



# Global Drifter Program (GDP)



*Drifting buoy measurements of Sea Surface Temperature,  
Mixed Layer Currents, Atmospheric Pressure and Winds*

<http://www.aoml.noaa.gov/phod/dac/gdp.html>

**Rick Lumpkin, NOAA/AOML**



**27th Data Buoy Cooperation Panel session**

**26—30 September 2011**

**Geneva, Switzerland**

**GDP:** the principal component of the *Global Surface Drifting Buoy Array*, a branch of NOAA's *Global Ocean Observing System* (GOOS) and *Global Climate Observing System* (GCOS) and a scientific project of the DBCP.

***Objectives:***

**Maintain** a global 5°x5° array of ~1250 satellite-tracked Lagrangian surface drifting buoys to meet the need for an accurate and globally dense set of in-situ observations: mixed layer currents, SST, atmospheric pressure, winds, and salinity.

**Provide** data processing system for scientific use of these data.

These data support short-term (seasonal-to-interannual) climate predictions as well as climate research and monitoring.

# Organization of the Global Drifter Program



Funding from NOAA's Climate Program Office.



**AOML (Miami, FL)**  
**Rick Lumpkin**



**JIMO (La Jolla, CA)**  
**Luca Centurioni**

Supervises the industry, upgrades the technology, purchases most drifters, and develops enhanced data sets.

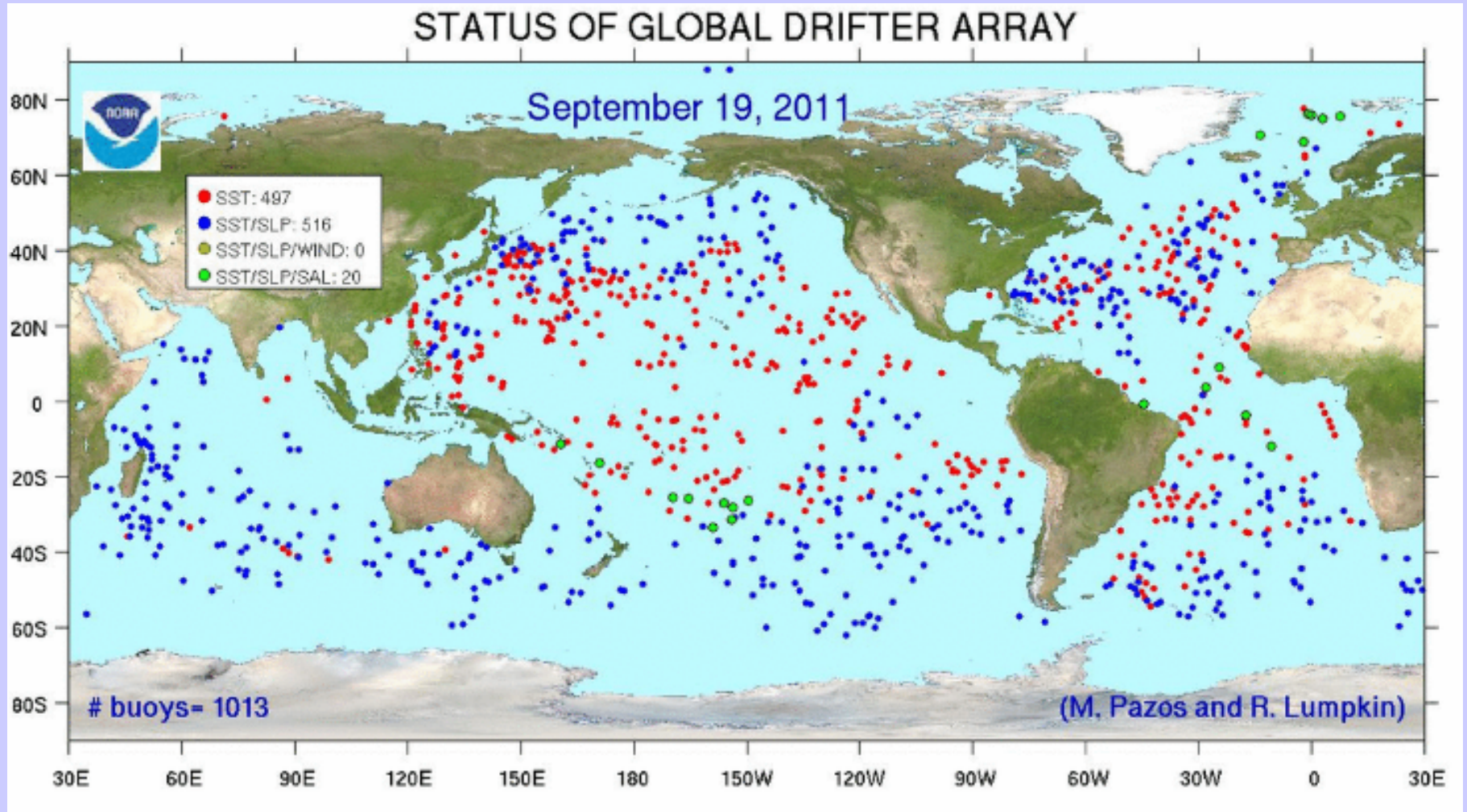
**Manufacturers** in private industry, who build the drifters according to closely monitored specifications

**Drifter Operations Center (DOC)**

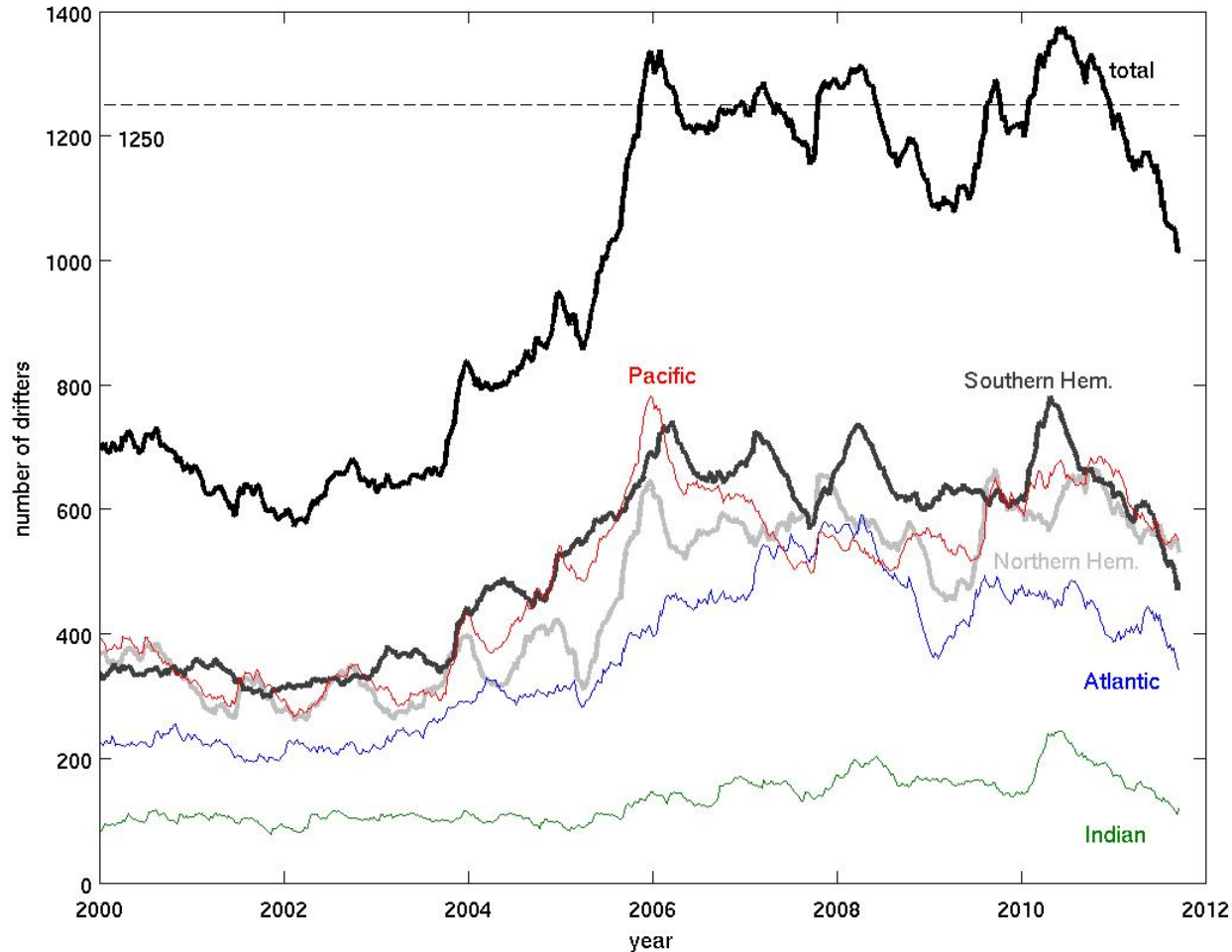
**Drifter Data Assembly Center (DAC)**

# Current status of the global array

Last year: ~1350 GDP drifters

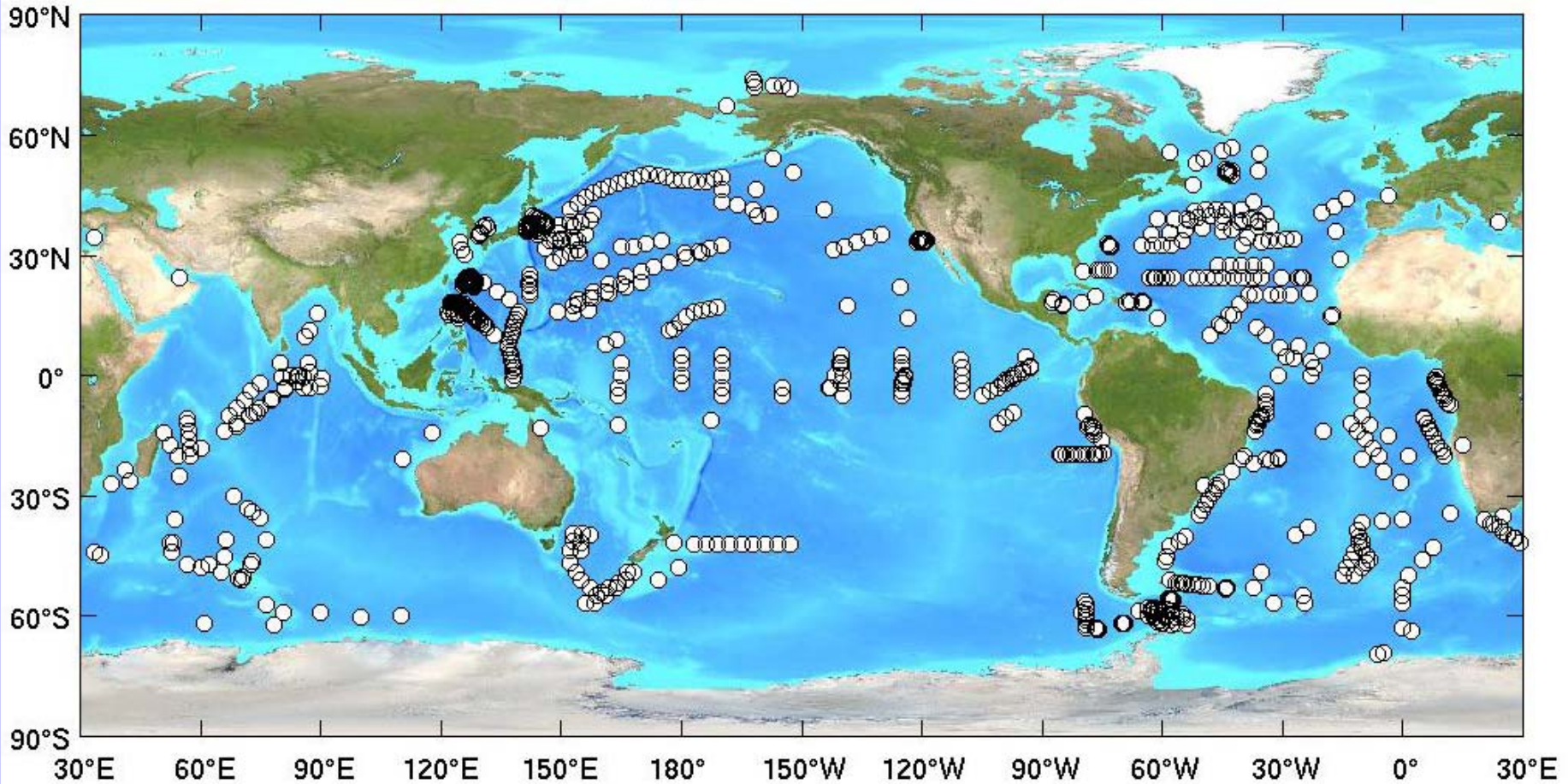


# Why have the array dropped from 1350 last year to ~1000 now?



$$\text{Array size now} = \text{array size then} + N_{\text{deploy}} - N_{\text{deaths}}$$

## GDP drifter deployments, 8 Sep 2010-8 Sep 2011



981 drifters deployed  
(19 below average)  
911 funded by NOAA  
(111 above average)

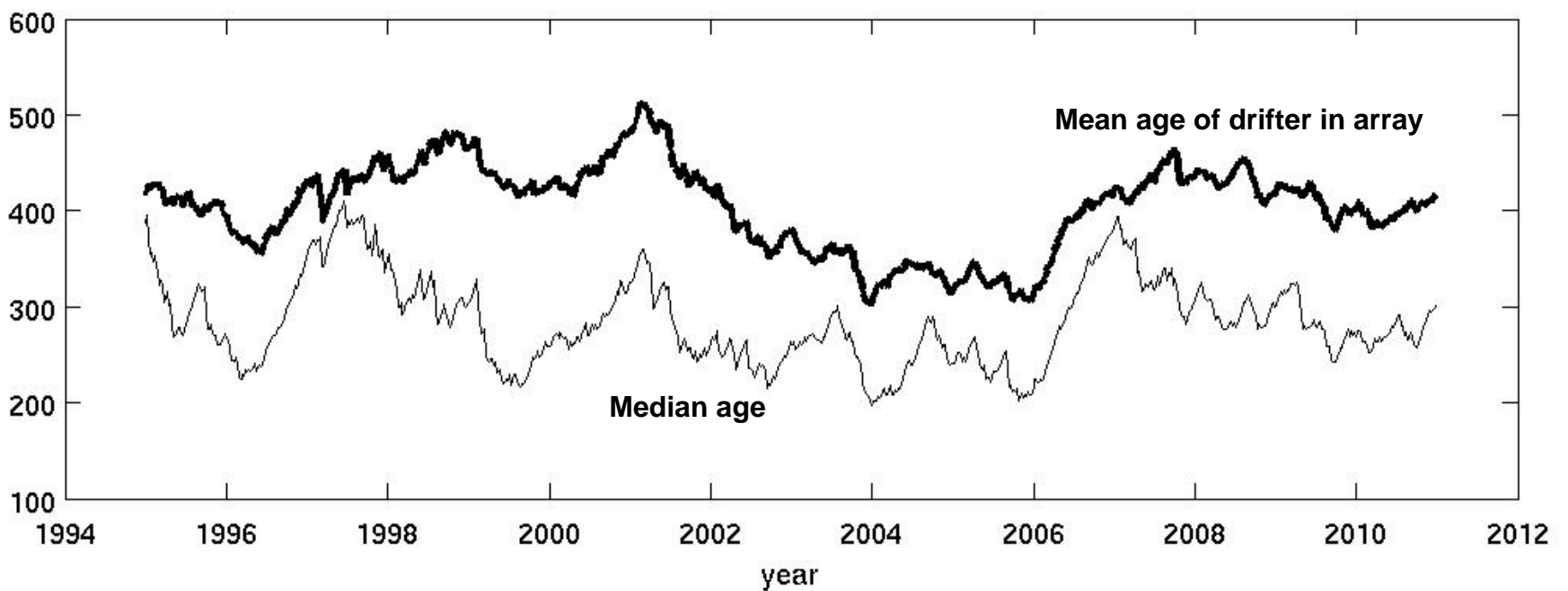
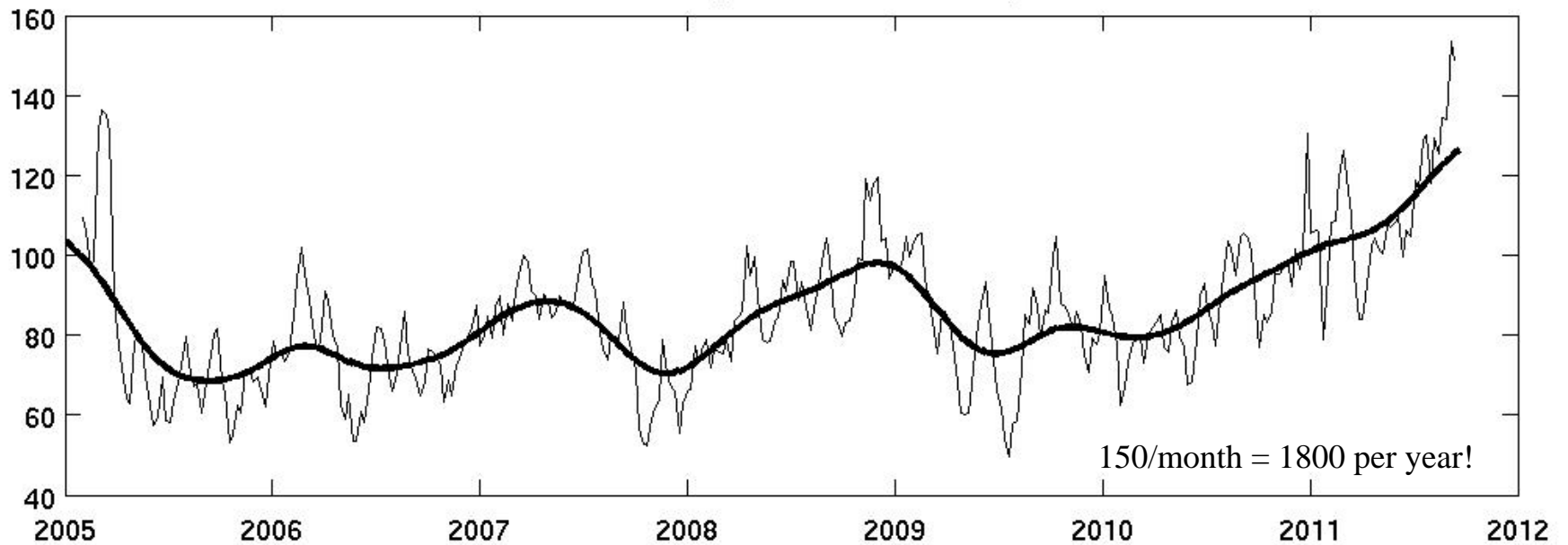
Drifter Operations Center:  
Shaun Dolk (Miami, FL USA)  
[Shaun.Dolk@noaa.gov](mailto:Shaun.Dolk@noaa.gov)

# Deployments by manufacturer

2011 = 26 June 2010—26 June 2011, same for earlier years.

<u><i>Manufacturer</i></u>	<u><i>2011</i></u>	<u><i>2010</i></u>	<u><i>2009</i></u>	<u><i>2008</i></u>	<u><i>2007</i></u>
Technocean	326	362	219	206	295
Clearwater	318	437	314	380	496
Metocean	206	195	173	187	130
Pacific Gyre	200	296	225	232	83

Number of deaths per 1250 drifters per month





# Deployments vs. deaths

1350 drifters (last year)

+ ~980 (deployed)

- ~1320 (deaths in last 12 months)

= 1010 drifters

# Drifter deaths, June 2010—June 2011

(June instead of September because the latest QC data, which includes drifter death metadata, currently to 26 June 2011).

1318 total deaths (including 54 failed on deployments)

264 aground

50 picked up

994 quit transmitting (893 w/<25% chance that they were picked up or ran aground)

For reference, **2009**: 1010 total deaths (39 failed on deployment)

**2008**: 1121 (46)    **2007**: 1041 (34)    **2006**: 986 (55)

This was a record bad year for drifters dying.

# Deaths by manufacturer

Causes: all (quit, ran aground, picked up). Includes Failed on Deployment.

2011 = 26 June 2010—26 June 2011, same for earlier years.

<u><i>Manufacturer</i></u>	<u><i>2011</i></u>	<u><i>2010</i></u>	<u><i>2009</i></u>	<u><i>2008</i></u>	<u><i>2007</i></u>
<b>Technocean</b>	<b>407</b>	270	282	237	349
Clearwater	385	428	447	478	501
<b>Metocean</b>	<b>243</b>	199	147	160	88
<b>Pacific Gyre</b>	<b>260</b>	217	193	162	123

# “Quit” deaths by manufacturer

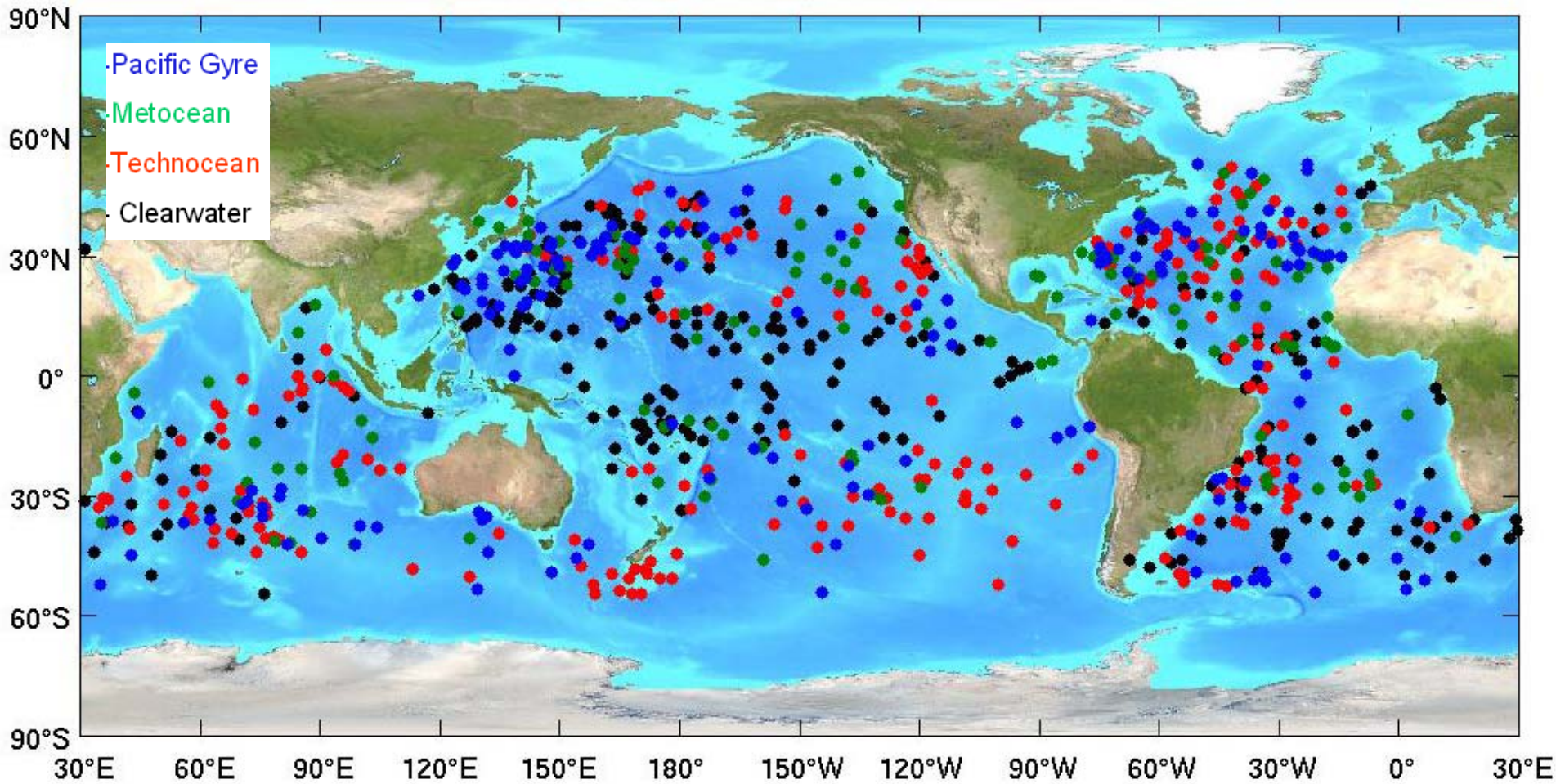
Cause: “quit transmitting”, with estimated chance of “ran aground” or “picked up” less than 25%. Includes “failed on deployment”. Doesn’t include deaths poleward of 55°N/S.

2011 = 26 June 2010—26 June 2011, same for earlier years.

<u><i>Manufacturer</i></u>	<u><i>2011</i></u>	<u><i>2010</i></u>	<u><i>2009</i></u>	<u><i>2008</i></u>	<u><i>2007</i></u>
Technocean	<b>248</b>	116	132	101	133
Clearwater	259	282	270	286	260
Metocean	<b>135</b>	109	97	97	50
Pacific Gyre	<b>174</b>	116	104	90	61

Technocean: 2.1× increase in 2011 compared to 2007-2010 avg.  
Metocean: 1.3×      Pac Gyre: 1.7×      Clearwater: 0.9×.

Location of 'quit' deaths, June 2010-June 2011



# Median age of “quit” drifters (days)

Cause: “quit transmitting”, with estimated chance of “ran aground” or “picked up” less than 25%. Includes “failed on deployment”. Doesn’t include deaths poleward of 55°N/S.

2011 = 26 June 2010—26 June 2011, same for earlier years.

<u><i>Manufacturer</i></u>	<u>2011</u>	<u>2010</u>	<u>2009</u>	<u>2008</u>	<u>2007</u>
Technocean	250	733	812	488	424
Clearwater	200	147	269	313	219
Metocean	403	442	396	305	334
Pacific Gyre	345	233	136	197	360

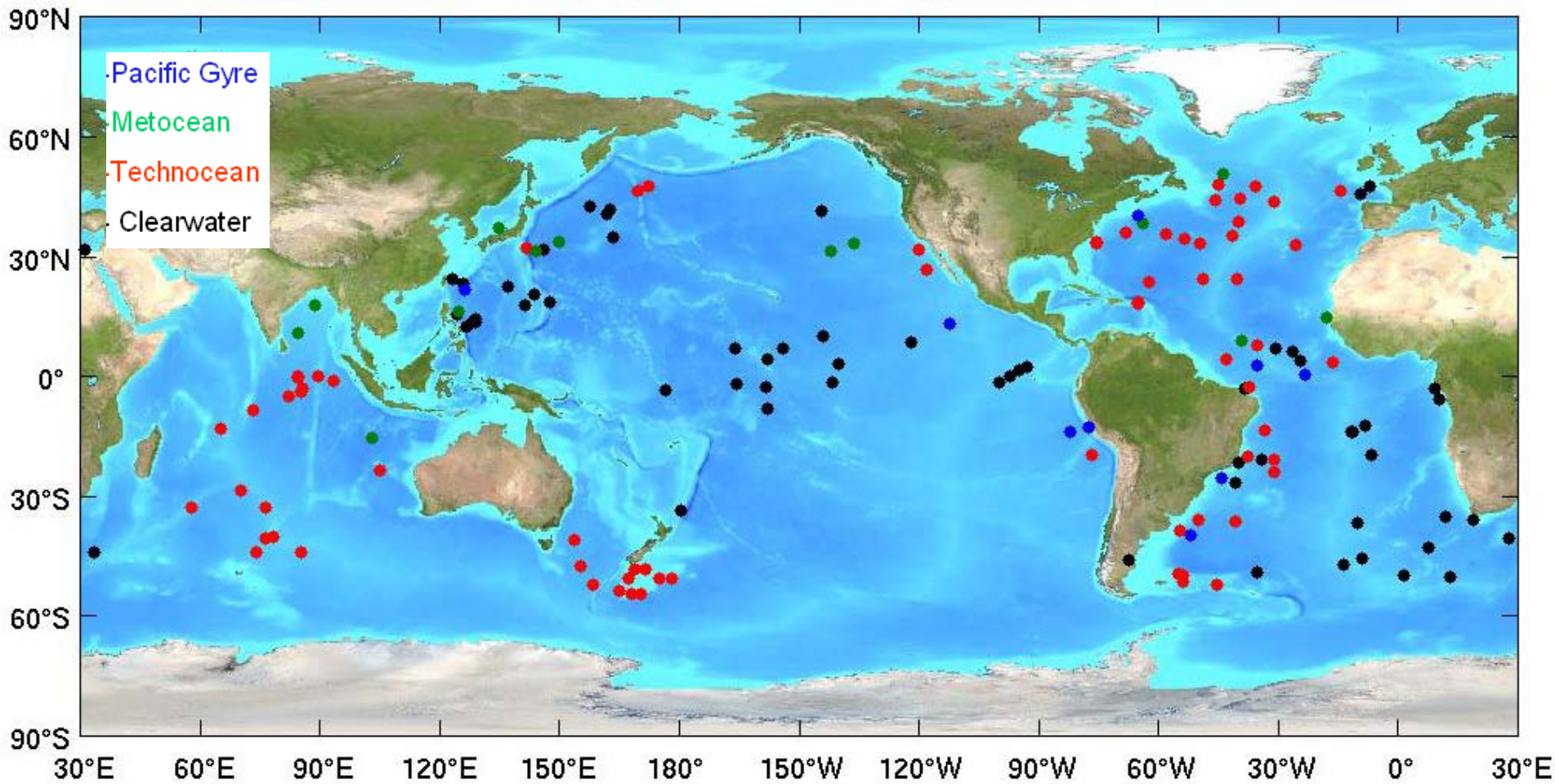
# Percent which live <90 days

# died by “quit transmitting”, with estimated chance of “ran aground” or “picked up” less than 25%. Includes “failed on deployment”. Doesn’t include deaths poleward of 55°N/S, divided by # deployed that year.

2011 = 26 June 2010—26 June 2011, same for earlier years.

<u><i>Manufacturer</i></u>	<u><i>2011</i></u>	<u><i>2010</i></u>	<u><i>2009</i></u>	<u><i>2008</i></u>	<u><i>2007</i></u>
<i>Technocean</i>	21%	5%	5%	12%	12%
Clearwater	19%	23%	11%	10%	9%
<i>Metocean</i>	7%	4%	7%	6%	7%
Pacific Gyre	5%	12%	16%	13%	11%

# Location of 'quit' deaths within 90d of deployment, June 2010-June 2011



61 Clearwater, 70 Technocean, 14 Metocean, 9 Pacific Gyre

Divide by # deployments: 20% CW, 21% Techn., 7% Metocean, 5% PacGyre.



# Age distribution of “quit” drifters

Cause: “quit transmitting”, with estimated chance of “ran aground” or “picked up” less than 25%.  
Includes “failed on deployment”. Doesn’t include deaths poleward of 55°N/S.

2011 = 26 June 2010

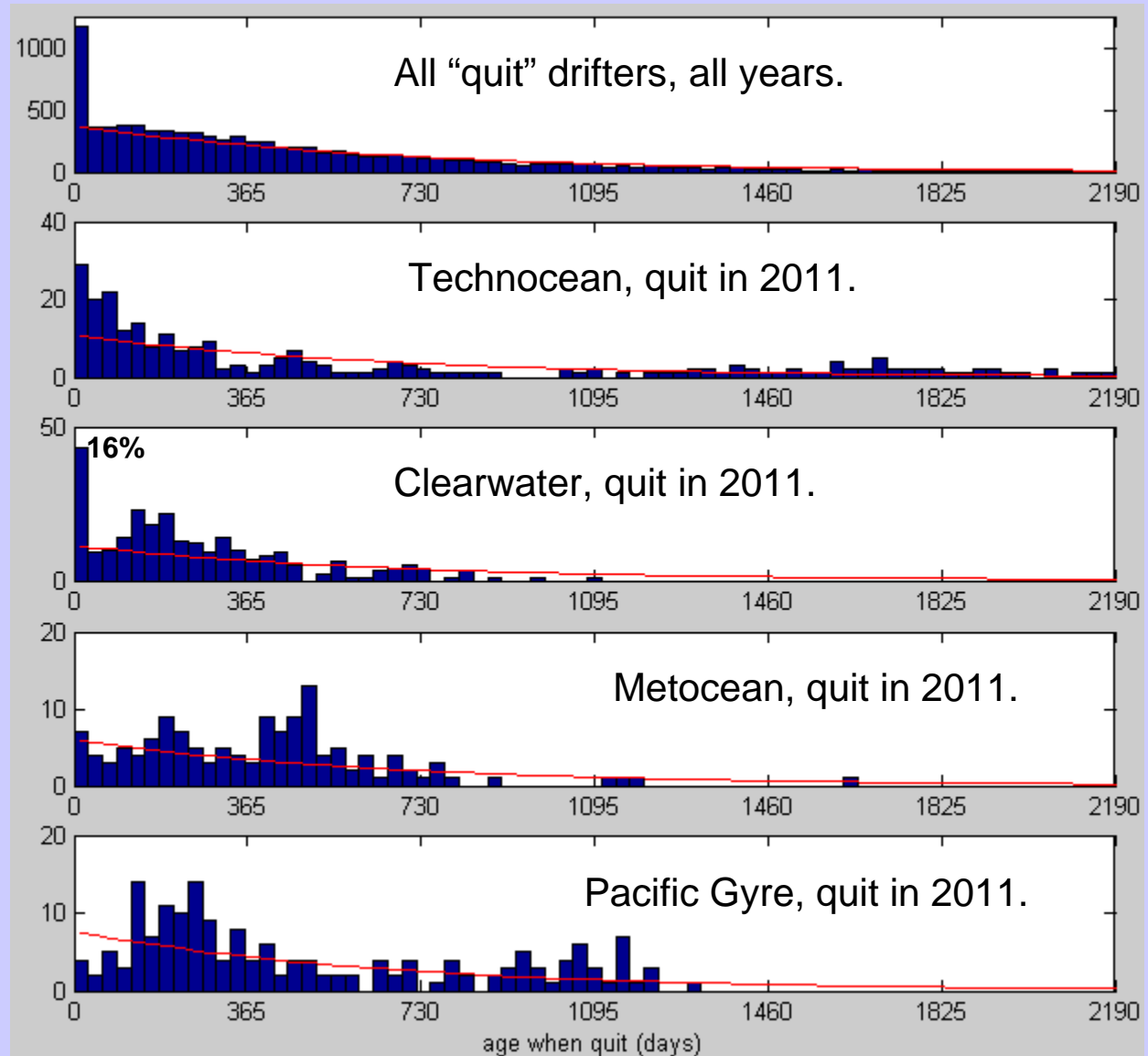
—26 June 2011.

Top: all “quit” drifters.

Red curve: 4.5% chance  
of dying every 30d.

Exponential decay  
histogram, mean=650d,  
median/half life=450d.

Historical record: 13.7%  
chance of dying first 30d.

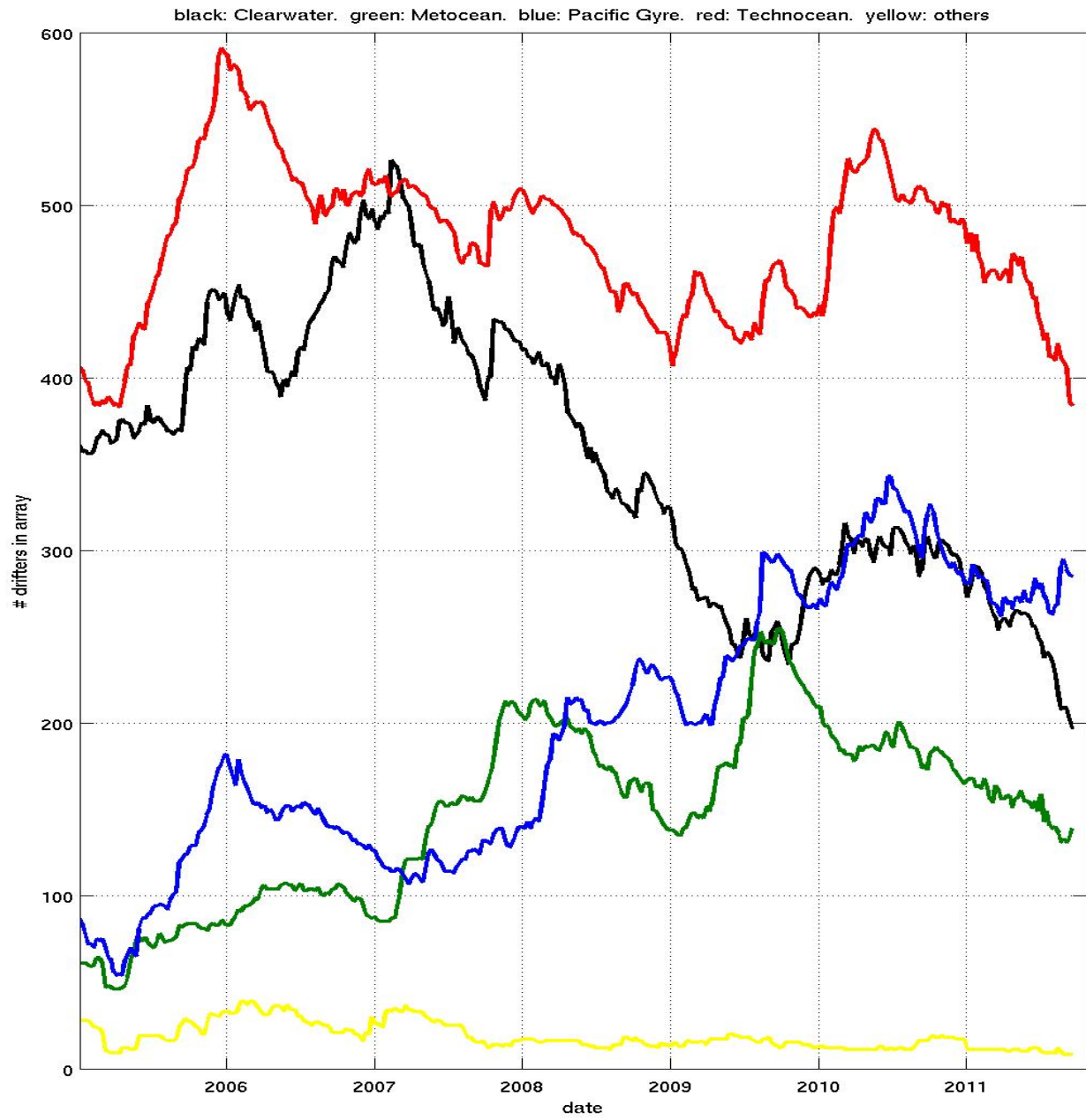


# Technocean: bad batteries in packs



Photos courtesy Hank White.

Undeployed drifters in inventory will have battery packs replaced by Technocean.



# 2011 Deployment highlights

- 20 in the Tropical Atlantic during the PIRATA Northeast Extension cruise aboard the NOAA ship *Ronald H. Brown*
- 20 across the Pacific during the DART servicing cruise
- 20 in the western Indian Ocean and 30 in the eastern Atlantic and Gulf of Guinea from various US Navy vessels, as part of the “African Partnership Station III” program
- 7 off the coast of Japan to help track debris associated with the March 11, 2011 earthquake and tsunami
- 23 in the equatorial Pacific during the TRITON servicing cruise

# Deployment plans for 2011

Operational Buoy Deployments	800
Consortium Research Buoy Deployments	<u>200</u>
Total Deployments in 2012	1000

Regional deployment opportunities in 2012 include the possible US Navy-led “African Partnership Station IV” program in the western Indian and eastern Atlantic, the NSF-funded “Dynamo” project aboard the *Revelle* in the tropical Indian Ocean, and the 2012 Argo charter of the *Kaharoa* in the South Pacific. As in previous years, cruises to service the global tropical moored array will be used opportunistically to seed drifters.

# Our appreciation to the following partners for their contributions to GDP activities

NOAA's Voluntary Observation Ships, Ships of Opportunity, and National Marine Fisheries Service programs

Argo program

International Ice Patrol

Institut de Recherche pour le Développement;

Météo-France (France)

Leibniz-Institut für Meereswissenschaften an der Universität Kiel

(Germany)

New Zealand Met. Service

Australian Bureau of Meteorology

Fundação Universidade Federal do Rio Grande; Instituto Nacional de Meteorologia; Centro de Hydrografia de Marinha; INPE (Nacional Space Institute); Brazilian Navy; Brazilian Naval Directorate of Hydrography and Navigation (Brazil)

Fisheries Research Institute; Servicio de Hidrografía Naval (Argentina)

Instituto Canario de Ciencias Marinas; Universidad de Las Palmas de Gran Canaria (Spain)

Instituto Nazionale di Oceanografia e di Geofisica Sperimentale (Italy)

National Institute of Oceanography; National Institute of Ocean Technology (India)

Institute of Hydrological and Oceanic Services (Taiwan)

Centro de Investigacion Cientifica y de Educacion Superior de Ensenada (Mexico)

Korean Oceanographic Research and Development Institute, National Oceanographic Research Institute; Ministry of Maritime Affairs and Fisheries (Korea)

Instituto del Mar del Peru

Tristan da Cunha Administration, Tristan Island

United Kingdom Met Office

Fisheries Department of Falkland Islands

Environment Canada

University of Cape Town; South African Weather Service (South Africa)

Scripps Institution of Oceanography, Woods Hole

Oceanographic Institution, Oregon State University,

Marine Resources Research Institute, NOAA/Pacific

Marine Environmental Laboratory, NOAA/National Data

Buoy Center (United States of America)

United States Air Force

US Naval Oceanographic Office

United States Coast Guard

Raytheon Polar Services

