

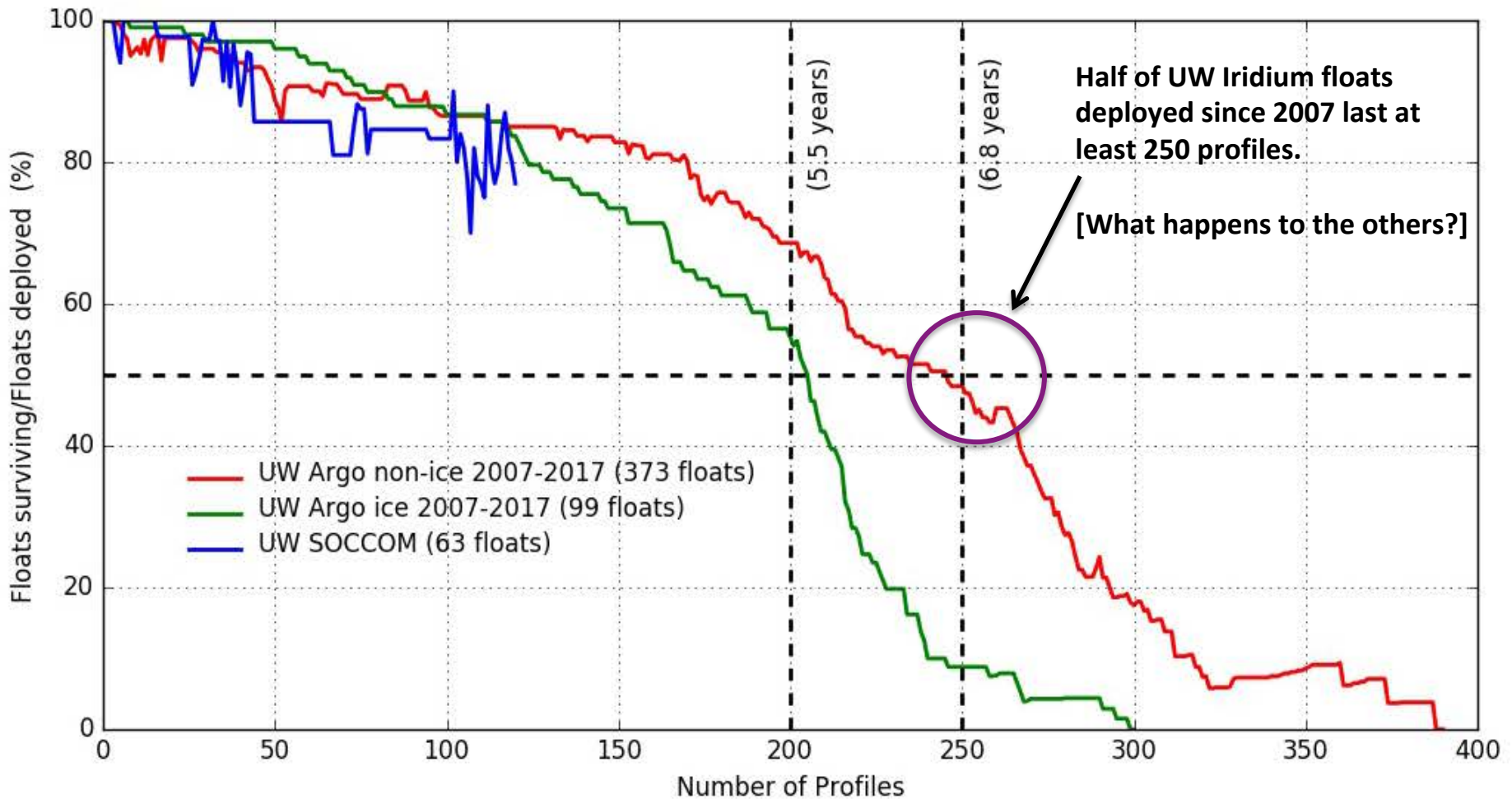
A Newly Discovered (and Possibly Widespread) Mode of APEX Float Failure

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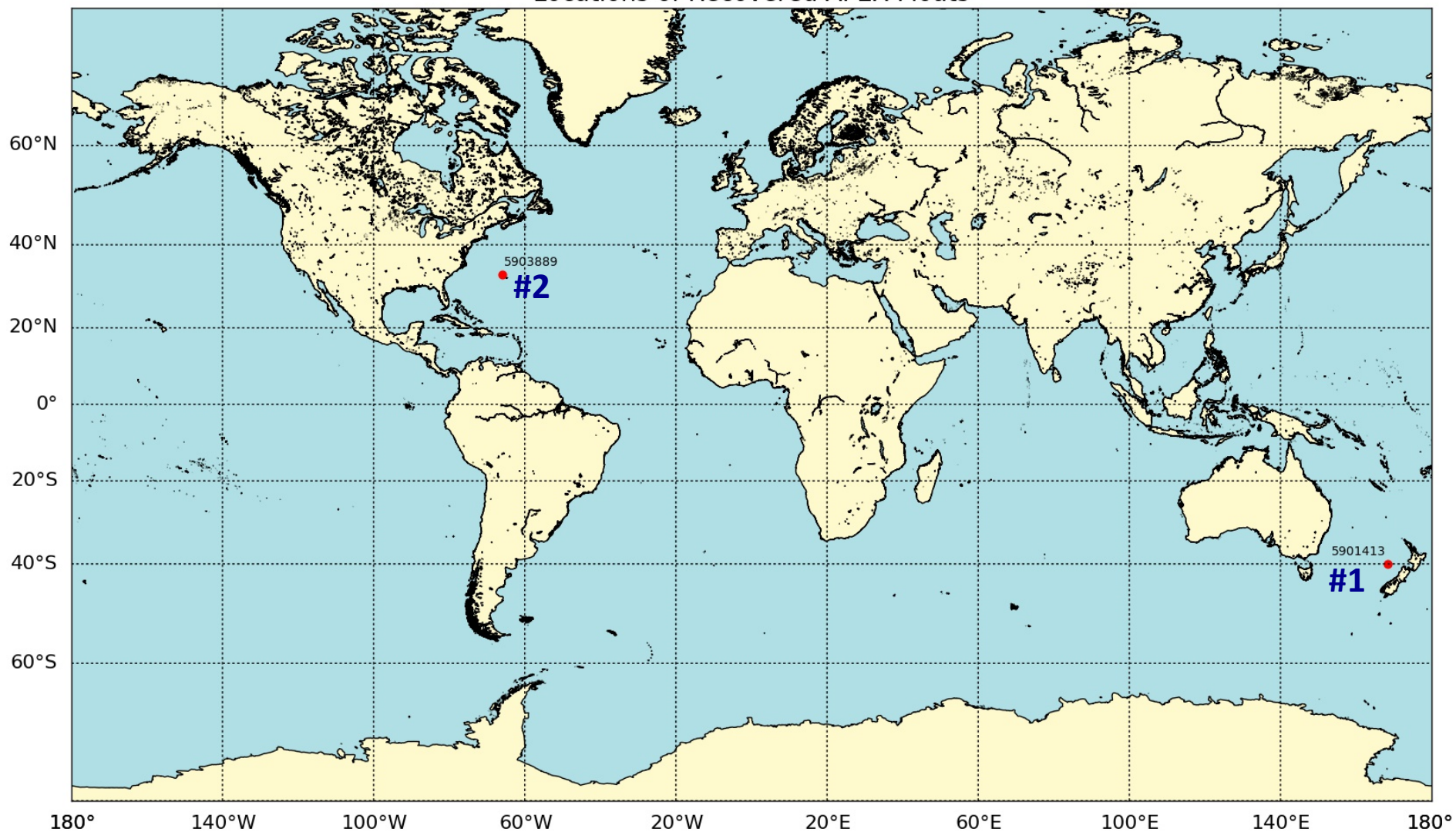
Argo Steering Team Meeting, Sidney BC Canada
3/14/18





A performance history of several types of UW APEX floats since 2007

Locations of Recovered APEX Floats



Recovered APEX floats #1 (near New Zealand) and #2 (near Bermuda)

Float 5901413, dredged up by a trawler near New Zealand, 7/2015

Massive corrosion was found where the endcap meets the hull; the O-ring seal was breached, resulting in flooding and catastrophic failure of the float. The sacrificial anode (not shown) was completely missing due to corrosion.

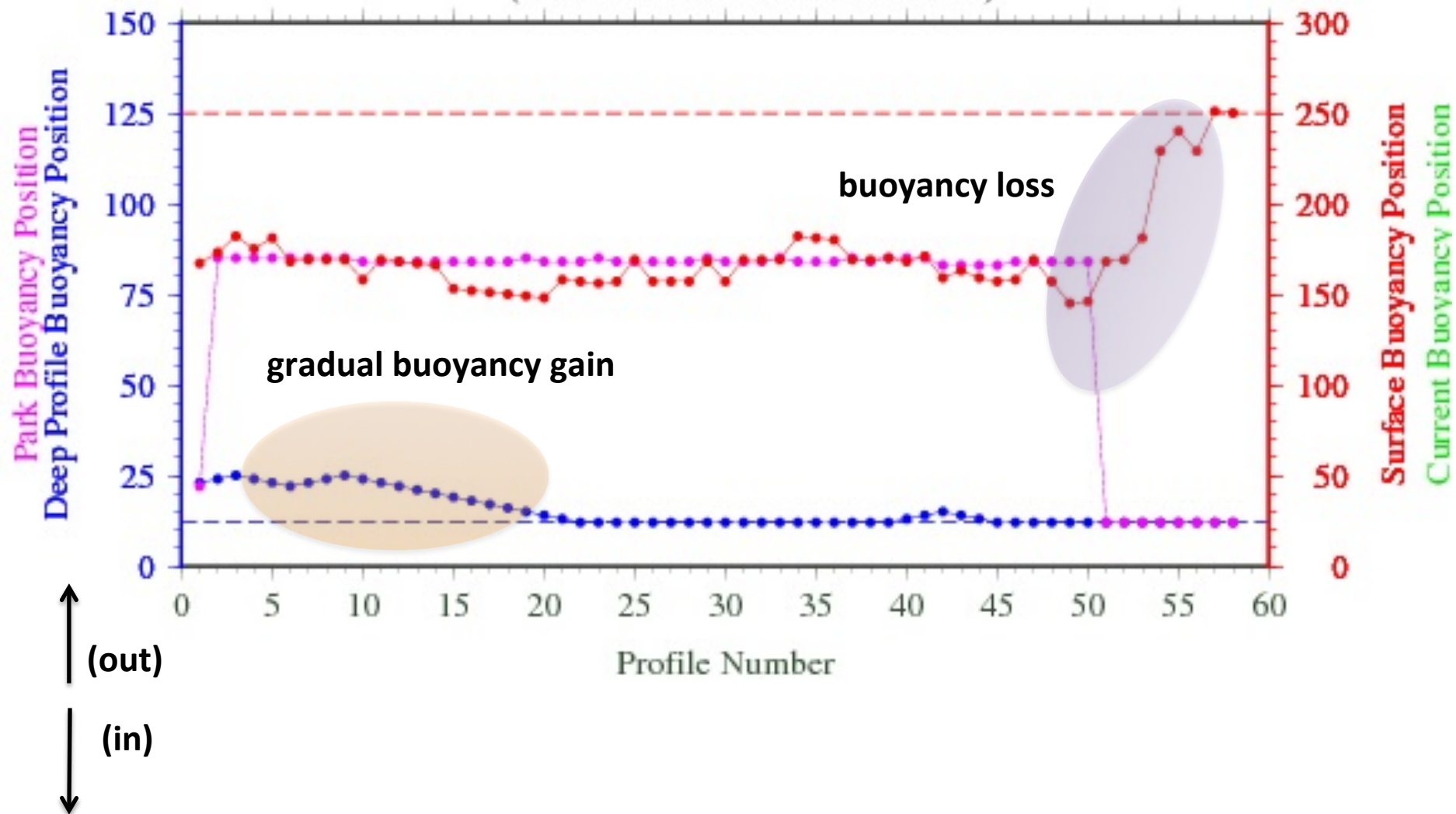


**The corroded endcap
found on float 5901413**

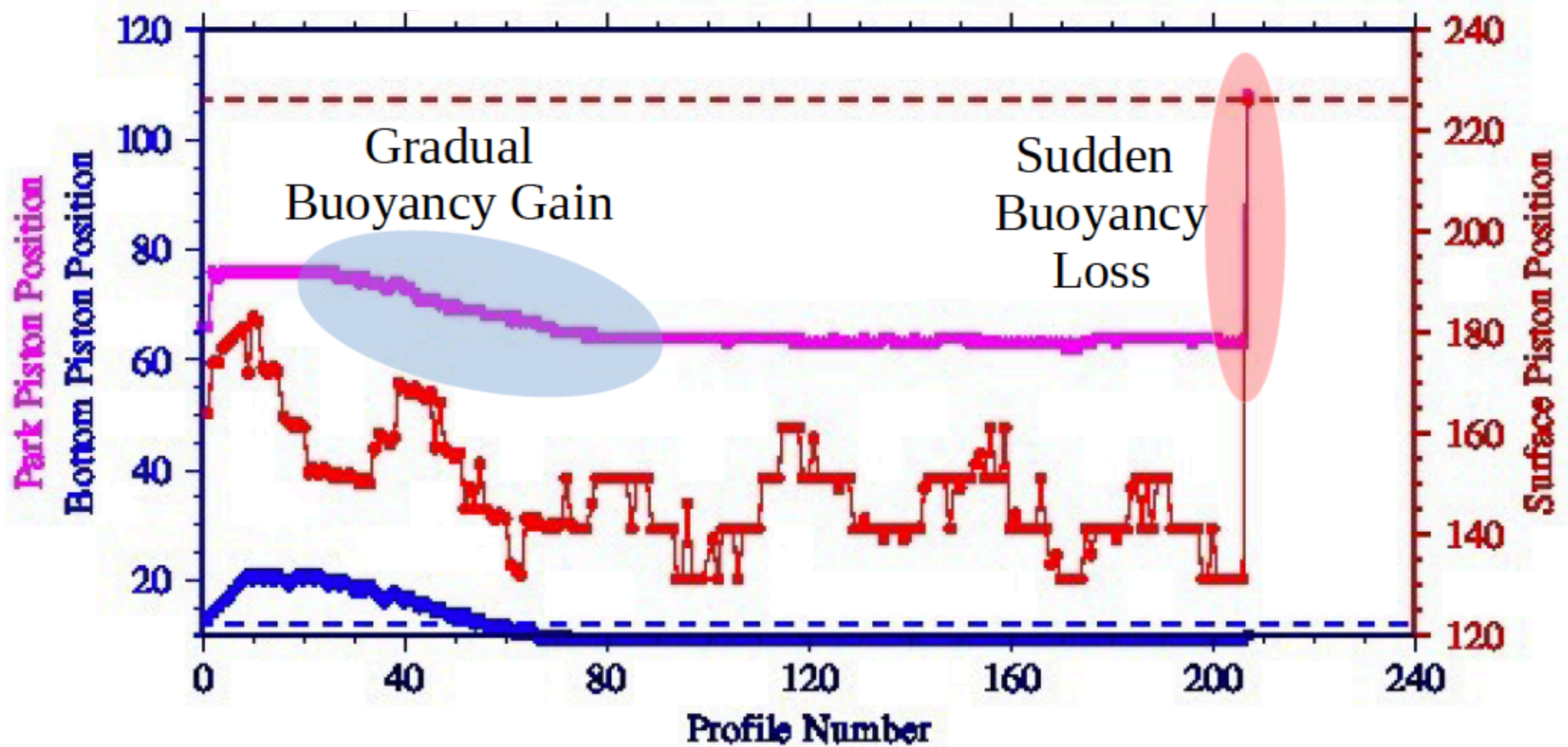


Buoyancy Position (Float 67085/3187/3020/5901413)

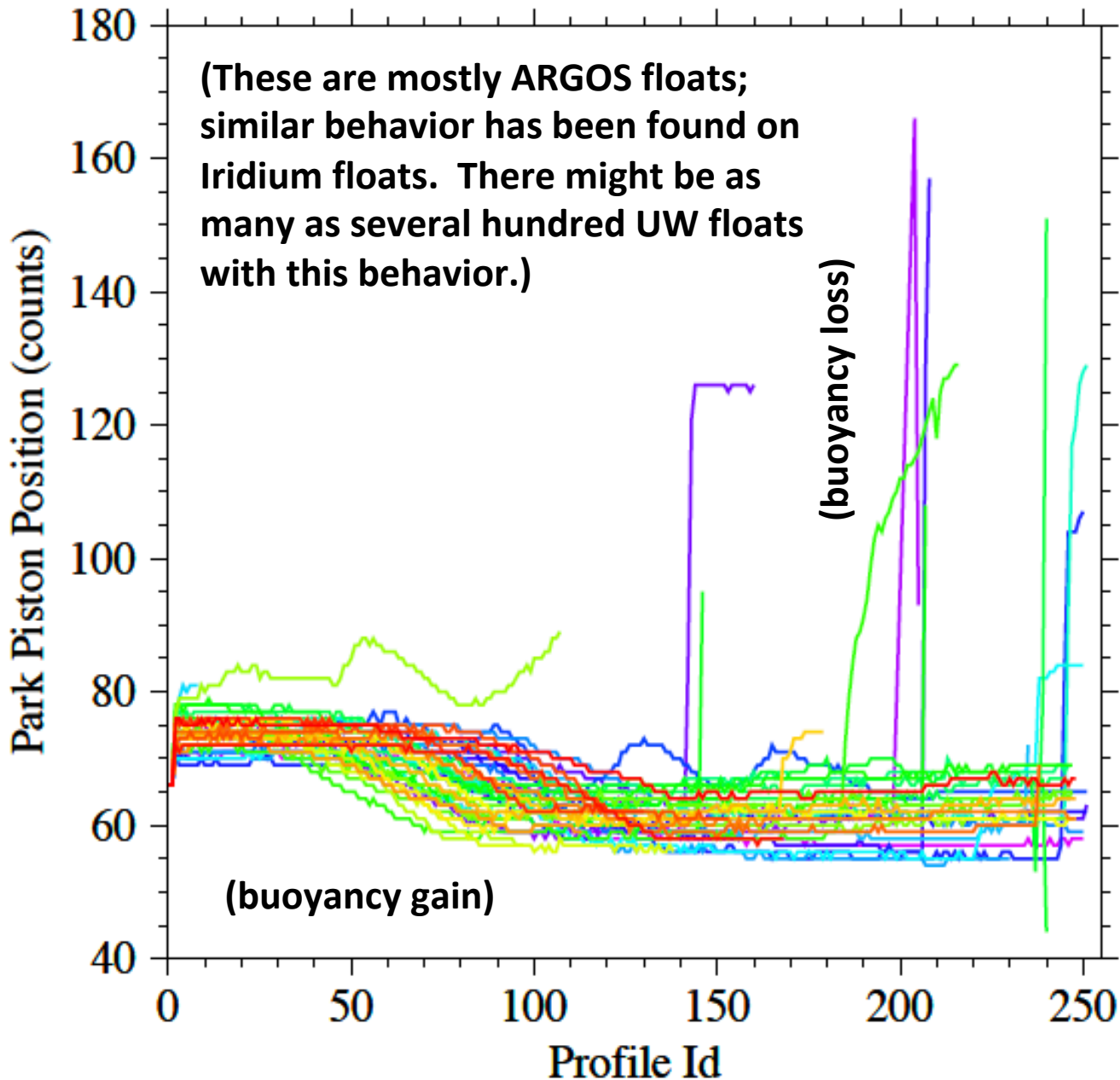
(Date: 2007-02-01 to 2010-05-02)



Piston Position Time Series



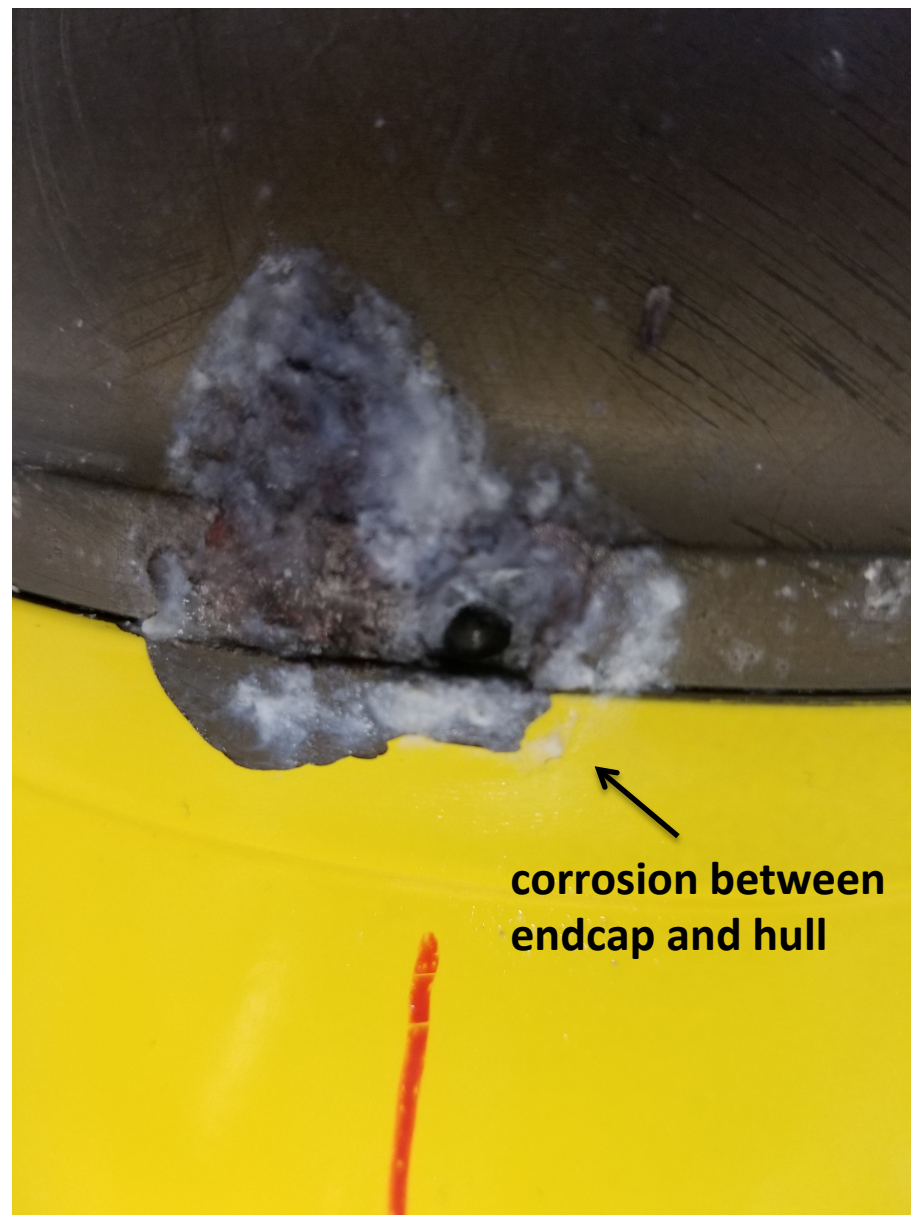
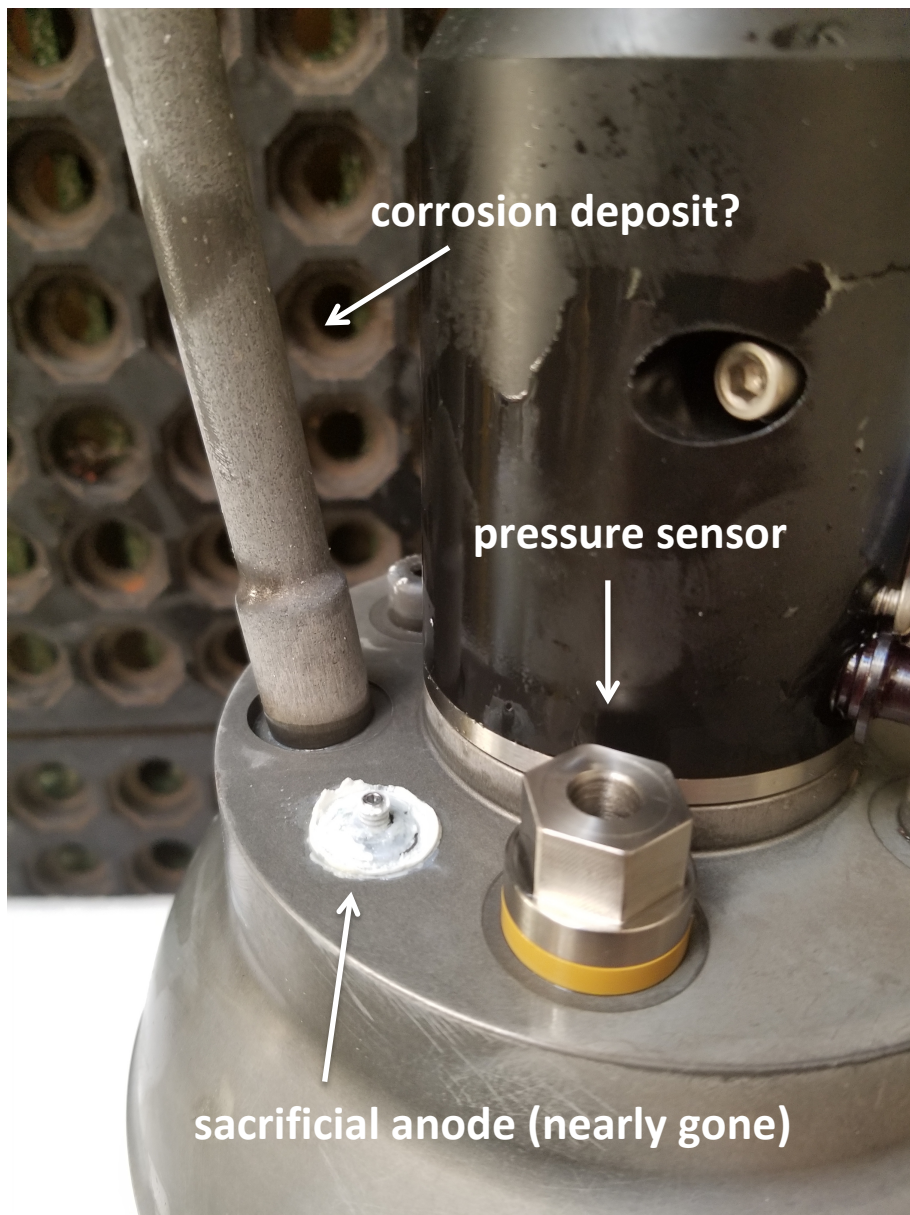
Kaharoa 2010 Deployments (48 floats)



**The sacrificial anode and
pressure sensor on floats
prior to deployment**

The sacrificial anode is present in order to mitigate galvanic corrosion (i.e., slow corrosion due to the presence of dissimilar metals). The anode is made of a metal (here zinc) that is highly active and will corrode first before the metal in the instrument itself corrodes.

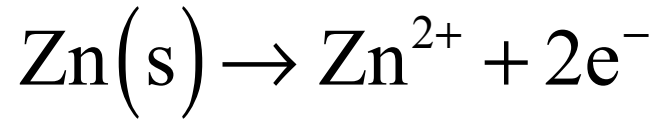




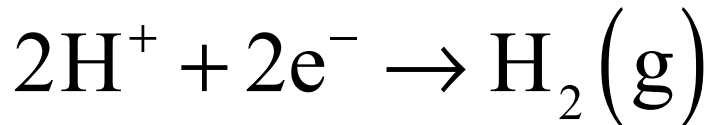
Float 5903889, from near Bermuda

What is happening?

One scenario: stray currents/voltages are dissolving the hull.



(the hypothesized reaction at the anode; this is a much faster and stronger reaction than the slow galvanic reaction of dissimilar metals and requires an energy source)



(the predicted result of the reaction: zinc chloride and hydrogen gas are produced; after the anode is dissolved, the same reaction will begin to dissolve the hull)

[Note: this reaction requires a negative voltage since the sacrificial anode is normally connected to ground; there are only a few places where the stray currents resulting from a negative voltage might occur. Updates will be provided as more is learned.]