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

Luca Centurioni, SIO

29th Data Buoy Cooperation Panel session

23-27 September 2013

Paris, France

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 5ºx5º 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. Additional instrument development at Scripps funded by ONR.

AOML (Miami, FL)
Rick Lumpkin

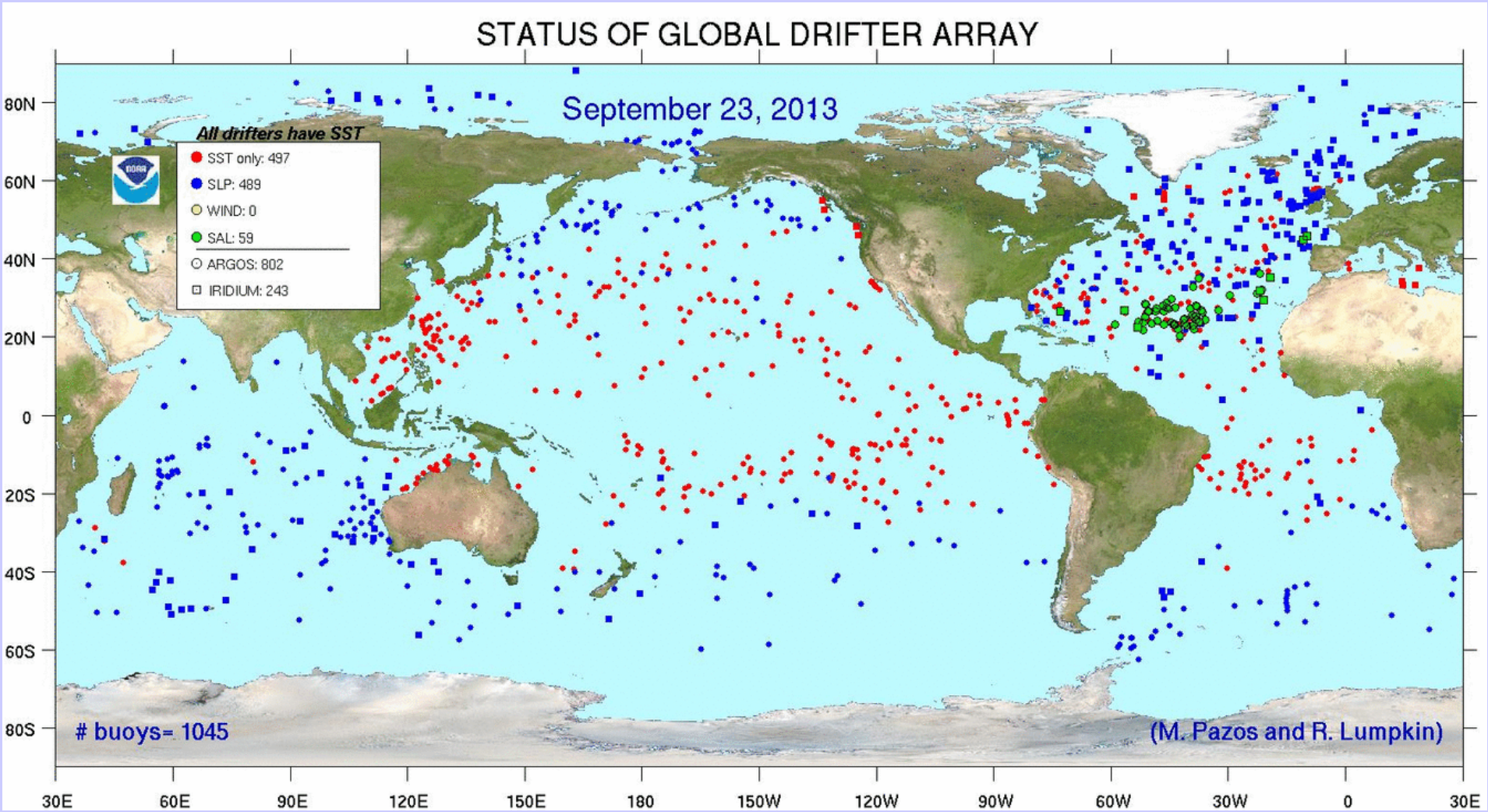
Scripps (La Jolla, CA)
Luca Centurioni
Supervises the industry, upgrades the technology, purchases most drifters, and develops enhanced data sets.

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

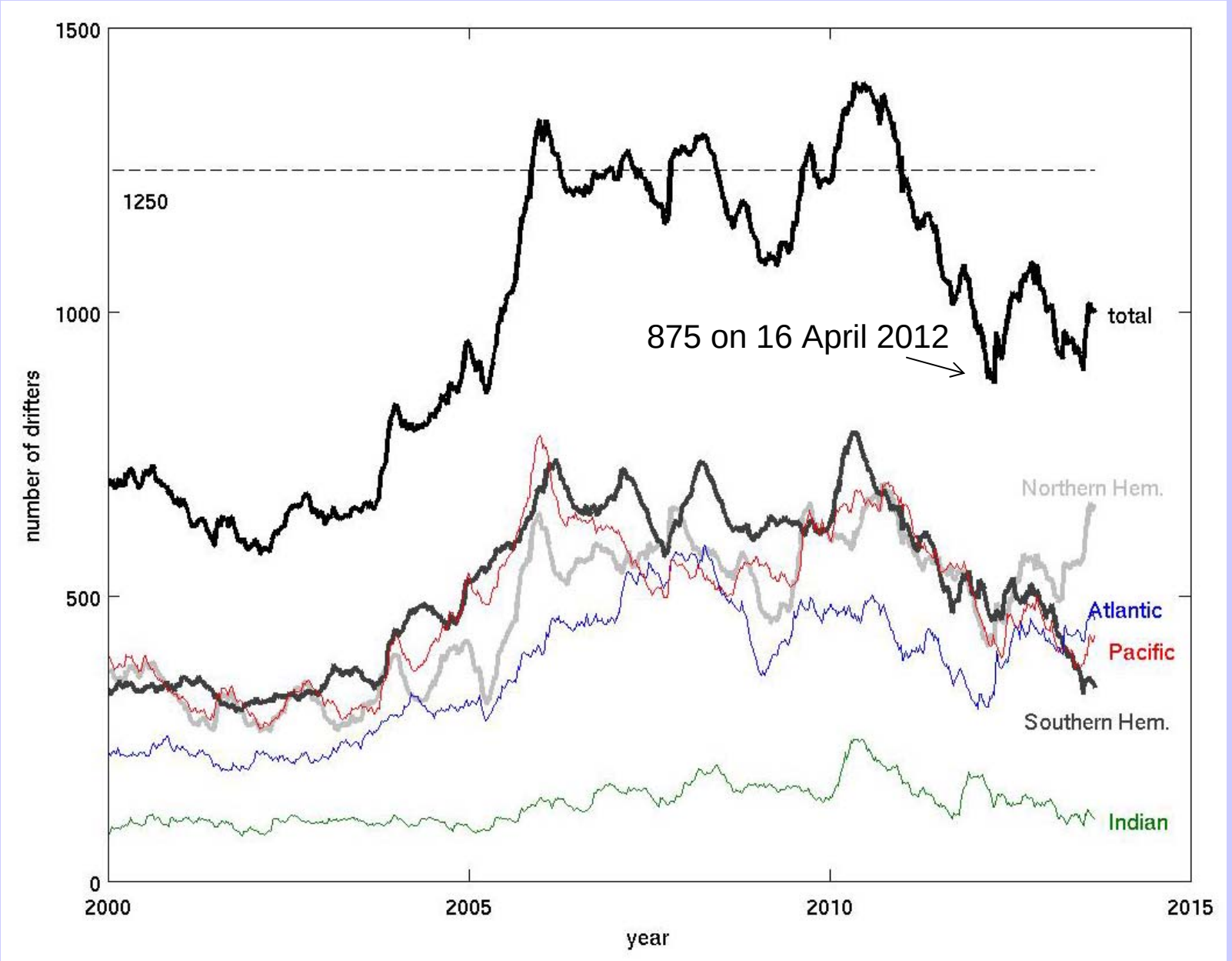
Drifter Operations Center (DOC)

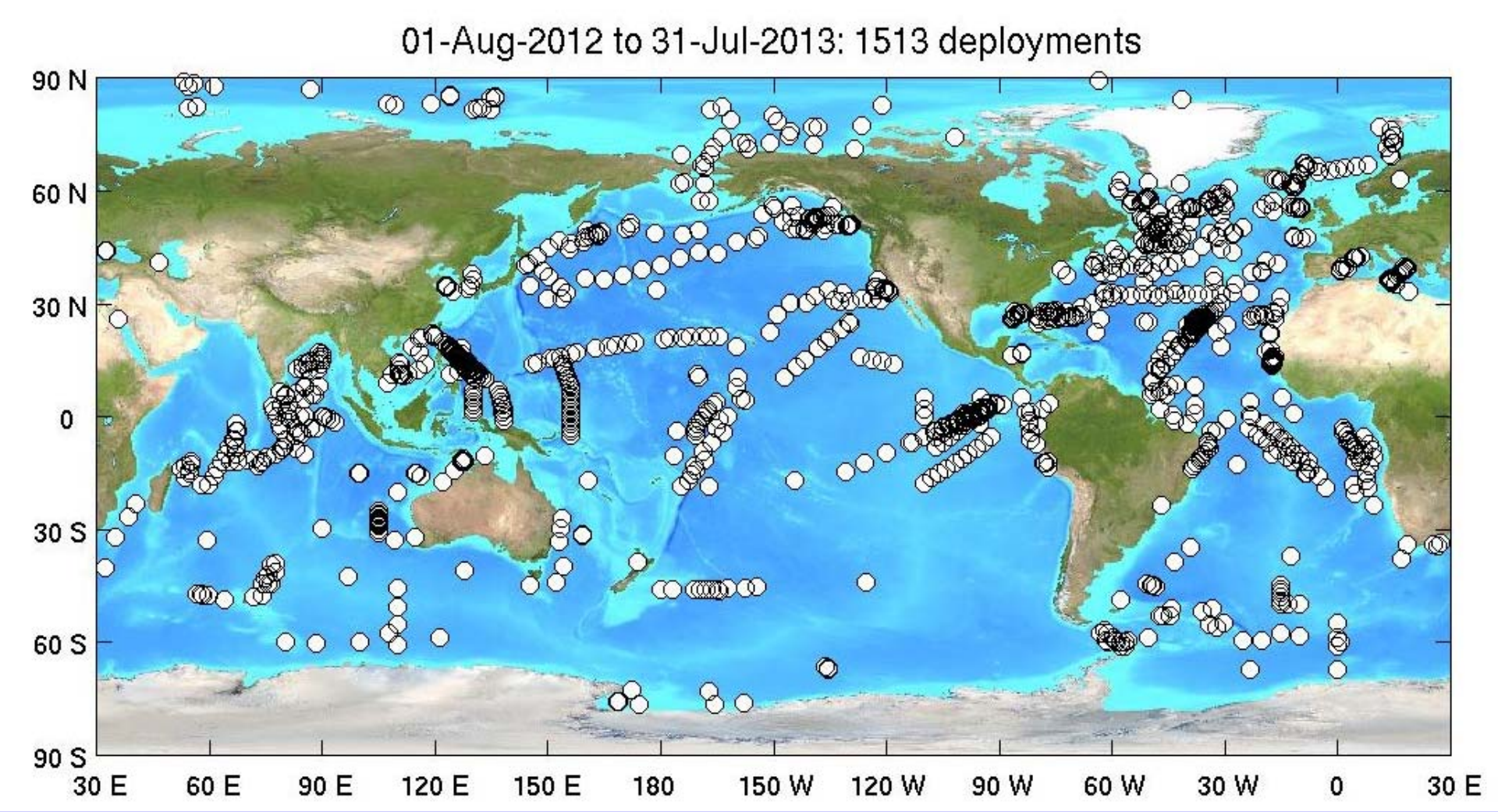
Drifter Data Assembly Center (DAC)

Current status of the global array



Evolution of the array





1513 drifters deployed in the period 1 Aug 2012 to 1 Aug 2013.

Drifter Operations Center:
Shaun Dolk (Miami, FL USA)
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2012-2013 Deployment highlights

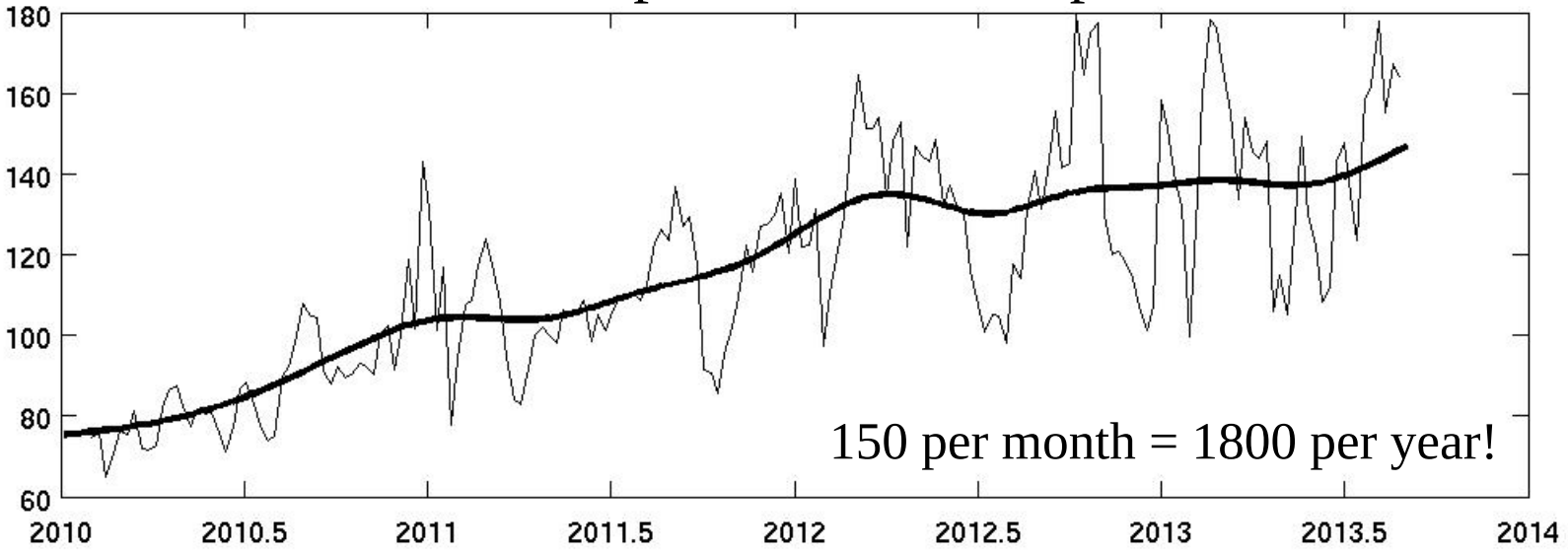
- 20 SVPBs in the West Indian Ocean (PI Helen Philips)
- 20 SVPBs in the North Indian Ocean (RAMA servicing; PMEL and NIO)
- 12 SVPBs in the Indian Ocean (deployed by Indonesian collaborators)
- 15 SVPBs in the East Indian Ocean (RAMA servicing in conjunction with PMEL)

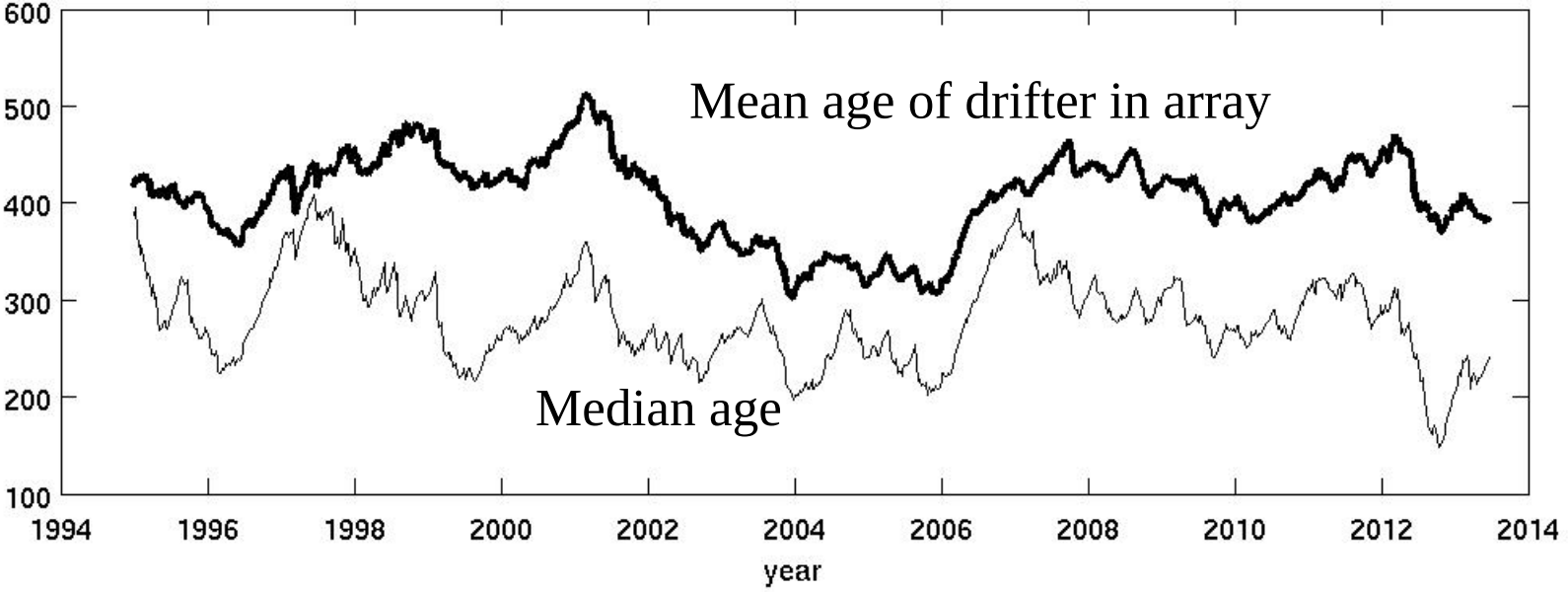
- 20 SVPBs in the North Pacific (deployed during annual DART array servicing)
- 18 SVPs in the Equatorial Pacific (deployed by JAMSTEC collaborators)
- 25 SVPs in the Equatorial Pacific (deployed by Ecuadorian, Peruvian, and Columbian collaborators)

- 20 SVPs in the North Atlantic (deployed during CLIVAR cruise)
- 24 SVPBs in the Drake Passage (PI Christian Reiss)
- 14 SVPs in the Gulf of Guinea (deployed by R/V *Lady Amber*)

- 26 SVPs in the Tropical Atlantic (SPURS)
- 80 SVPGSs in the Tropical Atlantic (SPURS)
- 5 SVPBSs in the Tropical Atlantic (SPURS)

Number of deaths per 1250 drifters per month





Factors reducing lifetime (1)

Faulty battery packs: battery packs assembled from poor quality cells have now been eliminated from the GDP array, and were partly responsible for the dramatic lifetime decreases in 2010—2011. The GDP is recommending the use of high quality alkaline cells.

A second cause of concern is that there is evidence that battery packs are not properly assembled and secured and this can result in individual cells getting damaged on deployment or due to shock/vibrations while deployed. The GDP is recommending a thorough revision of battery pack assembly and installation techniques.

Factors reducing lifetime (2a)

Power Consumption

Argos 2 vs Argos 3: some PMT modems running in Argos 2 mode are not energy efficient, shortening lifetimes considerably. Partially responsible for decreased lifetimes in 2012—2013. All undeployed drifters manufactured in 2012 with PMTs operating in A2 were retrofitted to run as Argos 3. Nearly six months of A3 drifter deployments are showing encouraging results.

Argos 3 optimization: c.f. presentation by Andy Sybrandy. No need, esp. at high latitudes, to talk to every possible satellite.

Factors reducing lifetime (2b)

Increased power demand resulting from the implementation of **strain gauge**. Solution: lower duty cycle on strain gauge.

Increased power demand related to **inefficient GPS location acquisition** can shorten lifetimes for Iridium drifters.

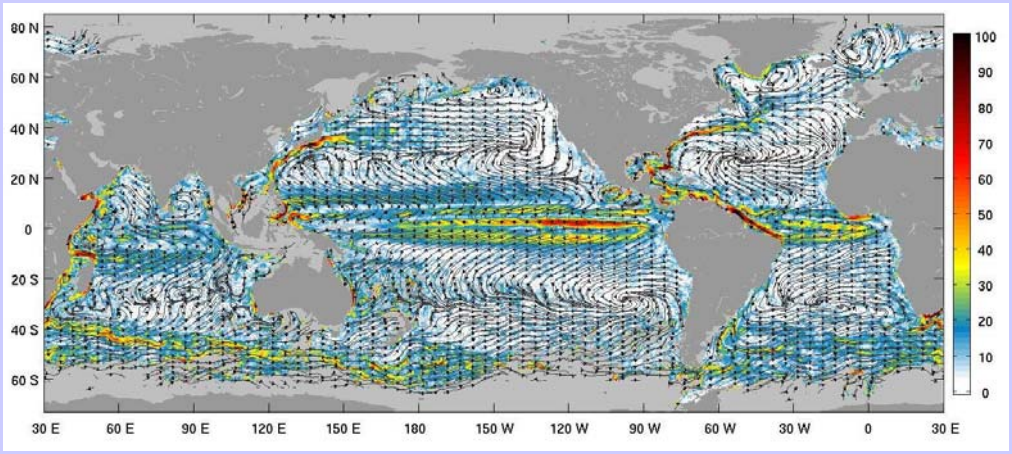
The need for more power might exacerbate the problems connected with the structural integrity of the battery pack, where the failure of one or more cell brings the battery capacity below a critical level. **The GDP is recommending a thorough revision of the drifter's energy budget.**

Technical developments

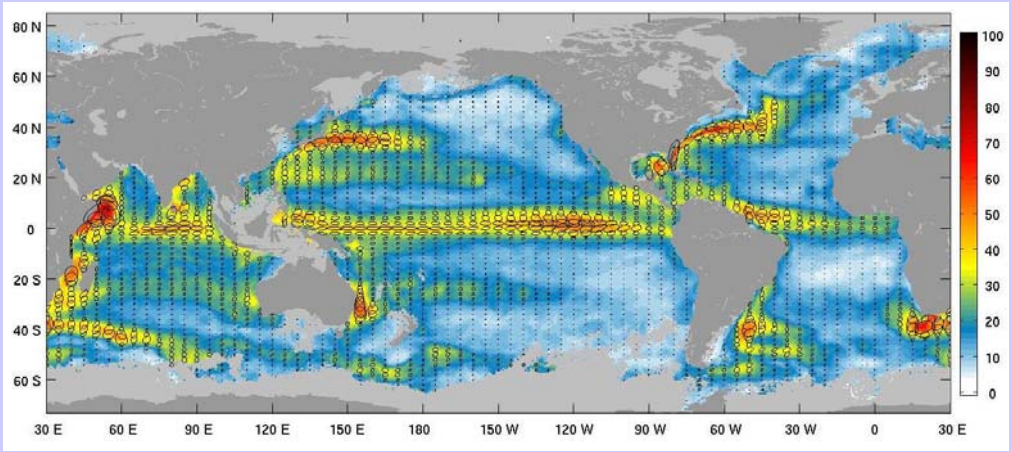
Overall goal: homogenize and ruggedize the SVP design

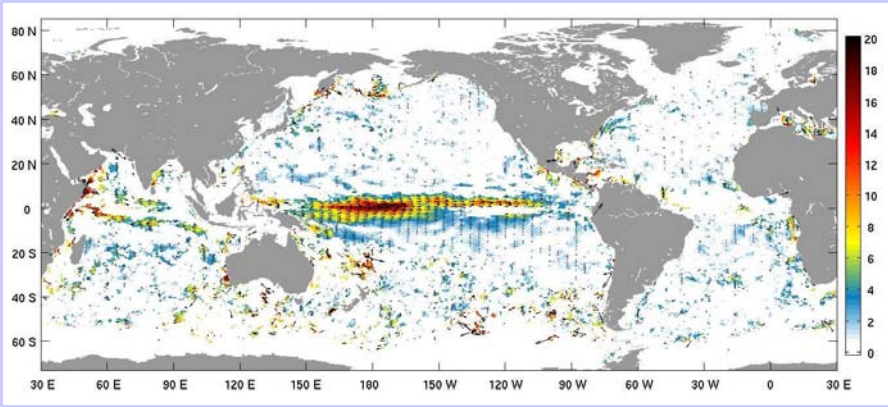
- Ruggedized tether attachment for strength and water infiltration implemented across the drifter fleet;
- Recommendation for high quality batteries issued to manufacturers and implemented;
- Design of ruggedized battery packs completed and currently under evaluation;
- Recommendation for more accurate SST (0.05°C) issued to manufacturers and implemented by SIO;
- Recommendation for ruggedized drogue design issued to manufacturers and implemented;
- SIO completed SVP and SVPB drifter design and started production;
- New tether material (synthetic rope) is currently under evaluation.

New product: global near-surface currents, monthly, ½° resolution



Above: time-mean currents. Below: eddy residuals.

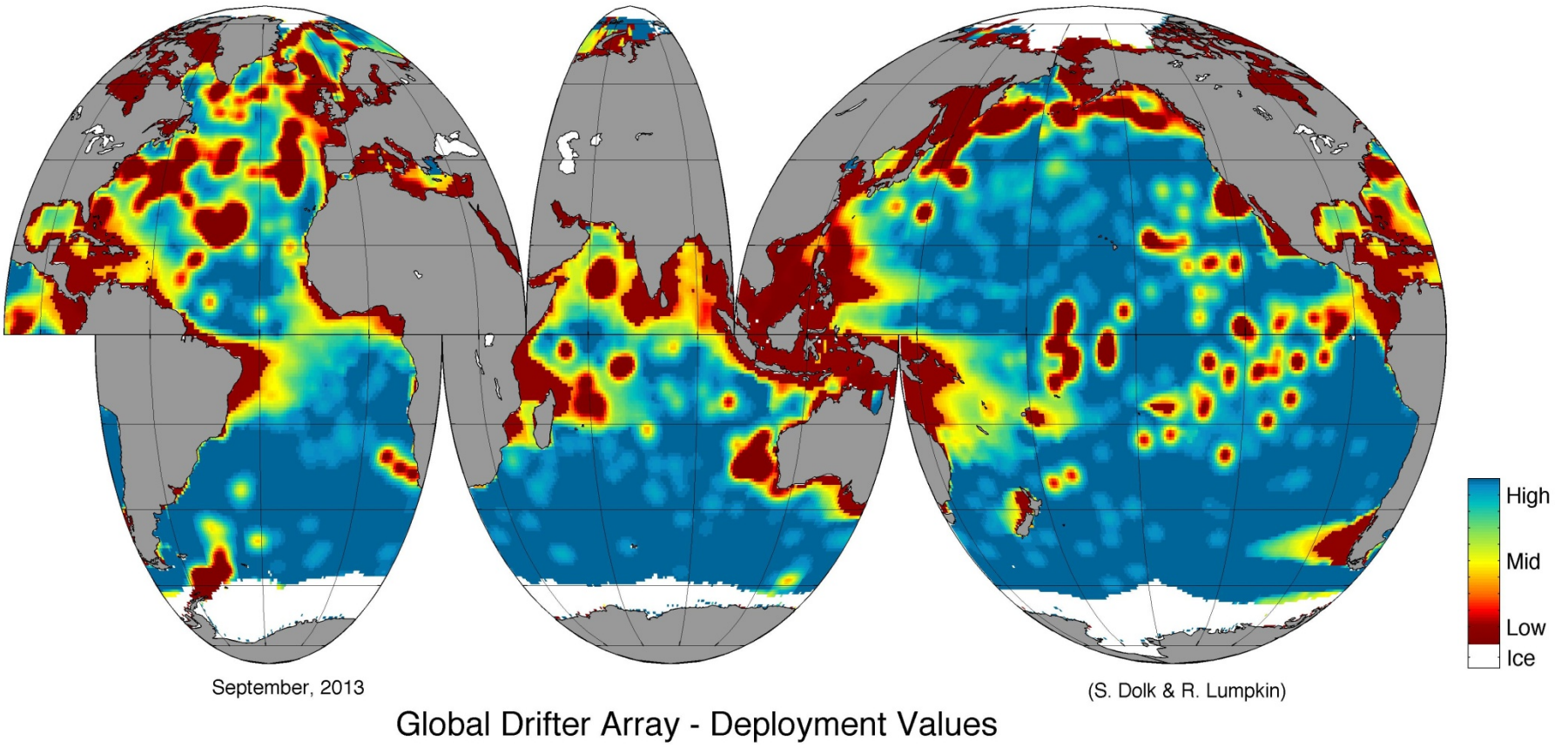




Current related to Southern Oscillation Index.

Lumpkin and Johnson (2013)
http://www.aoml.noaa.gov/phod/dac/dac_meanvel.php

New product: drifter deployment value maps



http://www.aoml.noaa.gov/phod/dac/doc_valuemaps.php

Deployment plans for 2013-2014

In the coming year, the GDP Deployment Plan is:

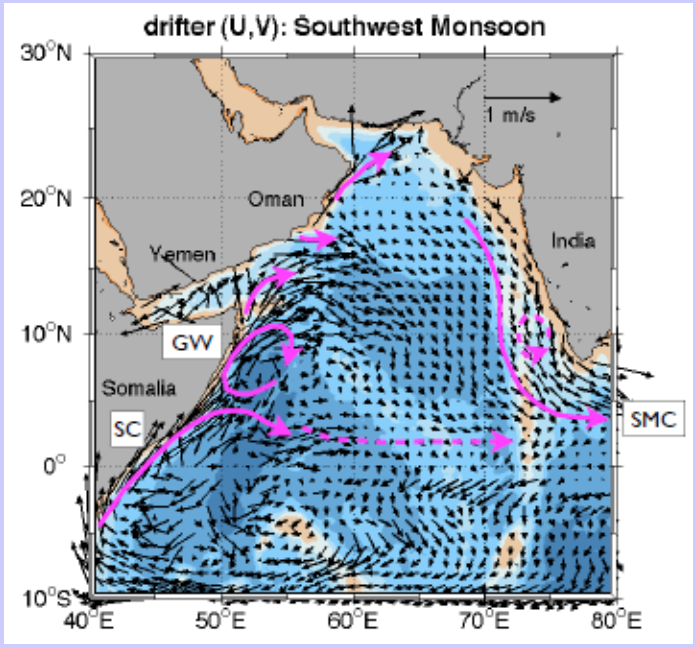
Operational Buoy Deployments	800
Consortium Research Buoy Deployments	200
Total Deployments in 2013-2014	1000

More deployments will be needed to return the array to its goal size of 1250 drifters, and will be conducted if more drifters are available for deployment.

Regional deployment opportunities planned for 2013-2014 will include:

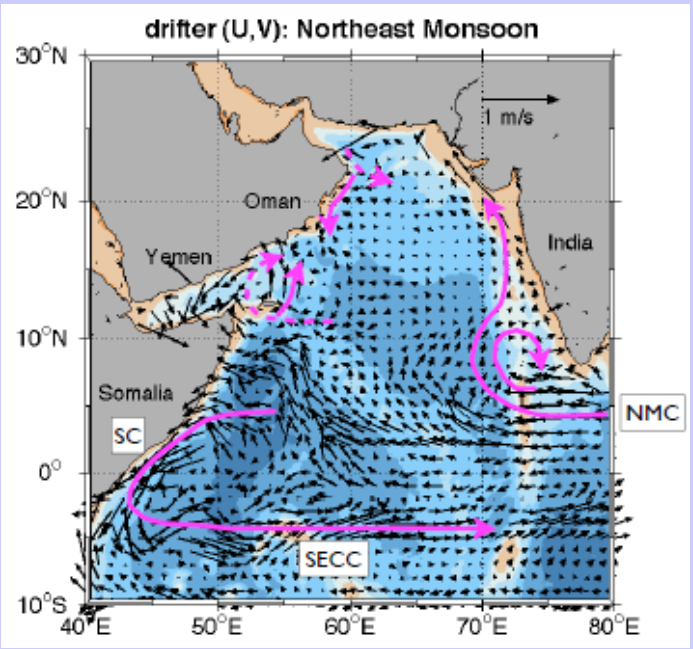
- 28 SVPBs in the Drake Passage (PI Christian Reiss)
- 30 SVPBs in the South Pacific (deployed by KIOST collaborators)
- 10 SVPBs in the North Indian Ocean (deployed by Australian Navy)
- 20 SVPBs in the North Pacific (deployed during annual DART array servicing)
- 20 SVPs in the Tropical Atlantic (deployed during annual PIRATA NEE cruise)
- 20 SVPBs in the North Indian Ocean (deployed during IX12)
- 30 SVPBs in the Southern Oceans (deployed during Barcelona World Race)
- 25 SVPs in the Equatorial Pacific (deployed during STRATUS cruise)

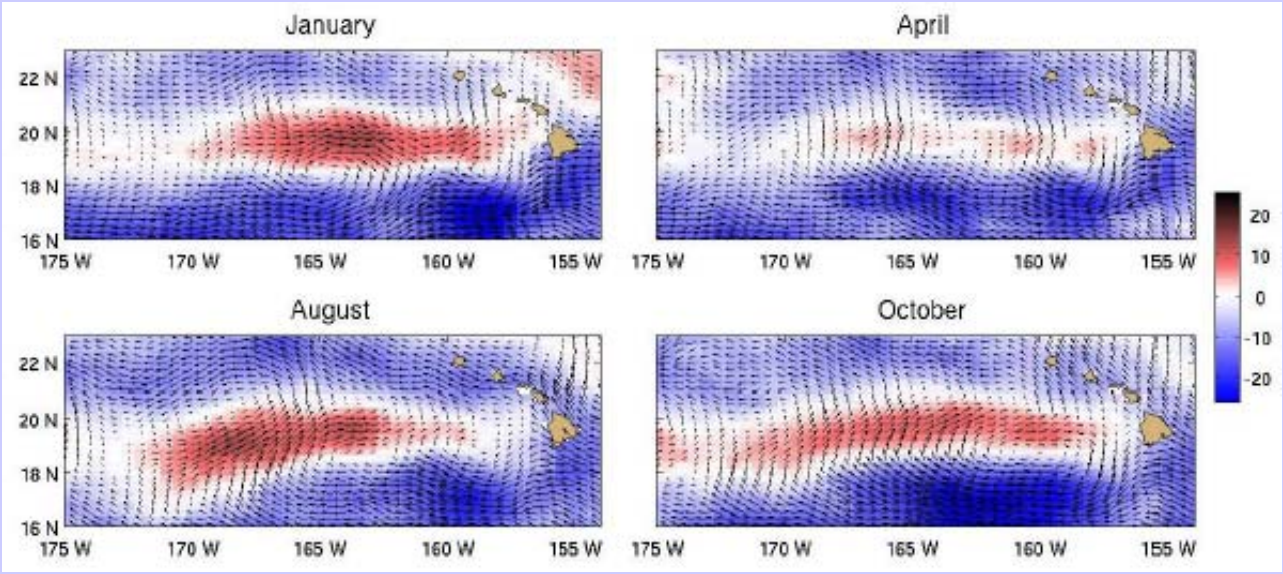
Research



Evolution of monsoon-driven current variations in the Arabian Sea

Beal et al. (2013)





Dynamics of the Hawaiian Lee Countercurrent

Lumpkin and Flament (2013)

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; NOAA/Pacific Marine Environmental Laboratory, NOAA/National Data Buoy Center

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, (United States)

United States Air Force

US Naval Oceanographic Office

United States Coast Guard

Raytheon Polar Services