Deployment of Drifting Buoys from Ships

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

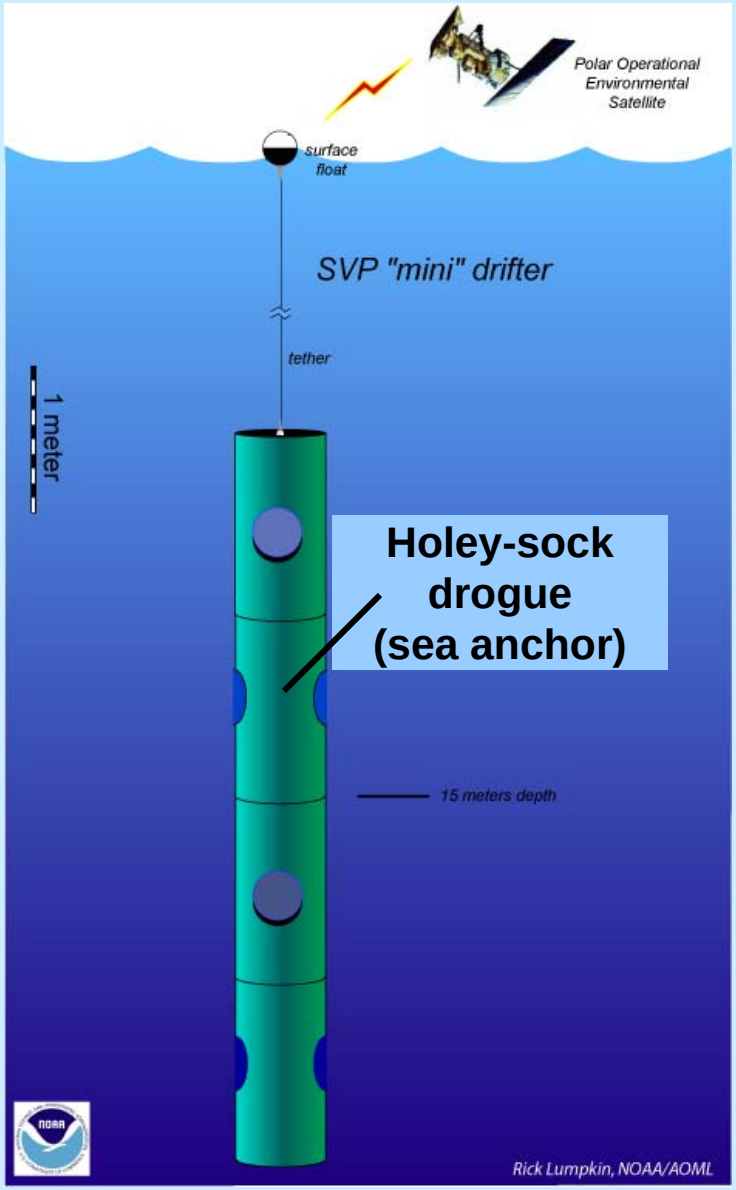
Rick.Lumpkin@noaa.gov

4th International PMO conference

8—10 December 2010

Orlando, FL

The drifter



Spherical surface float

Polyurethane impregnated tether

Holey Sock nylon drogue centered at 15-m depth

D-cells batteries inside the float

Sensors:

Drogue: **drogue detection by submergence or tether strain sensor**

Thermistor: **measure SST**

Voltage: **Indicates batteries' life**

Cost: **~$1400**

Other Sensors that can be added:

Barometric pressure, wind, subsurface temperatures, salinity

Data transmission

Transmission via satellite (Argos or Iridium).

Argos: position determined from Doppler shift, accuracy ~500m.

Iridium: position from GPS.

Frequency: ~hourly.

Lifetime

Transmitter average lifetime: 450 days.

Longest on record: 10 years, 4 months, 21 days.

Drogue average lifetime: 300 days (goal).

Death reasons: “quit transmitting”, ran aground, picked up.

NOAA's Global Drifter Program: a branch of the *Global Ocean Observing System* (GOOS) and *Global Climate Observing System* (GCOS) and a scientific project of the Data Buoy Cooperation Panel (DBCP).

***Objectives*:**

Maintain a global 5ºx5º array of satellite-tracked Lagrangian surface drifting buoys to meet the need for an accurate and globally dense set of surface ocean observations;
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.

The GDP is funded by NOAA's Climate Program Office; we rely on partnerships with meteorological agencies to upgrade a number of drifters to include barometers.

GDP web page:

www.aoml.noaa.gov/phod/dac/gdp.html

The Global Drifter Program
Satellite-tracked surface drifting buoys

NOAA AOML PhOD Global Ocn Obs GDP Search Popular topics..

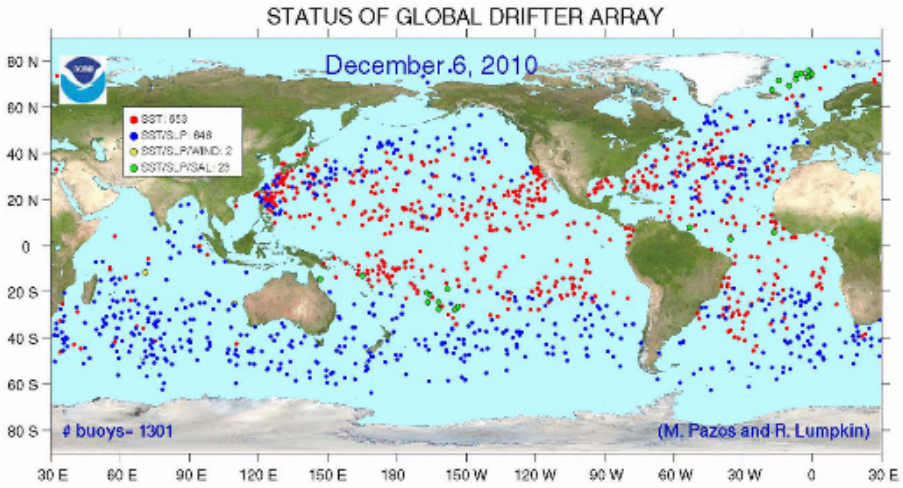
Global Ocean Observations
- Ship Of Opportunity Program
- Global Drifter Program
- ARGO Center
- Western Boundary Time Series
- PIRATA Northeast Extension

Global Drifter Program
- Information
- Data and Products
- Operations

Contact
- Contact Information

The Global Drifter Program

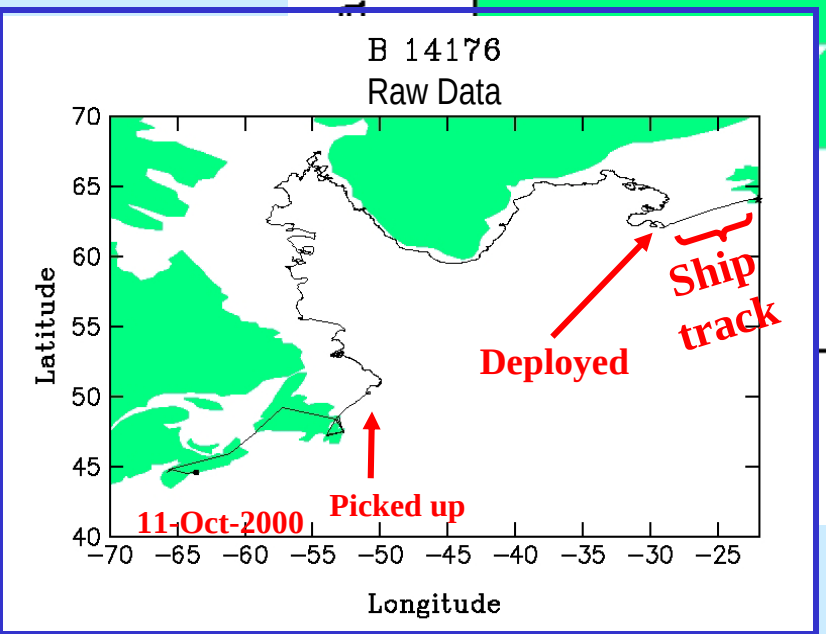
Satellite-tracked surface drifting buoy observations of currents, sea surface temperature, atmospheric pressure, winds and salinity. More information ...

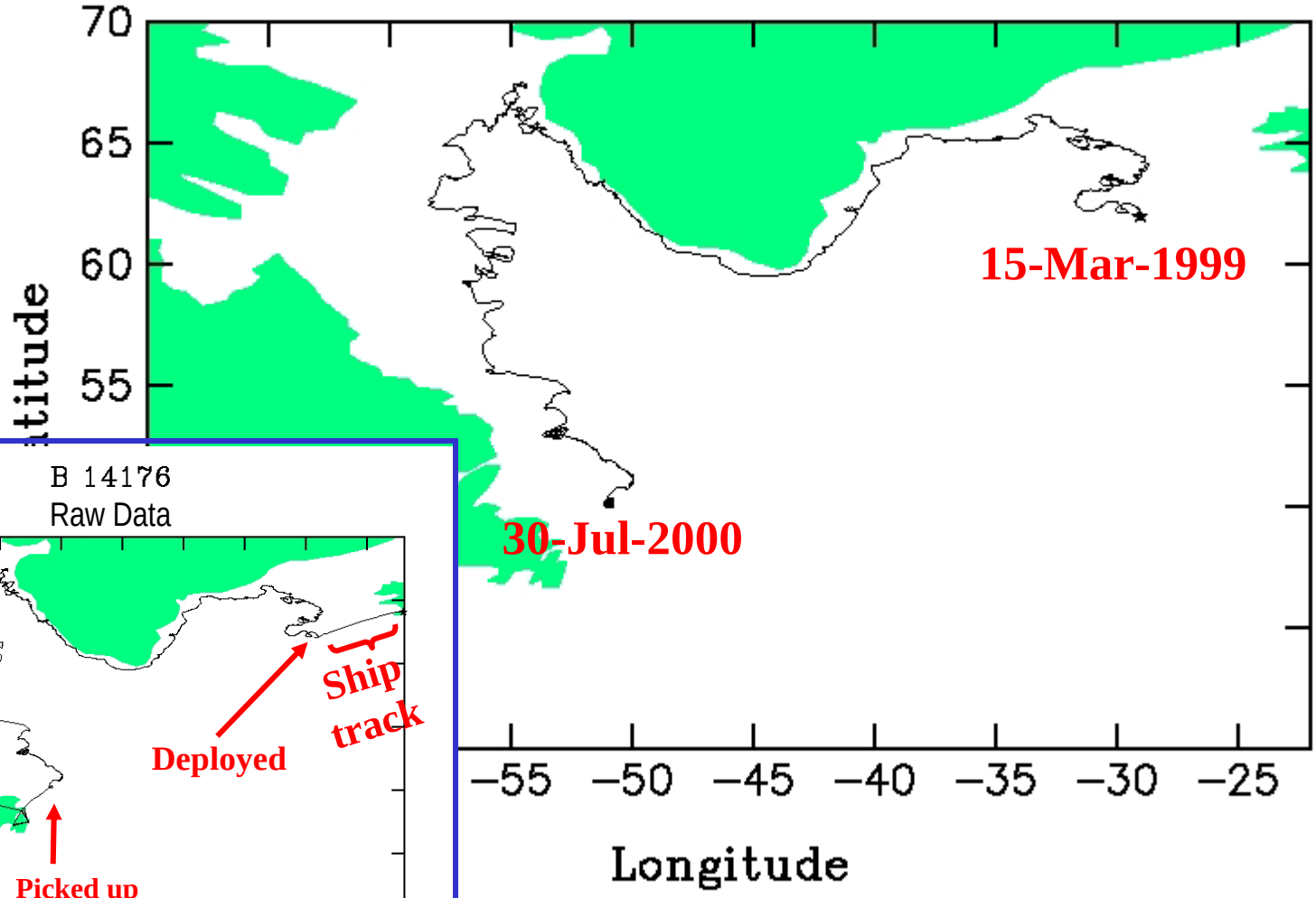


QC Examples

Drifter 14176 cleaned and interpolated file

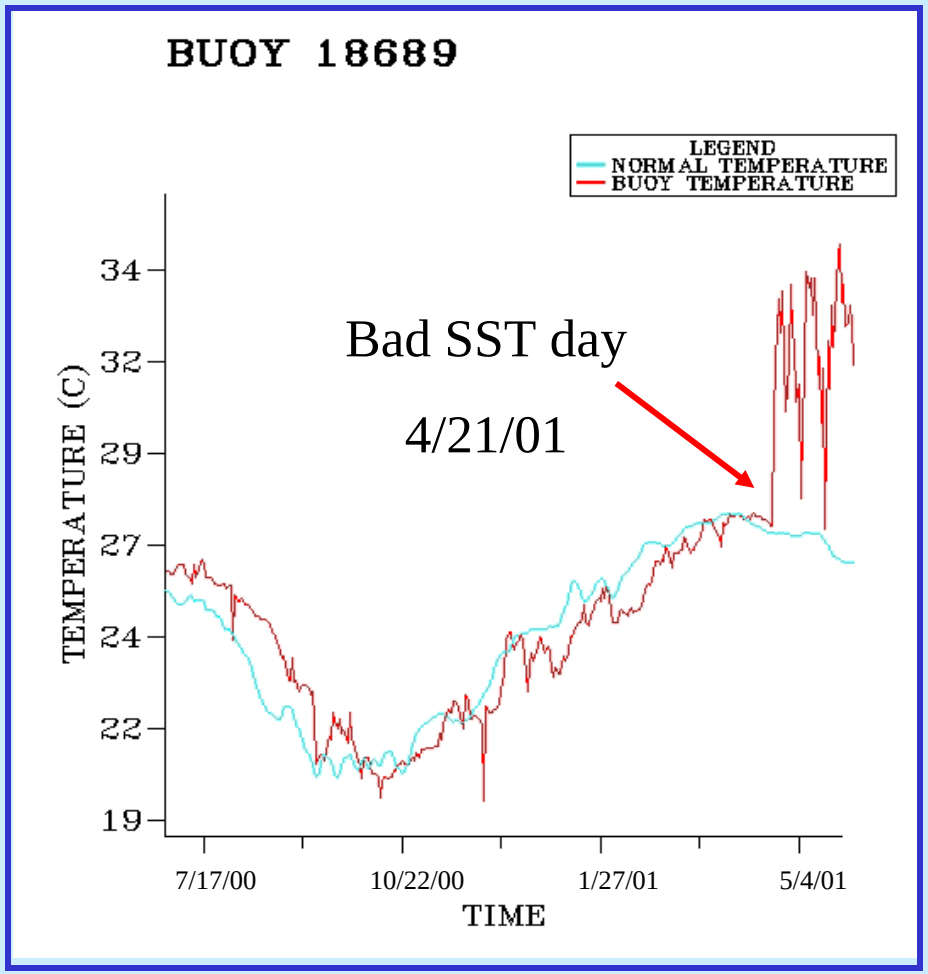
After editing and interpolation procedures have been applied

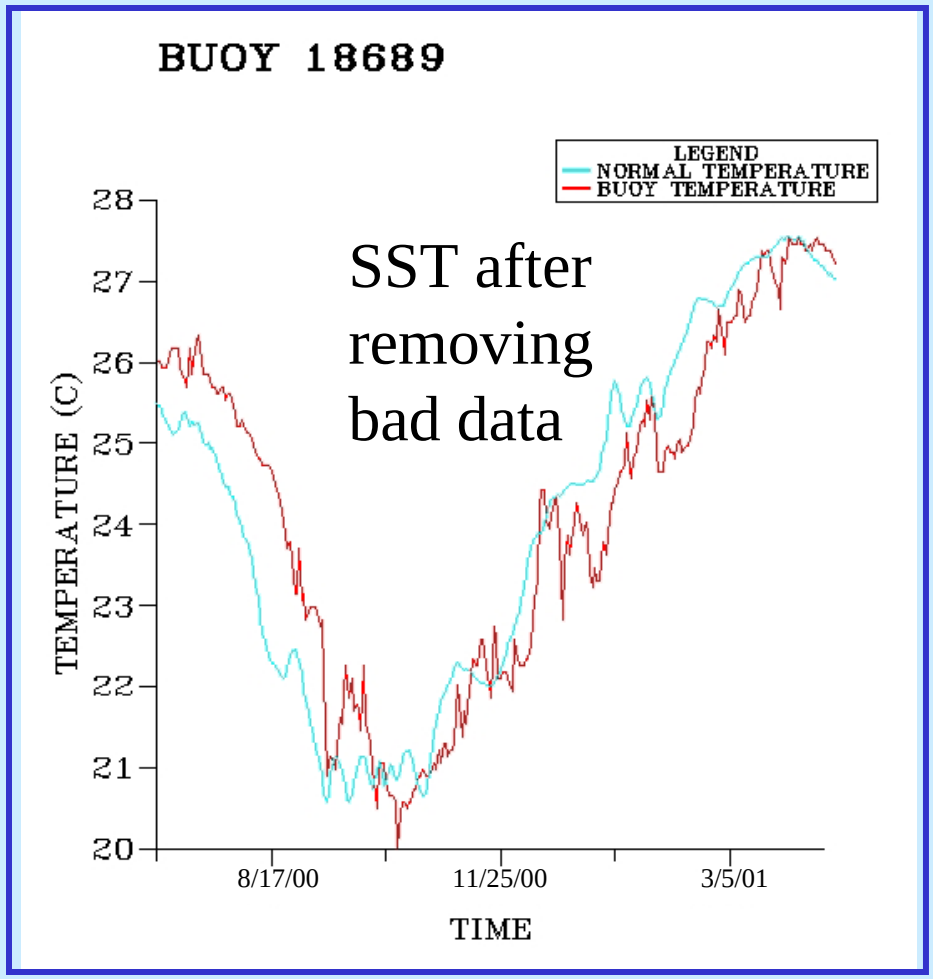




QC Examples

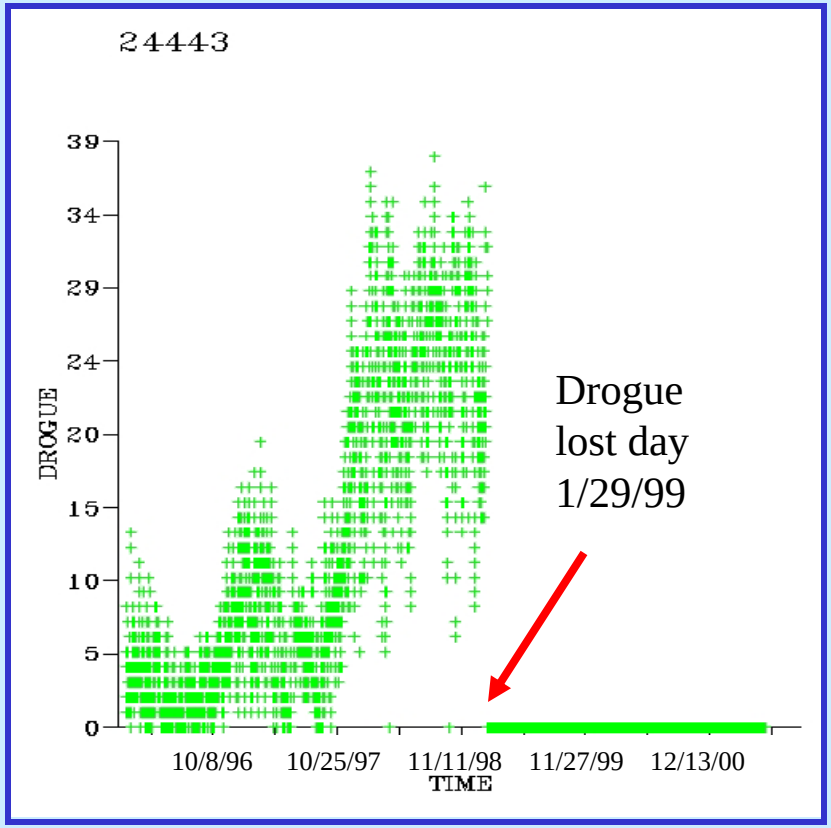
Sea Surface Temperature: bad values removed

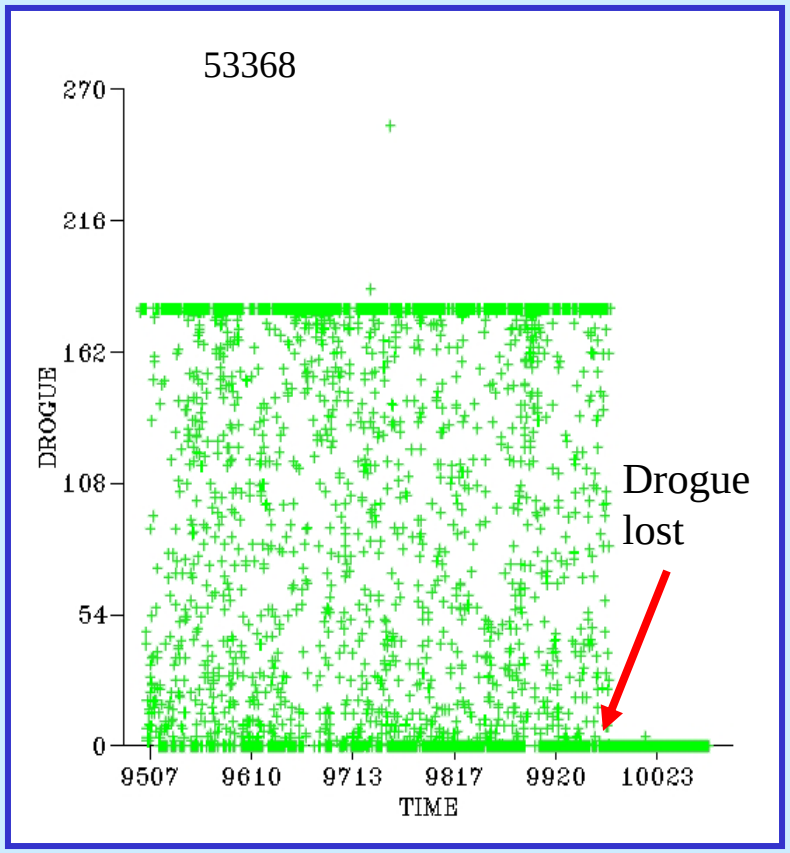




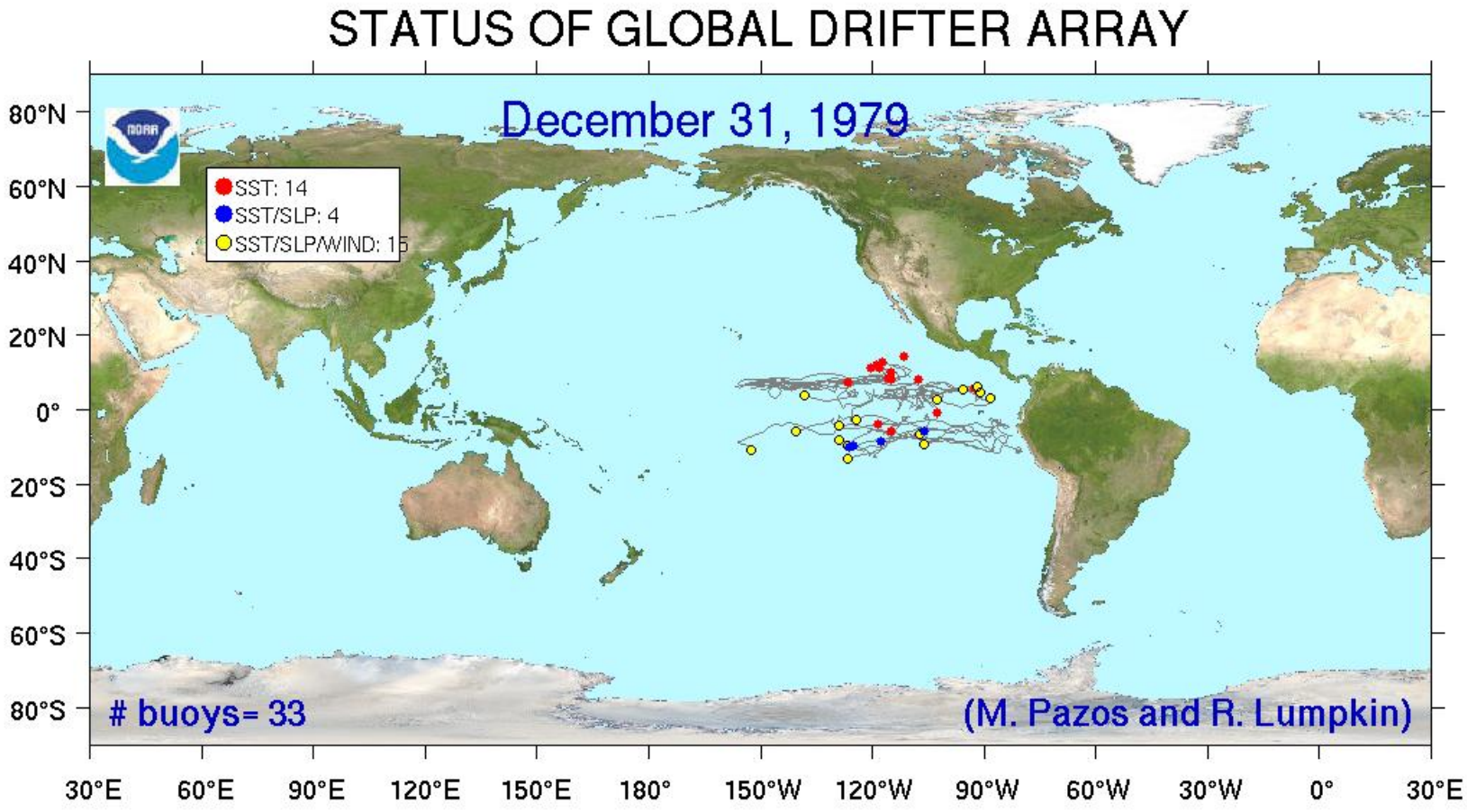
QC Examples

Determining drogue off time

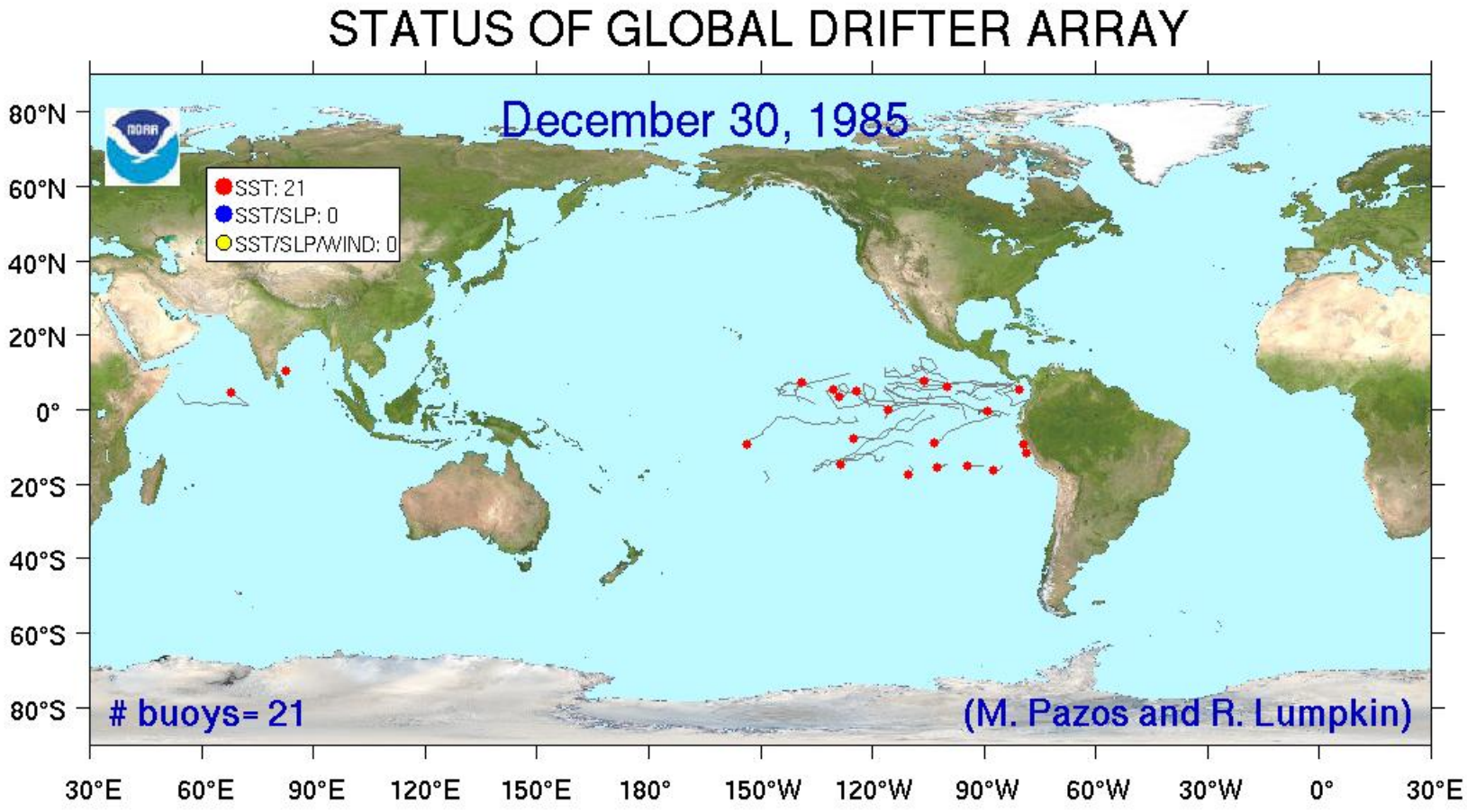




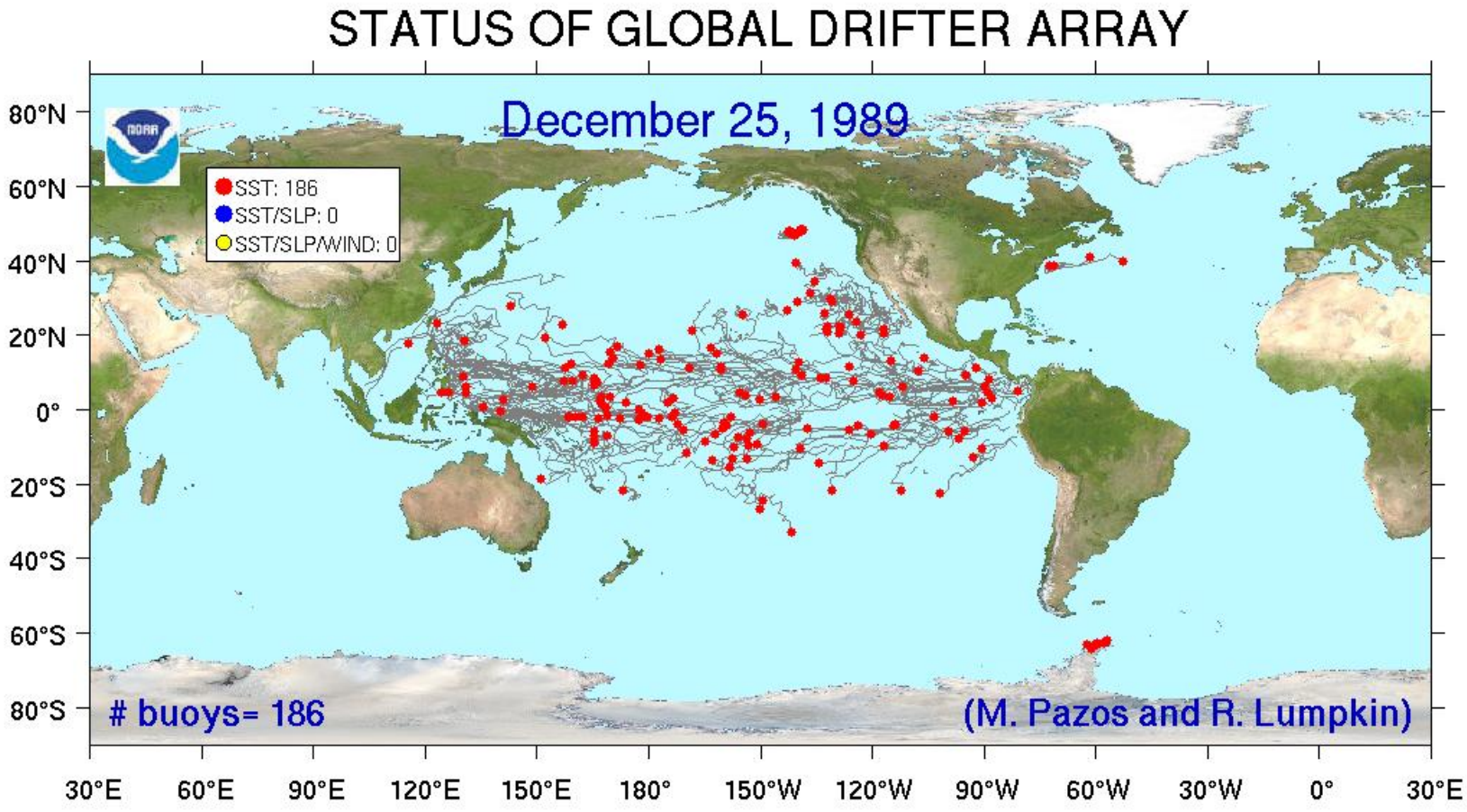
Typical submergence record for Technocean "drogue loss"
(sharp drop to zero when drifter is picked up).



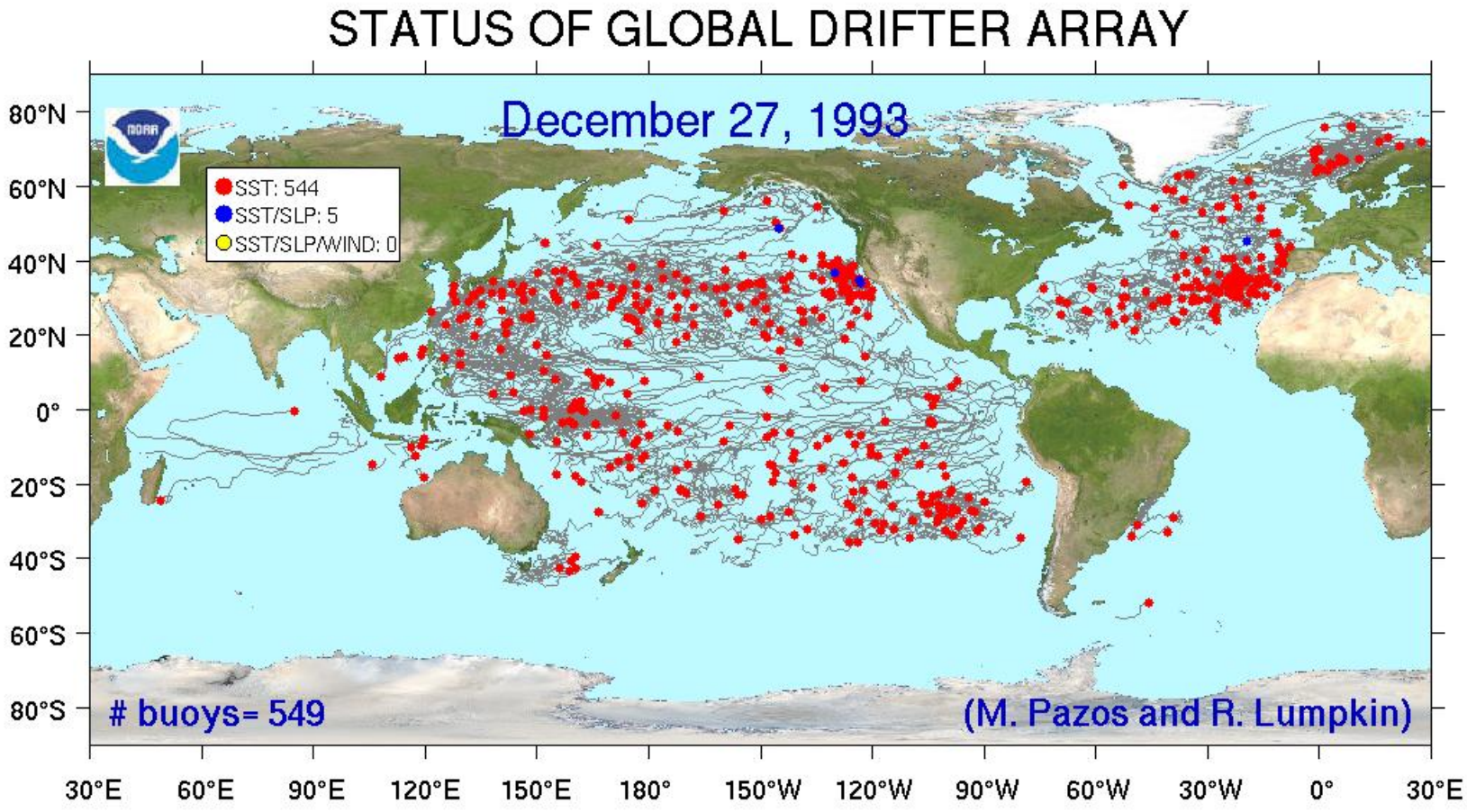
First deployments of Surface Velocity Program-type drifters as part of TOGA: ***Tropical Pacific.***



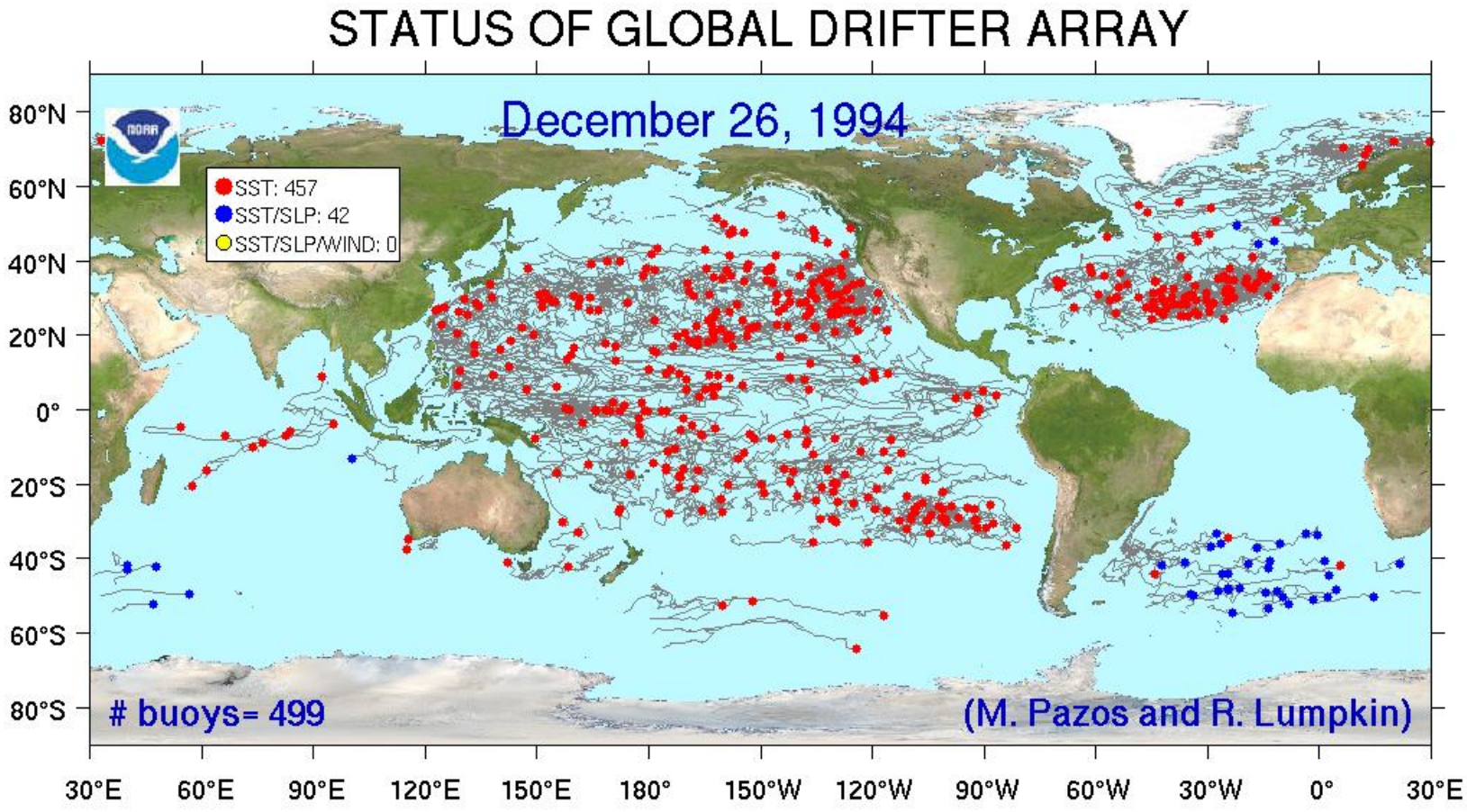
First non-tropical Pacific deployments.



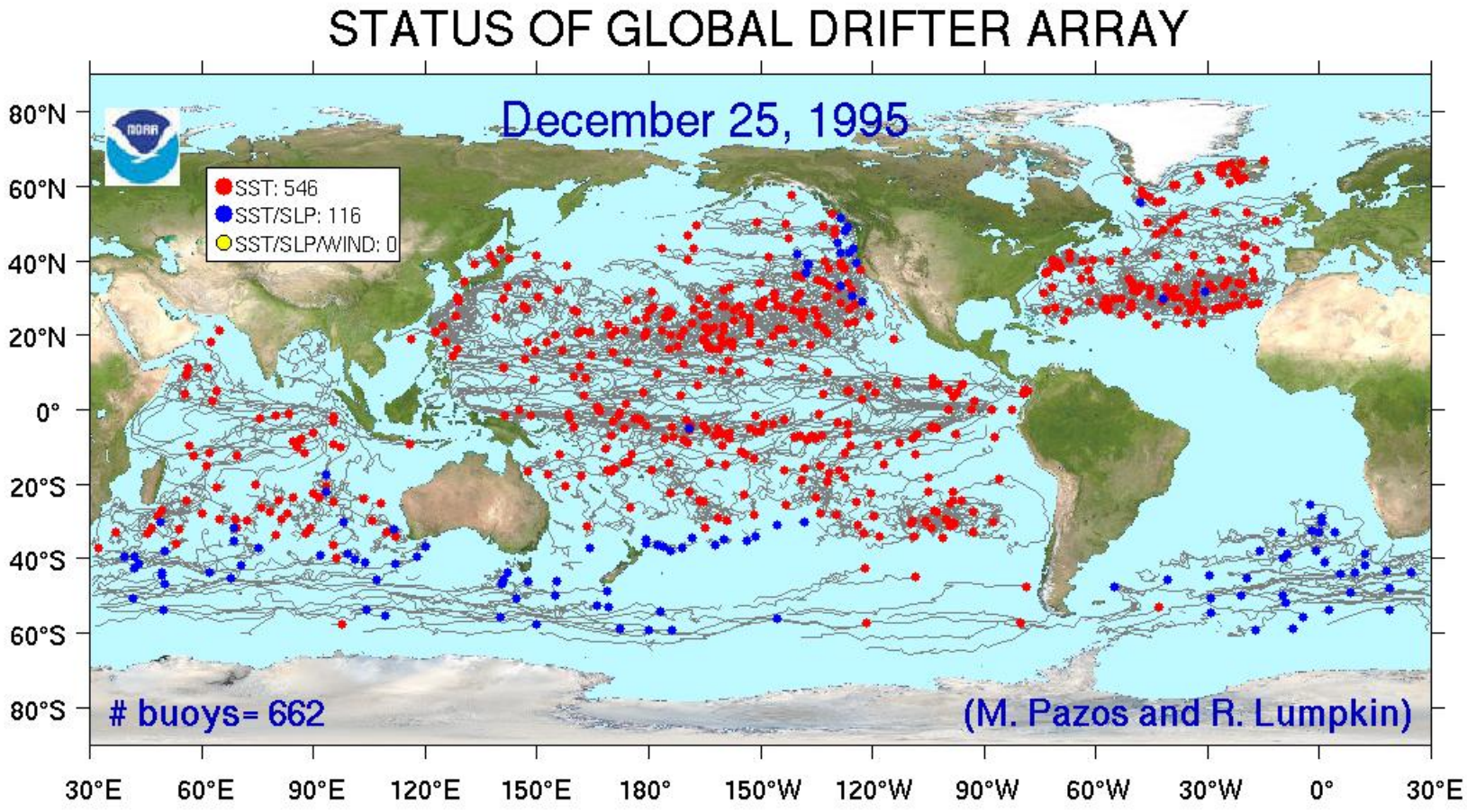
1989: start of sustained North Atlantic deployments

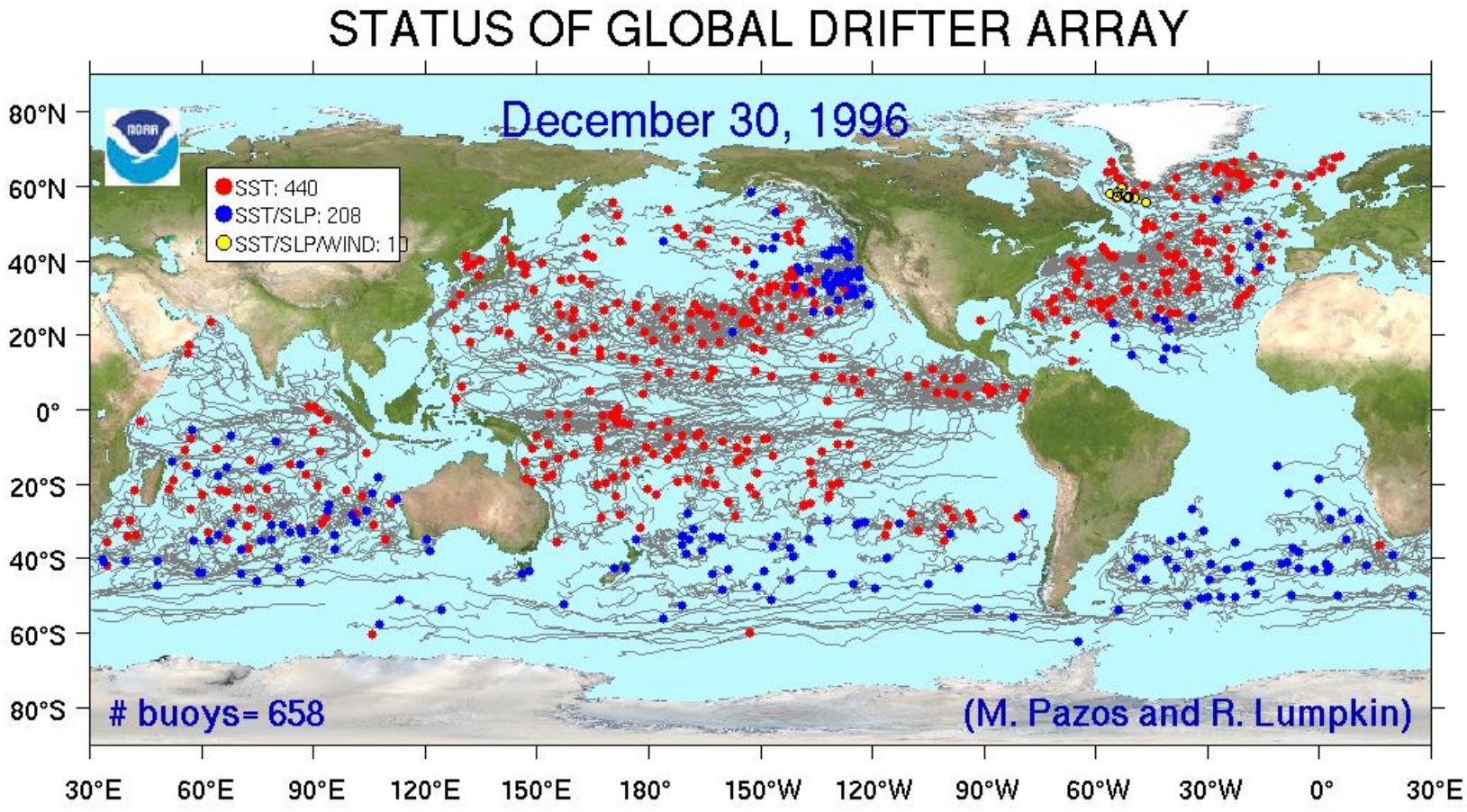


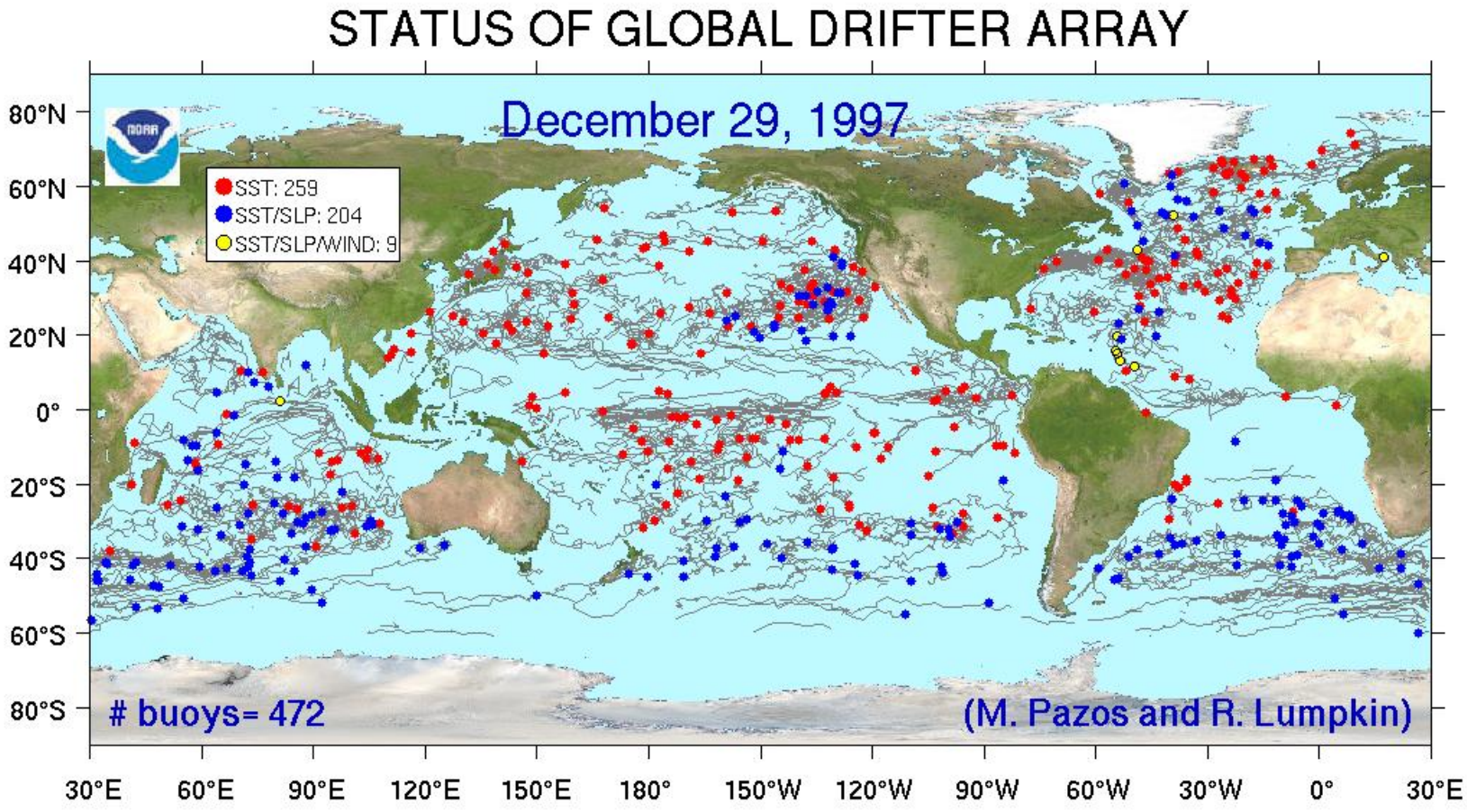
1993: start of sustained South Atlantic deployments



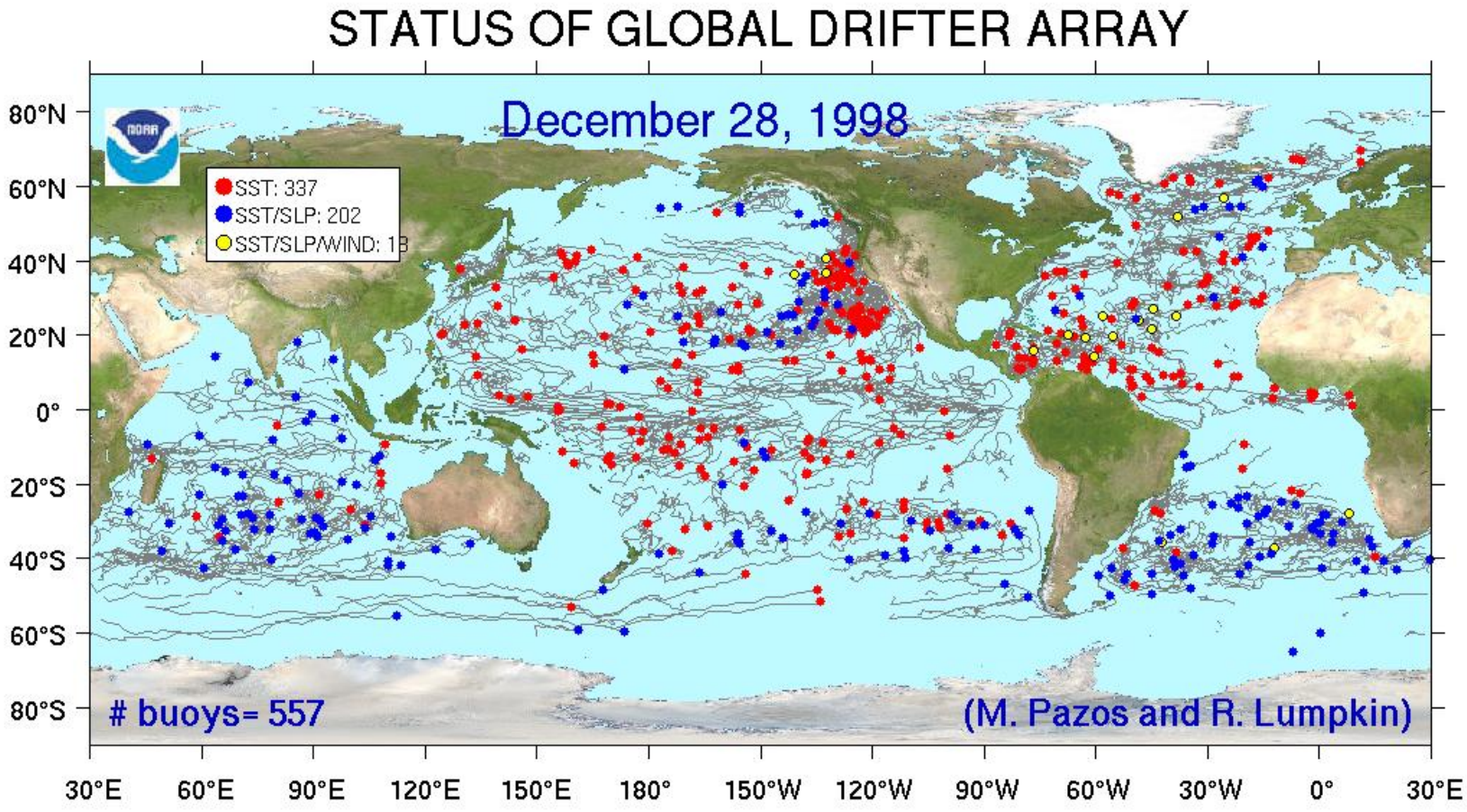
1994: start of sustained Indian Ocean deployments

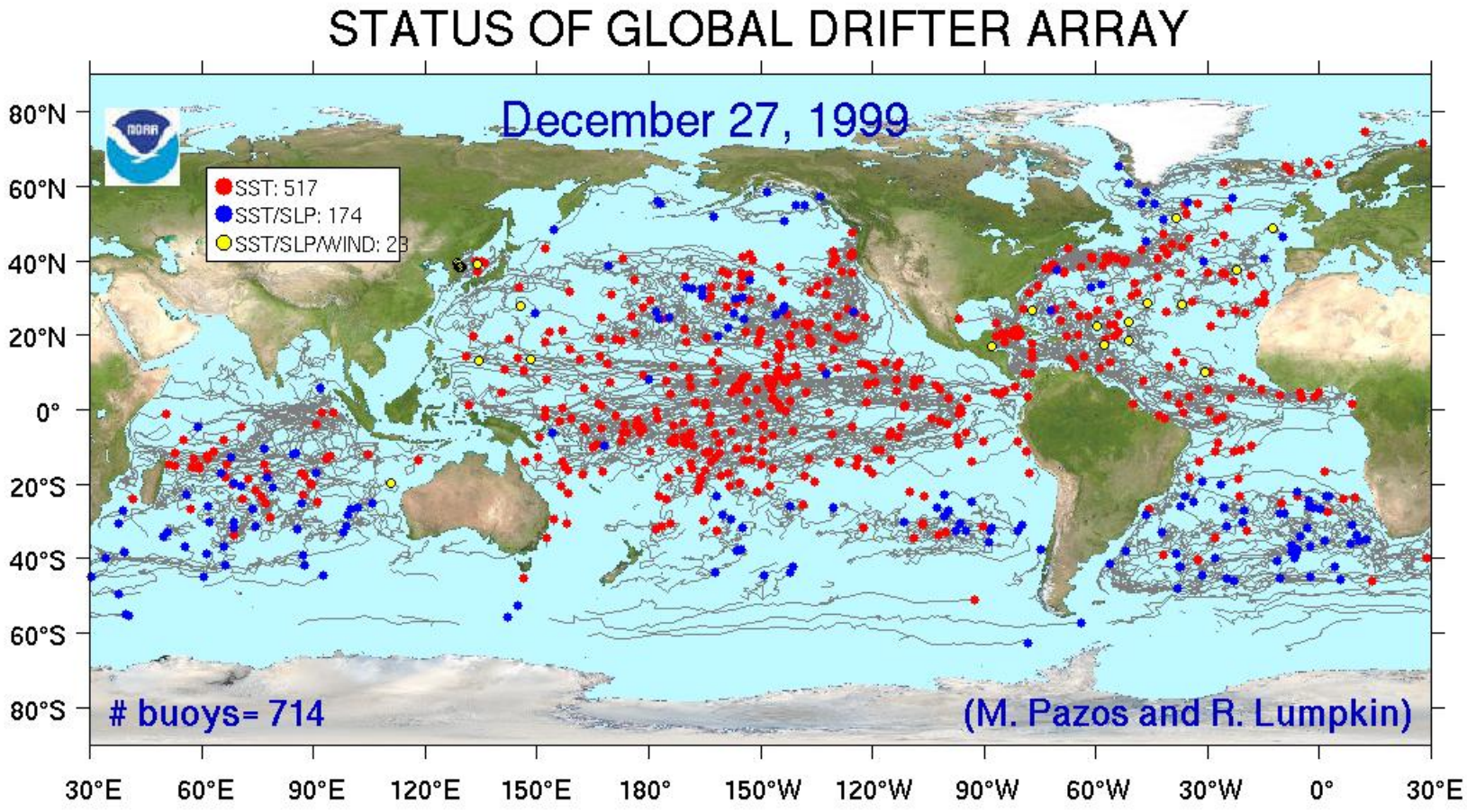

STATUS OF GLOBAL DRIFTER ARRAY
December 25, 1995
SST: 546
SST/SLP: 116
SST/SLP/WIND: 0
buoys= 662
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

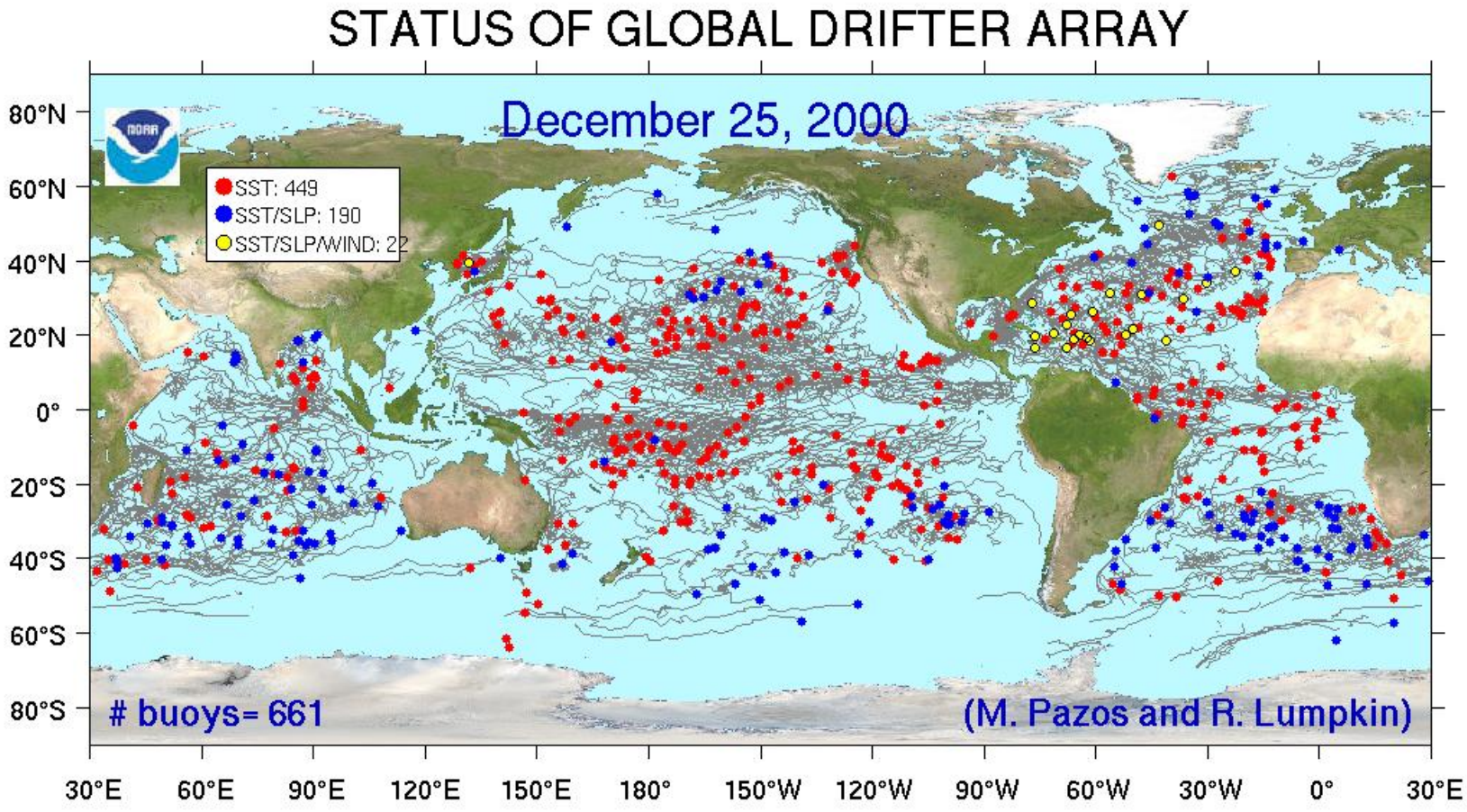

STATUS OF GLOBAL DRIFTER ARRAY
December 30, 1996
SST: 440
SST/SLP: 208
SST/SLP/WIND: 10
buoys= 658
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

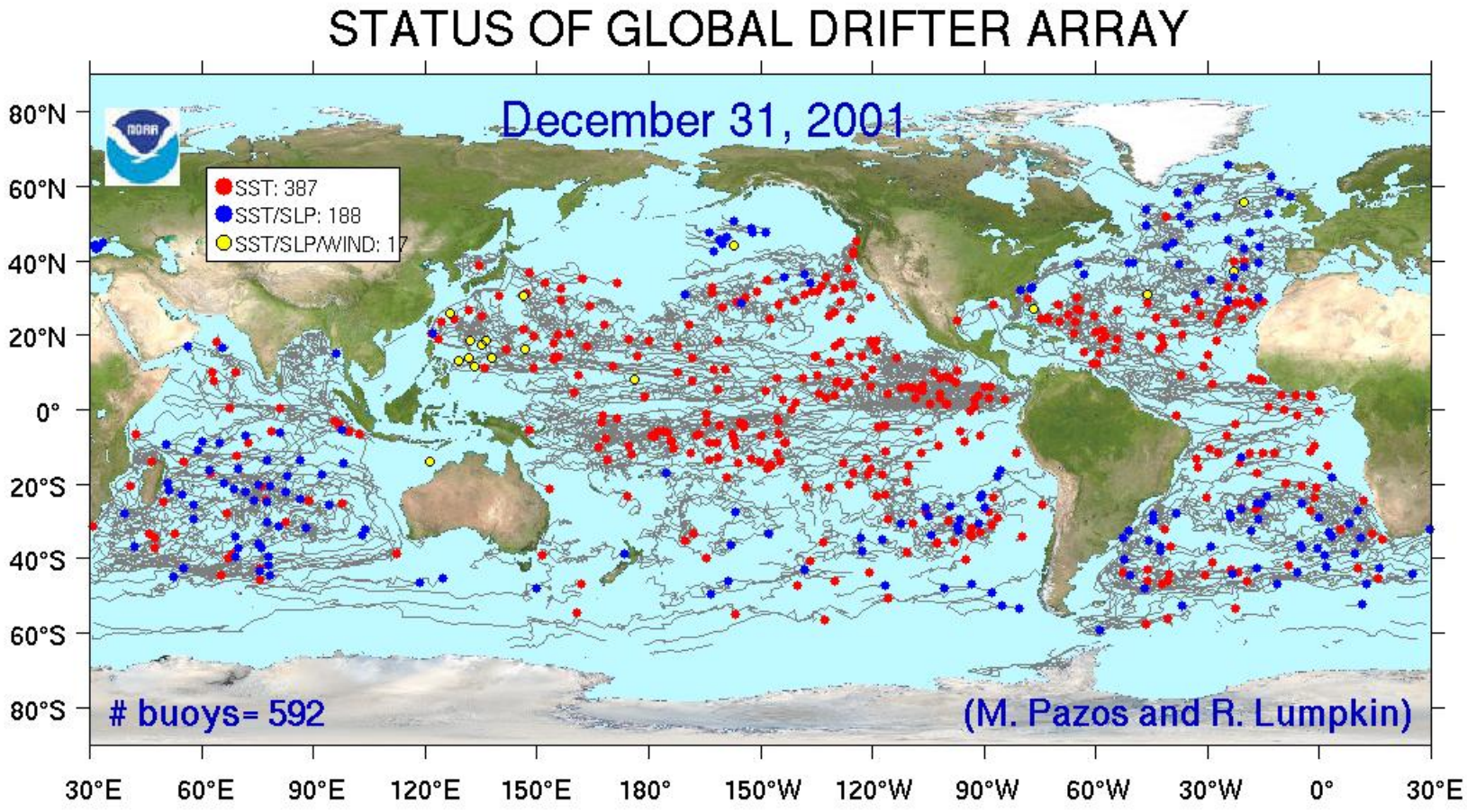


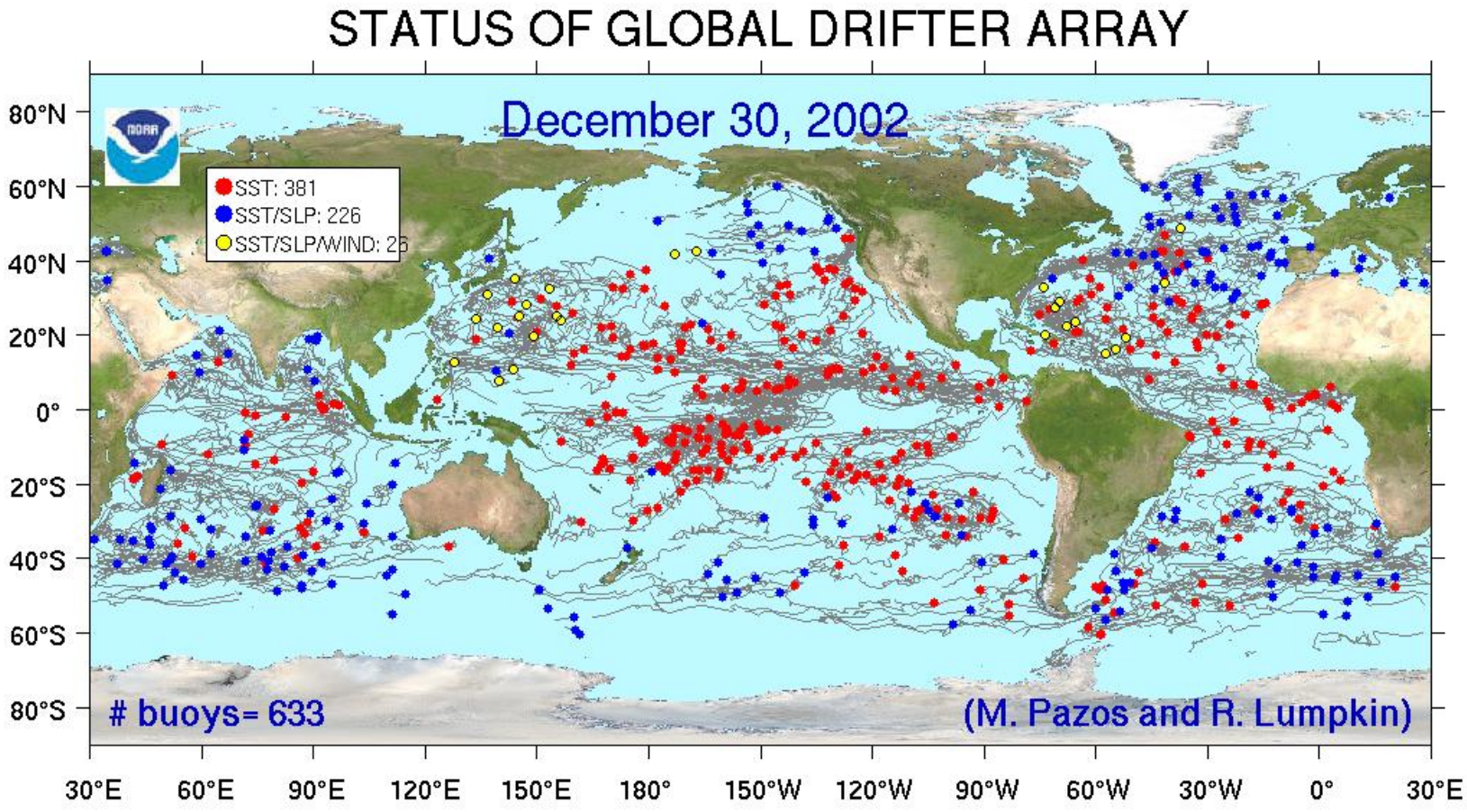
1997: start of sustained Tropical Atlantic deployments

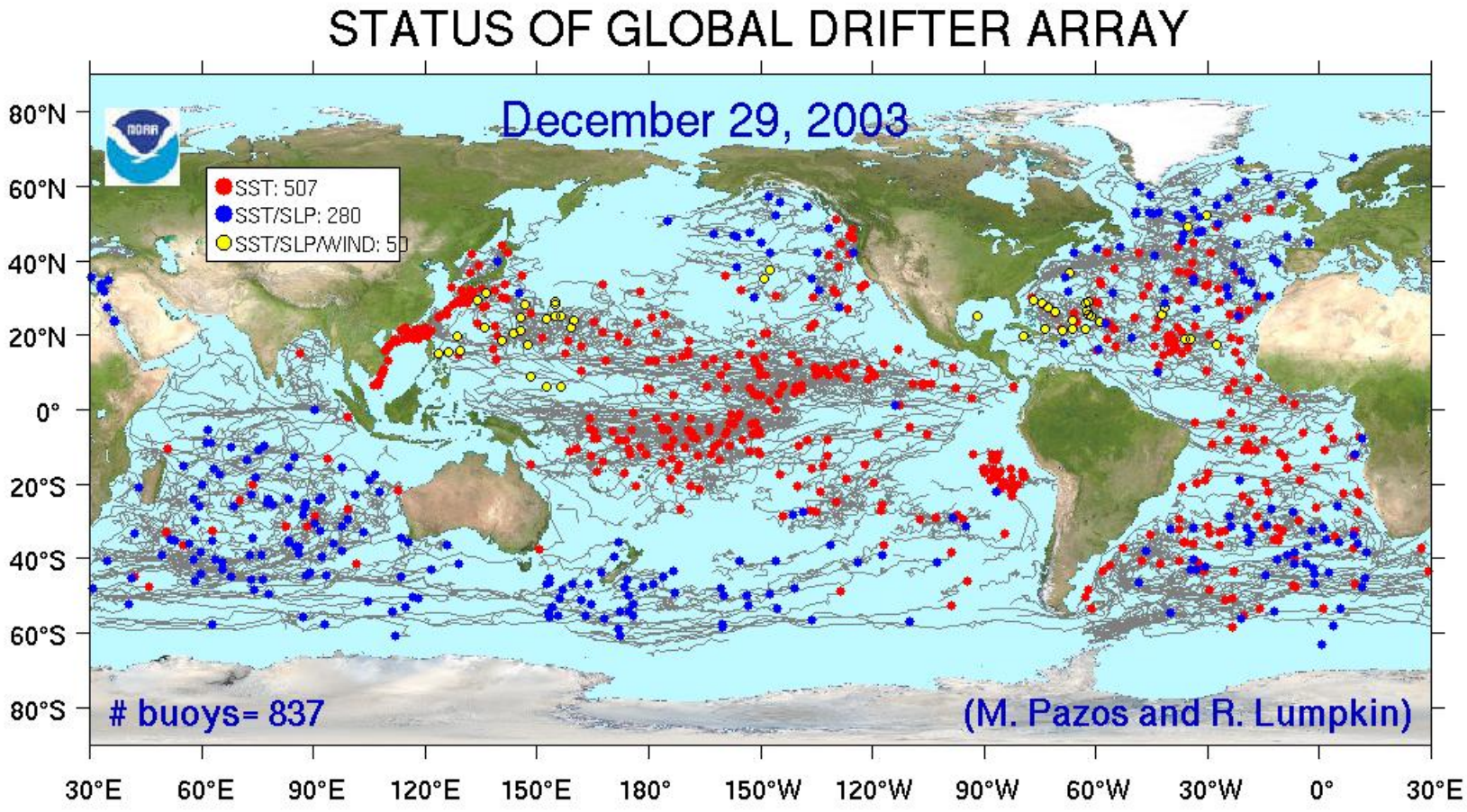

STATUS OF GLOBAL DRIFTER ARRAY
December 28, 1998
SST: 337
SST/SLP: 202
SST/SLP/WIND: 18
buoys= 557
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

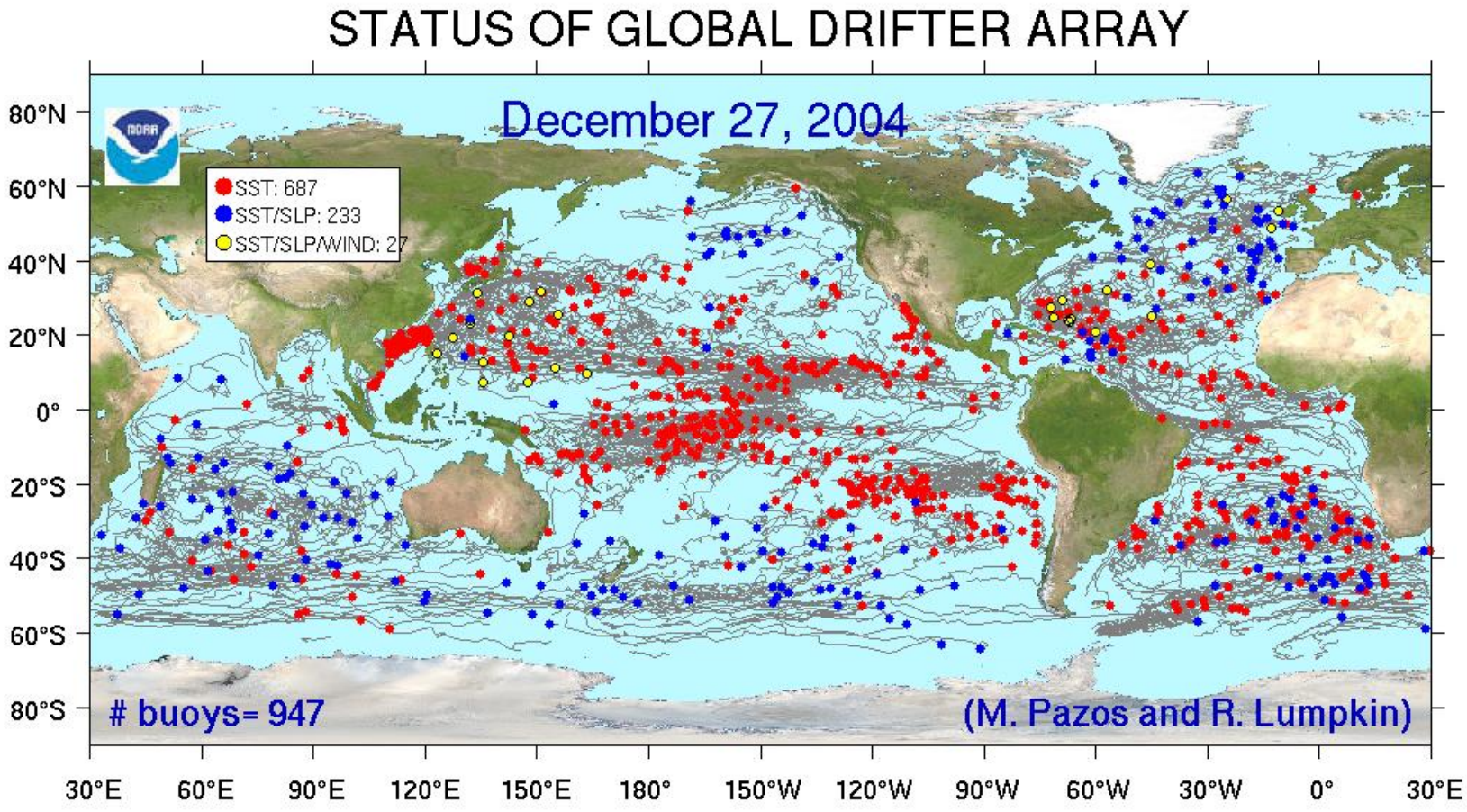

STATUS OF GLOBAL DRIFTER ARRAY
December 27, 1999
SST: 517
SST/SLP: 174
SST/SLP/WIND: 23
buoys= 714
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

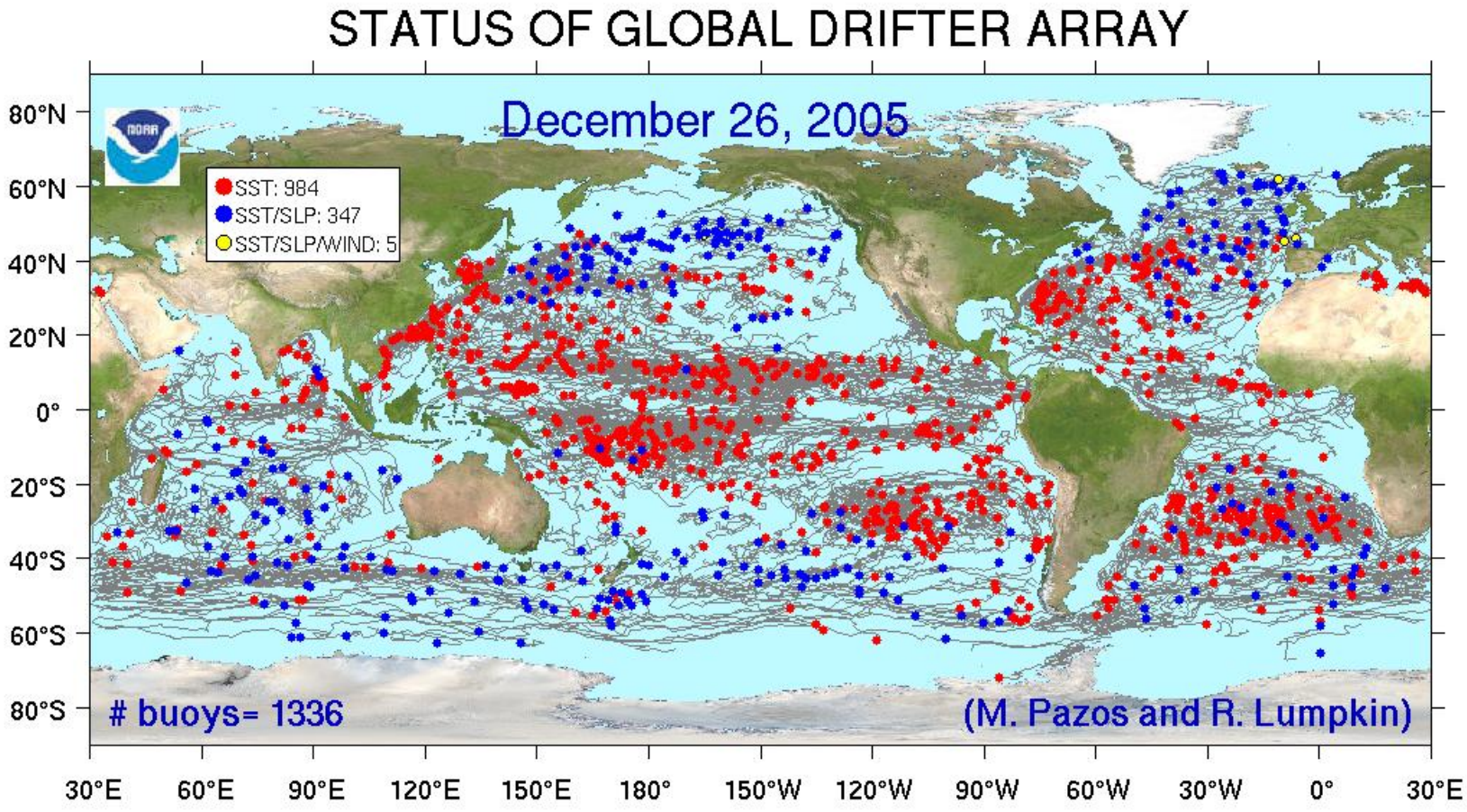

STATUS OF GLOBAL DRIFTER ARRAY
December 25, 2000
SST: 449
SST/SLP: 190
SST/SLP/WIND: 22
buoys= 661
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E


STATUS OF GLOBAL DRIFTER ARRAY
December 31, 2001
SST: 387
SST/SLP: 188
SST/SLP/WIND: 17
buoys= 592
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

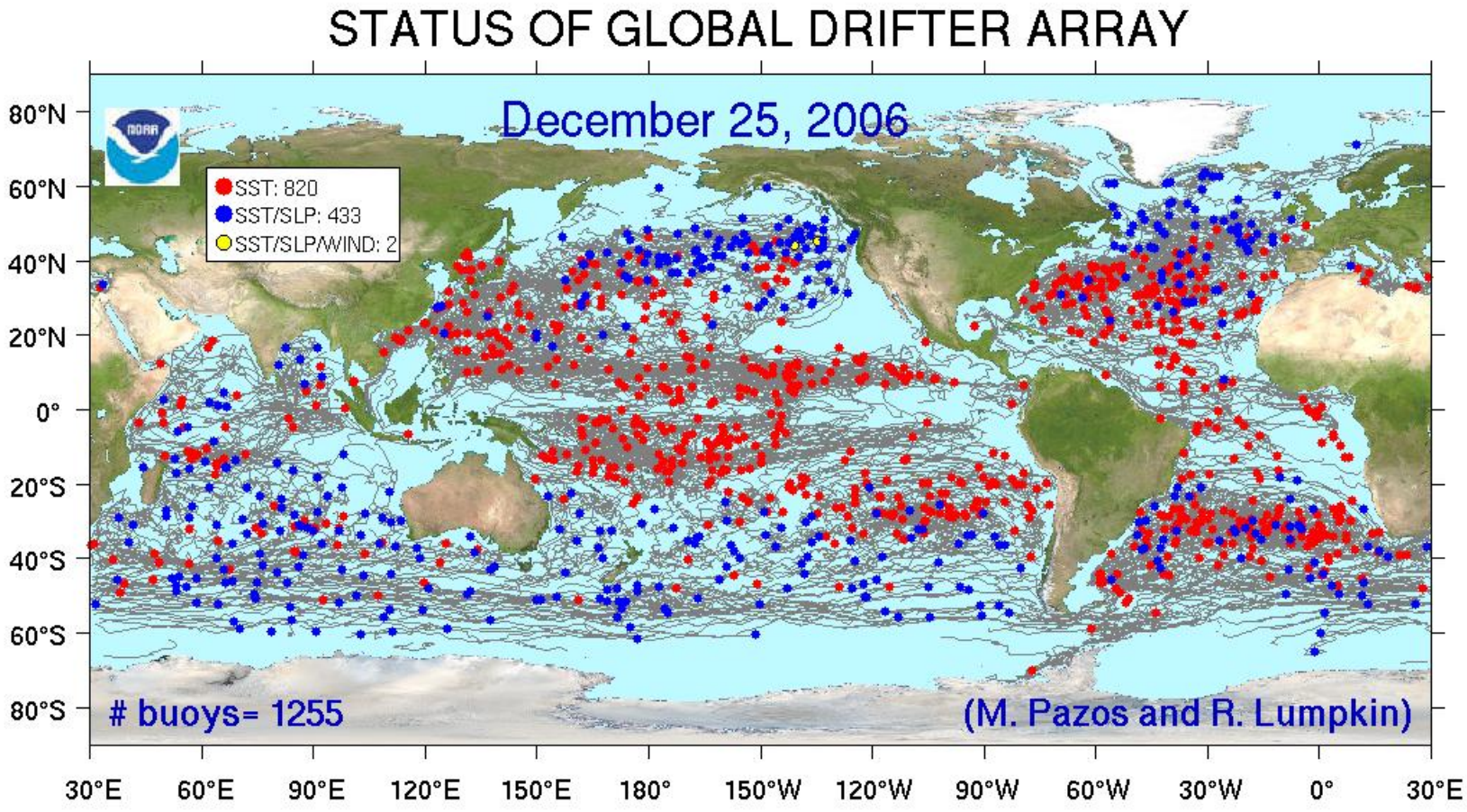

STATUS OF GLOBAL DRIFTER ARRAY
December 30, 2002
SST: 381
SST/SLP: 226
SST/SLP/WIND: 26
buoys= 633
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

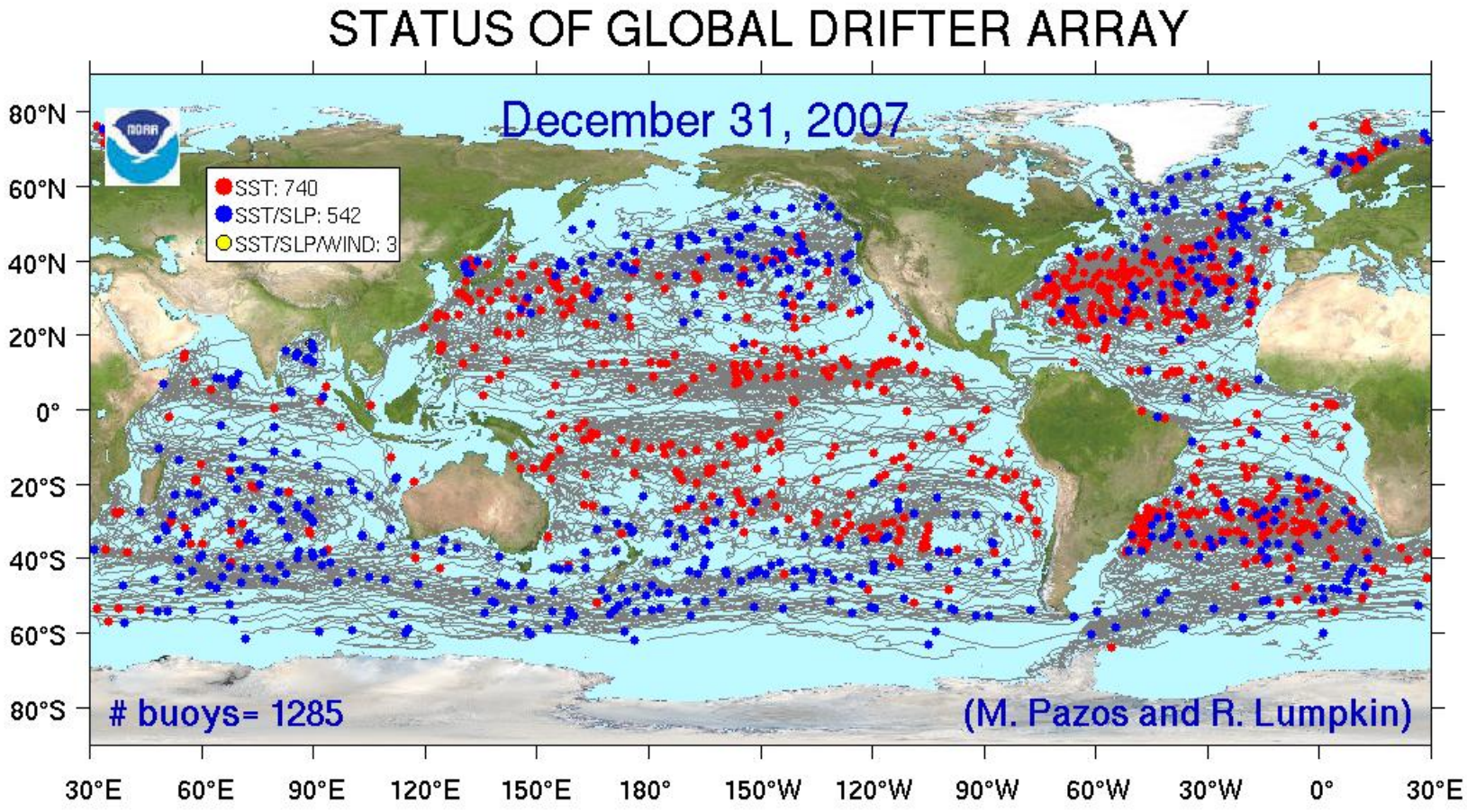

STATUS OF GLOBAL DRIFTER ARRAY
December 29, 2003
SST: 507
SST/SLP: 280
SST/SLP/WIND: 50
buoys= 837
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

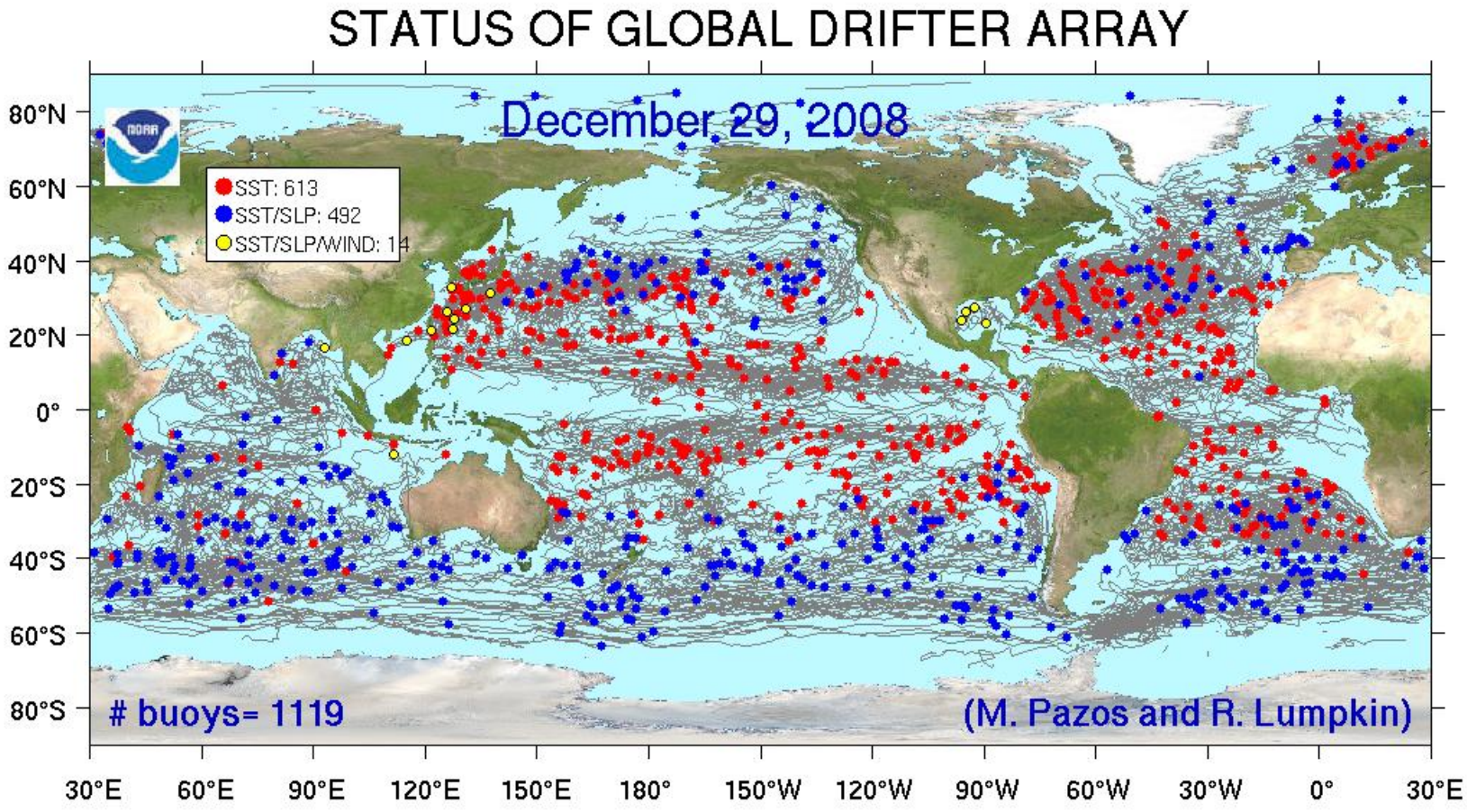

STATUS OF GLOBAL DRIFTER ARRAY
December 27, 2004
SST: 687
SST/SLP: 233
SST/SLP/WIND: 27
buoys= 947
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

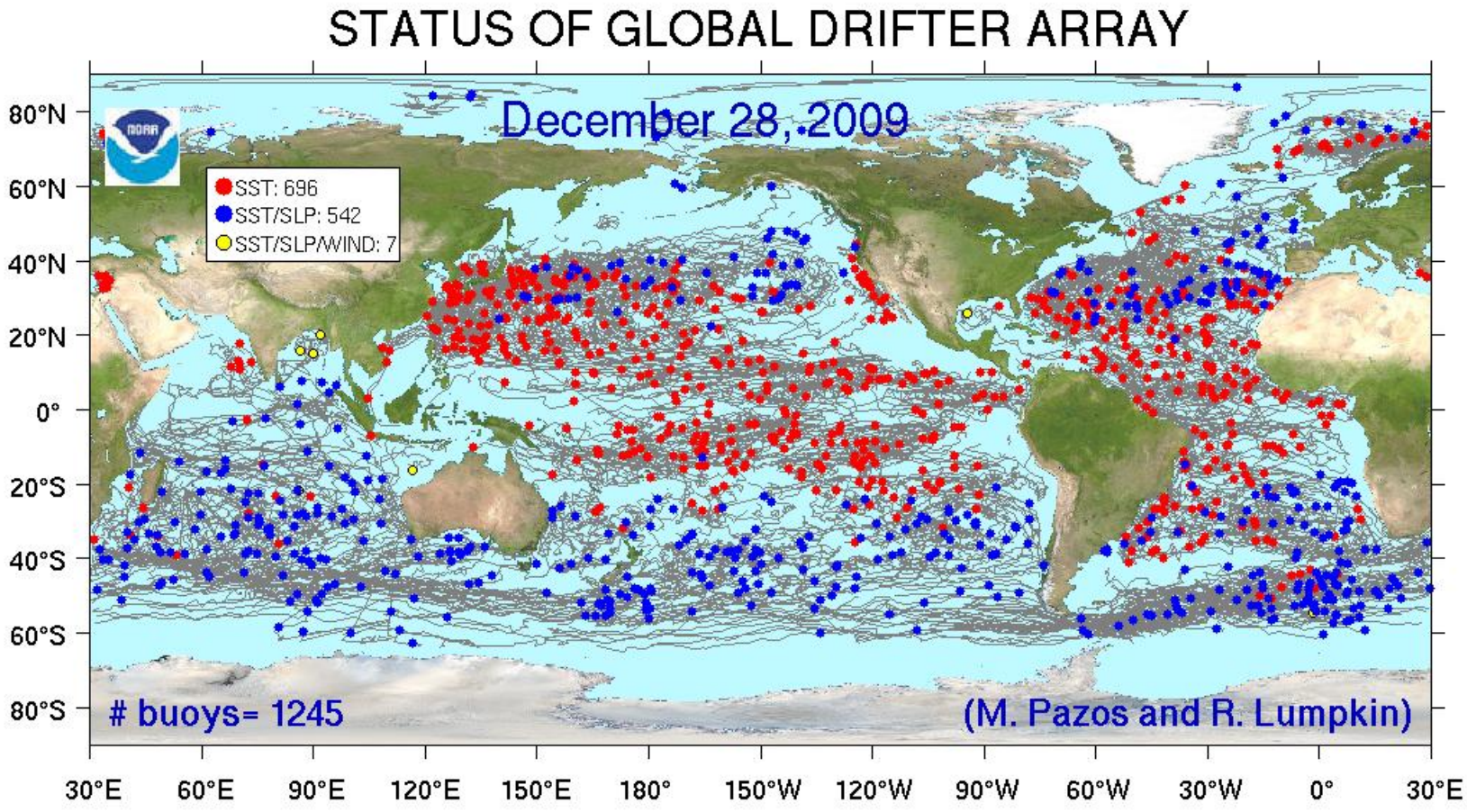


2005: GCOS goal of 1250 drifters reached in September.

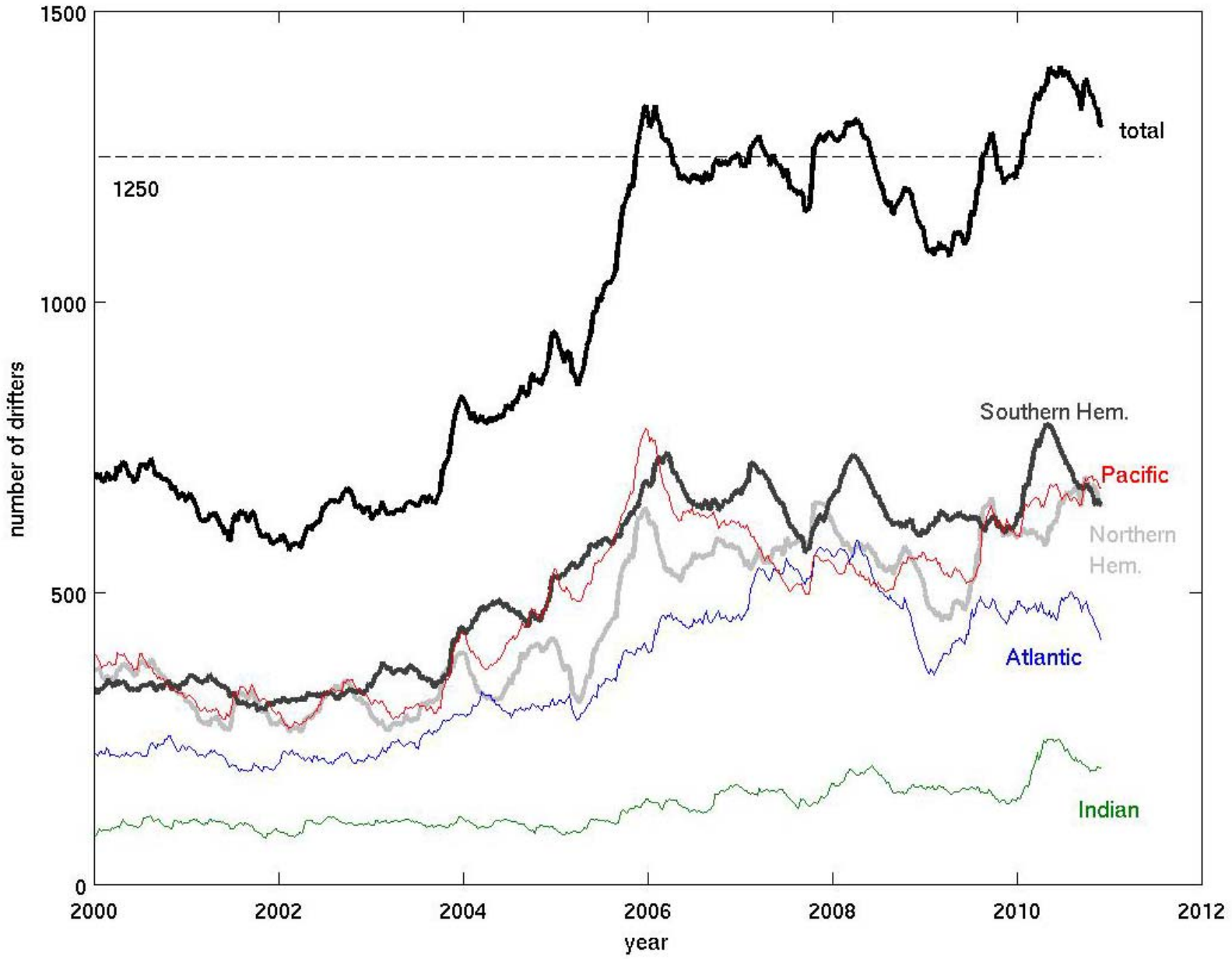

STATUS OF GLOBAL DRIFTER ARRAY
December 25, 2006
SST: 820
SST/SLP: 433
SST/SLP/WIND: 2
buoys= 1255
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E


STATUS OF GLOBAL DRIFTER ARRAY
December 31, 2007
SST: 740
SST/SLP: 542
SST/SLP/WIND: 3
buoys= 1285
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

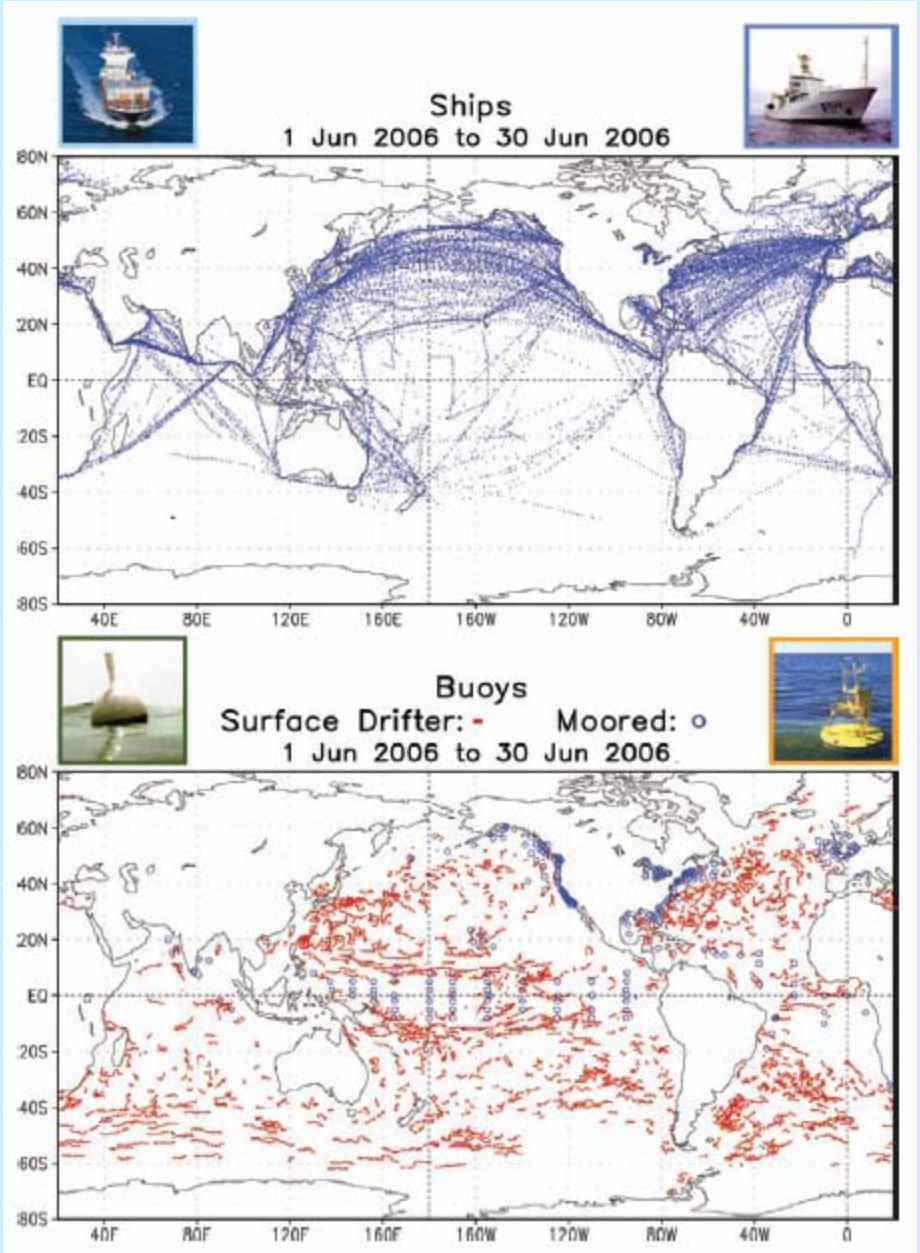

STATUS OF GLOBAL DRIFTER ARRAY
December 29, 2008
SST: 613
SST/SLP: 492
SST/SLP/WIND: 14
buoys= 1119
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E


STATUS OF GLOBAL DRIFTER ARRAY
December 28, 2009
SST: 696
SST/SLP: 542
SST/SLP/WIND: 7
buoys= 1245
(M. Pazos and R. Lumpkin)
80°N
60°N
40°N
20°N
0°
20°S
40°S
60°S
80°S
30°E
60°E
90°E
120°E
150°E
180°
150°W
120°W
90°W
60°W
30°W
0°
30°E

Size of the array vs. time

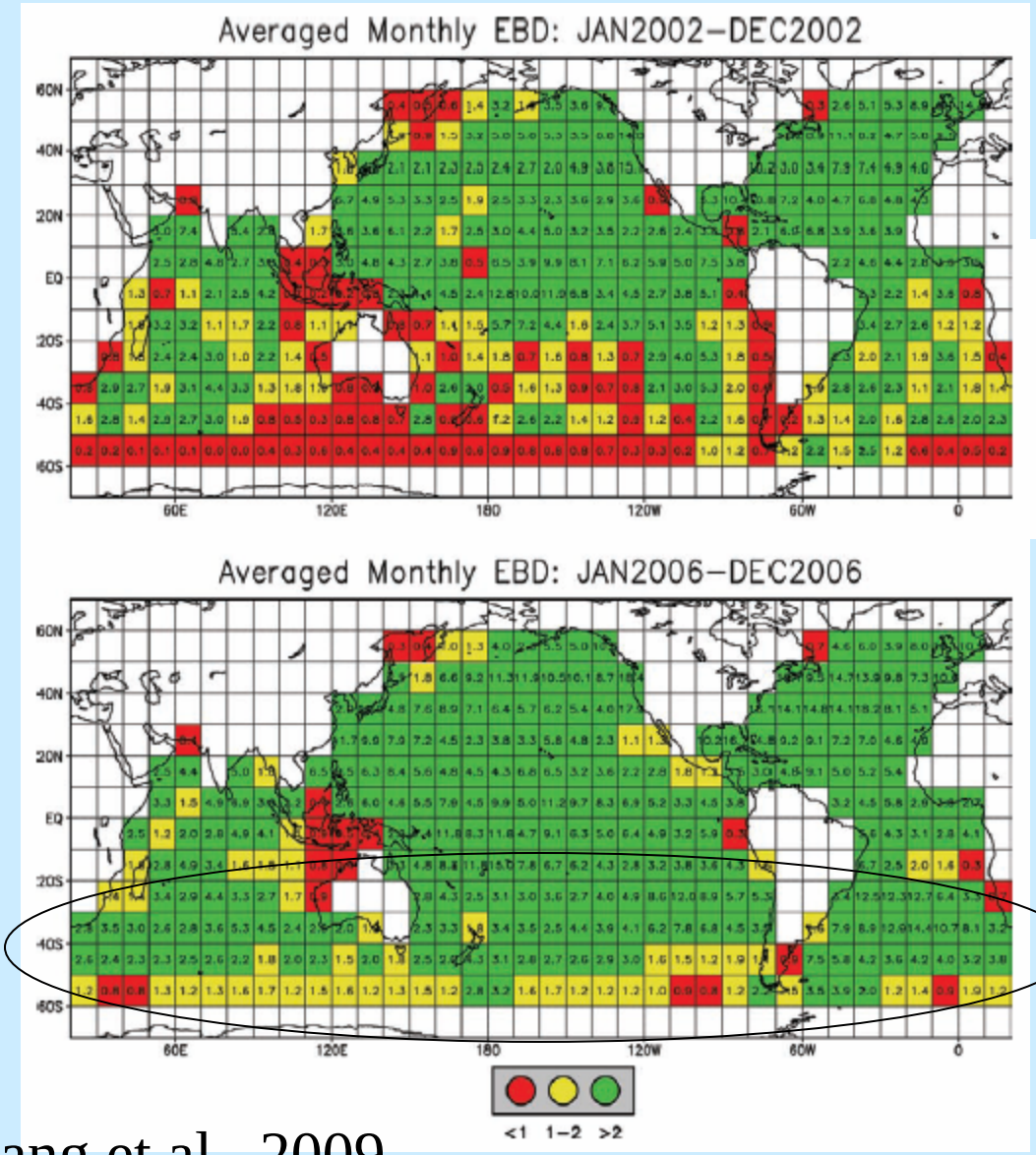


Spatial coverage of SST observations



Zhang et al., 2009

Equivalent buoy density (EBD)



A combined ship–buoy density, Equivalent Buoy Density, is thus defined as

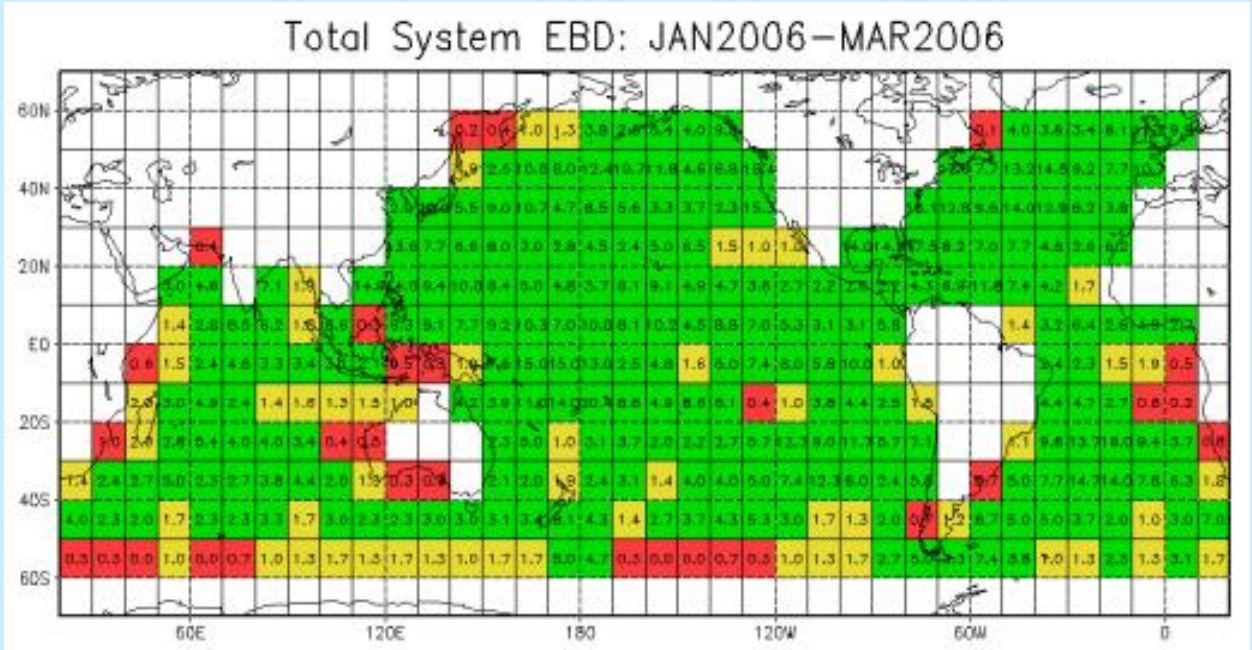
$$\mathrm{EBD} = n_b + \frac{n_s}{7},$$

where n_b and n_s are the independent number of observations from buoys and ships, respectively.

EBD>2 in a 10º box means potential satellite bias error <0.5ºC compared to a maximum of 2ºC.

Large improvement in SO primarily due to drifters

Zhang et al., 2009



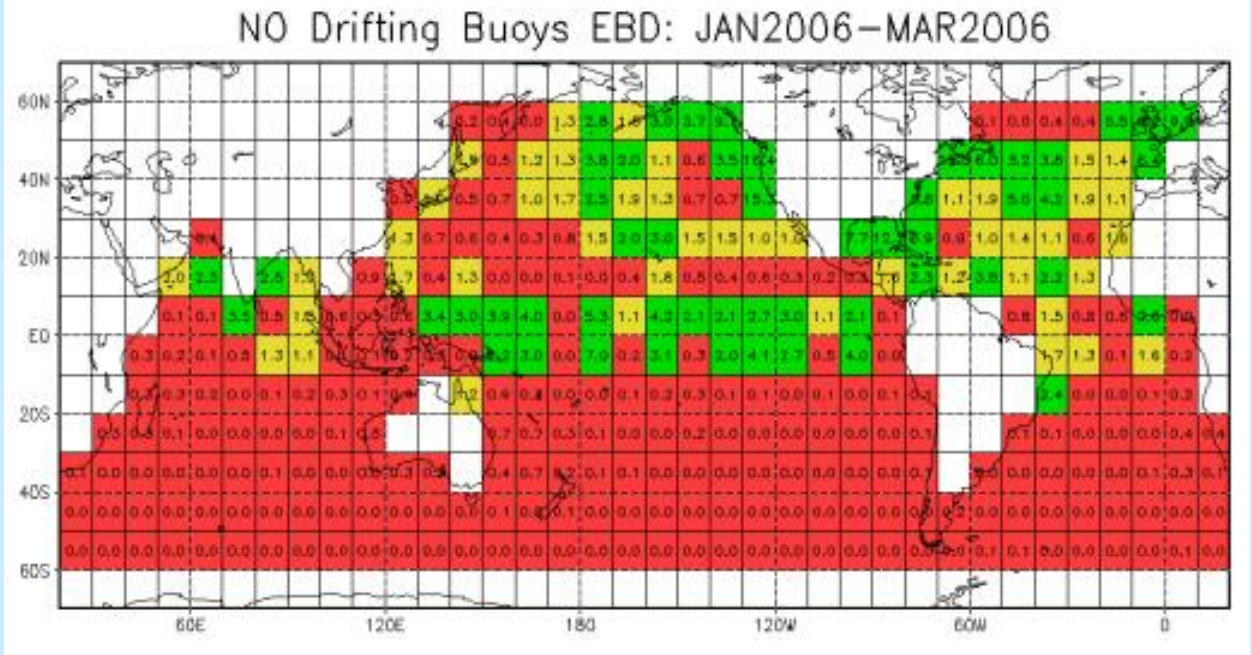
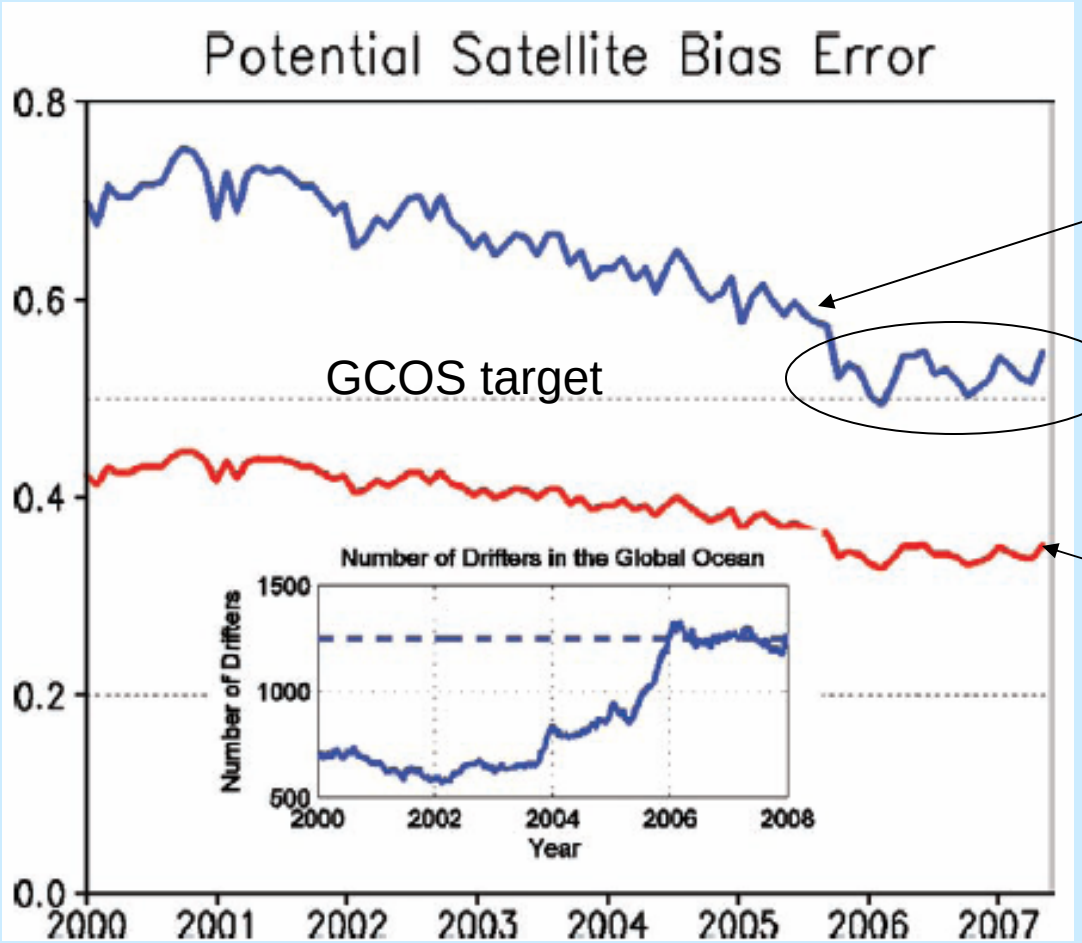


Figure courtesy
Huai-min Zhang,
NOAA/NCDC

Reduction in potential satellite bias error



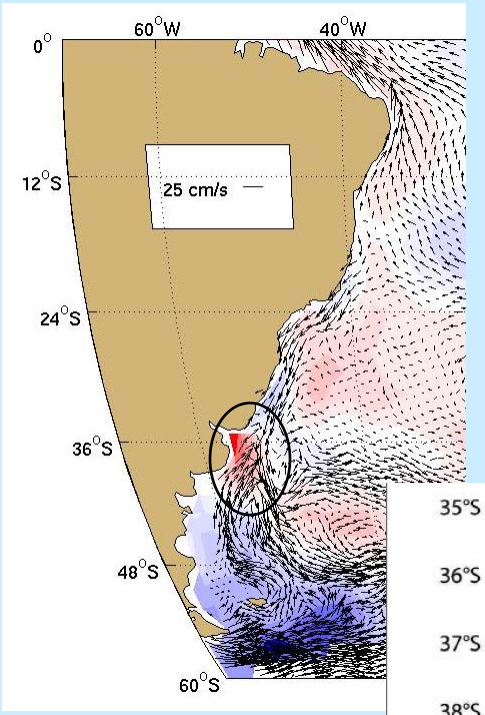
Worst case scenario

Plateau at target

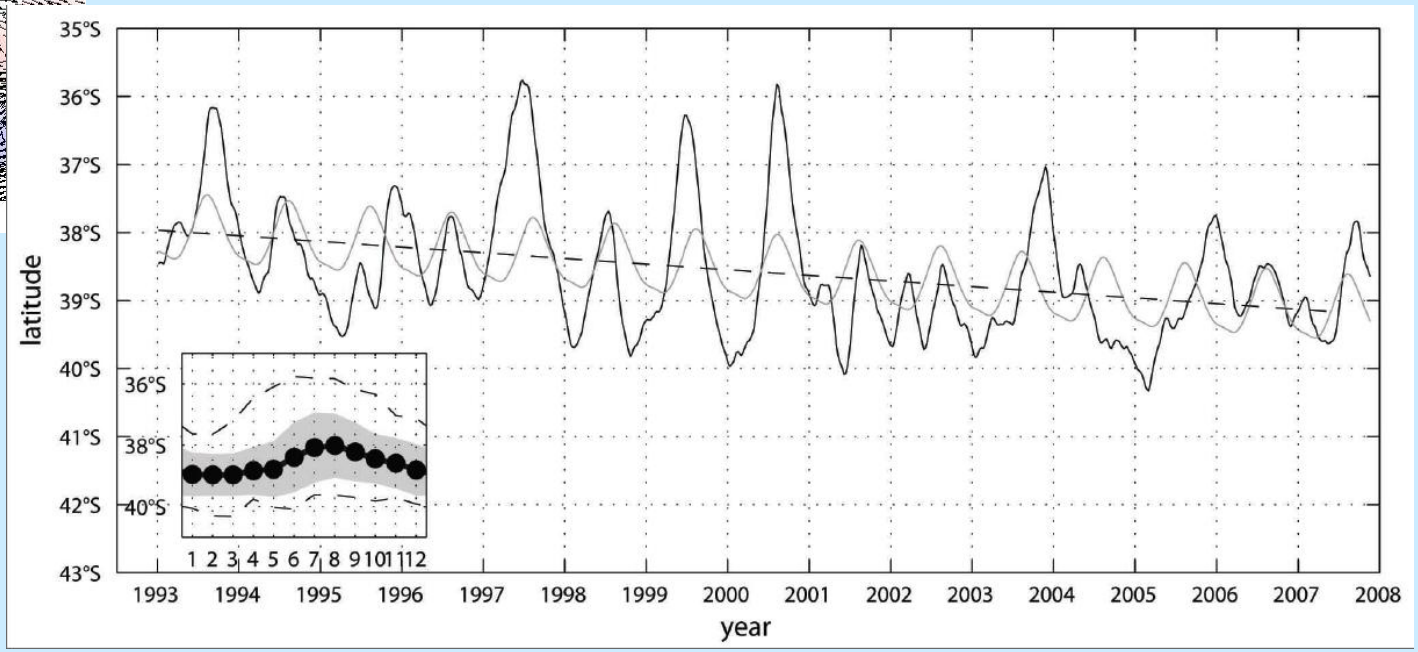
Normal

Zhang et al., 2009

Climate research example

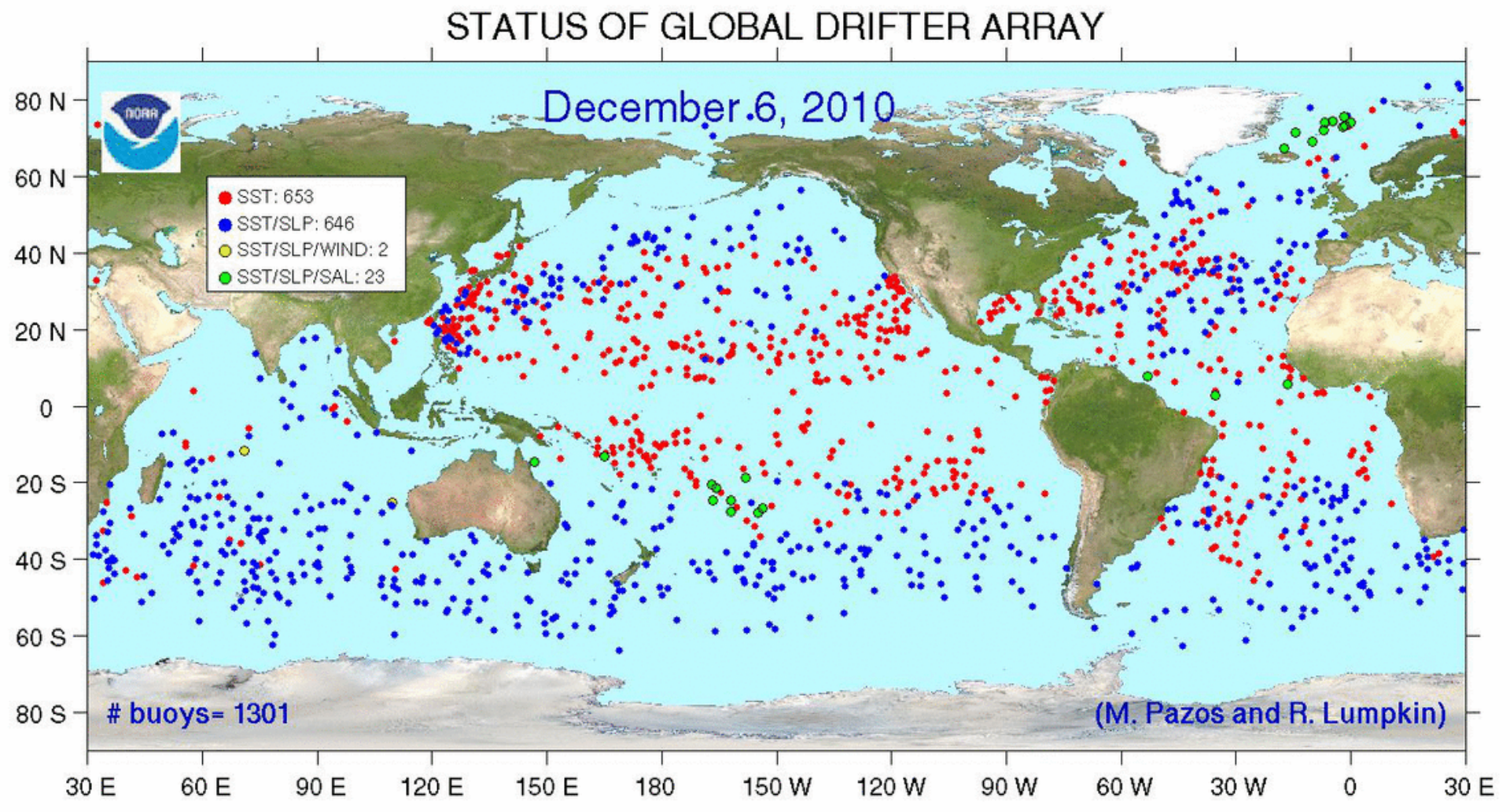


Lumpkin and Garzoli (in press): combine drifter velocity with satellite observations to track long-term changes in Brazil/Malvinas Confluence.



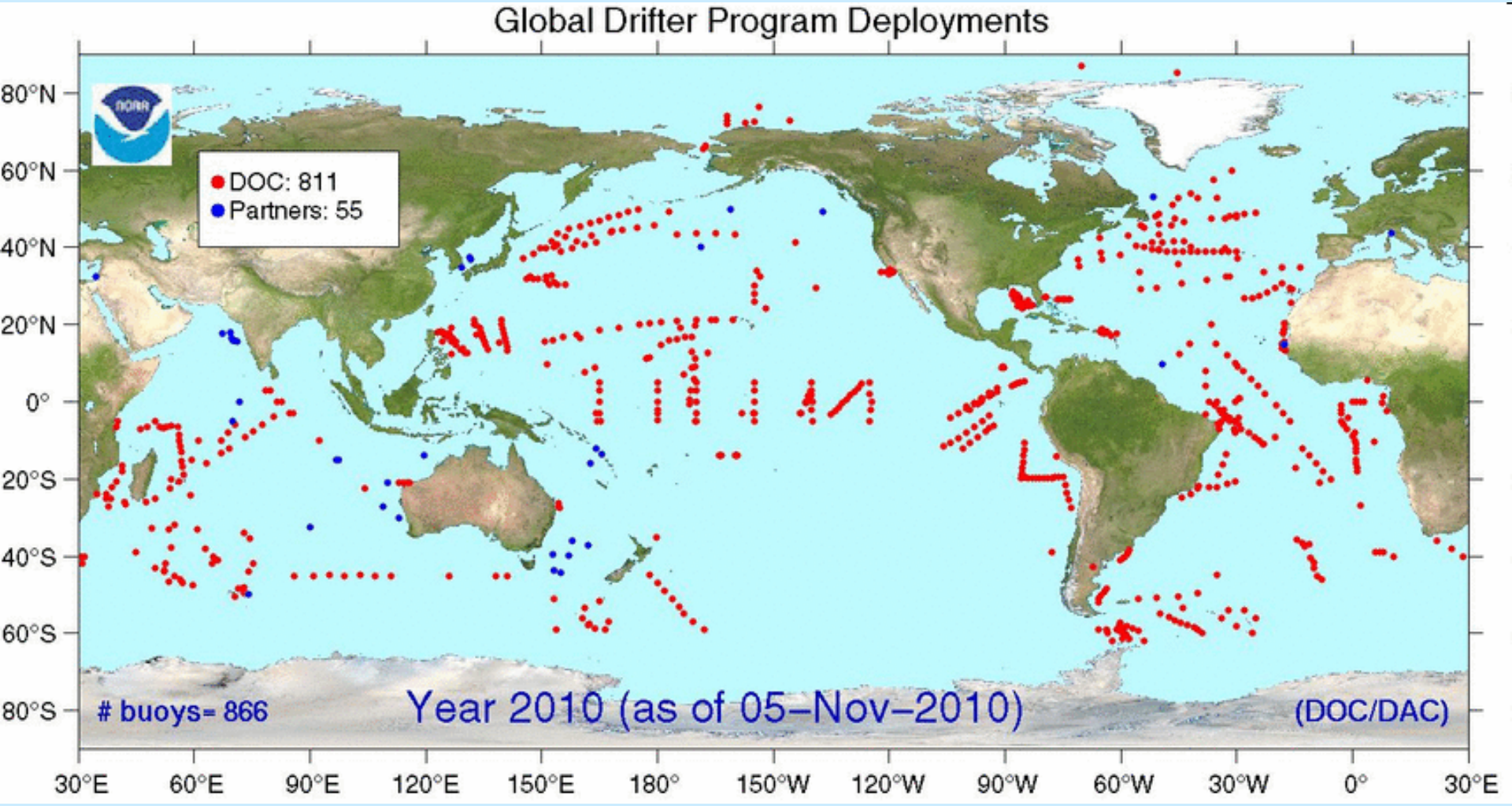
Requirements

Maintain a global array of 1250 drifters at ~5ºx5º, in collaboration with numerous national and international partners.



Drifter deployments arranged from:

- Cargo ships and other Volunteer Observation Ships
- Research Vessels
- Aircraft

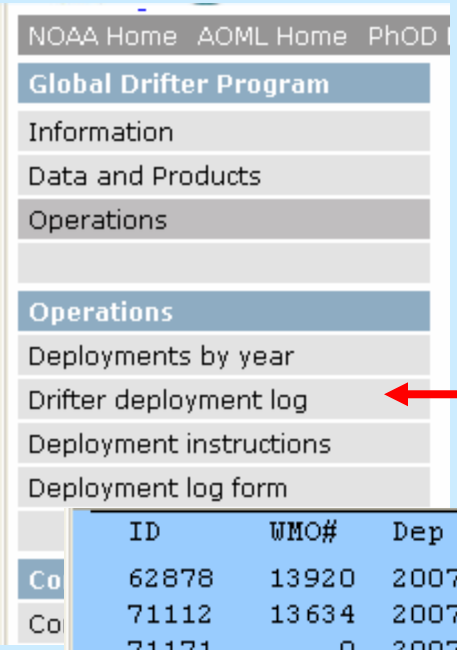


866 drifters deployed

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

2010 Deployment highlights

- 35 across the Pacific Ocean during DART servicing cruise.
- 17 in the central Gulf of Guinea from the R/V *Ronald H. Brown*, CLIVAR line A13.
- ~40 drifters in the western Indian Ocean and 15 in the Gulf of Guinea from various US Navy vessels, as part of the “African Partnership Station II” program.
- 10 from the Argo-chartered *Kaharoa* along 45°S, from 86—141°E.
- 36 from the R/Vs *Walton Smith* and *Nancy Foster* to monitor ocean currents in the Gulf of Mexico, in support of NOAA’s response to the Deepwater Horizon oil spill.

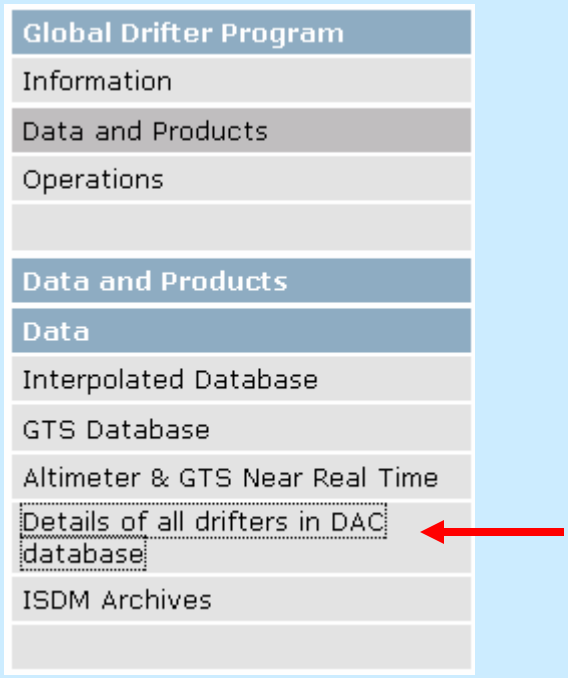


Drifter Deployment Log

ID	WMO#	Dep date	Lat	Long	Ship	Manufacturer	Type	Prgm
62878	13920	2007 05 19 20	26.0N	025 00.4W	RONALD BROWN	!Pacific Gy	SVP3	6129
71112	13634	2007 05 19 20	29.6N	023 04.0W	RONALD BROWN	!Metocean	SVP3	6129
71171	0	2007 05 19 00	00.1N	086 12.4W	JOSEPHINE MAERSK	!Metocean	SVP3	6129
62892	13607	2007 05 15 14	00.3N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62875	13633	2007 05 14 11	28.7N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
63269	0	2007 05 14 09	16.0S	006 22.8E	ATLANTIC ACTION	?Clearwater	SVP3	7325
63915	71697	2007 05 14 60	02 S	063 20.1W	LM GOULD	!Technocean	SVPBD2	7325
63920	33654	2007 05 14 59	00.2S	063 48.0W	LM GOULD	!Technocean	SVPBD2	7325
72184	13636	2007 05 14 11	28.7N	023 00.0W	RONALD BROWN	!Pacific Gy	SVPBD2	6129
36164	17656	2007 05 13 37	07 S	012 03.1W	Tristan	!Technocean	SVPBD2	9325
54355	15603	2007 05 13 05	00 S	004 33.3E	ATLANTIC ACTION	!Clearwater	SVP3	9325
59838	43538	2007 05 13 29	34.5N	128 28.1W	EXPLORER	!Pacific Gy	SVP3	8325
59863	43539	2007 05 13 29	58.6N	127 00.0W	EXPLORER	!Pacific Gy	SVP3	8325
59892	51630	2007 05 13 29	09.1N	130 00.0W	EXPLORER	!Pacific Gy	SVP3	8325
62884	13921	2007 05 13 10	00 N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62249	15601	2007 05 12 01	00 S	002 52.0E	ATLANTIC ACTION	!Clearwater	SVP3	6129
62885	13922	2007 05 12 06	00 N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62891	13924	2007 05 12 08	00.4N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62895	13926	2007 05 12 07	05.4N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62901	13929	2007 05 12 08	00.4N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62882	13925	2007 05 11 04	03.5N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
71170	0	2007 05 11 03	00 N	001 10.5E	ATLANTIC ACTION	!Metocean	SVP3	6129

Directory file

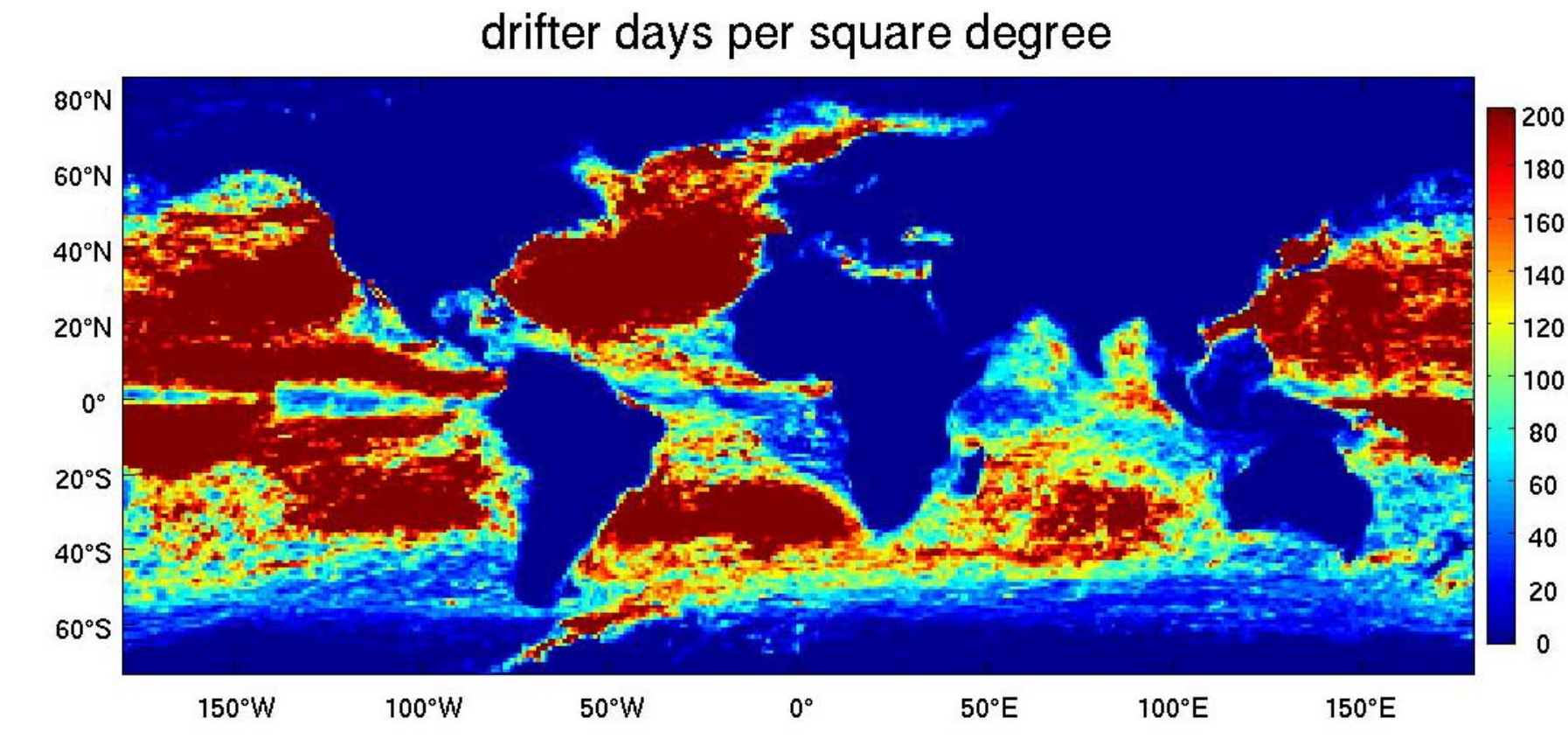
> Details of all drifters in database



LIST AND DETAILS OF ALL BUOYS IN DATABASE AS OF JUNE 30, 2010

ID	WMO	EXP	1st DATE	1st LAT	1st LON	END DATE	END LAT.	END LON.	DROG OFF	DEATH CODES	MANUF.	TYPE
71505	31748	5325	6 27 2010	-24.02	318.08	6 30 2010	-24.66	318.17	0 0	0 0	Clearwater	SVPB
89862	16942	9325	6 27 2010	-49.53	72.80	6 30 2010	-49.66	73.37	0 0	0 0	Technocean	SVPB
90417	31749	5325	6 27 2010	2.07	337.29	6 30 2010	1.95	334.86	0 0	0 0	Clearwater	SVP
41769	15939	6129	6 26 2010	-5.07	343.80	6 30 2010	-4.94	342.32	0 0	0 0	Clearwater	SVP
90418	15948	5325	6 26 2010	-0.96	340.23	6 30 2010	-0.43	339.73	0 0	0 0	Clearwater	SVP
92786	0	8325	6 25 2010	74.98	359.10	6 30 2010	74.62	0.30	0 0	0 0	Pacific Gyr	SVPS
92791	63561	8325	6 25 2010	74.98	359.11	6 30 2010	74.63	0.35	0 0	0 0	Pacific Gyr	SVPS
99241	46909	7325	6 25 2010	36.71	237.41	6 30 2010	36.93	236.66	0 0	0 0	SIO	SVP
92783	64936	8325	6 24 2010	75.00	357.94	6 30 2010	74.63	0.08	0 0	0 0	Pacific Gyr	SVPS
92785	64937	8325	6 24 2010	75.00	357.95	6 30 2010	74.64	0.15	0 0	0 0	Pacific Gyr	SVPS
90146	21967	8325	6 21 2010	41.44	154.76	6 30 2010	41.55	154.73	0 0	0 0	Clearwater	SVPB
92872	44921	8325	6 20 2010	41.91	295.11	6 30 2010	40.61	295.85	0 0	0 0	Pacific Gyr	SVP
71125	13590	6129	6 19 2010	29.15	344.44	6 30 2010	28.84	343.96	0 0	0 0	Metocean	SVP
92869	44906	8325	6 19 2010	41.59	296.99	6 30 2010	42.29	297.16	0 0	0 0	Pacific Gyr	SVP
92870	44907	8325	6 19 2010	41.73	296.30	6 30 2010	42.83	296.92	0 0	0 0	Pacific Gyr	SVP
92871	44916	8325	6 19 2010	41.77	295.93	6 30 2010	41.31	295.65	0 0	0 0	Pacific Gyr	SVP
92881	44929	8325	6 19 2010	40.61	300.82	6 30 2010	41.03	310.32	0 0	0 0	Pacific Gyr	SVP
92882	44939	8325	6 19 2010	40.67	301.98	6 30 2010	40.77	302.63	0 0	0 0	Pacific Gyr	SVP
92883	44940	8325	6 19 2010	41.18	300.01	6 30 2010	39.13	307.64	0 0	0 0	Pacific Gyr	SVP
92884	44941	8325	6 19 2010	41.31	299.04	6 30 2010	42.19	300.23	0 0	0 0	Pacific Gyr	SVP
67849	33945	7325	6 18 2010	-45.89	292.76	6 30 2010	-46.25	292.88	0 0	0 0	Clearwater	SVPB
67850	33947	7325	6 18 2010	-45.88	292.79	6 30 2010	-46.22	292.81	0 0	0 0	Clearwater	SVPB
67876	33948	7325	6 18 2010	-45.89	292.81	6 30 2010	-45.95	292.71	0 0	0 0	Clearwater	SVPB
67877	33949	7325	6 18 2010	-45.89	292.68	6 30 2010	-46.14	292.78	0 0	0 0	Clearwater	SVPB
67880	33950	7325	6 18 2010	-45.85	292.71	6 30 2010	-46.17	292.72	0 0	0 0	Clearwater	SVPB

Challenges



The GDP is not funded to charter vessels – we rely on ships of opportunity and research cruises. Reliance on other components of the ocean observing system (SOOP, XBTs, tropical moored array, Argo, etc.).

Methods

A drifter weighs about 44 lbs (20kg) and is about 16” high and 25” across.

It is designed to be simple to deploy, by a single person, from the lowest possible deck (preferably less than 10 meters including heave) near the stern. The ship may be traveling between 2 and 25 knots.

Methods

DEPLOYMENT INSTRUCTIONS

Read Carefully

FOLD

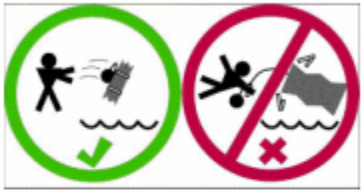
1. Remove plastic wrap 	2. DO NOT REMOVE paper tape, cardboard, or anything BUT plastic. 
3. Throw buoy in water. 	

Version 7.00

DEPLOYMENT INSTRUCTIONS for SVP AND SVP-BAROMETER DRIFTERS

Remove the buoys from the shipping container. REMOVE ONLY the plastic shrink-wrap. DO NOT REMOVE paper tape securing the drogue and tether. DO NOT REMOVE cardboard surrounding the float.

DANGER: DO NOT REMOVE the paper tape securing the tether and drogue. If you do, the drogue and/or tether can unfurl during deployment and cause injury!



2) Record the five digit ID number of the drifter. This number can be found on the shipping container, the plastic shrink-wrap or the protective cardboard box. It is also inscribed on the surface float.

3) If testing the buoy is desired prior to deployment, the magnet can be removed from the buoy by separating it from the float through a hole in the box surrounding the float. This action will start the ARGOS transmitter for testing. Re-attaching the magnet in the same position will turn off the transmitter and reset the program starting point. The transmitter will restart on its original program when the magnet is again removed.

4) Throw the buoy from the storm leeward possible deck (preferably less than 10 meters including leaves), into the sea. The ship may be traveling between 2 - 25 knots. The tether and drogue are secured with paper tape that will dissolve in the water.

5) Record the date, time (GMT) and location of deployment as well as the five digit ID, and send this information to the Global Drifter Program.

Thank you very much for your help!

CONTACT PERSON:
Craig A. Engler, Global Drifter Program
NOAA/AOML/PhOD, 4301 Rickenbacker Cswy, Miami, FL 33149, USA
Tel: 305-361-4439 Fax: 305-361-4366 Telex: 6507457401
email: Craig.Engler@noaa.gov
Web site: http://www.aoml.noaa.gov/phod/dac/dcp_form.html

****

Sample log sheet

ID	Date	Time (GMT)	Latitude	Longitude
~~xxxxx~~	mm/dd/yy	hh:mm	DD mm.mm N/S	DDD mm.mm E/W
_____	___/___/___	___:___	___ _____ __	___ _____ __

Version 7.00

Packaging

Methods: how to deploy

1. Remove plastic wrap.

Methods: how to deploy

1. Remove plastic wrap.
2. Record 5-digit ID number (for deployment report).

Methods: how to deploy

1. Remove plastic wrap.
2. Record 5-digit ID number (for deployment report).
3. Throw drifter in water.

Methods: how to deploy

Sample log sheet

ID	Date	Time (GMT)	Latitude	Longitude
xxxxx	mm/dd/yy	hh:mm	DD mm.mm NS	DDD mm.mm EW
_____	___/___/___	___:___	___ _____ __	___ _____ __

1. Remove plastic wrap.
2. Record 5-digit ID number (for deployment report).
3. Throw drifter in water.
4. Fill out deployment report and sent to NOAA/AOML (e-mail address given in instructions accompanying drifter).

Tether and drogue secured with paper tape that will dissolve in water

Drogue starts sinking minutes after deployment

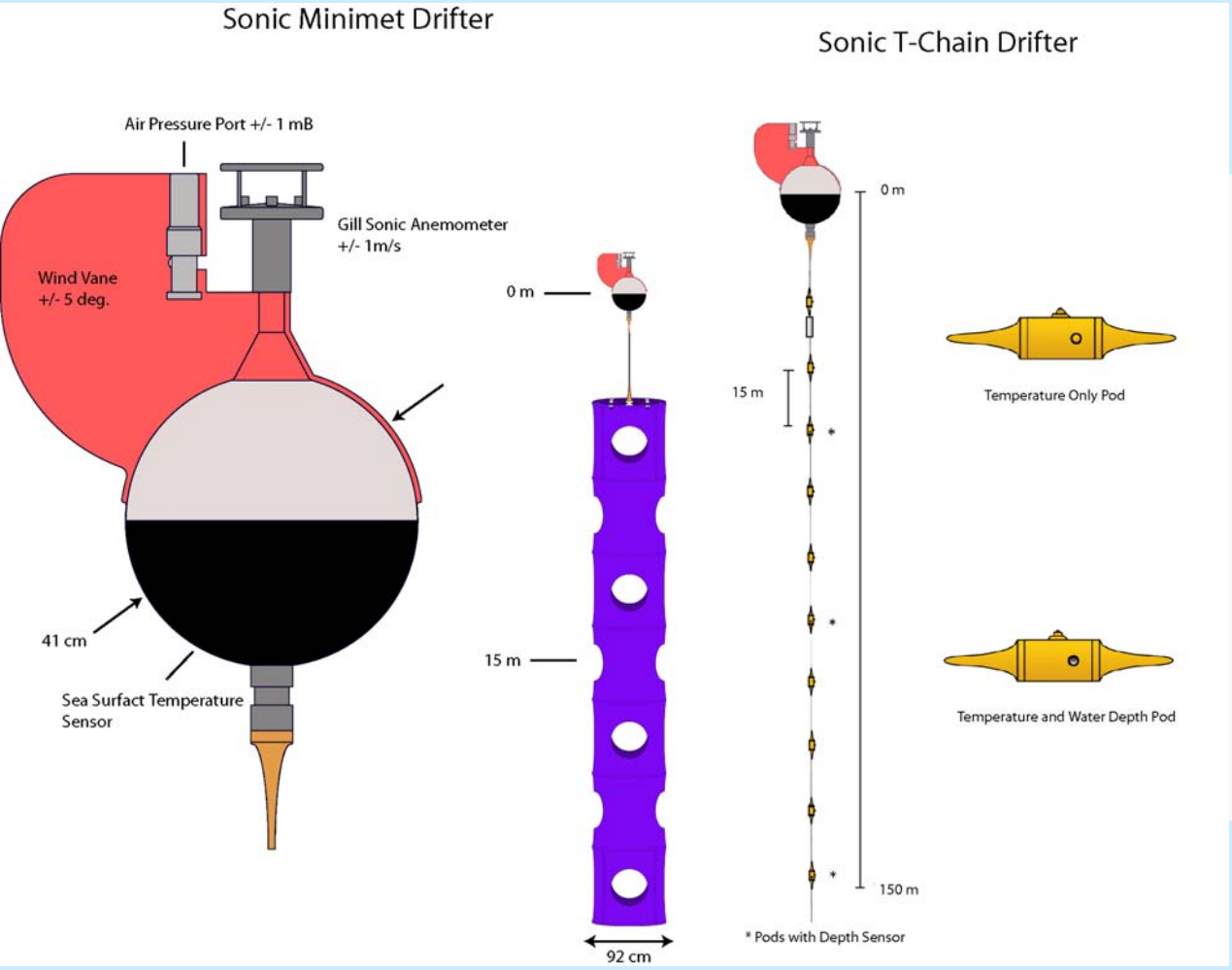
Drogue stretches vertically, when tape dissolves

Safety Measures

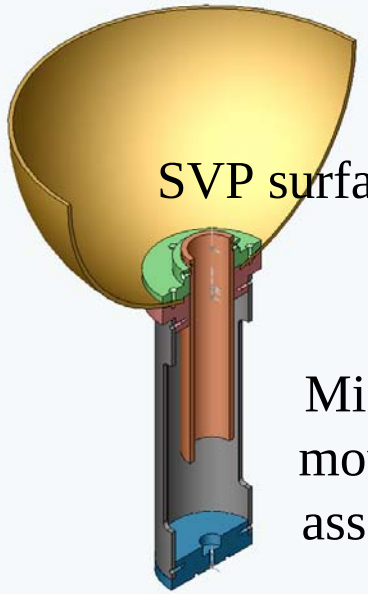
Paper tape is used to secure the drogue and tether. This warning label is prominently displayed on the tape and in the deployment instructions.

In high wind, an unfurled drogue can become a kite, becoming a potential hazard. An unfurled tether can be compromised (kinked) and can become entangled.

experimental drifters



Salinity drifter



SVP surface float

Microcat
mounting
assembly

2011: goals and plans for the GDP

Deploy ~1000 drifters from commercial vessels and research ships.

<u>MAINTAIN</u> 1250 drifters at a nominal resolution of 5° x 5°.

Continue to update quality-controlled interpolated database.

Evaluate performance of various manufacturers' drifters.

Continue to participate in Data Buoy Cooperation Panel activities and projects.

Continue to evaluate array evolution, drogue presence and drogue lifetime.

Prepare for large-scale deployments of salinity-measuring 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 Metereologia; 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 Dvelopment 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

Extra slides

Metadata

Metadata ***describes*** the characteristics of the data. The drifter metadata describes:

- Argos ID number
- GDP unique ID
- WMO number
- Program number
- Contact Information
- Deployment time, latitude and longitude
- Manufacturer
- Buoy type
- Drogue type, length, and brief description of its characteristics
- Sensors transfer functions
- Track inventory of drifters, both in storage and in transit

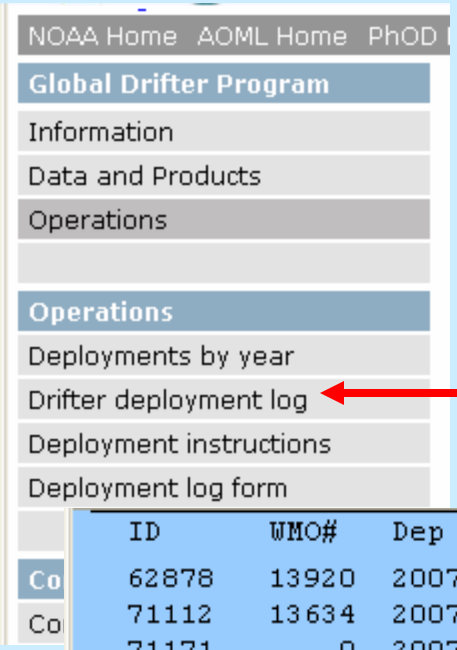
Metadata helps ***share*** reliable information, and ***maintain*** homogeneity of the database

Without METADATA no data set is complete

Metadata

Drifter metadata inclues:

- Argos or Iridium ID (transmitter) number
- GDP unique ID
- WMO number
- Program number
- Contact Information
- Deployment time, latitude and longitude
- Manufacturer
- Buoy type
- Drogue type, length, and brief description of its characteristics
- Sensors transfer functions
- Track inventory of drifters, both in storage and in transit



Sample Drifter Deployment Log

ID	WMO#	Dep date	Lat	Long	Ship	Manufacturer	Type	Prgm
62878	13920	2007 05 19 20	26.0N	025 00.4W	RONALD BROWN	!Pacific Gy	SVP3	6129
71112	13634	2007 05 19 20	29.6N	023 04.0W	RONALD BROWN	!Metocean	SVP3	6129
71171	0	2007 05 19 00	00.1N	086 12.4W	JOSEPHINE MAERSK	!Metocean	SVP3	6129
62892	13607	2007 05 15 14	00.3N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62875	13633	2007 05 14 11	28.7N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
63269	0	2007 05 14 09	16.0S	006 22.8E	ATLANTIC ACTION	?Clearwater	SVP3	7325
63915	71697	2007 05 14 60	02 S	063 20.1W	LM GOULD	!Technocean	SVPBD2	7325
63920	33654	2007 05 14 59	00.2S	063 48.0W	LM GOULD	!Technocean	SVPBD2	7325
72184	13636	2007 05 14 11	28.7N	023 00.0W	RONALD BROWN	!Pacific Gy	SVPBD2	6129
36164	17656	2007 05 13 37	07 S	012 03.1W	Tristan	!Technocean	SVPBD2	9325
54355	15603	2007 05 13 05	00 S	004 33.3E	ATLANTIC ACTION	!Clearwater	SVP3	9325
59838	43538	2007 05 13 29	34.5N	128 28.1W	EXPLORER	!Pacific Gy	SVP3	8325
59863	43539	2007 05 13 29	58.6N	127 00.0W	EXPLORER	!Pacific Gy	SVP3	8325
59892	51630	2007 05 13 29	09.1N	130 00.0W	EXPLORER	!Pacific Gy	SVP3	8325
62884	13921	2007 05 13 10	00 N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62249	15601	2007 05 12 01	00 S	002 52.0E	ATLANTIC ACTION	!Clearwater	SVP3	6129
62885	13922	2007 05 12 06	00 N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62891	13924	2007 05 12 08	00.4N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62895	13926	2007 05 12 07	05.4N	023 00.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62901	13929	2007 05 12 08	00.4N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
62882	13925	2007 05 11 04	03.5N	022 59.0W	RONALD BROWN	!Pacific Gy	SVP3	6129
71170	0	2007 05 11 03	00 N	001 10.5E	ATLANTIC ACTION	!Metocean	SVP3	6129

Sample Specification Sheet

Manufacturers are required to send DAC specification sheets

Argos ID(s) 70850-70857

Manufacturer
Technocean

Sensor array
SVPB Battery voltage, drogue sensor, SST, barometer

Surface float description
41 cm. diameter, ABS plastic surface float.

Tether description
a) 0.32 cm OD polypropylene-impregnated wire rope between surface
float and drogue.
b) Tether attachment to 2.0 cm steel ring at base of surface float;
marine epoxy filled cavity surrounding ring for restraint.
c) 5 cm dia. by 32 cm long polyurethane strain relief molded below
surface float. Attachment point of tether to drogue hub covered by 5 cm
dia. by 32 cm long polyurethane strain relief.

Drogue description
a) Holey sock made from Cordura nylon cloth; diameter 61 cms, length 610
cms. construction consists of 5 cylindrical sections, each 122 cms long. Two
30 cm dia. holes cut opposite each other in each section. Axis joining holes
is rotated by 90° between successive sections. Drogue is centered at 15 m.

Drogue depth
15 m at center

Drogue length
6.1 meters

Message Length
56 bits

Message format

8 bits	Checksum
4 bits	Rank
6 bits	Age
11 bits	Barometric pressure
9 bits	Sea surface temperature
9 bits	Air pressure tendency
6 bits	Submergence count
3 bits	Battery voltage

Delayed Mode Quality Control Procedures

Quality Control Steps

- **Drifter data is downloaded from Argos daily and also received at AOML once a month on CDs**

- **Convert raw data into engineering units and add to individual B-file by ID**

- **Determine deployment time and position of first good transmission from the water**

- **Run programs that identify buoys that are dead:**
  a) Transmit from the same location after a successful deployment (grounded)
  b) Do not have any new data after last update (quit)
  Such dates and positions are entered into the DIRECTORY file

Quality Control Steps (Continuation)

- **Software are run to check bad locations from ARGOS raw data based on speed between consecutive locations, bad points are deleted (P-files)**

- **Deviant SST values are removed by applying a temperature change criterion relative to the recent temperatures measured by the buoy (S-files)**

- **SST's from each drifter are compared with Reynold's climatology to determine temperature sensor failure, last good day is entered into the TMPFL file. SST after this date will be discarded**

- **We decode, archive and handle GTS data transmissions and deletions of other sensor data like pressure and wind, but NO quality control is applied to them**

Quality Control Steps (Continuation)

- **Buoys that possibly lost their drogues are identified.**
  Drogue lost date is determined and entered in the DIRECTORY file

- **All active buoys are processed and interpolated to 6 hour intervals, using the Kriging method**
  P (position edited) file + S (SST edited) file = K (interpolated) file

Refer to paper by Hansen and Poulain for details on the Editing and Kriging procedures:

Hansen, D.V. and P.-Marie Poulain, 1996. Quality Control and Interpolations of WOCE/TOGA Drifter Data. J. Atomos. Oceanic Tec., 13, 900-909

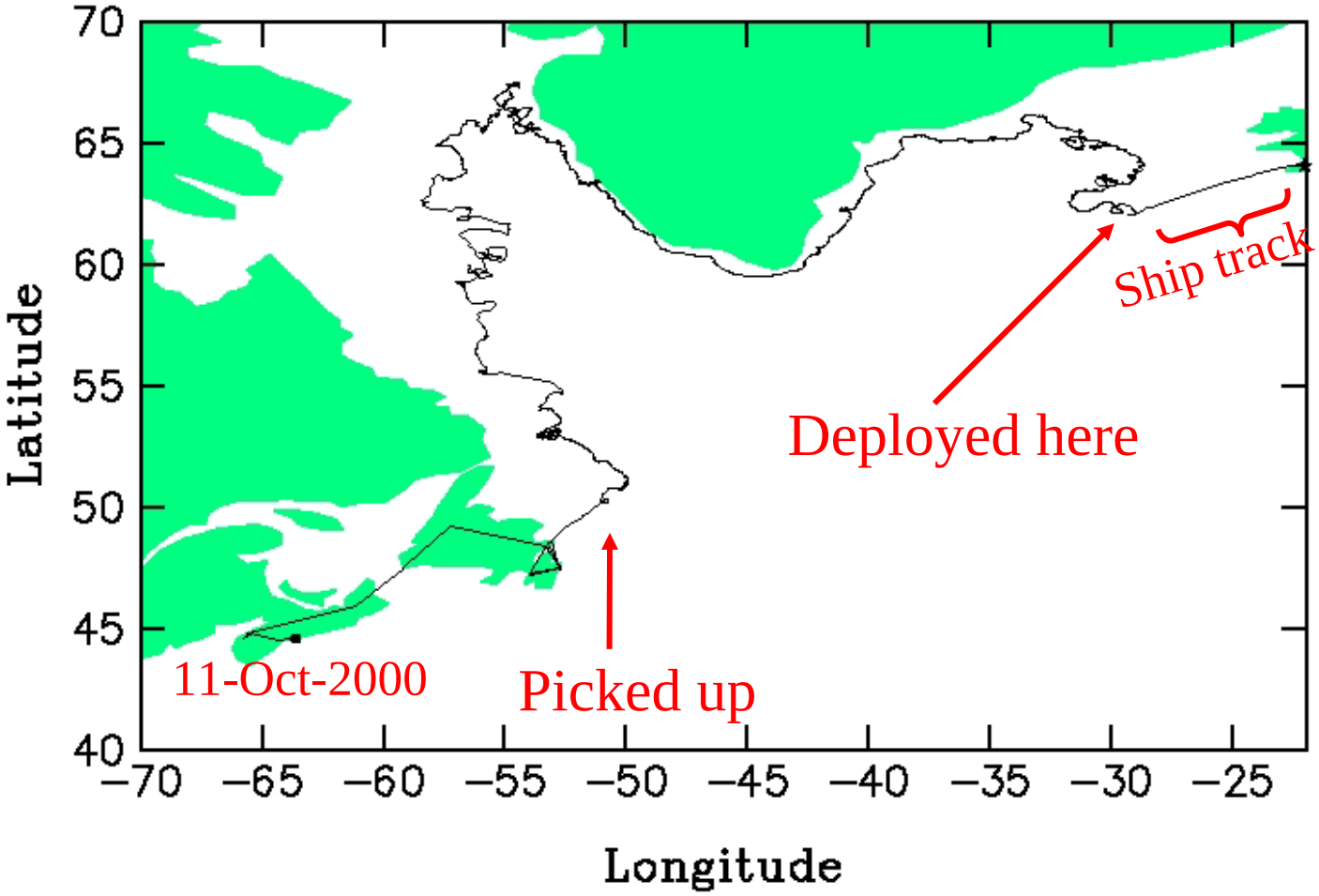
- ***Kriged drifter data can be accessed through the WEB***

WWW.AOML.NOAA.GOV/PHOD/DAC/DACDATA.HTML
> Interpolated database

- **Database is updated every 2-3 months and sent to MEDS for distribution and archival**

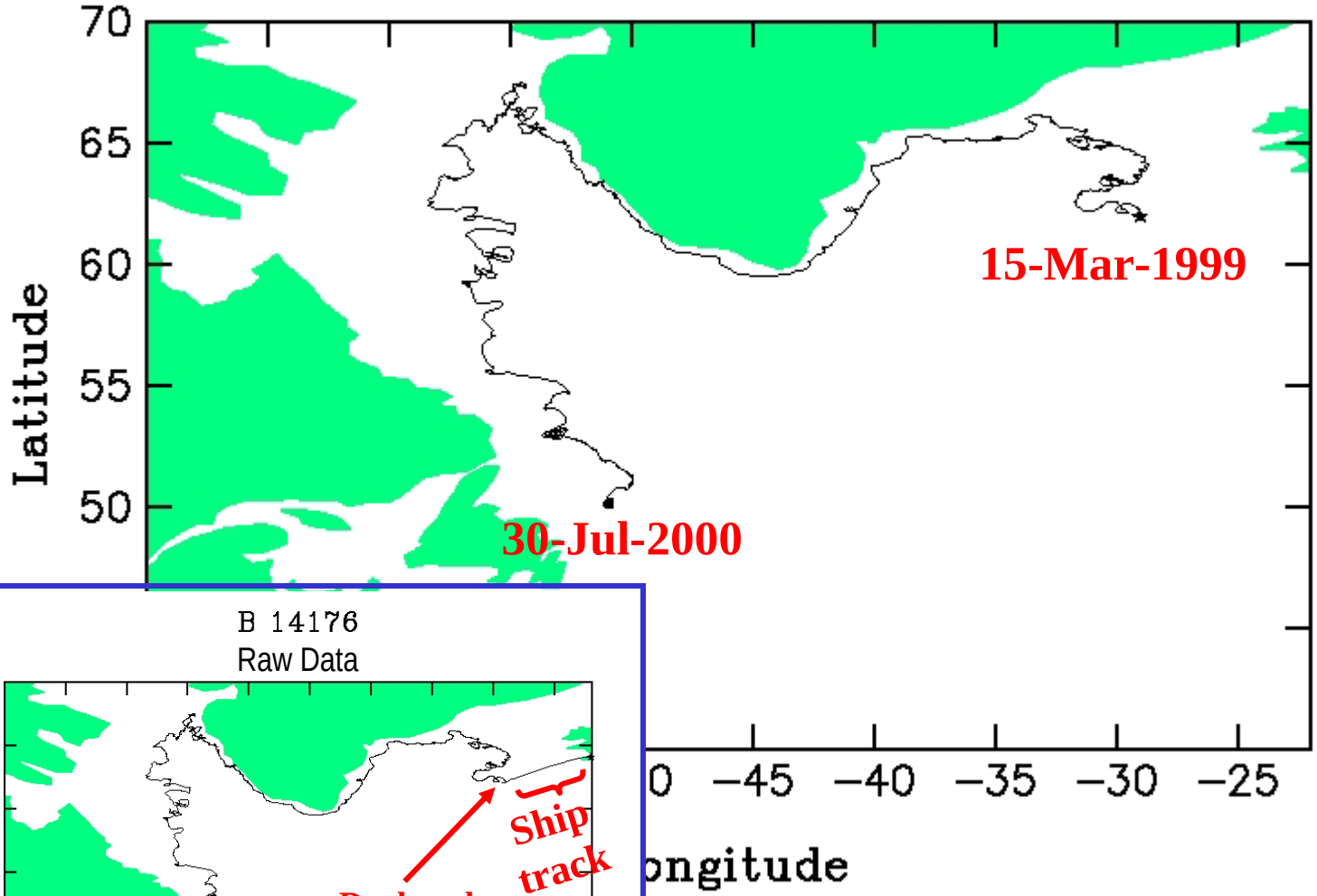
QC Examples

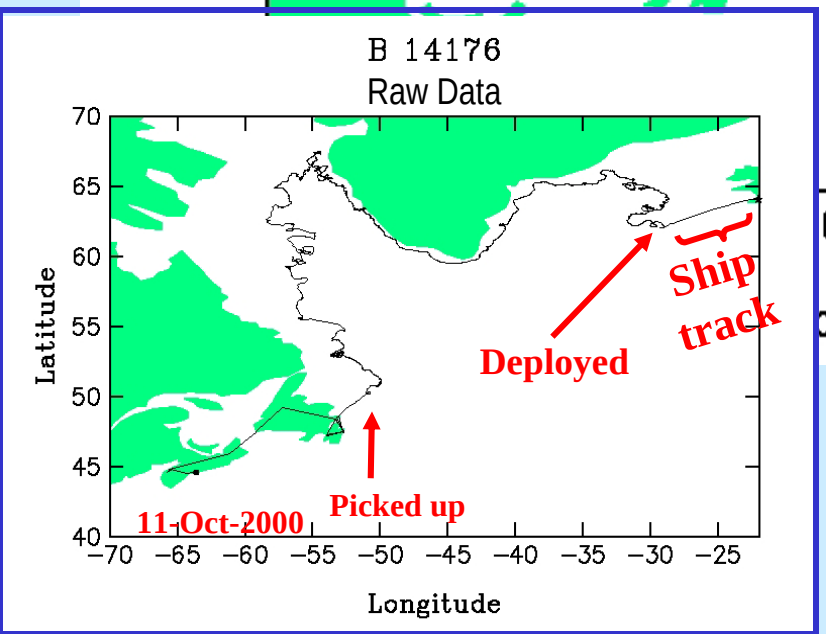
Drifter 14176 raw file



Drifter 14176 cleaned and interpolated file

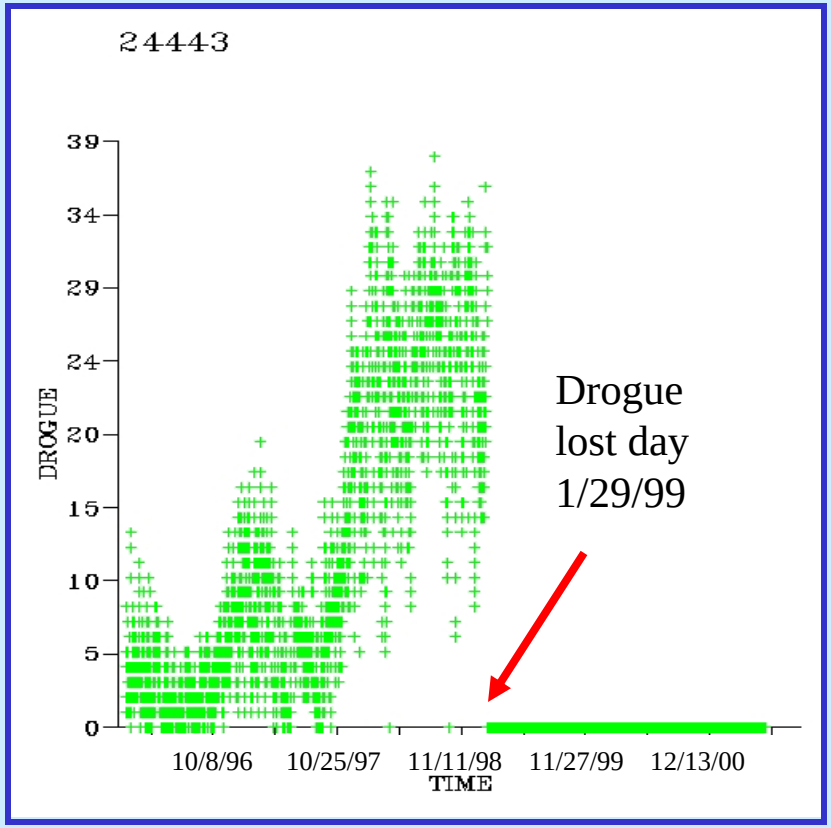
After editing and interpolation procedures have been applied

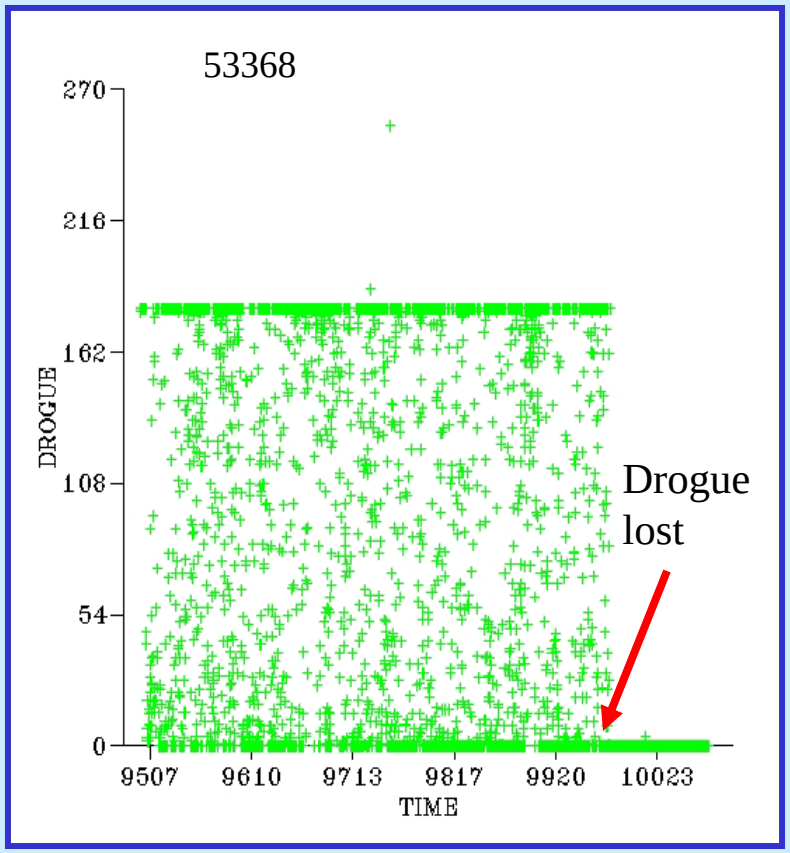




QC Examples

Determining drogue off time





Typical submergence record for Technocean "drogue loss"
(sharp drop to zero when drifter is picked up).

QC Examples

Compare SST with Reynold's Climatology