Atlantic Demonstration Buoys:

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Atlantic Demonstration Buoys
Objectives of Study

- **The Global Drifter Center is conducting a comparison study of SVP drifters built with the mini drogue.**

- **The study is being called Atlantic Demonstration Buoys (ADB).**

- **The SVP drifters with mini drogue were deployed as clusters in open ocean regions of the Atlantic Ocean.**

- **Each cluster consists of four drifters, one from each manufacturer.**

- **Drifters were activated before deployment, deployed in close proximity and within minutes of each other.**

- **As of this time eight clusters of ADB drifters have been deployed in the Atlantic Ocean.**

Procedure

•Purchased batch of SVP Drifters from Manufacturers

(Purchases made according to Federal Guidelines)

12 - Technocean

16 – Clearwater Instrumentation

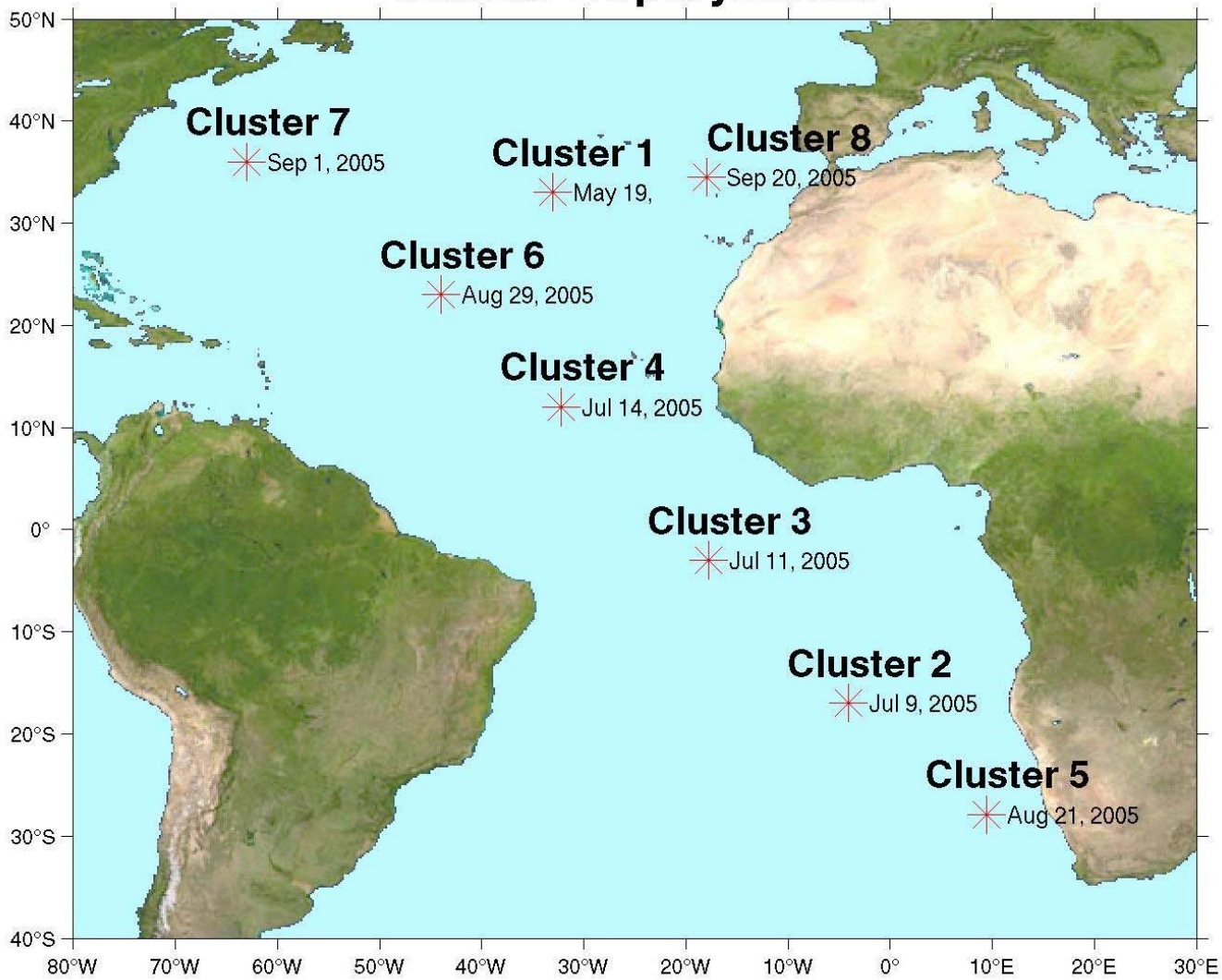
60 - Metocean

15 - Pacific Gyre

•Selected Voluntary Observing Ship Lines occupied by ship riders (AX-7 and AX-8)

•Selected under sampled region of Atlantic Ocean along these lines for deployment of cluster.

Cluster Deployments



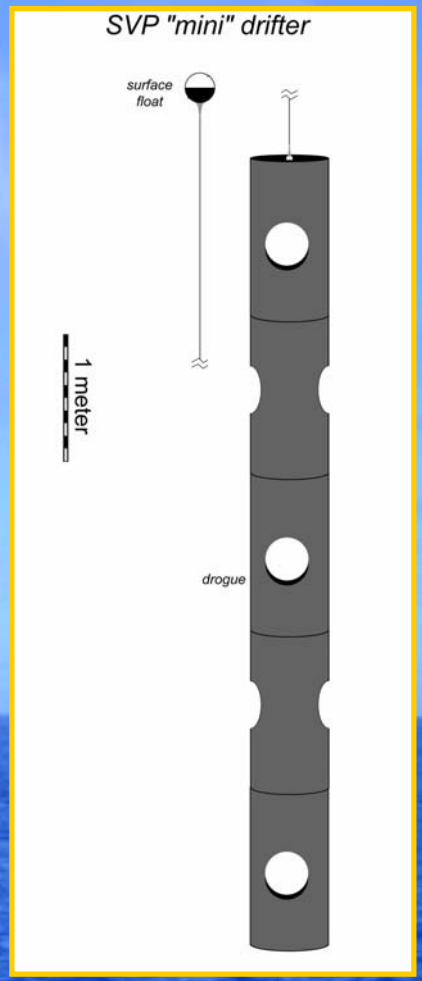
Drifters come in all shapes and sizes

Technocean
Surface Float: 38 cm
Drogue Segments: 5
Segments Length: 122 cm
Drogue Design: Wagon Wheel
Drag area above drogue: 1,234
Drag area of drogue: 52,139
Drag area ratio: 42.25 : 1

Metocean
Surface Float: 38 cm
Drogue Segments: 5
Segments Length: 130 cm
Drogue Design: Wire Rope Radials
Drag area above drogue: 1350.1
Drag area of drogue: 54,776.0
Drag area ratio: 40.57 : 1

Clearwater
Surface Float: 30.5 cm
Drogue Segments: 4
Segments Length: 122 cm
Drogue Design: Wire Rope Radials
Drag area above drogue: 1,042
Drag area of drogue: 42,672
Drag area ratio: 40.9 : 1
* Drogue sensor type: Tether strain

Pacific Gyre
Surface Float: 30.5 cm
Drogue Segments: 4
Segments Length: 122 cm
Drogue Design: Wire Rope Radials
Drag area above drogue: 942
Drag area of drogue: 41,664
Drag area ratio: 44.3 : 1



Tether Strain Gauge

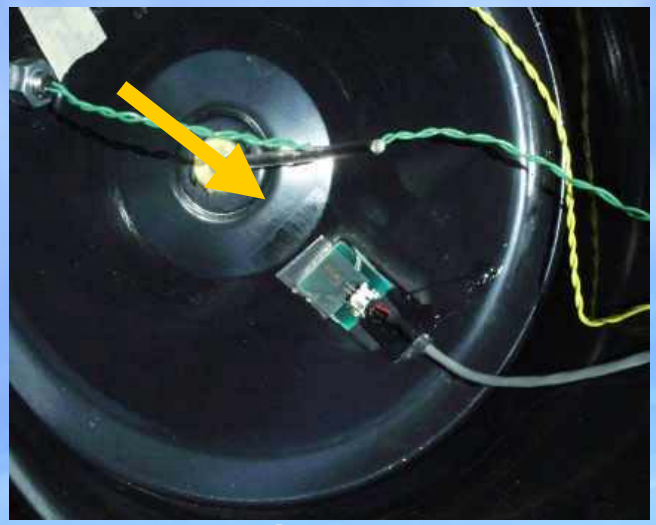
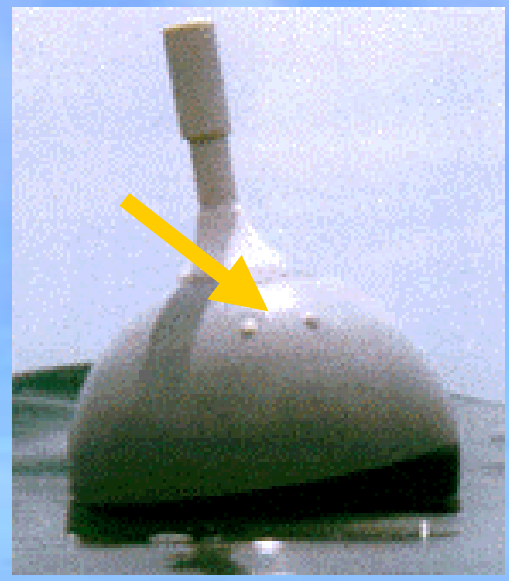


Figure courtesy *Clearwater Instrumentation*

The strain gauge is mounted near the tether attachment point at the bottom of the surface float.

The tugging of the drogue on the tether is transmitted to the surface float. This tugging is sufficient to produce very small fluctuations in the housing and strain gauge. Deformation of strain gauge are detected by sensitive circuitry of the controller.

Submergence Sensor



The submergence sensor is sampled 4 times every 90 seconds. The total number of times these sensors are underwater is summed over the 30-minute sampling period to determine the percentage of time the surface unit is submerged.

Buoy Activation Process

Technocean & Clearwater - **REMOVE ONLY** the plastic shrink-wrap if present… magnet is removed either manually or by deployment into the ocean where the velcro attachment base will dissolve .

Pacific Gyre – Throw entire box from the stern or lowest possible deck into the sea.

Metocean – Do not remove from box.. Remove Magnet prior to deployment.

Incomplete Cluster

Feedback from Vessel

Fm: Merkur

Re: Drifter Deployment

Drifters deployed as follows :-

1) 54623 Lat 10.28.32N long 030.19.26W at 09:20:14 utc

2) 44165 Lat 10.28.41N Long 030.19.63W at 09:21:28 utc

3) 55161 Lat 10.28.52N Long 030.20.03W at 09:22:50 utc

Please note that the last buoy's packaging needs to be revised to match the first two. There are no soluble paper restraints and the whole thing is awkward to manage in any wind, the drogue especially needs some sort of securing prior to launch o'wise all ok. Trust they transmitt ok.

Brgds Capt.Millar

Incomplete Cluster

Feedback from ship greeter Carrie Wolfe

“Captain Millar on the Merkur had a **hard** time with his last drifter. The first two were the "normal" ones in plastic. The last one was in a box.

Problems:

1) The box was opened when he got it, so he figured he'd just deploy it naked. The drogue caught the wind and flew off the stern taking a life buoy and almost the captain with it!
SO WE NEED TO PAPER TAPE THESE WITH A NOTE "DEPLOY IN BOX" – AND CHECK THIS FOR ME

2) The magnet was a pin (he saved it for me) with an orange ribbon and REALLY looking like it needed to be pulled, so he did. It doesnt look to me like the kinda thing that would fall out on its own. But if its a box deployment - how are they supposed to get to the magnet? “

Never deploy a drift buoy with an unsecured drogue!

Test Cluster

•Four Buoys two Metocean and two Pacific Gyre were deployed in Gulf Stream from a small vessel.

•Objective was to study deployment process.

Results:

- Two deployment boxes tore during loading of vessel.
- Deployment Instructions would detach from box due to high humidity.

Buoys sometimes "sink"!

SITE VISITS

•Site visits and meetings with manufacturers have lead to better understanding between user and vendor.

- Pacific Gyre – Jan. 2005

  Toured facility, discussed spec sheets, buoy packing, contract clauses.

- Technocean – Feb. 2005

  Toured facility, discussed submergence sensor sensitivty

- Clearwater – Aug. 2005

  Toured facility, discussed Tether Strain Gauge

- Metocean – Aug. 2005

  •Toured facility, discussed packing, buoy activation,containment of drogue, contract clauses.

- The August site visit to Metocean lead to improvements in shipping container design.

- This will reduce transportation and storage costs.

- Improved deployment configuration will ease dockside handling and at sea deployment.

Summary

•The drift buoys are not identical, all have a mini-drogue.

•Packing matters to an operator in the field.

•Best practice in this batch was to activate buoy, by removing magnet, prior to deployment.

Plans for 2006 ADB

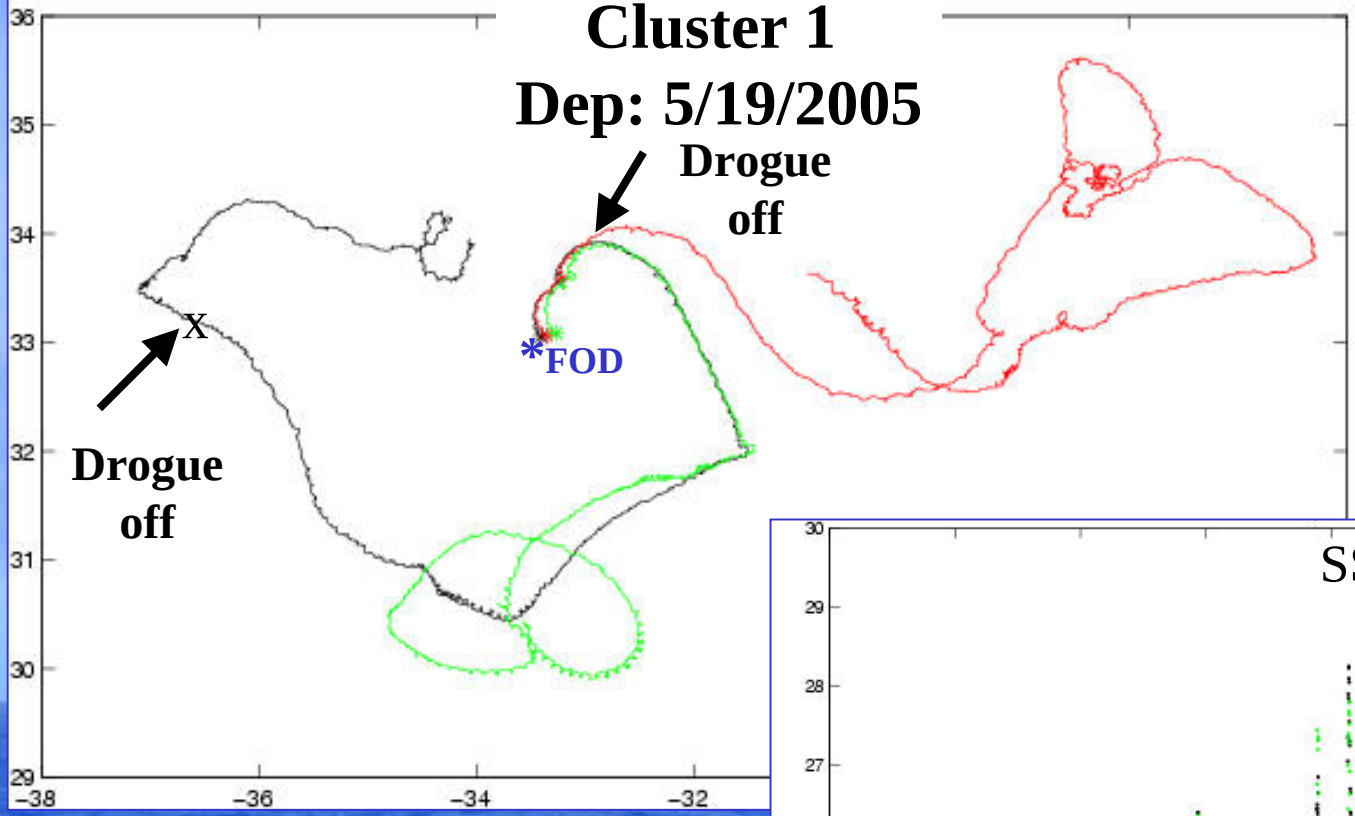
- The GDP has one complete 2005 cluster in AOML warehouse. Manufacturers have option to return buoy for inspection.

- GDP plans to deploy additional clusters from different batches of drifters.

- Continue to monitor sensors and work with manufacturer on design improvements.

- **Evaluation of drifters by cluster from deployment through 9/27/2005**
  - **Transmitter**
  - **Drogue sensor**
  - **SST sensor**
  - **Number and quality of transmissions per day**
- **Overall performance**
- **Problems found**

Cluster 1
Dep: 5/19/2005

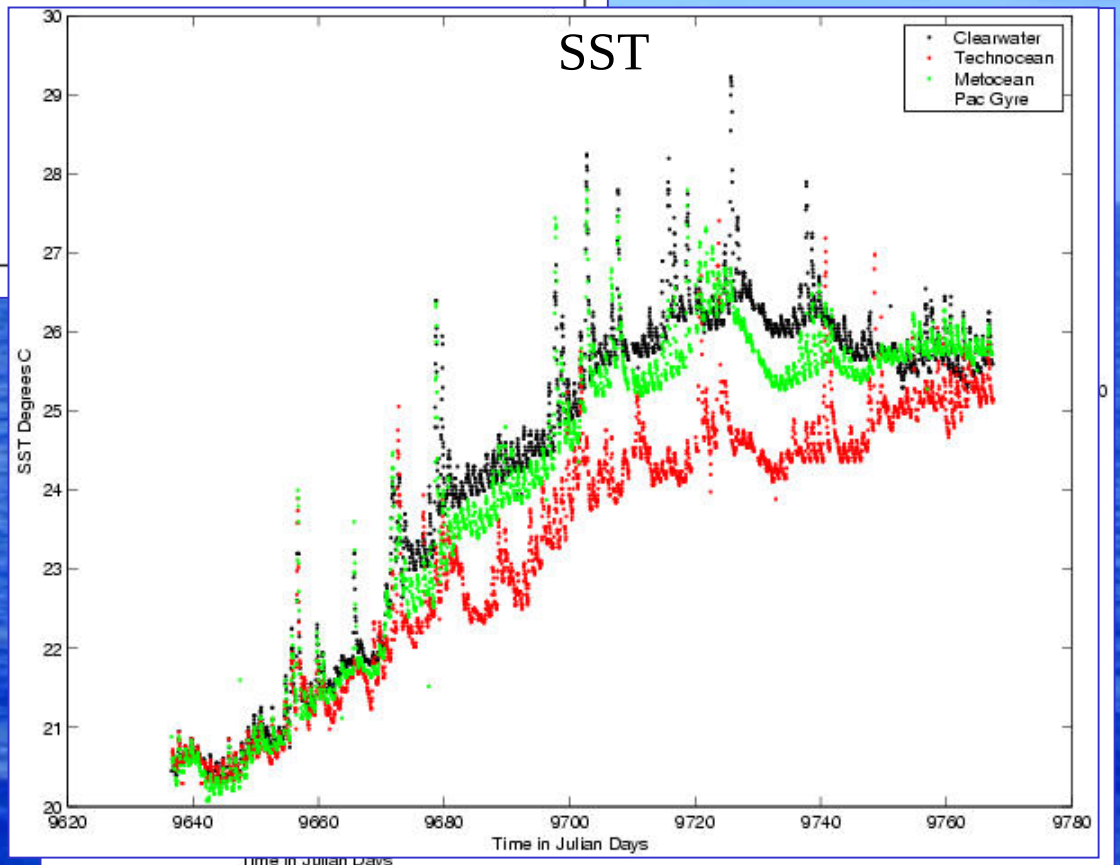


-- Clearwater

--Technocean

--Metocean

--Pacific Gyre



Cluster 1

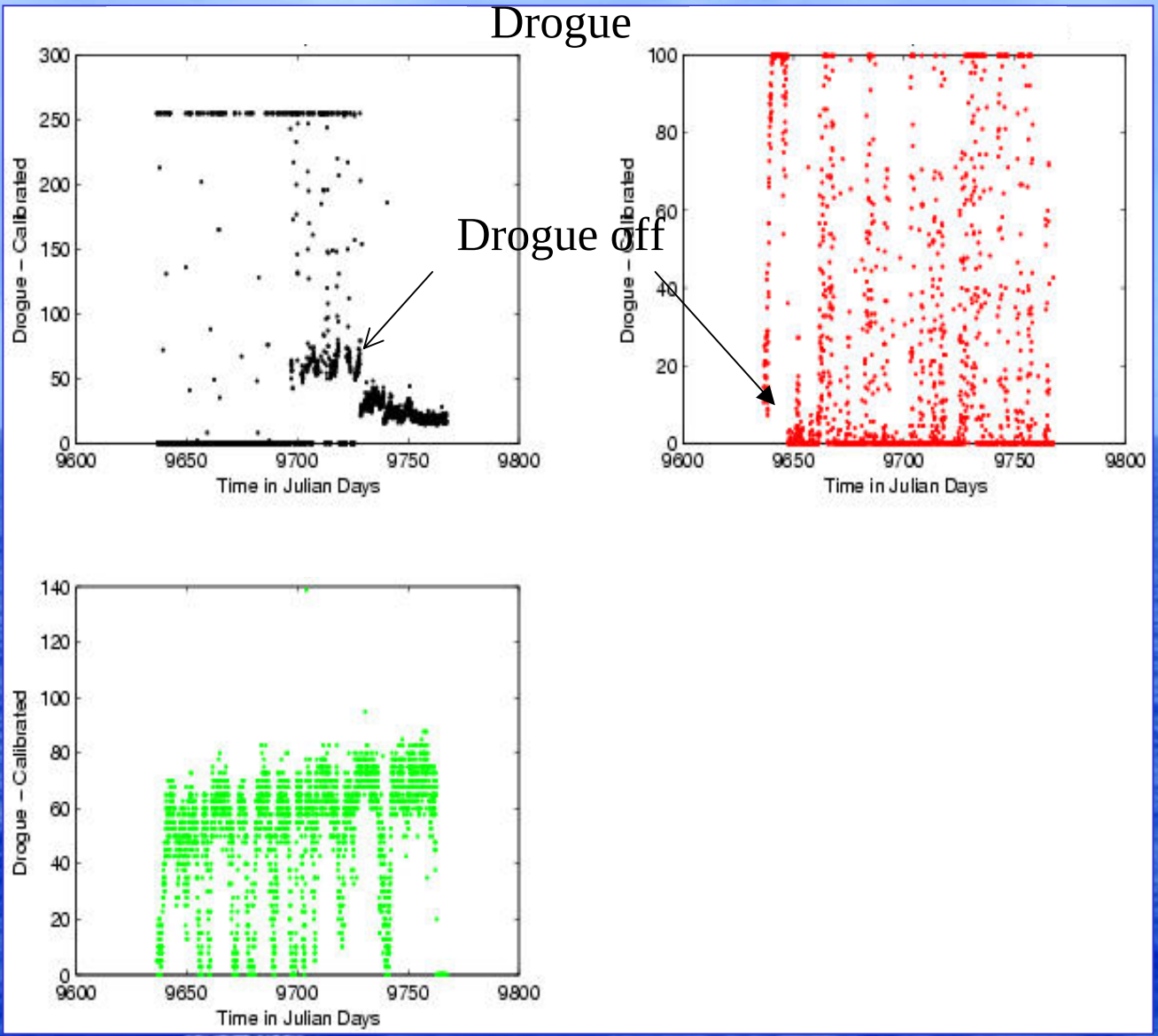
-- Clearwater

--Technocean

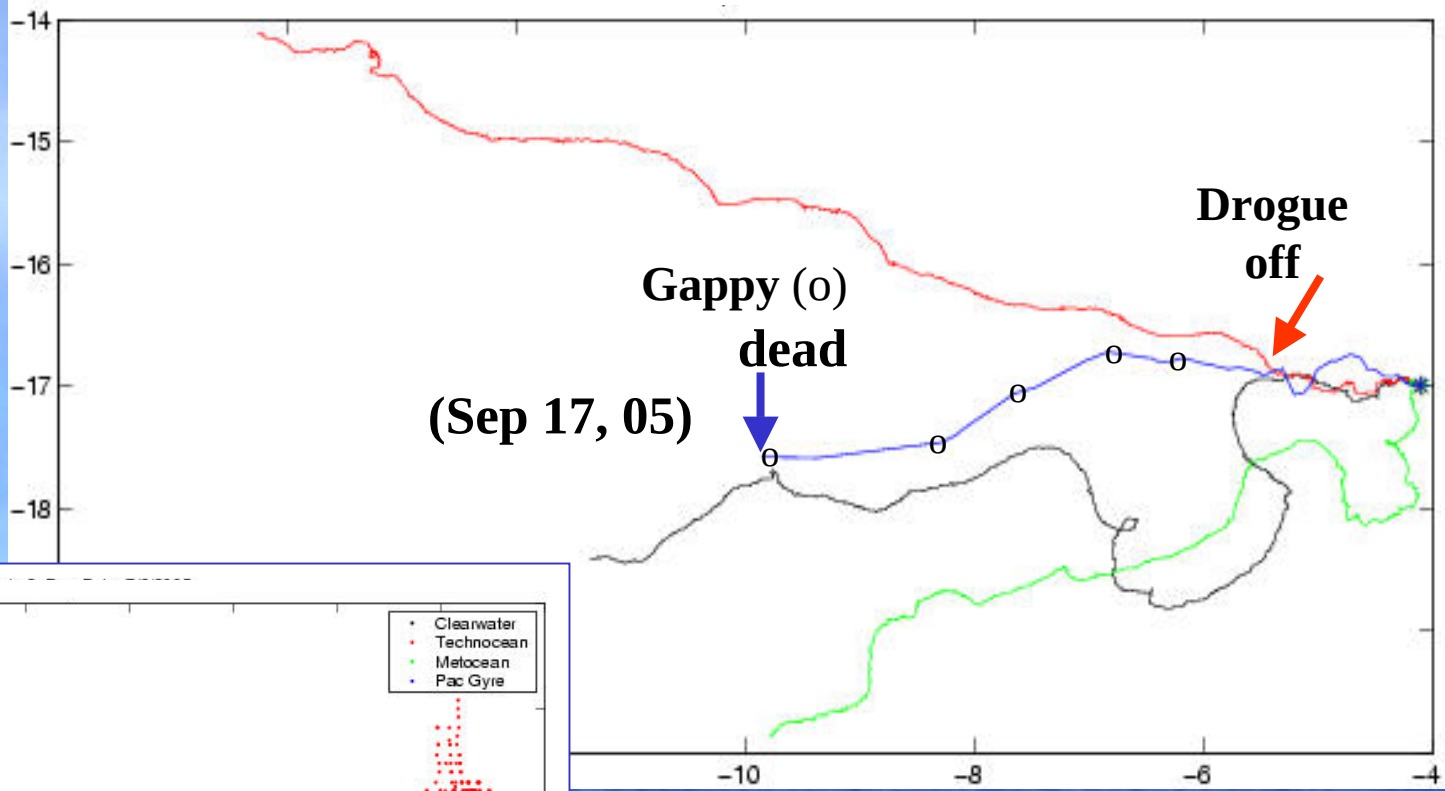
--Metocean

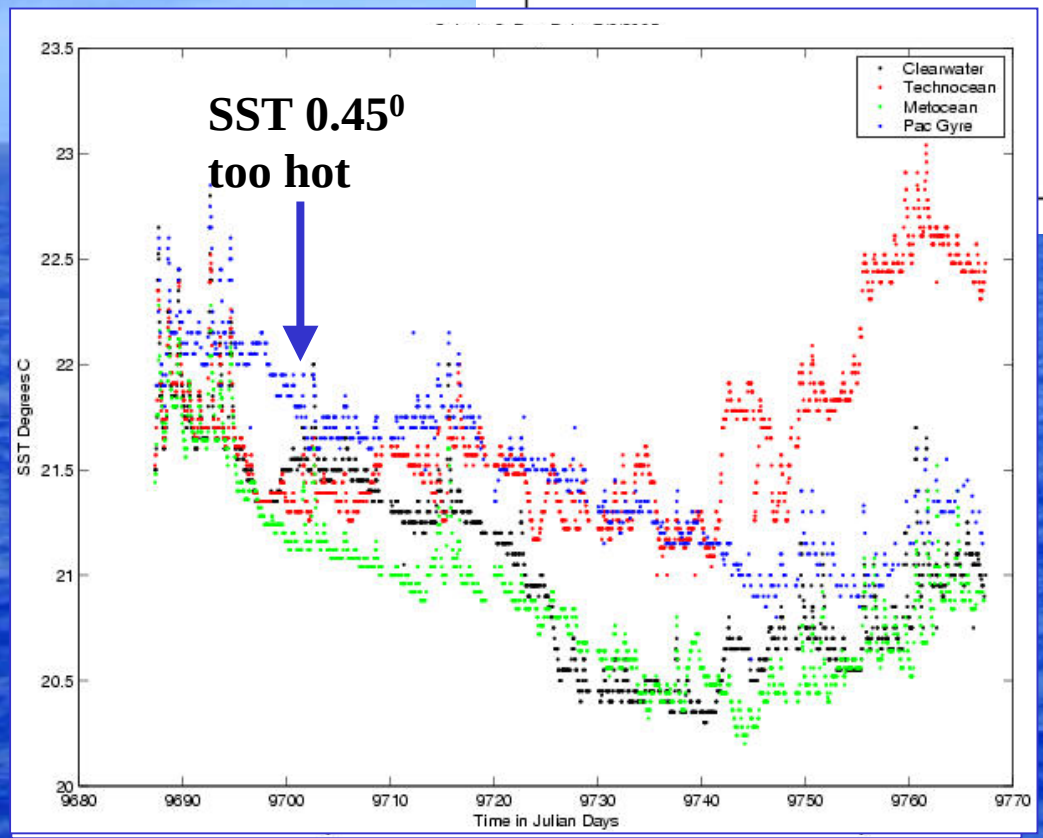
--Pacific Gyre

Drogue



Cluster 2
7/9/2005





-- Clearwater

--Technocean

--Metocean

--Pacific Gyre

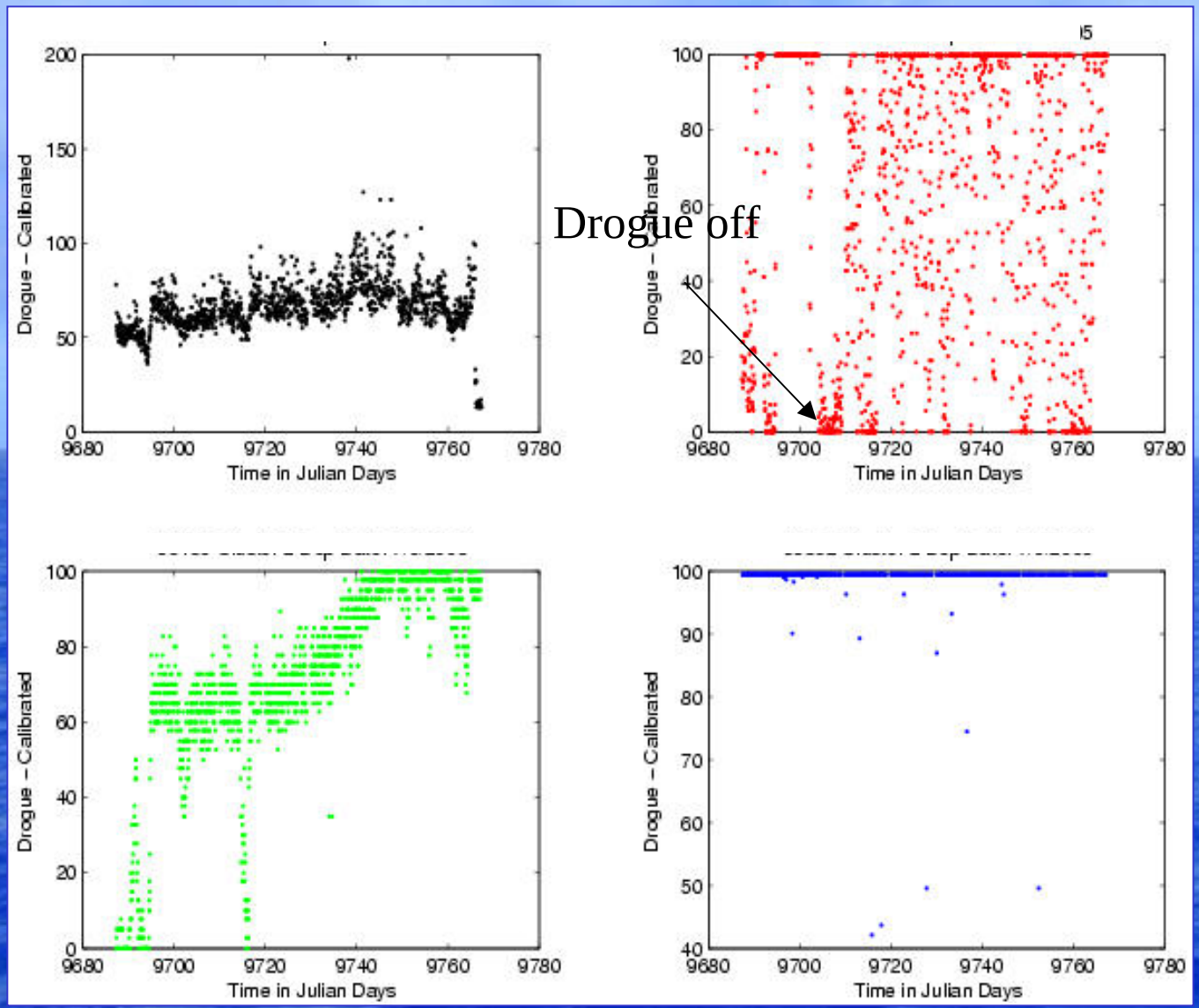
Cluster 2

-- Clearwater

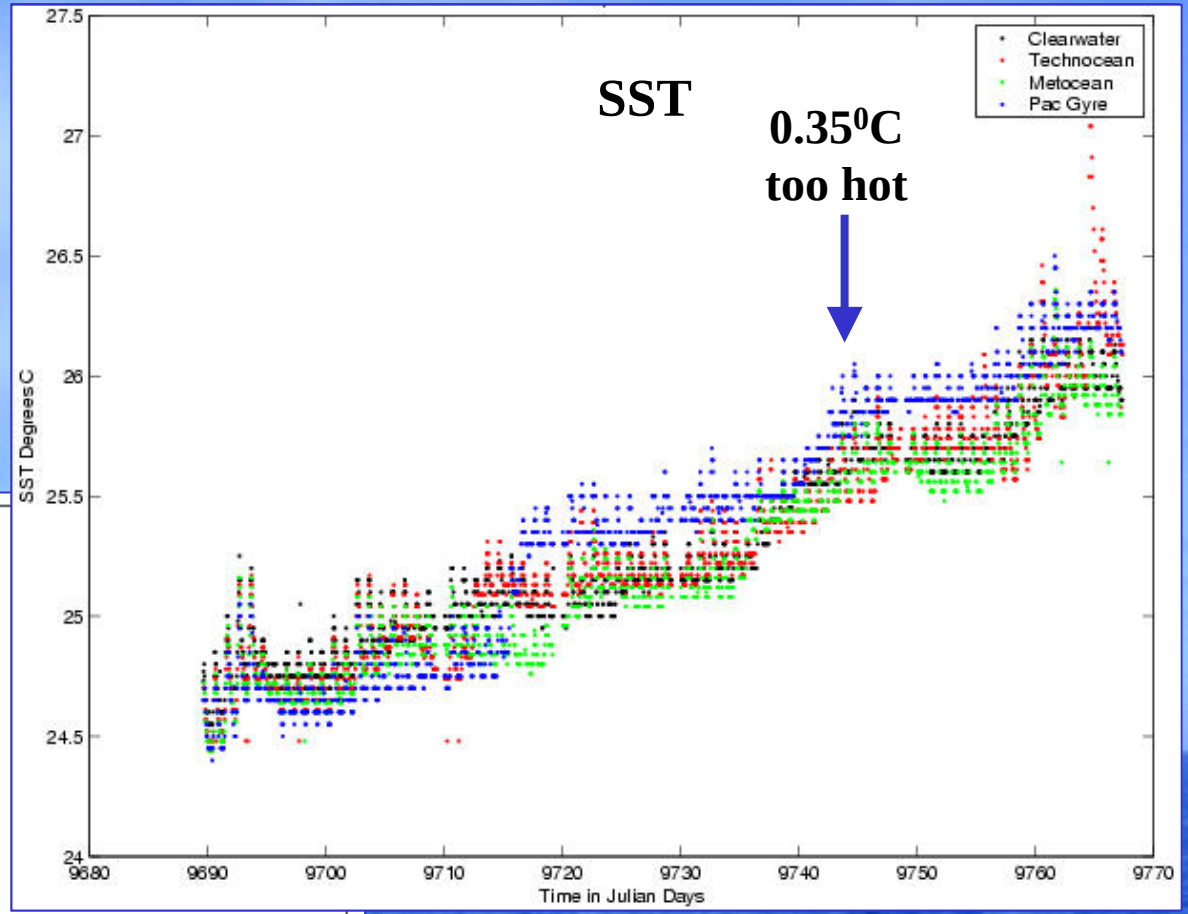
--Technocean

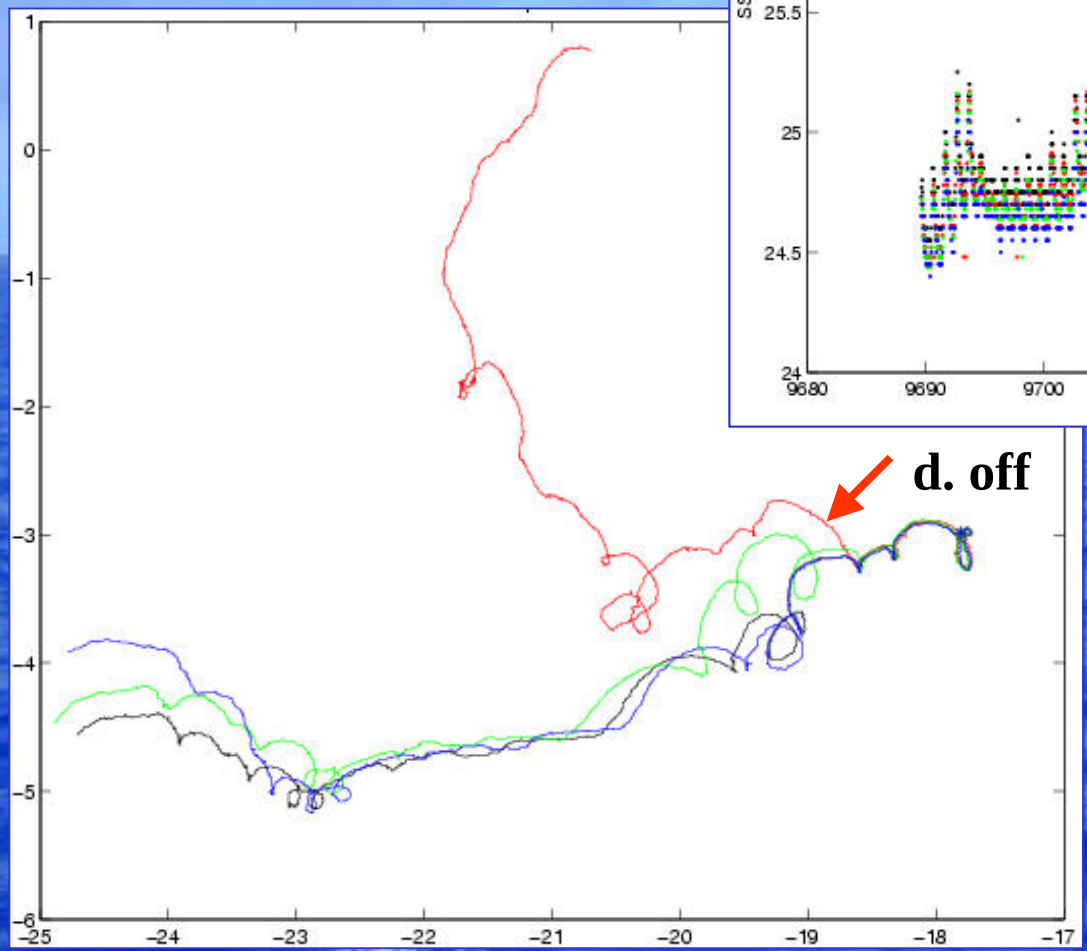
--Metocean

--Pacific Gyre



Cluster 3
7/11/2005





-- Clearwater

--Technocean

--Metocean

--Pacific Gyre

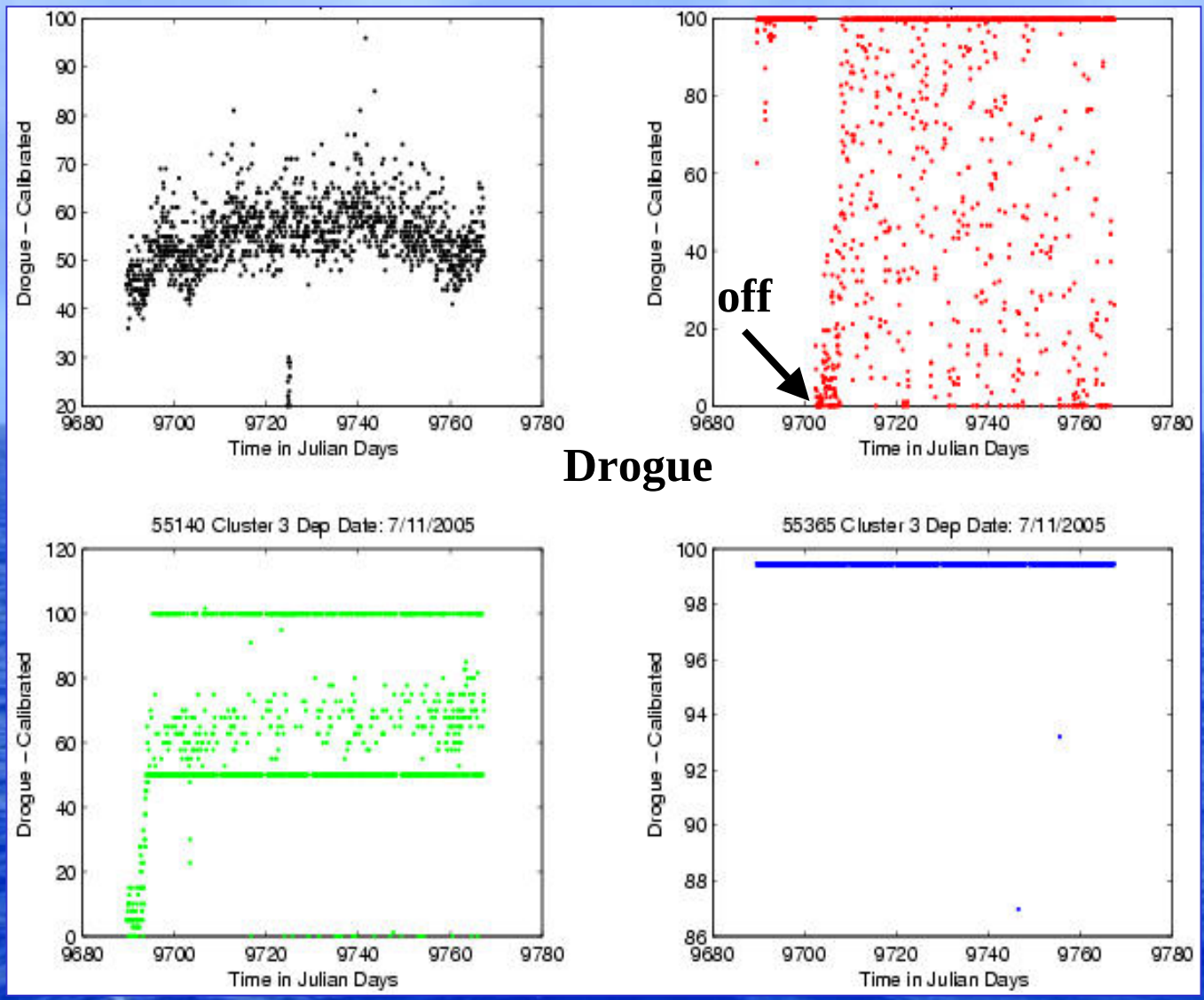
Cluster 3

-- Clearwater

--Technocean

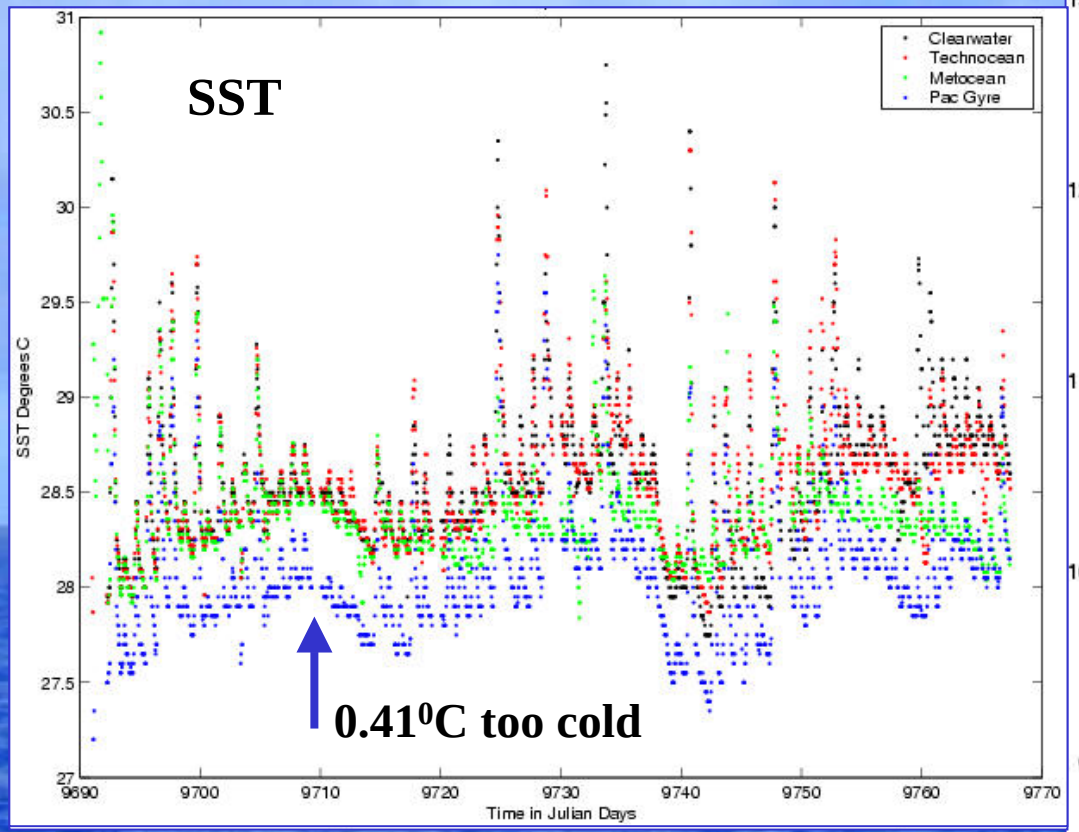
--Metocean

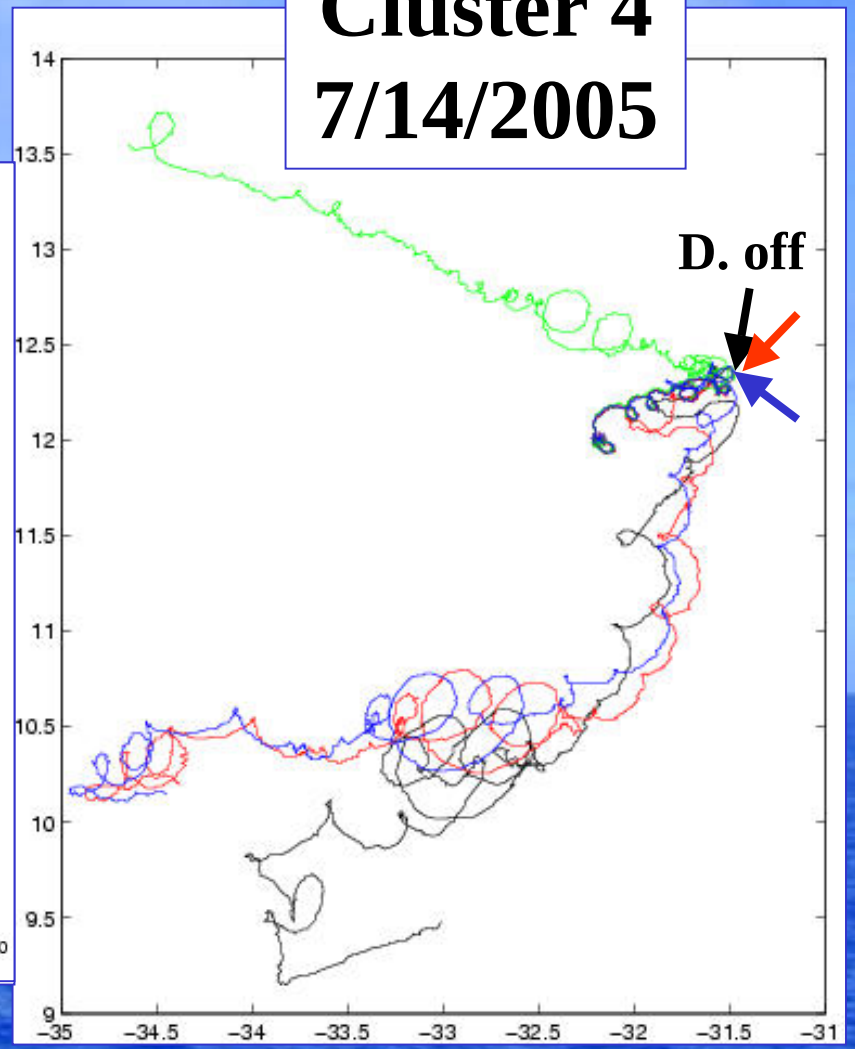
--Pacific Gyre



Drogue

Cluster 4
7/14/2005





-- Clearwater

--Technocean

--Metocean

--Pacific Gyre

3 buoys lost drogues at almost same time

7-29-05
8-01-05
8-01-05

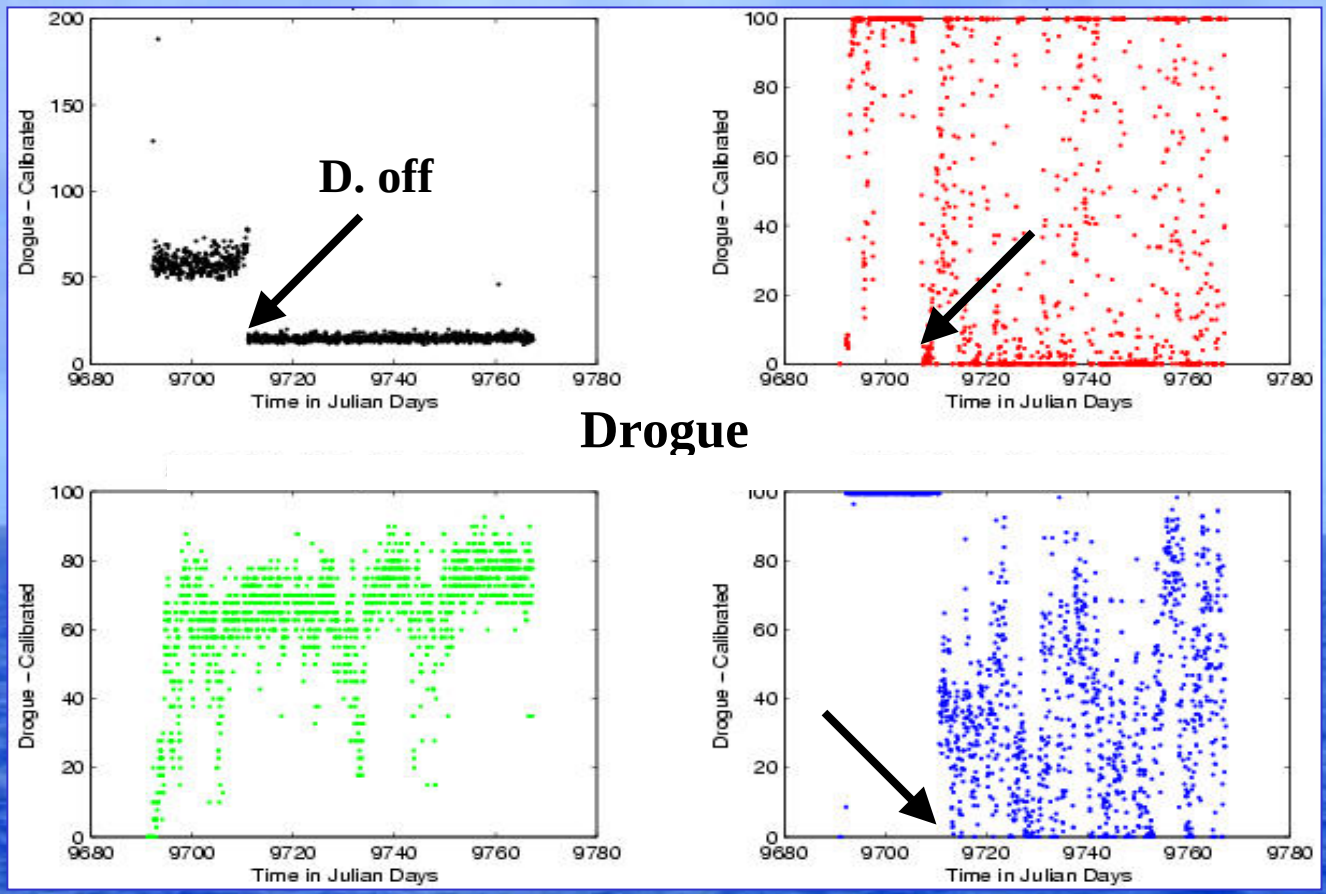
Cluster 4

-- Clearwater

--Technocean

--Metocean

--Pacific Gyre



3 buoys lost drogues at almost same time

7-29-05

8-01-05

8-01-05

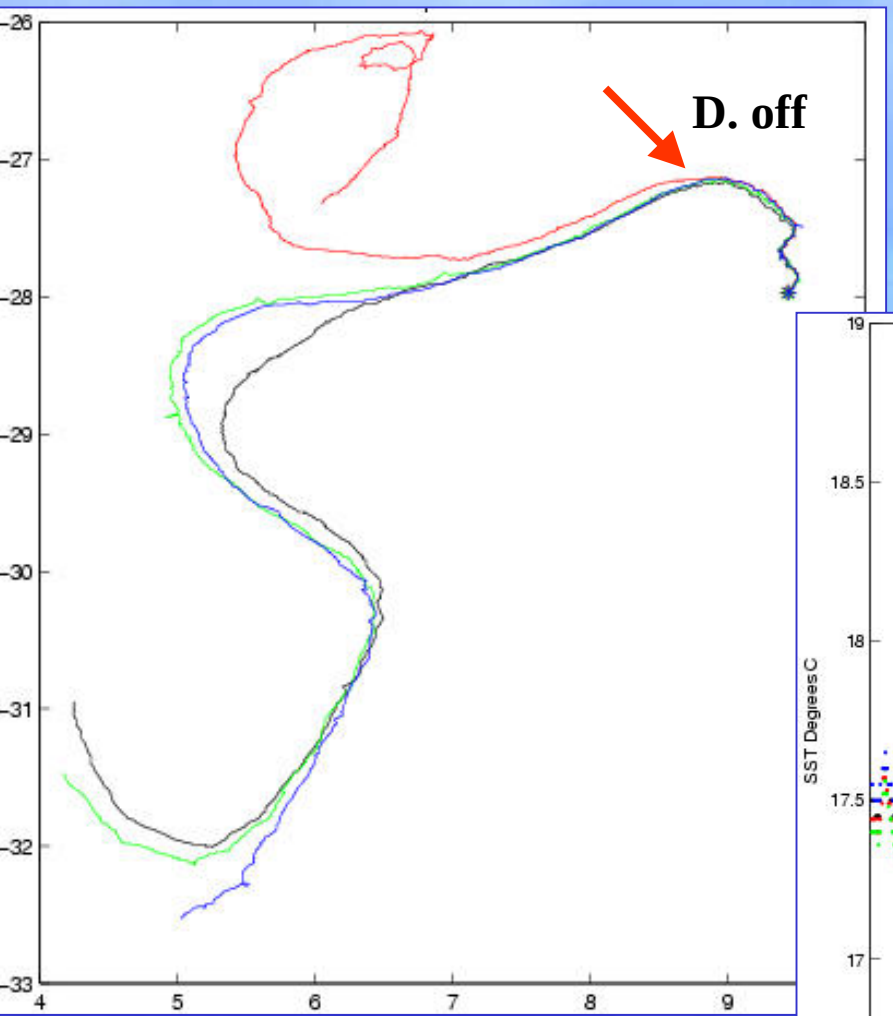
Cluster 5
8/21/2005

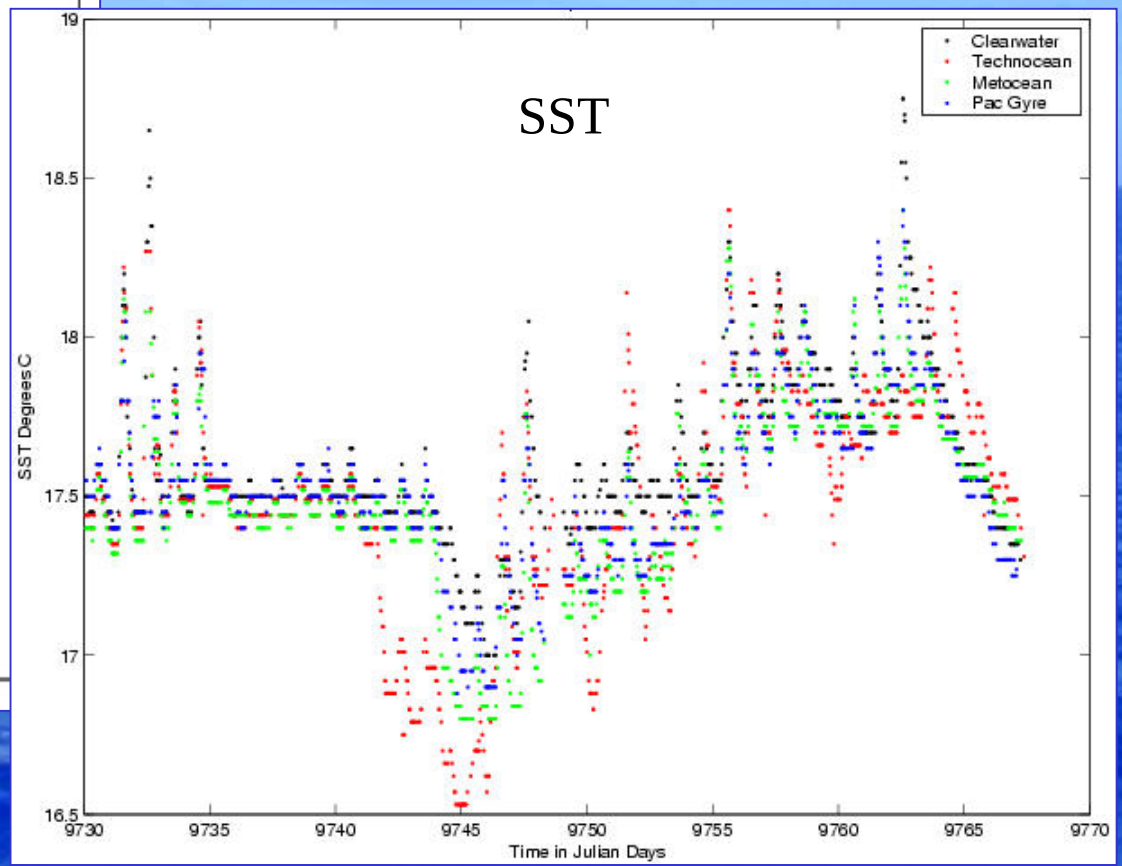
-- Clearwater

--Technocean

--Metocean

--Pacific Gyre





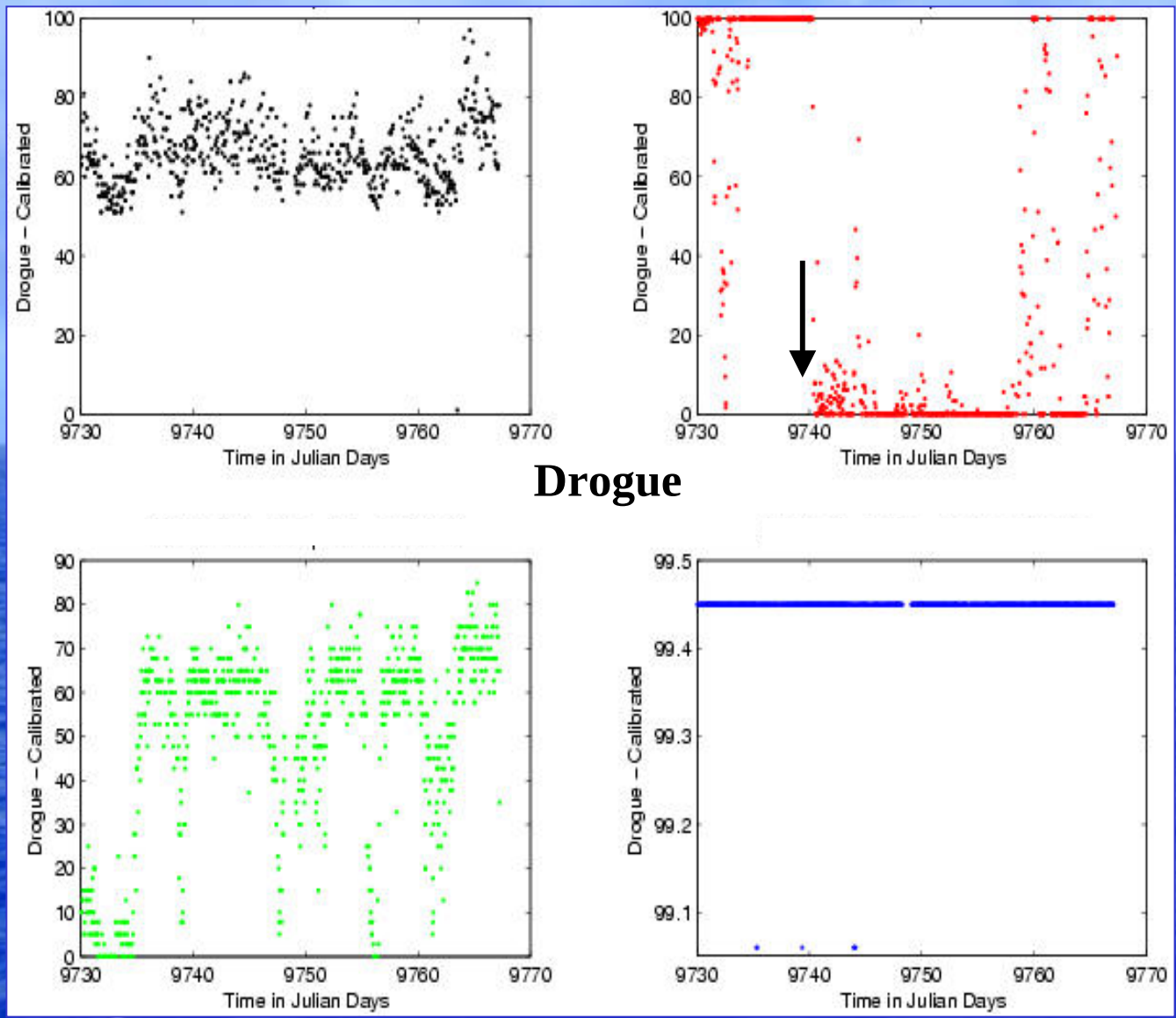
Cluster 5

-- Clearwater

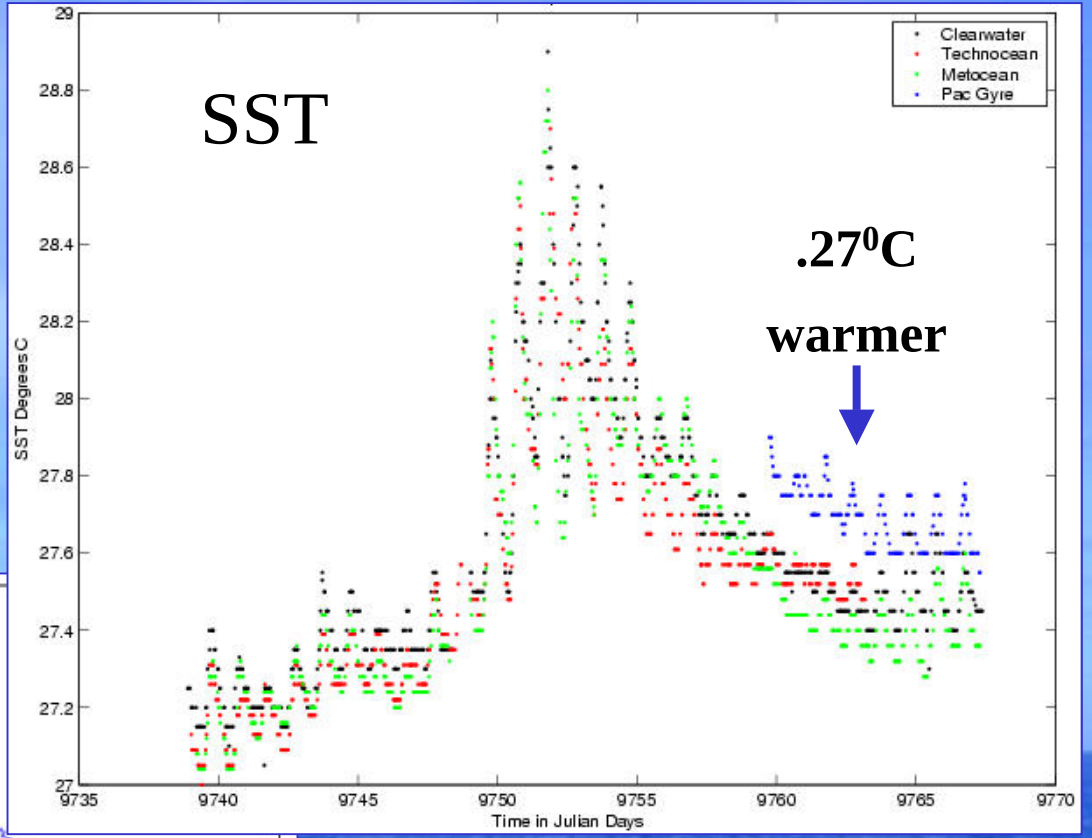
--Technocean

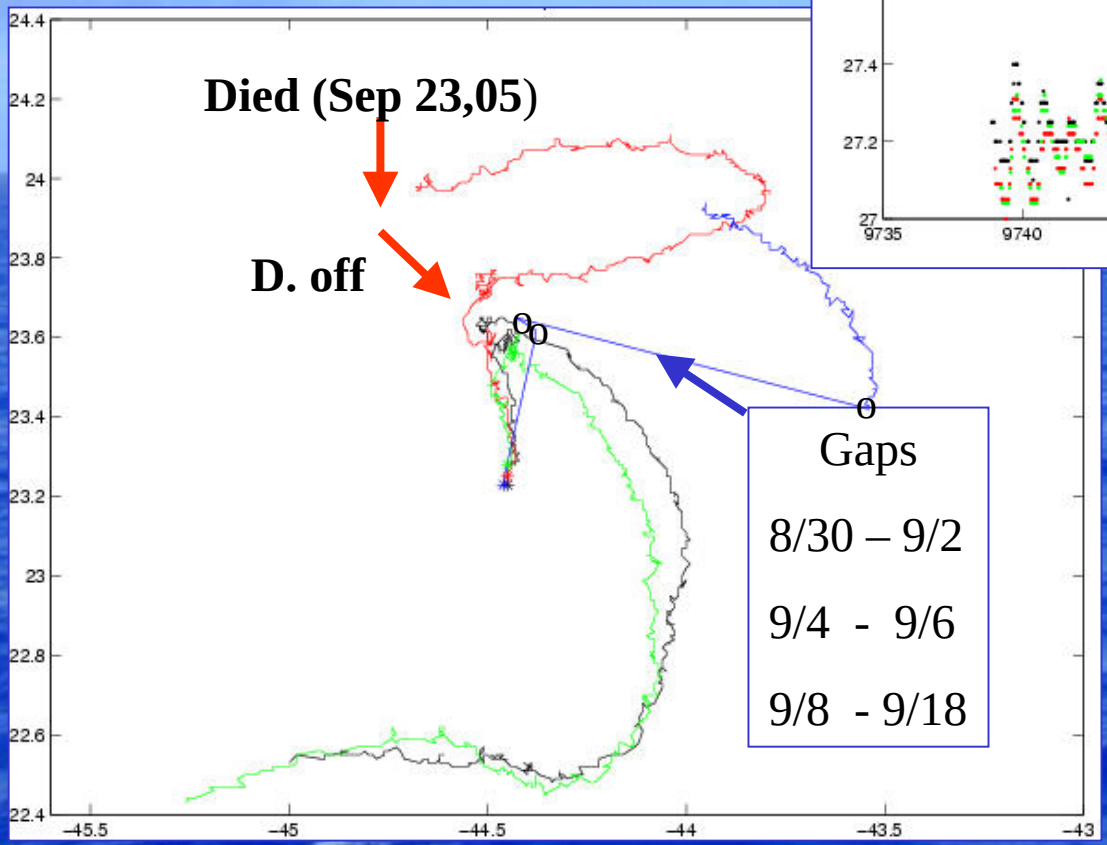
--Metocean

--Pacific Gyre



Cluster 6
8/29/2005





Gaps

8/30 – 9/2

9/4 - 9/6

9/8 - 9/18

-- Clearwater

--Technocean

--Metocean

--Pacific Gyre

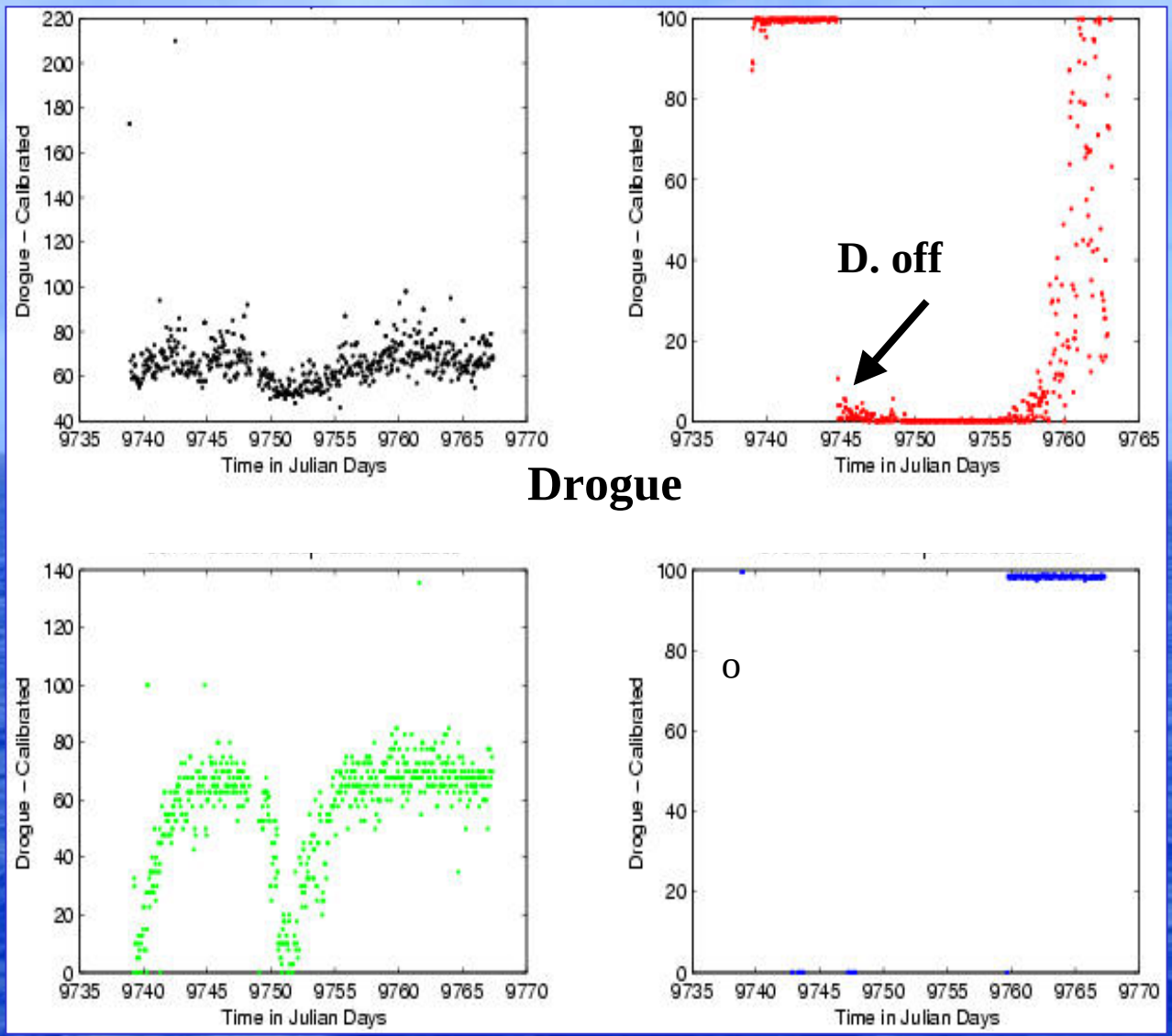
Cluster 6

-- Clearwater

--Technocean

--Metocean

--Pacific Gyre



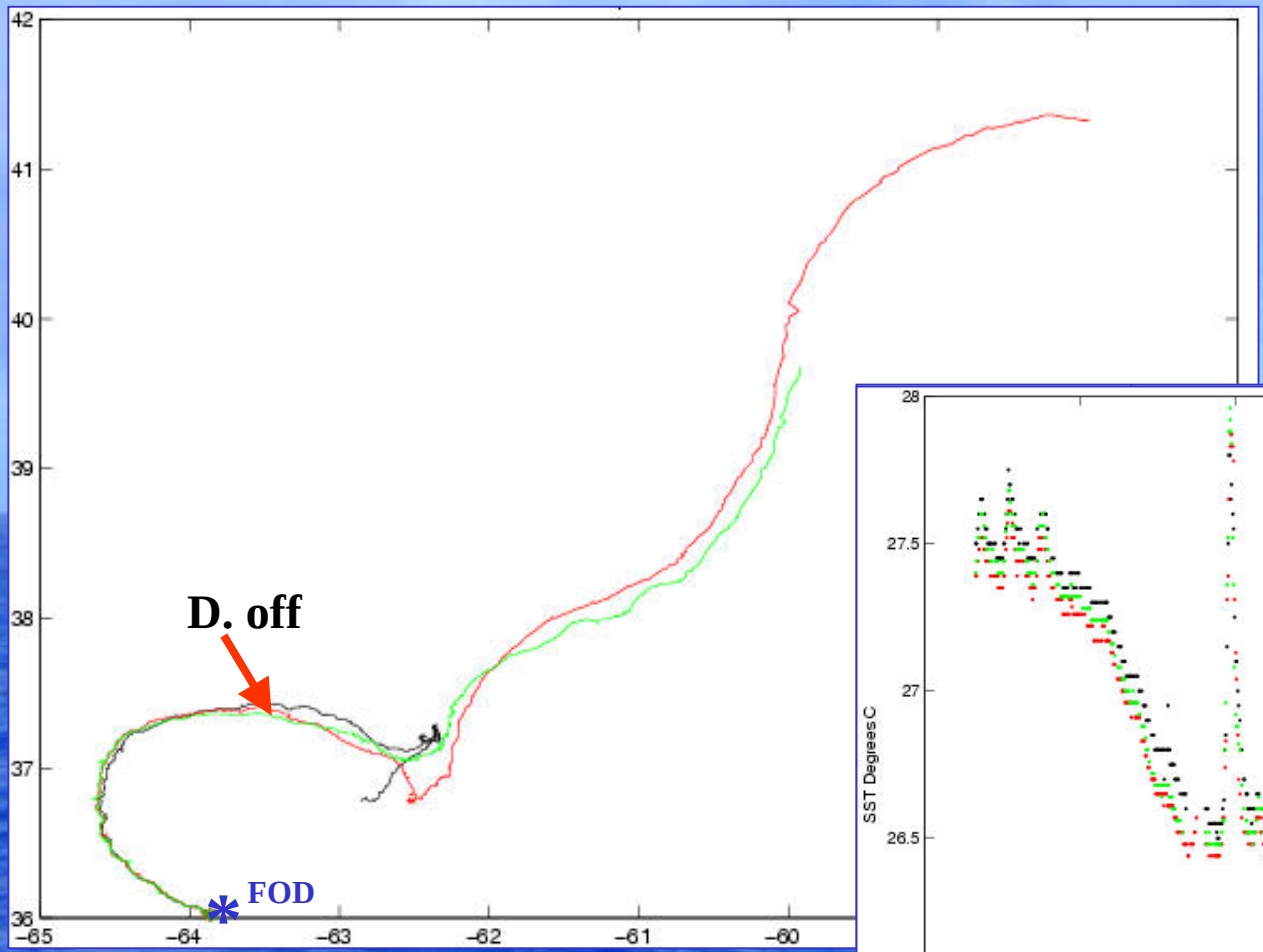
Cluster 7
9/1/2005

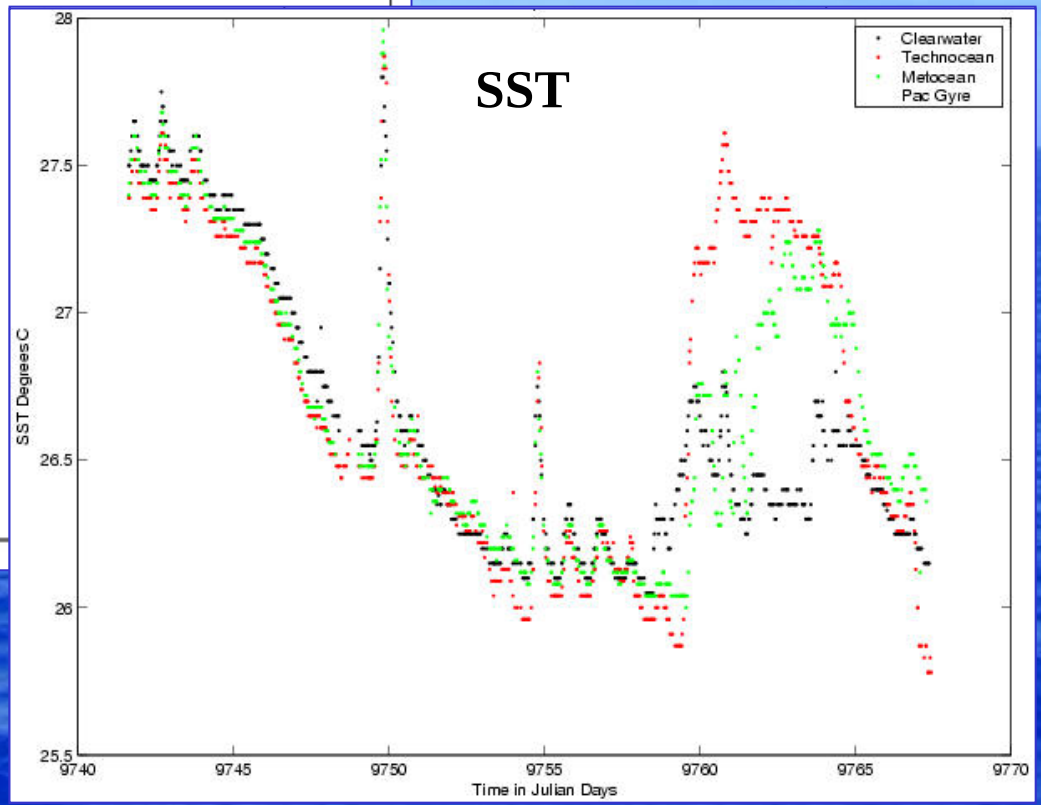
--Clearwater

--Technocean

--Metocean

--Pacific Gyre





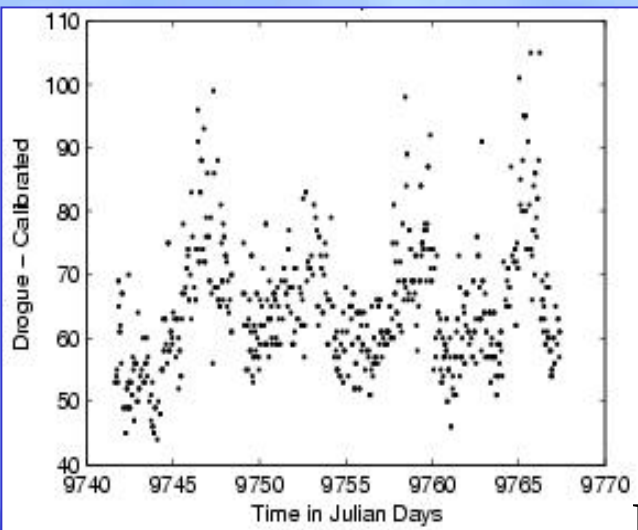
Cluster 7

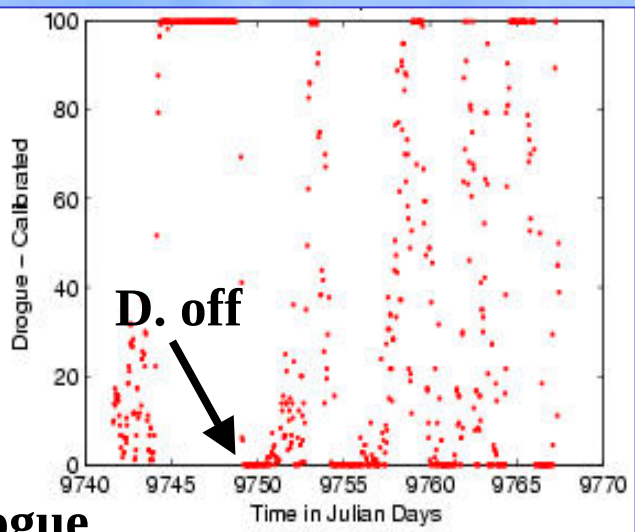
--Clearwater

--Technocean

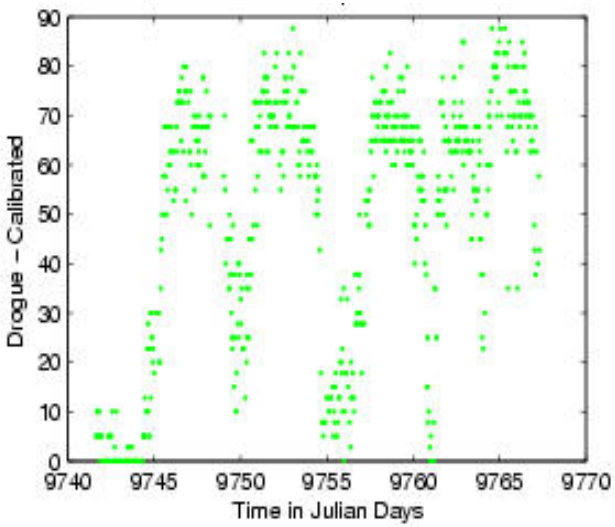
--Metocean

--Pacific Gyre





Drogue



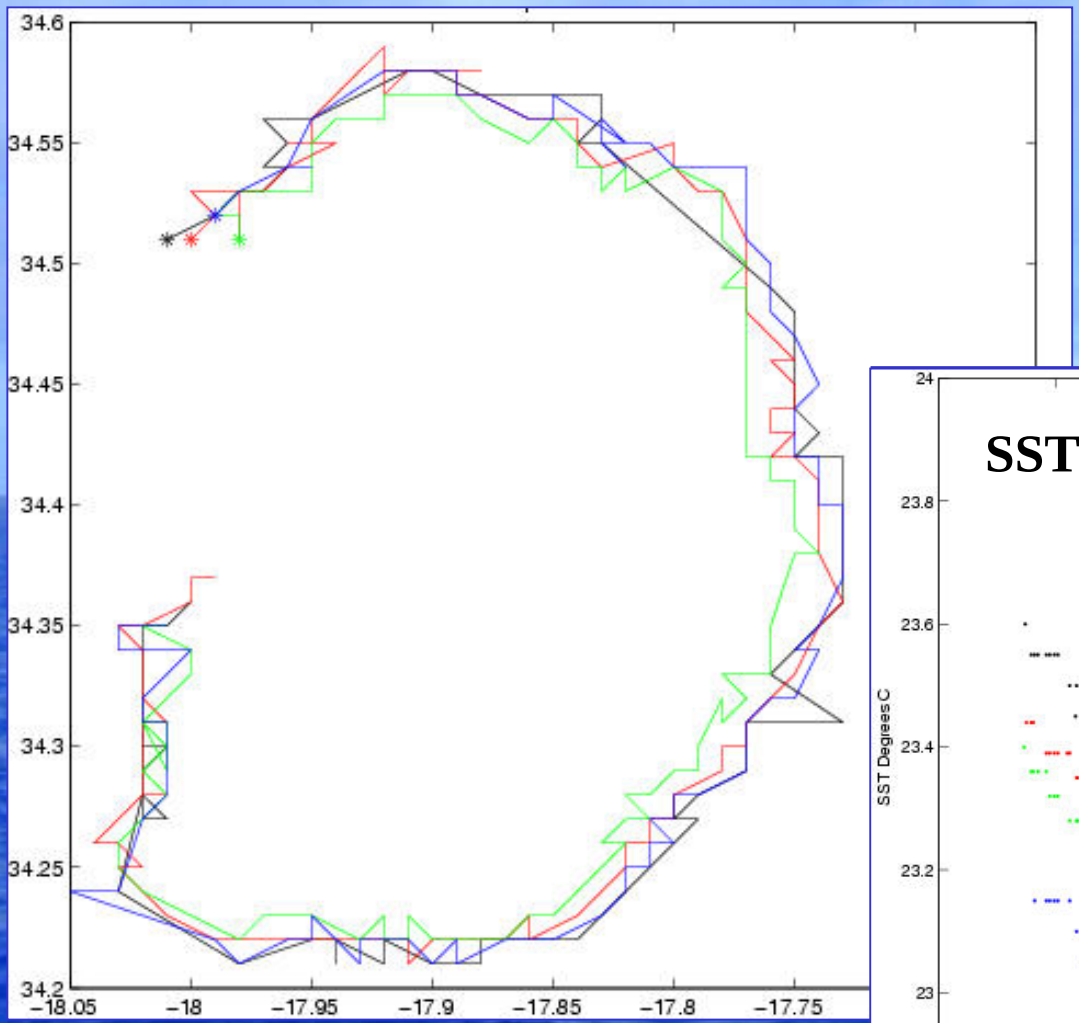
Cluster 8
9/20/2005

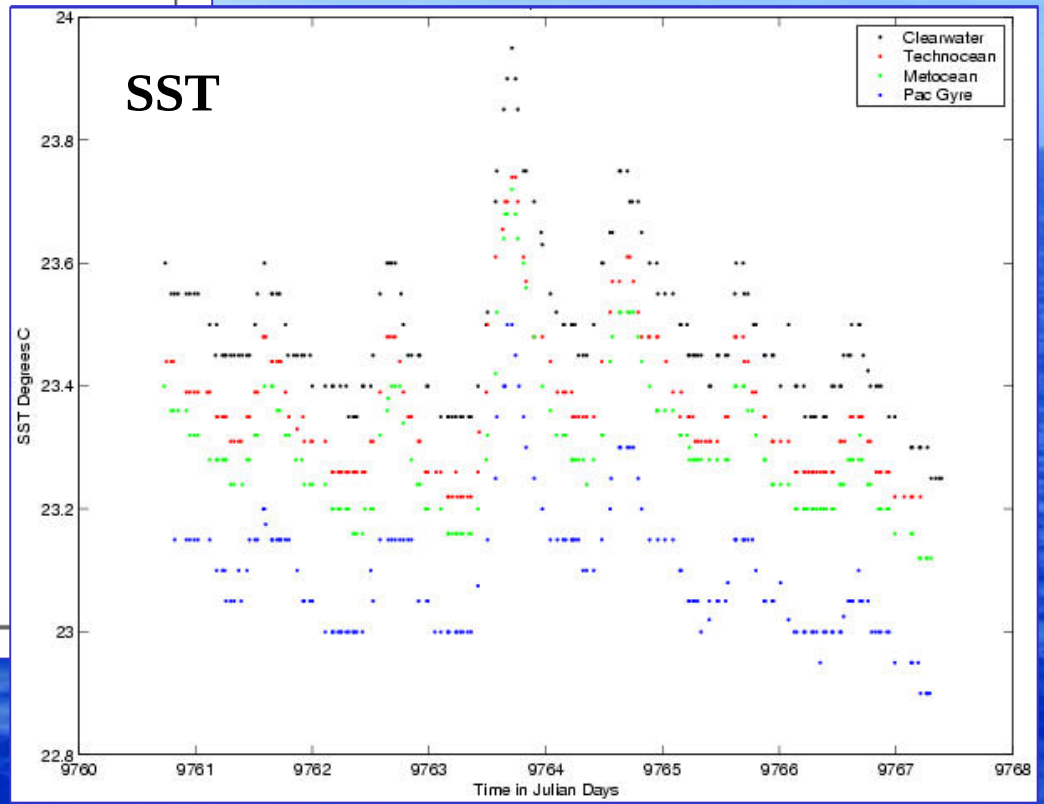
--Clearwater

--Technocean

--Metocean

--Pacific Gyre





Cluster 8

--Clearwater

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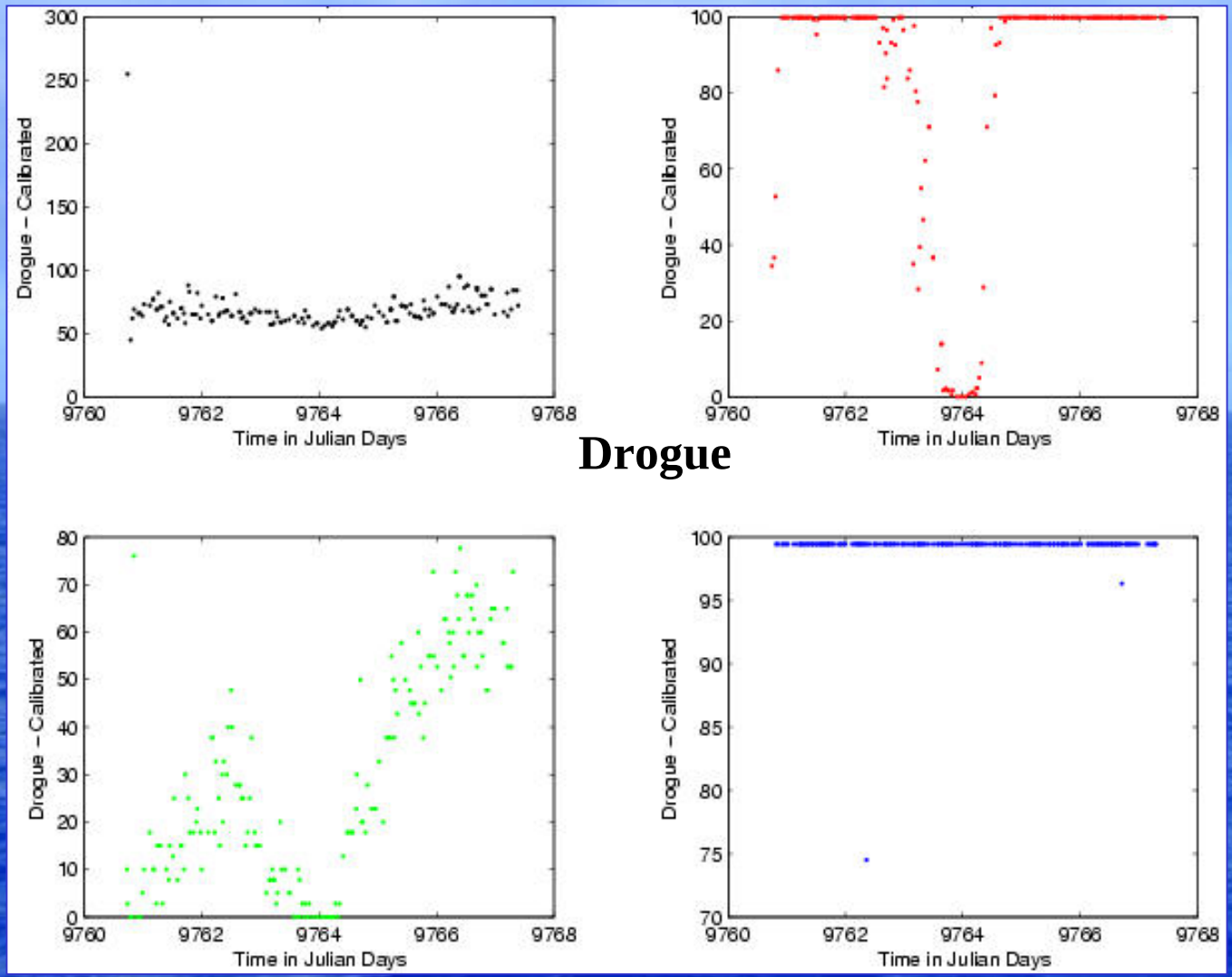
--Pacific Gyre



Drogue

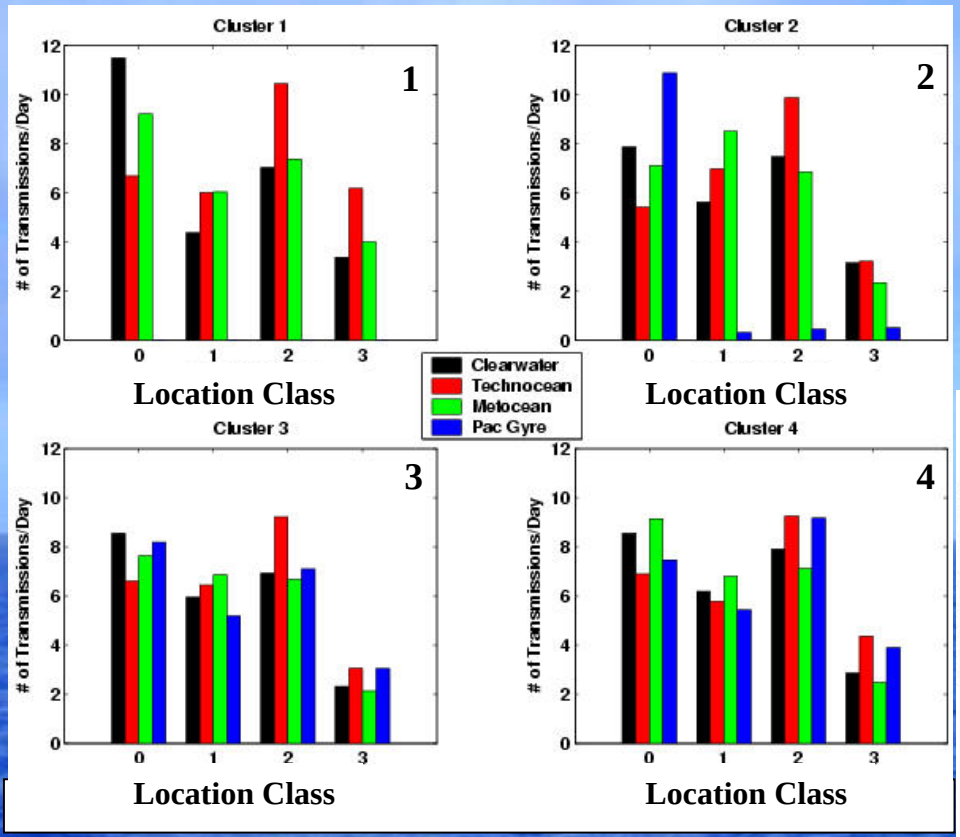
Number of Transmissions Per Day Location Classes

- Argos locations are calculated from all messages received during a satellite pass over a transmitter.
- Standard locations are calculated on reception of four or more messages.
- Each location is assigned to a location class. The classes vary according to the estimated accuracy of the location, f
- Location class
  - Satellite/trans
  - Number of m
  - Transmitter f

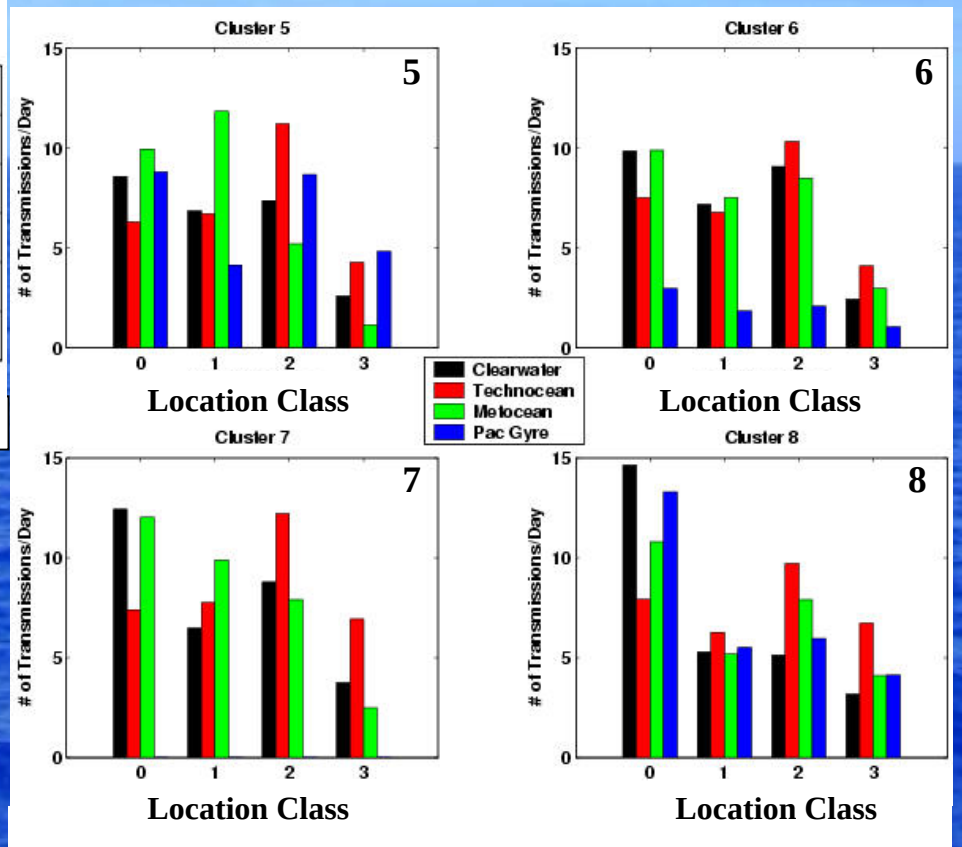
(fro

Class	Estimated Accuracy in latitude and longitude
3	< 150 m
2	150 m <=accuracy < 350 m
1	350 m <=accuracy <1000 m

Number of Transmissions Per Day In Each Location Class



•In each cluster, Technocean has the least amount of no locations and the most amount of class 2 and 3 transmissions.



•Pacific Gyre had some transmission issues in this batch: 2 gappy drifters, 2 failed on deployment and 1 died.

Summary Table of Drogue's Life Times

	Clusters							
Manufacturers	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Clearwater	91	78	149	18	*	*	133	*
Technocean	10	16	12	15	10	5	7	12
Metocean	125	84	*	*	86	*	*	61
Pacific Gyre	FOD	69	*	18	*	*	FOD	21

* OK until last update, January 31, 2006

Summary

- **Overall performance**
  - **Technocean had the best location accuracy**
  - **Clearwater and Metocean drifters are all still alive**
  - **Clearwater, Metocean and Technocean are transmitting good SST**
  - **Metocean drifters have their drogues attached**

Summary

***Problems with this batch of drifters*:**

- **Pacific Gyre:**
  - **2 buoys failed on deployment, 2 had transmission gaps (one, during the first 3 weeks, the other one, out of a total of 70 days, it missed 42 days of transmissions)**

    Manufacturer reported problem was related to antenna design and is actively working on it to solve this problem

  - **SST's were consistently off between 0.27 and 0.45^{0}C too hot in 3 of the drifters and 1 drifter had SST 0.36 too cold, when compared to the others in the same area, and against microwave SST.**

Summary

***Problems with this batch of drifters*:**

- **Technocean:**
  - **Submergence sensitivity makes it difficult to determine drogue off day. This problem has been communicated, and Technocean has actively addressed it.**
  - **Drogue loss a problem with this batch.**

    **** Manufacturer reported that drogue loss problem was due to a change in drogue design that would have reduced costs - reverted to original design*.**

Conclusions

These results are a preliminary evaluation of a single batch of drifters from each manufacturer. We will continue to monitor these clusters and deploy new clusters from different batches.

Preliminary results show the value of purchasing from multiple manufacturers. If a batch from one manufacturer has a problem, others can compensate.

Ultimately, what matters is not *one batch*, but the overall performance - dozens of batches, hundreds of drifters, to maintain an array of 1250 drifters!

Of greatest significance is how manufacturers react to problems: address/fix, communicate. We don't expect perfection, but we need active partnerships.

GOOOOOOAL!!!

1250

Problems found with this batch of drifters

- Some buoys showed SST offset; problem reported to manufacturer and it is being addressed.
- Manufacturer reported that drogue loss problem was due to a change in drogue design that would have reduced costs – reverted to original design.
- All manufacturers are now using consistent packaging – most effective shrink wrap packaging.
- One batch of drifters had transmission problems (data gaps): manufacturer reported the problem was related to antenna design, and is actively working on it to solve the problem.