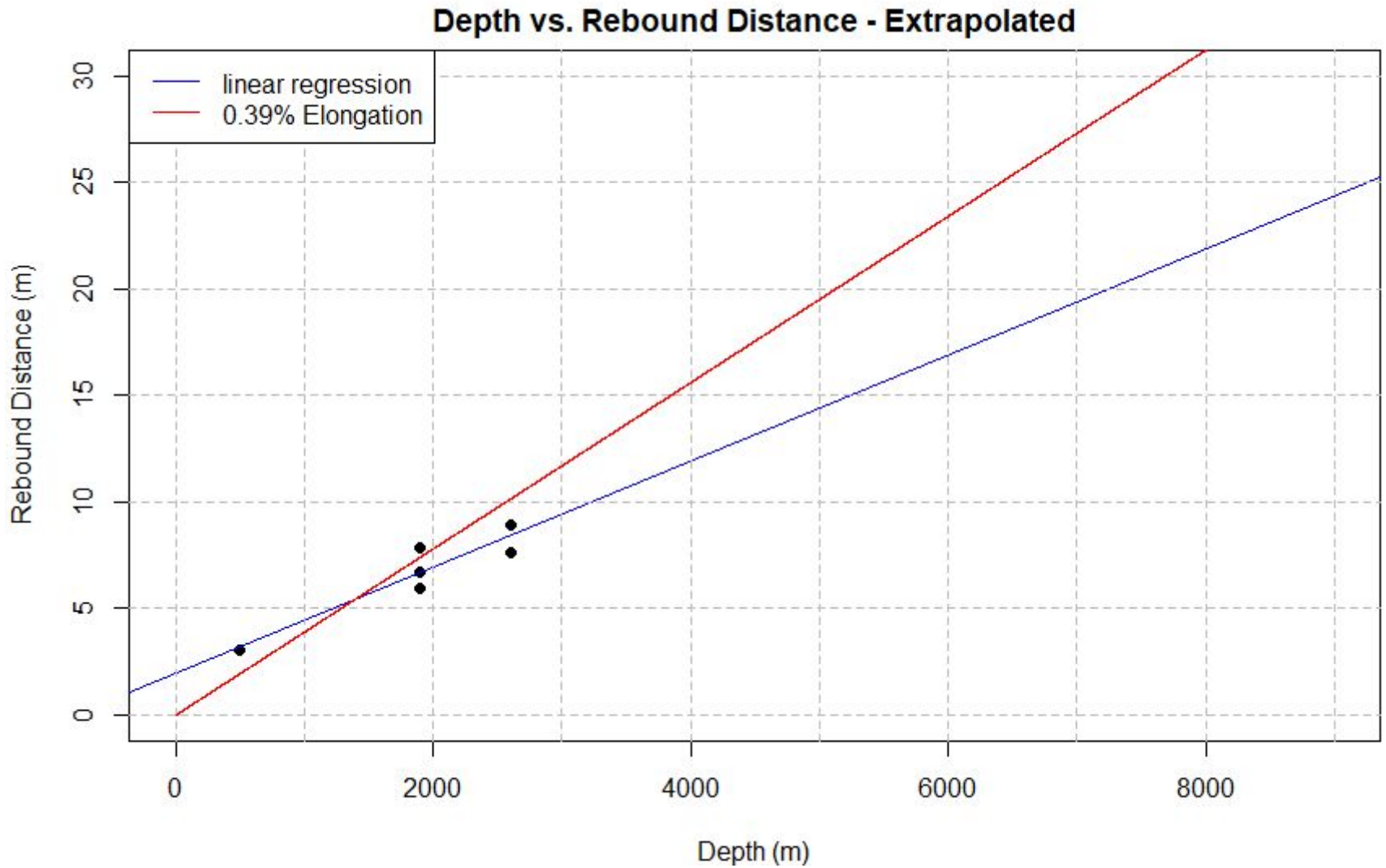


The recoil distances we measured closely track values for expected elongation

~6500/42000 = ~15%, ~.45% Elongation


Depth vs. Rebound Distance
linear regression
95% Confidence Interval
Rebound Distance (m)
0
2
4
6
8
10
0
500
1000
1500
2000
2500
3000
Depth (m)


Depth vs. Rebound Distance - Extrapolated
Rebound Distance (m)
0
5
10
15
20
25
30
0
2000
4000
6000
8000
Depth (m)

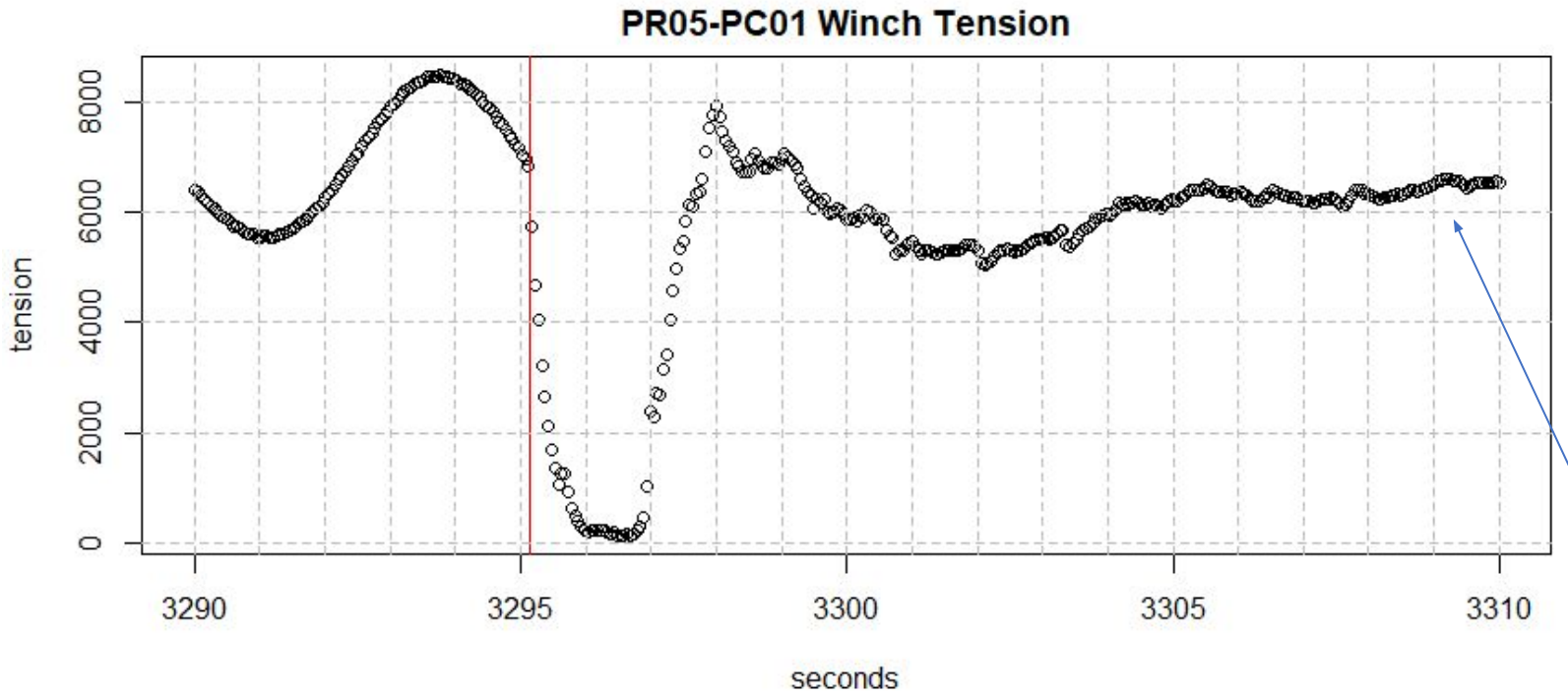

Depth vs. Rebound Distance - Extrapolated
linear regression
0.39% Elongation
Rebound Distance (m)
0
5
10
15
20
25
30
0
2000
4000
6000
8000
Depth (m)

- We were able to collect in-situ measurements of the recoil of synthetic line in piston-coring scenario
- Recoil of synthetic line is far greater than for the same diameter of steel wire
- More recoil = more potential for core deformation effects and greater rigging challenges

Time for an example?

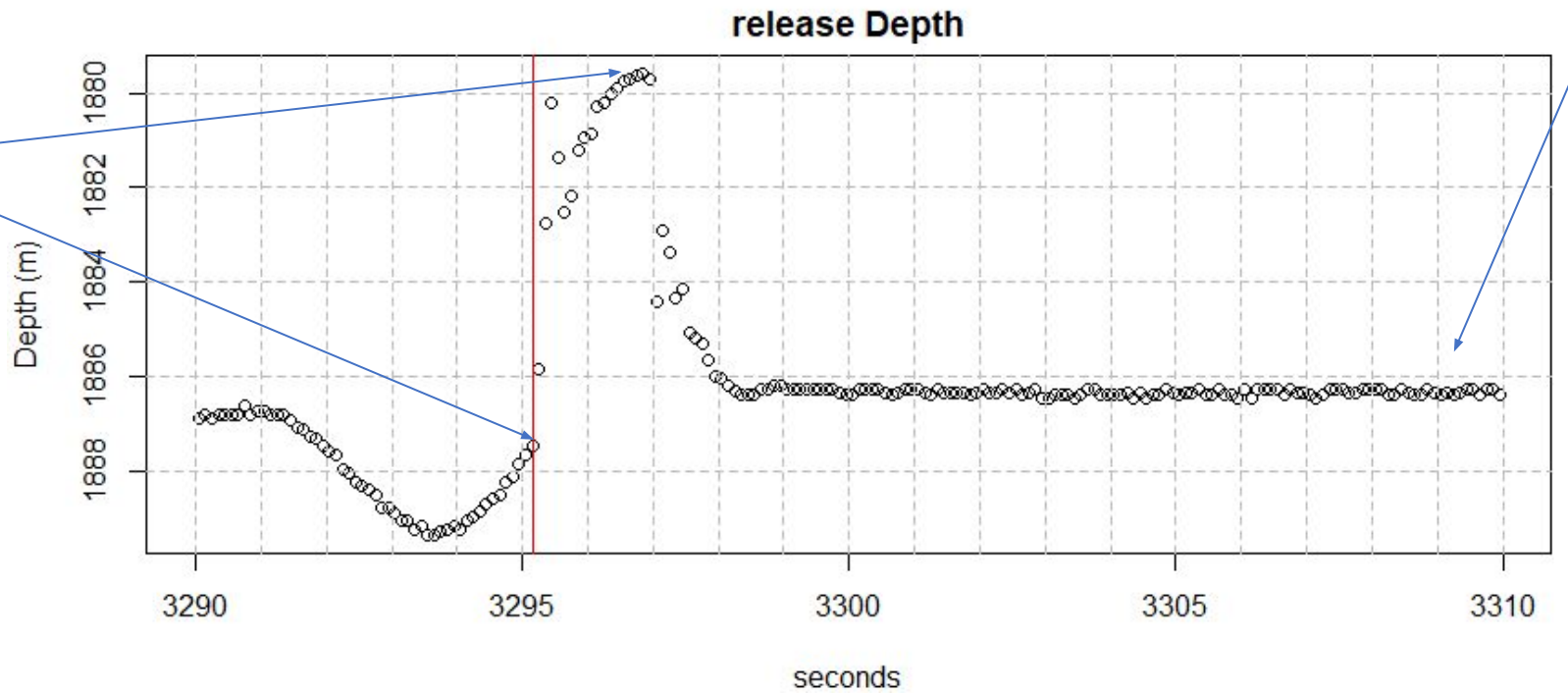
No Recoil Compensation

Depth: 1900m
Freefall: 3m
Scope: 3.8 m
Recovery: 1.5 m



Tension goes back up to corer weight, Release dragged back down to release depth

Measured 7.9m Recoil



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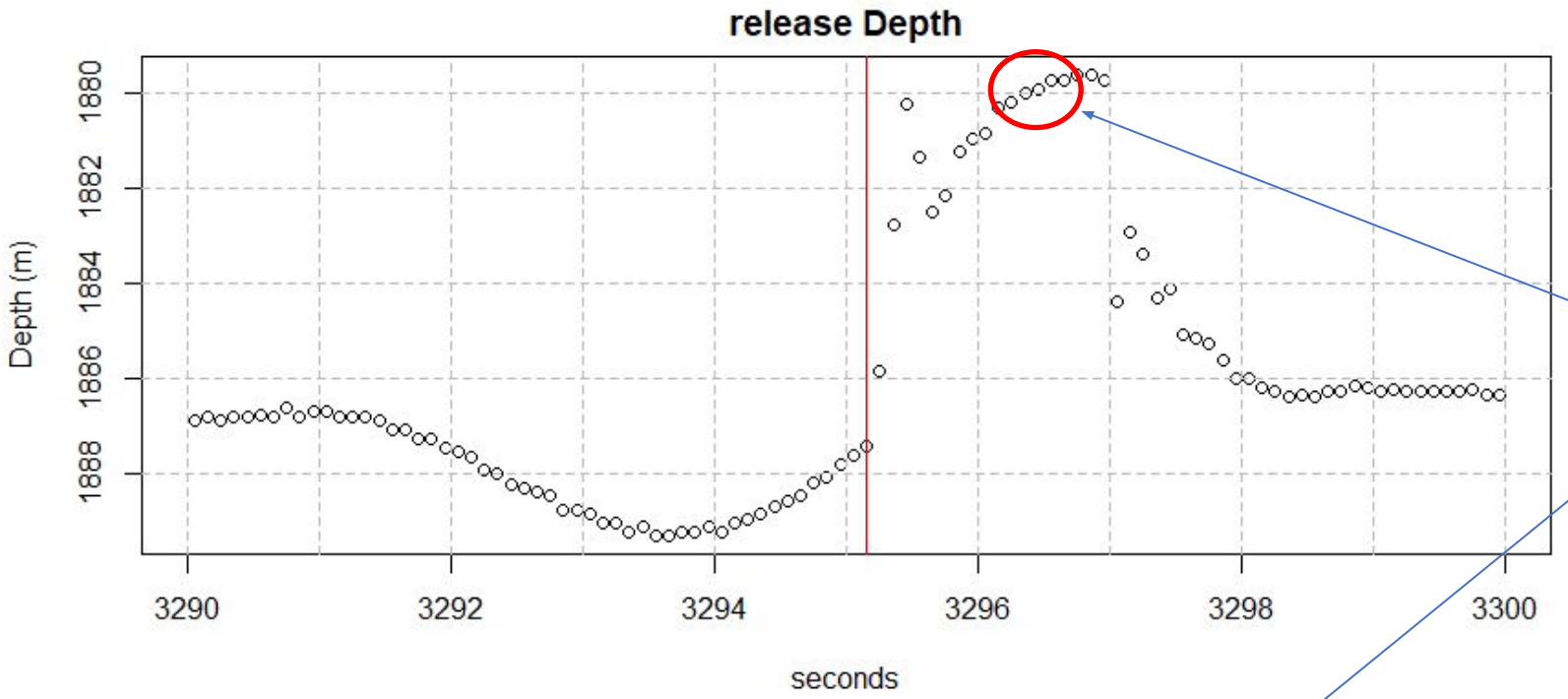
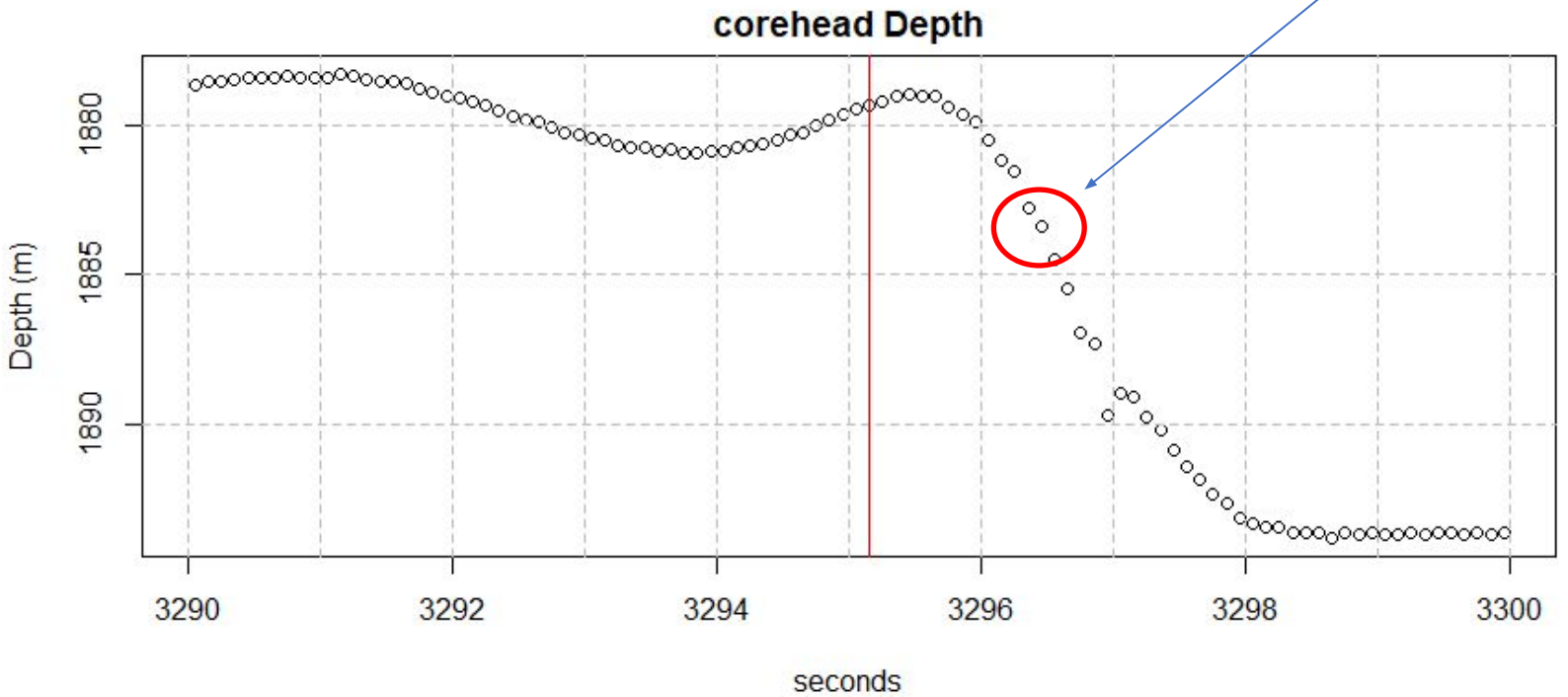
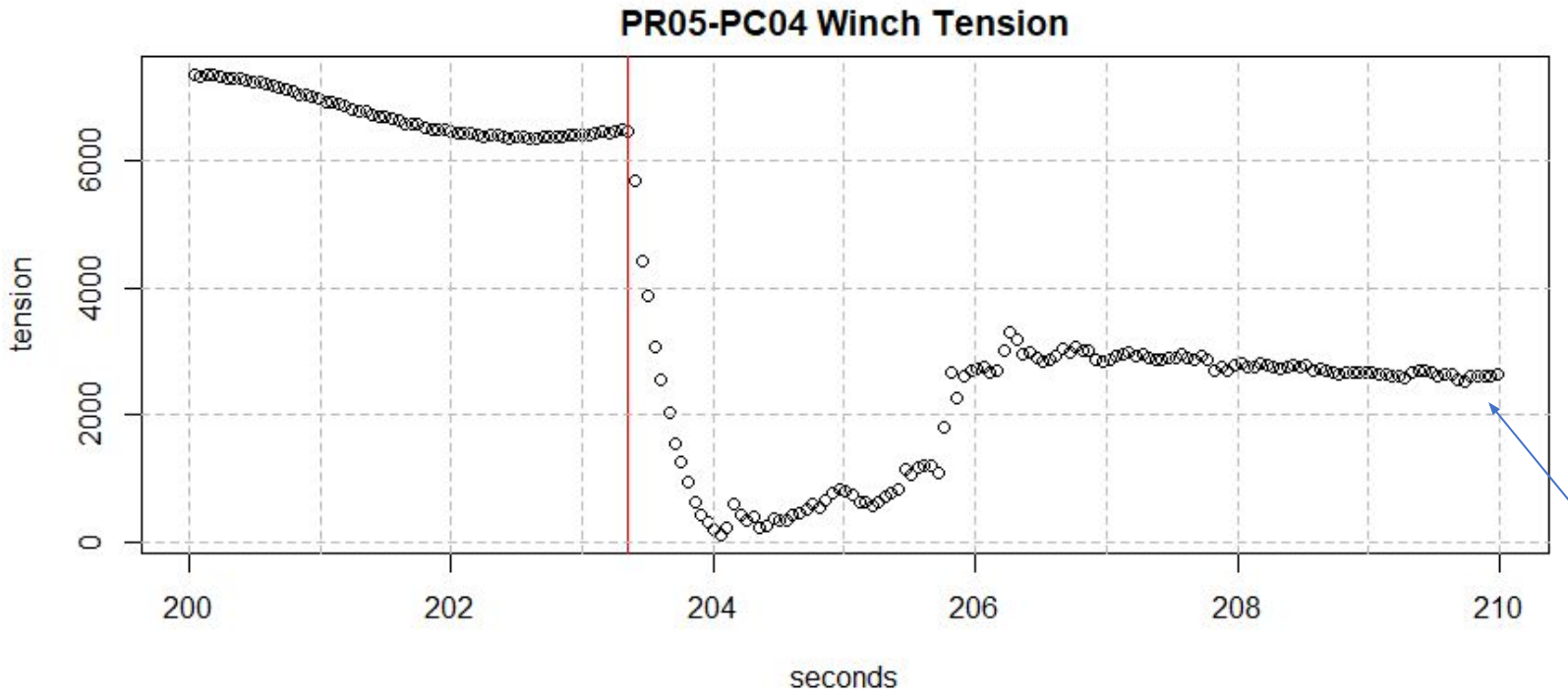


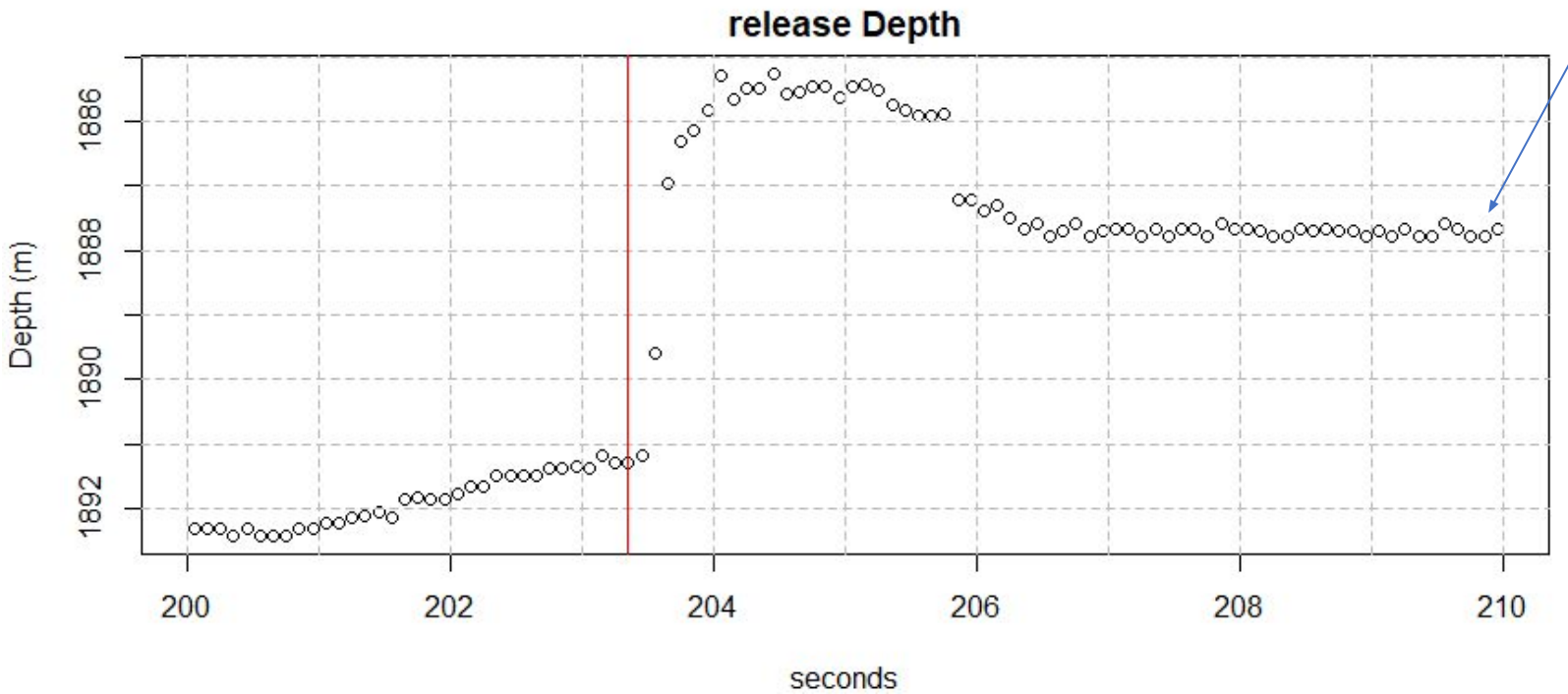


By the time corer has traveled freefall distance, release has rebounded farther than alotted scope

Adding scope and reducing freefall

Depth: 1900m
Freefall: 1m
Scope: 6.4 m
Recovery: 10.0 m

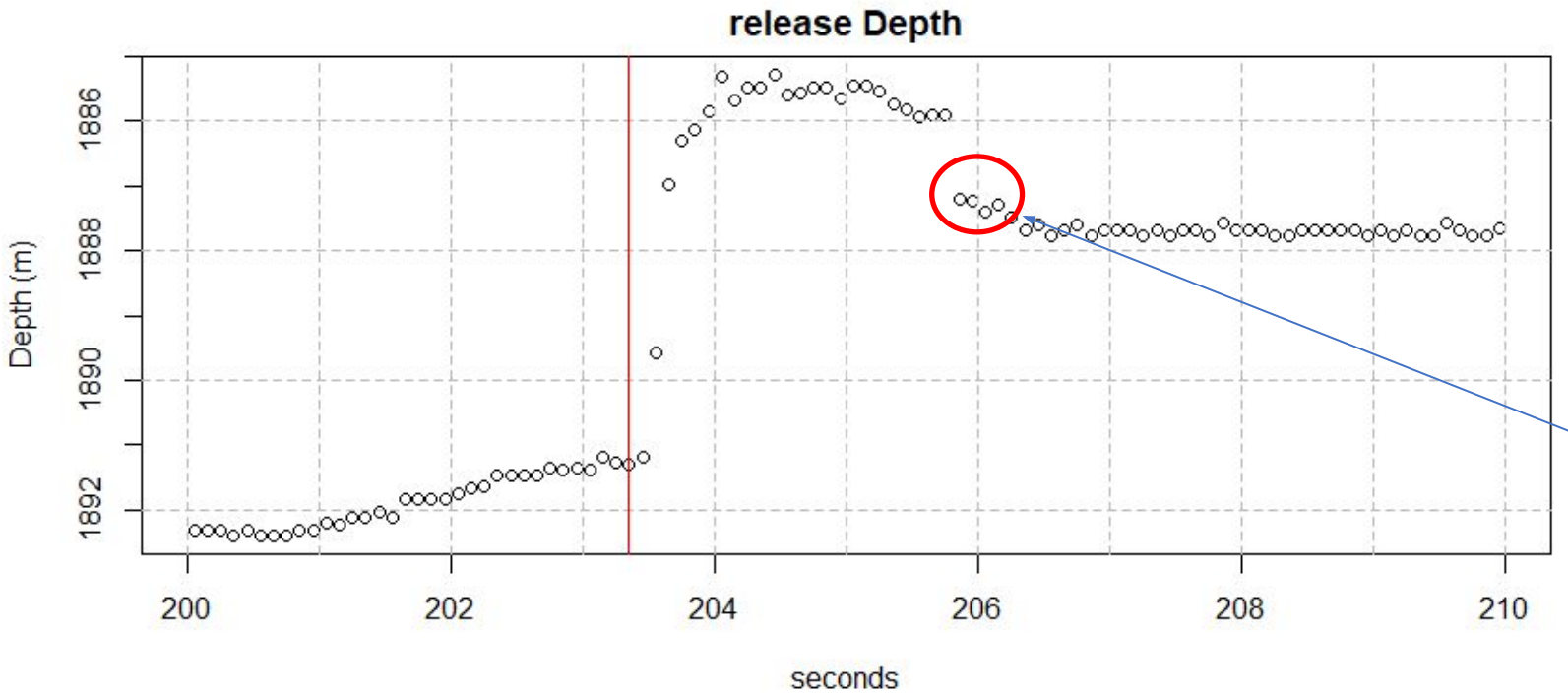


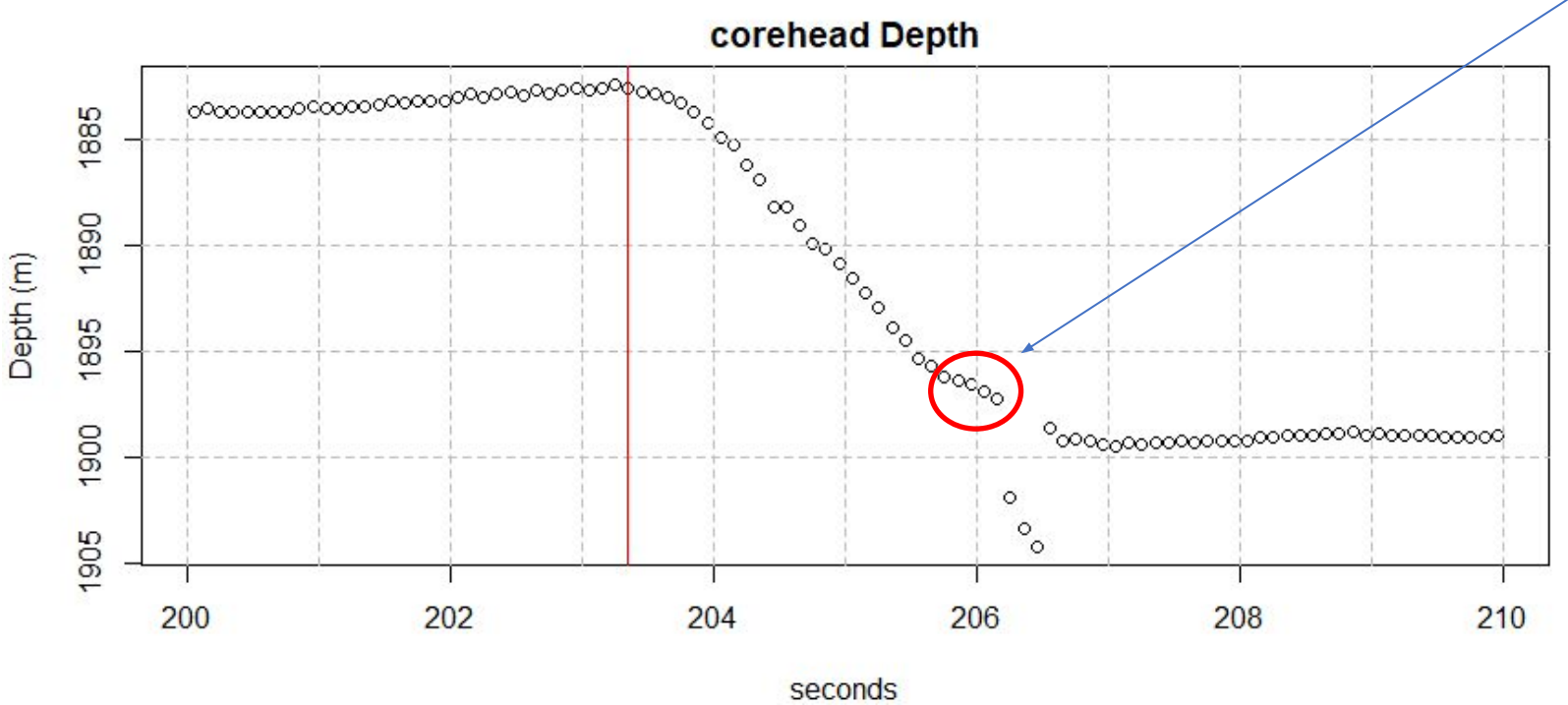


Tension stays off of winch

Adding scope and reducing freefall

Depth: 1900m
Freefall: 1m
Scope: 6.4 m
Recovery: 10.0 m





Corer has mostly completed descent by the time piston hits piston stop