

DBCP-WMO workshop “Evaluation of the Impact of
Sea Level Atmospheric Pressure Data Over the
Ocean from Drifting Buoys on Numerical Weather
Prediction”

Sedona, Arizona, May 21, 2012



Schedule

Time	Speaker/Activity
8:00-8:30	Coffee & presentations upload
8:30-9:00	Centurioni and Lumpkin
9:00-9:30	John Eyre for Miroslav Ondras (WMO)
9:30-10:00	Carla Cardinali (ECMWF)
10:00-10:30	Jean-Francois Mahfouf (Meteo France)
10:30-11:00	Coffee Break
11:00-11:30	Ron Gelaro (NASA)
11:30-12:00	John Eyre (UKMO)
12:00-13:30	Lunch break
13:30-15:00	Open discussion
15:00-15:30	Coffee Break
15:30-16:30	Open discussion
16:30-17:00	Wrap-up/end of meeting

Lunch Break (12:00 13:30)

Lunch is provided: choose & order your lunch during coffee break (10:30-11:00)

Sea Level Air-Pressure Measurements From Drifters

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What is the Global Drifter Program

- The GDP is:
- funded by NOAA and is the principal component of the Global Surface Drifting Buoy Array;
- a component of Global Ocean Observing System (GOOS);
- a scientific project of the Data Buoy Cooperation Panel DBCP (The DBCP is an international program coordinating the use of autonomous data buoys to observe atmospheric and oceanographic conditions, over ocean areas where few other measurements are taken)
- The DBCP and is a joint body of the WMO and of the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Goals of the GDP

The overall objectives of the GDP are to:

1) maintain a near-operational ocean-observing network of at least 1250 Lagrangian drifters ($5^{\circ} \times 5^{\circ}$) that, through the Argos and Iridium satellite systems, returns data of meteo-marine variables including near-surface ocean currents, sea surface temperature (SST), sea surface salinity (SSS), sea-level atmospheric pressure (SLP), sea-level winds (SLW) and subsurface temperature (T_z).

2) to provide a data processing system for the scientific use of the data.

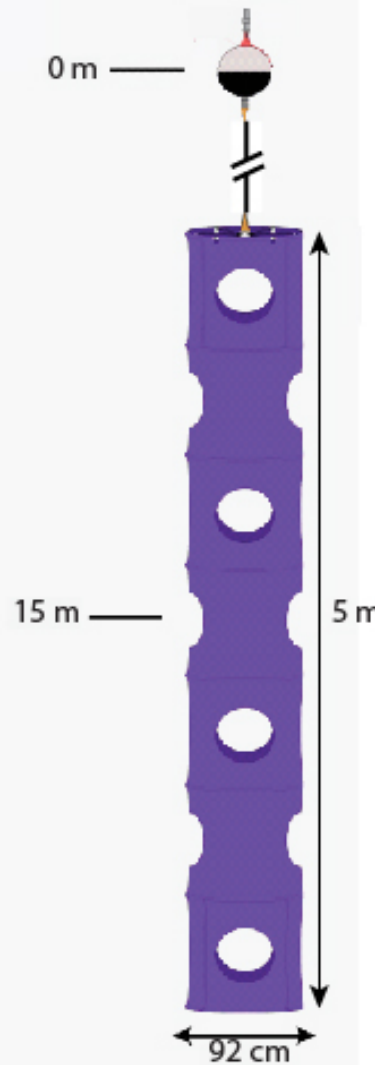
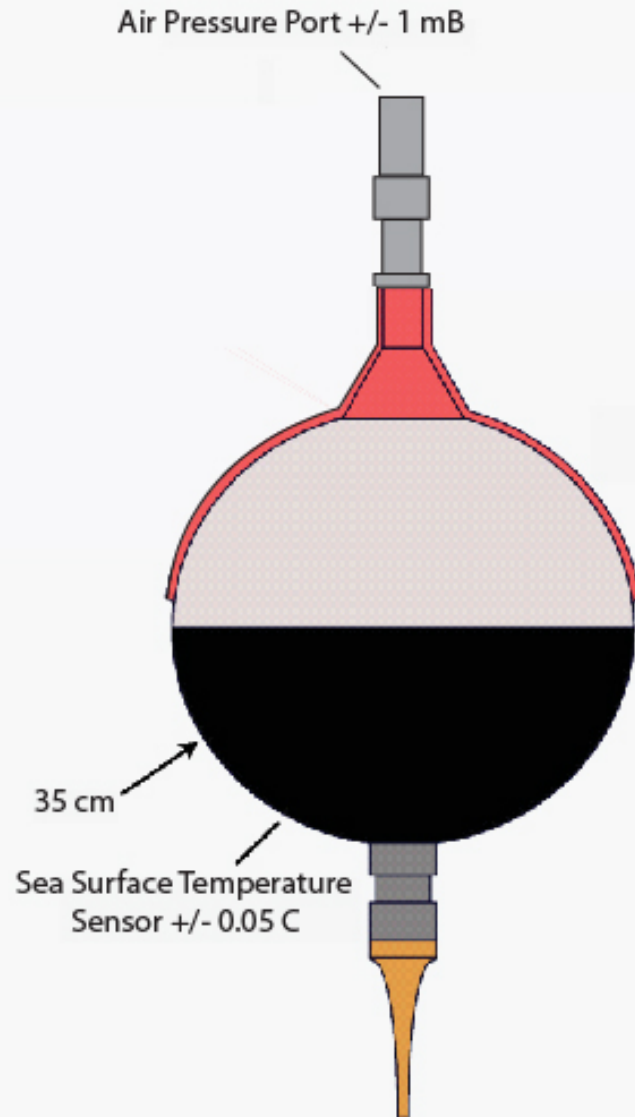
Global Drifter Program Management Structure

- 1) AOML (Head: Lumpkin) organizes the global deployments, manages the real & delayed time data, performs quality control, maintains historical GDP archive, compiles performance statistics and uses drifter data for oceanographic & climate research.
- 2) SIO-CIMEC (Head: Centurioni) procures ~90% of the GDP drifters, oversees the technology, develops new drifters, maintains an enhanced global surface currents dataset and uses drifter data for oceanographic & climate research.

Meteorological components of the GDP

- SVPB drifters array provide global SLP measurements;
- Hurricane drifter array: targeted deployments of drifting temperature chains (0-150m), and drifters with sea-level wind and air pressure sensors

SVPB



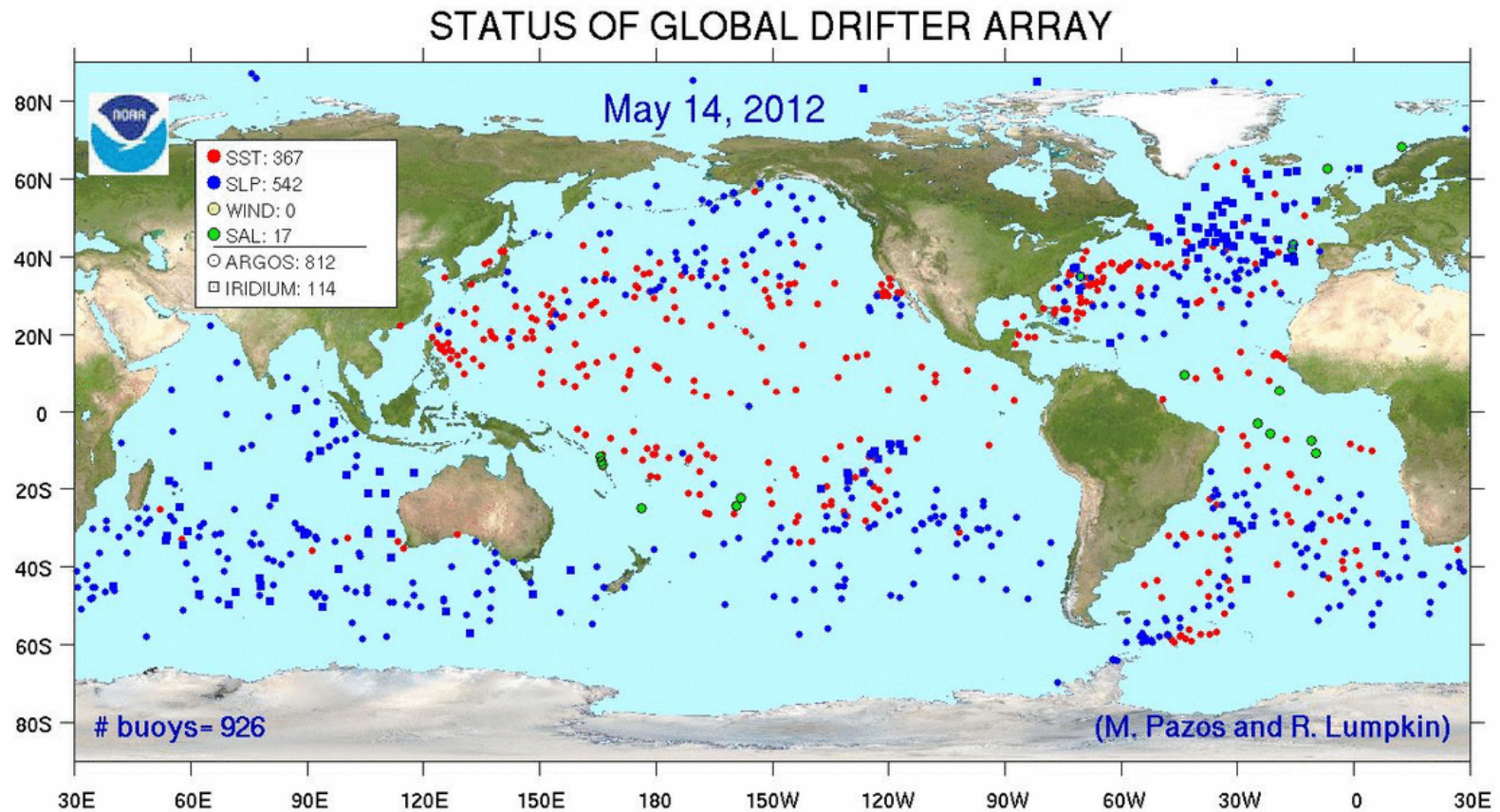
Barometer Drifter

Main Specs

- SST accuracy +/- 0.1-0.05°C
- Endurance: 1+ year
- Fixing: Argos or GPS
- SLP: +/- 1mbar
- SLP sensor: Honeywell HPB
- Drogue depth: 15 m
- Slip: 1 cm/s in 10 m/s wind;
- Cost (w/out baro): \$1,400-\$1,800
- Baro upgrade: \$1,000
- Telemetry: Argos or Iridium
- The barometer is sampled every 15 minutes
- SLP data are sent every ~2hrs with Argos
- SLP iridium can transmit once per hour;
- Data latency Argos: ~ 90min
- Data latency Iridium: ~ 5min

The Global Drifter Program

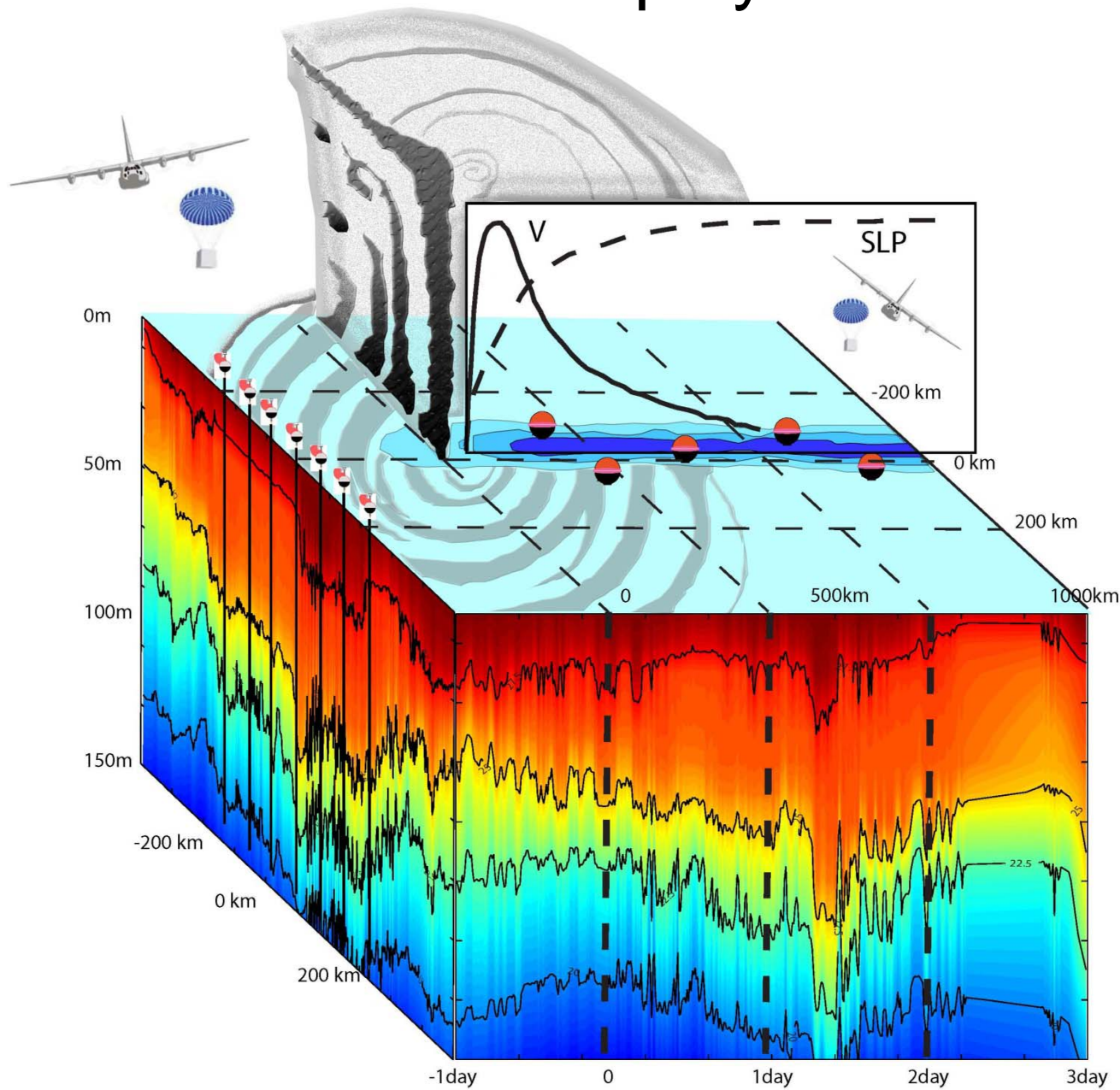
(<http://www.aoml.noaa.gov/phod/dac/index.php>)



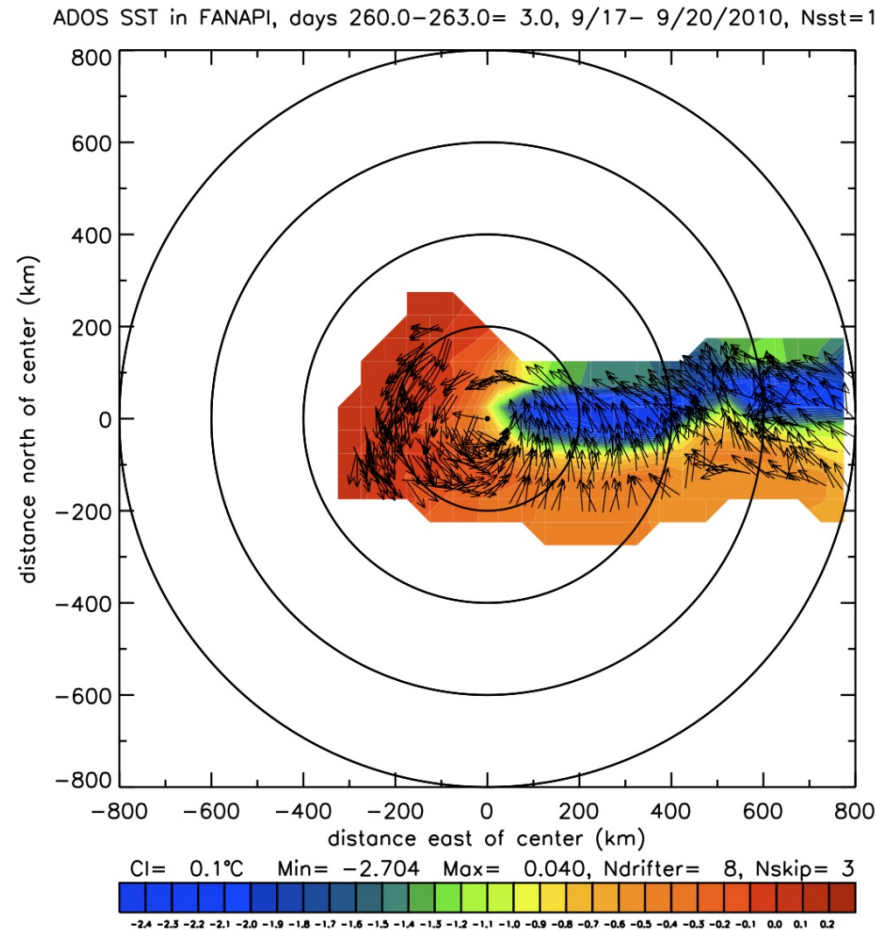
Air-Deployment by 53rd Hurricane Hunter Squadron of Air National Guard



ITOP drifter deployments

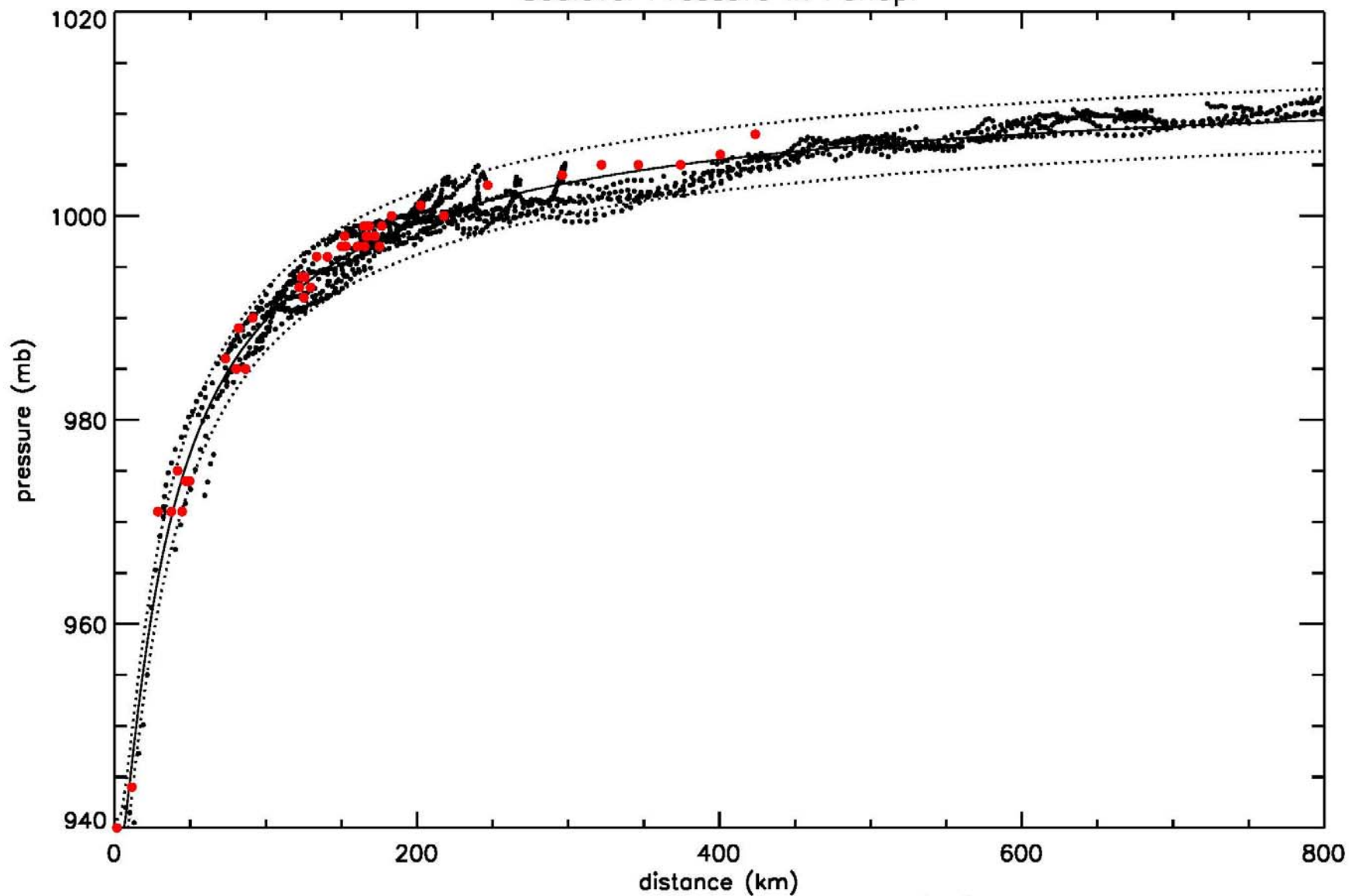


Cold wake & wind observations from the ADOS Array



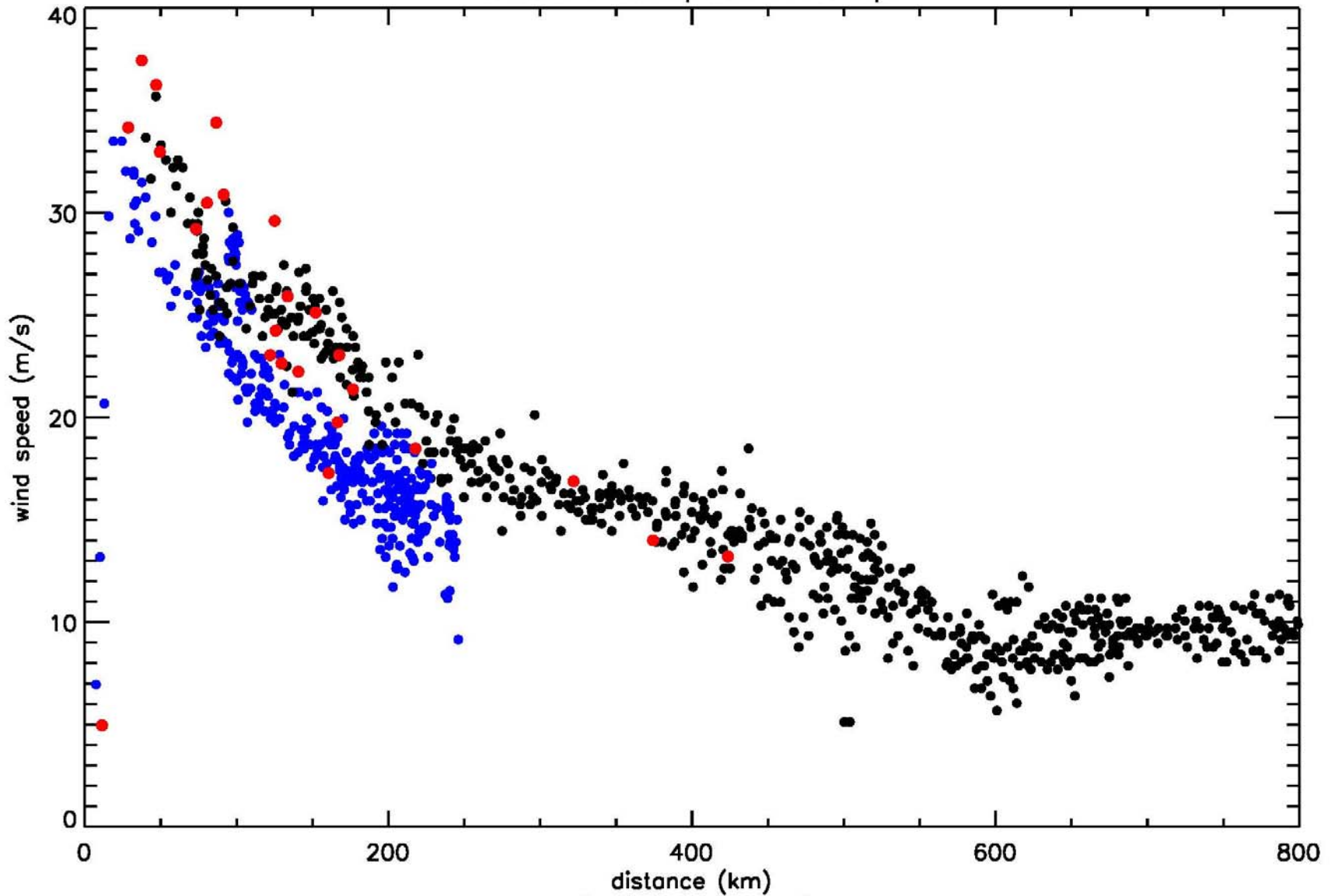
SST observations from the eight ADOS drifters deployed ahead of typhoon Fanapi on September 17, 2010. SST changes during first 3 days after Fanapi passed over the ADOS drifters are shown. The vectors represent wind directions. For clarity, only every third wind vector is plotted. The data are plotted in storm co-ordinates, i.e. referred to the center of the storm. The storm is advancing approximately from east to west.

Sealevel Pressure in Fanapi



Ndrift=16 Nplot=1466, 9/17/2010 0Z - 9/20/2010 0Z
function fit: coeff= 15.17 0.79 1015.06 937.79, Avdiff=-0.009mb, stdev= 1.5mb

Drifter Wind Speed in Fanapi



Ndrift= 8 Nplot=1804, 9/17/2010 - 9/20/2010, Dropsondes: N= 31

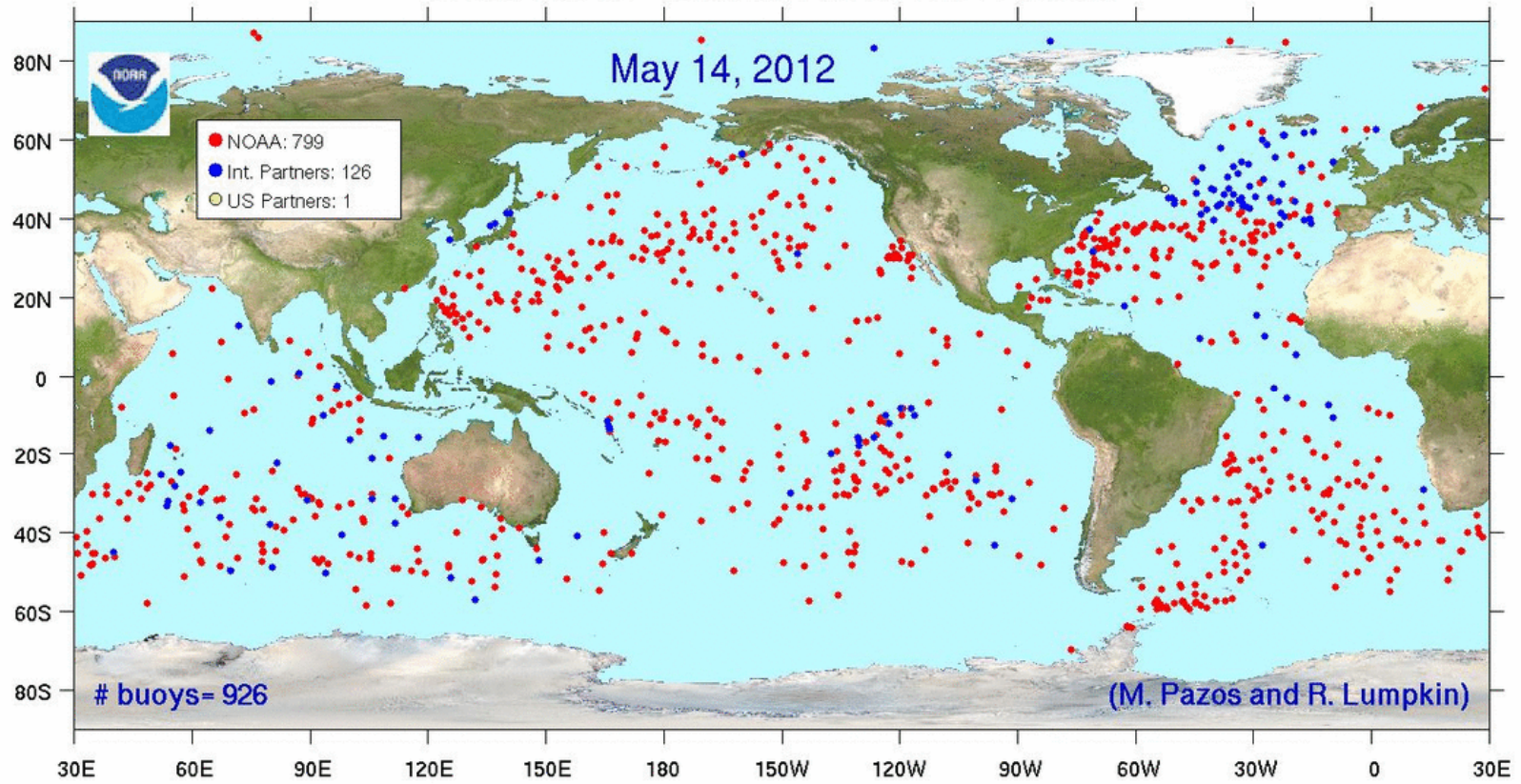
Data route

- Drifter data (SST, SLP, position and mixed layer currents at 15 m depth) are posted to the GTS
- CLS (Argos services) is responsible for initial QC and posting to GTS;
- Additional QC is provided by national weather services who can ask for a drifter to be removed from GTS (see for example <http://www.meteo.shom.fr/qctools/>);

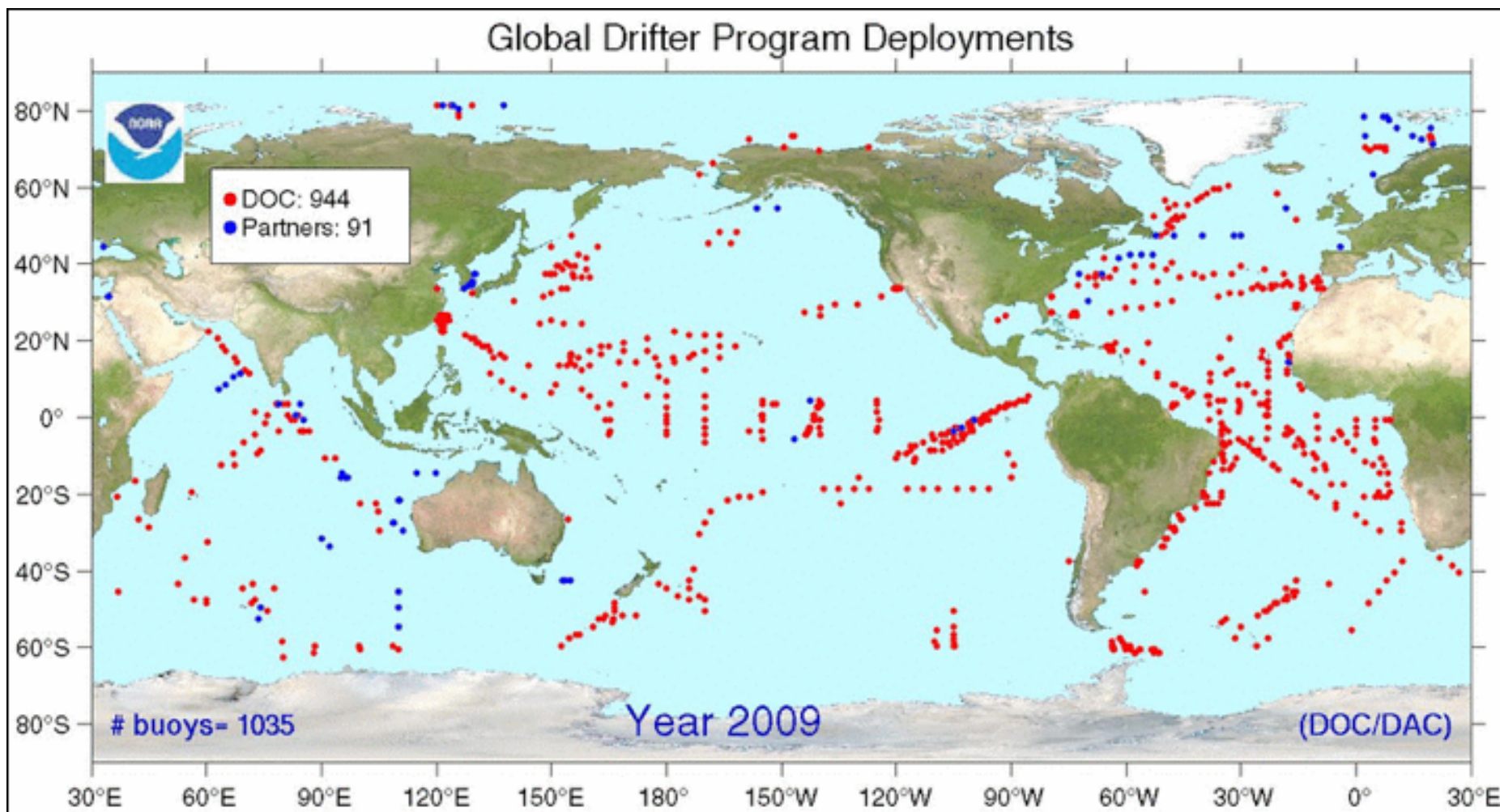
Implementation of the barometer array

- GDP-SIO buys 290 barometer upgrades/year;
- An additional 190 barometers are purchased every 2nd year by GDP-SIO;
- Another 100 GDP-AOML drifters are upgraded to barometer every year by WS (Australia, New Zealand, South Africa, etc.);
- ~80 SVP/year are deployed by E-SURFMAR;
- Total: 565 barometers/year (=> \$565K/year, \$400K/year from NOAA's GDP funds);
- While the DBCP has recommended outfitting the whole GDP array with barometers by 2012, the current funding level suggests that this target will be delayed or not met even in years to come.
- Drifters are deployed by VOS or by Research or Operational Agencies;
- \$500K additional would be required to fit each drifter with a barometer.

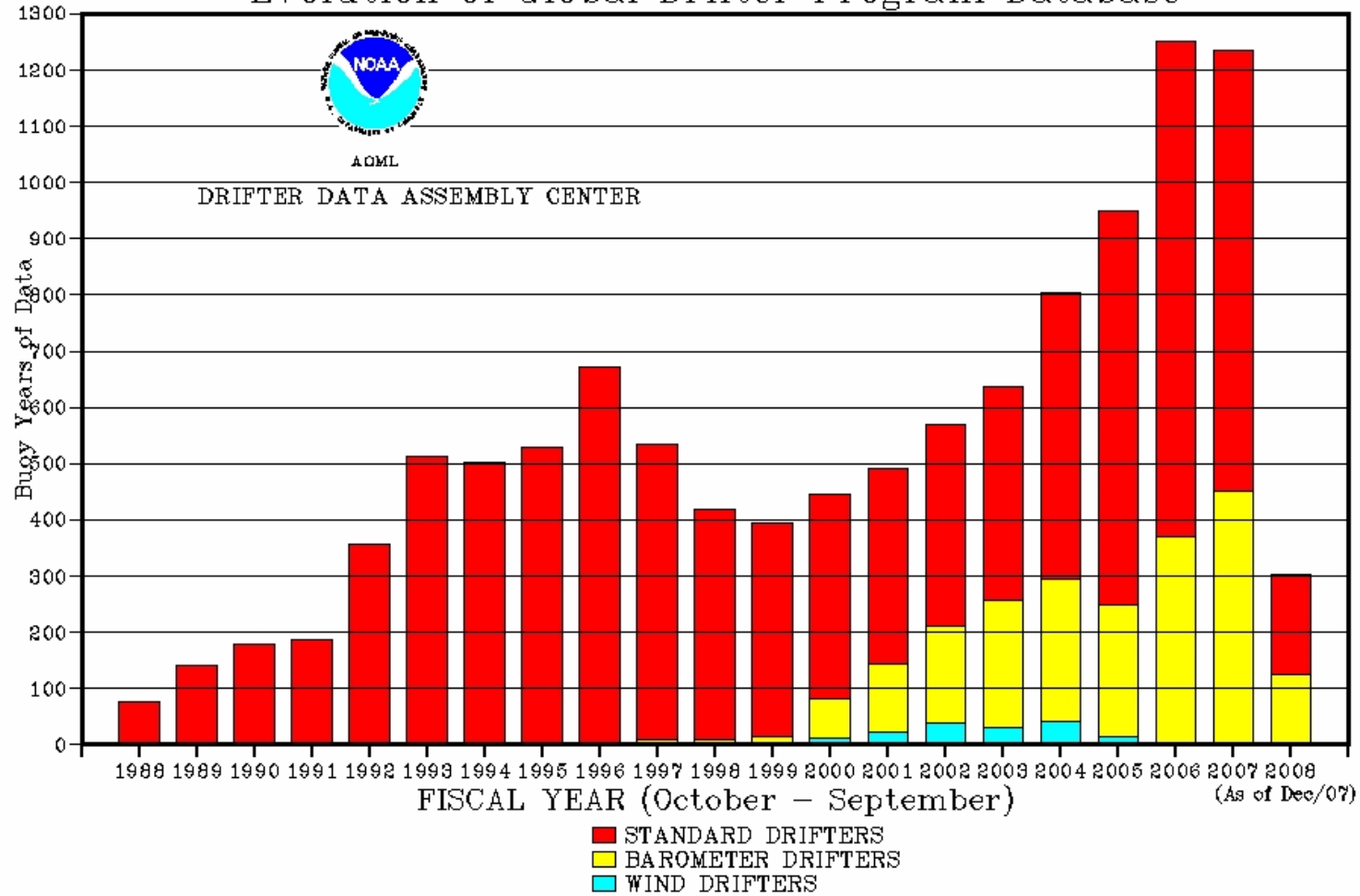
STATUS OF GLOBAL DRIFTER ARRAY



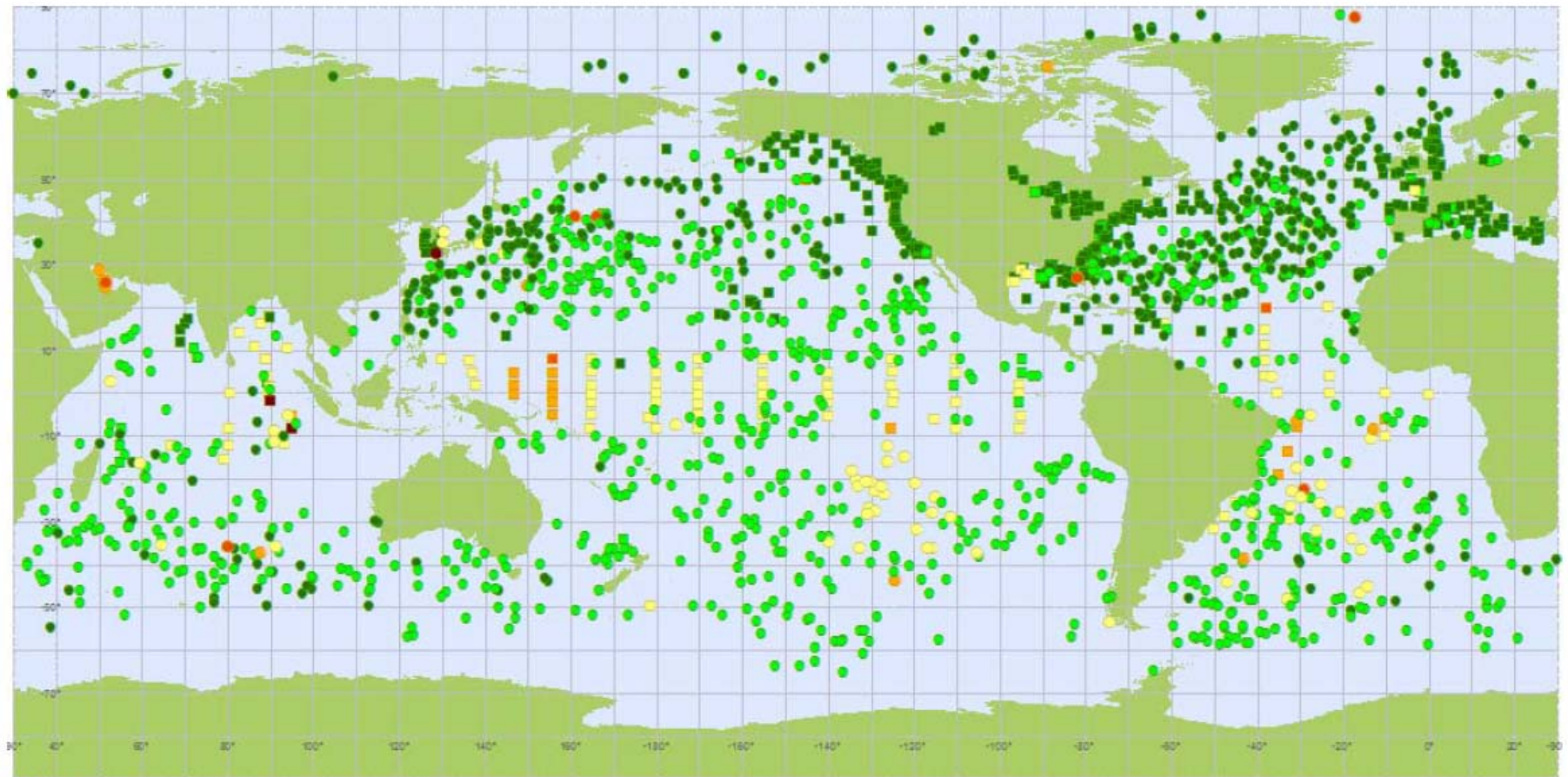
DEPLOYMENT STRATEGY



Evolution of Global Drifter Program Database



AVERAGE GTS DELAY OF BUOY DATA



DBCP

Average Delay (min)



< 60



61 - 120



121 - 180



181 - 240



241 - 300



> 301

July 2011

Issues related to sustainability of barometer array

- Pros:
 - 1) GDP enjoys collaboration from the international community (hardware, deployment opportunities, leverage on satellite air-time providers, QC)
 - 2) SLP data are used to correct inverse barometer effect needed for altimetry;
- Cons
 - 1) The GDP is an oceanographic & climate program (priorities are SST and mixed layer velocity)
 - 2) Because of shrinking budgets (i.e. flat budget since FY'09) it is harder to justify the purchase of barometers with Ocean & Climate funds;
 - 3) A formal, systematic study on the impact of drifters' SLP data on NWP has never been performed.

A DBCP-WMO Pilot Project Was Funded in Oct. '11 to:

- Investigate the impact of the present SVPB array;
- Reach out and engage with NWP experts;
- Enable GDP Pis (Centurioni and Lumpkin) to make a strong case for maintaining the SVPB array status-quo or to advocate for expansion of the array if supported by the conclusion of this pilot project or...
- ...to spend the funds to expand the collection oceanographic data (e.g. more salinity) if SVPB array is redundant/not effective.

Specific Goals of the pilot project

- 1) quantify the impact of SLP data from the existing SVPB network on improving the quality of NWP;
- 2) Provide a scientific/operational rationale for designing the temporal and spatial resolution, as well as the optimal geographical distribution of the SVPB array taking into account all sources of data (e.g. moorings, ships).

What do we (oceanographers) know so far...

OSEs have been run at ECMWF to evaluate the impact of marine buoys and ship-borne SLP data [*Andersson, 2009*, quoting Radnoti et al].

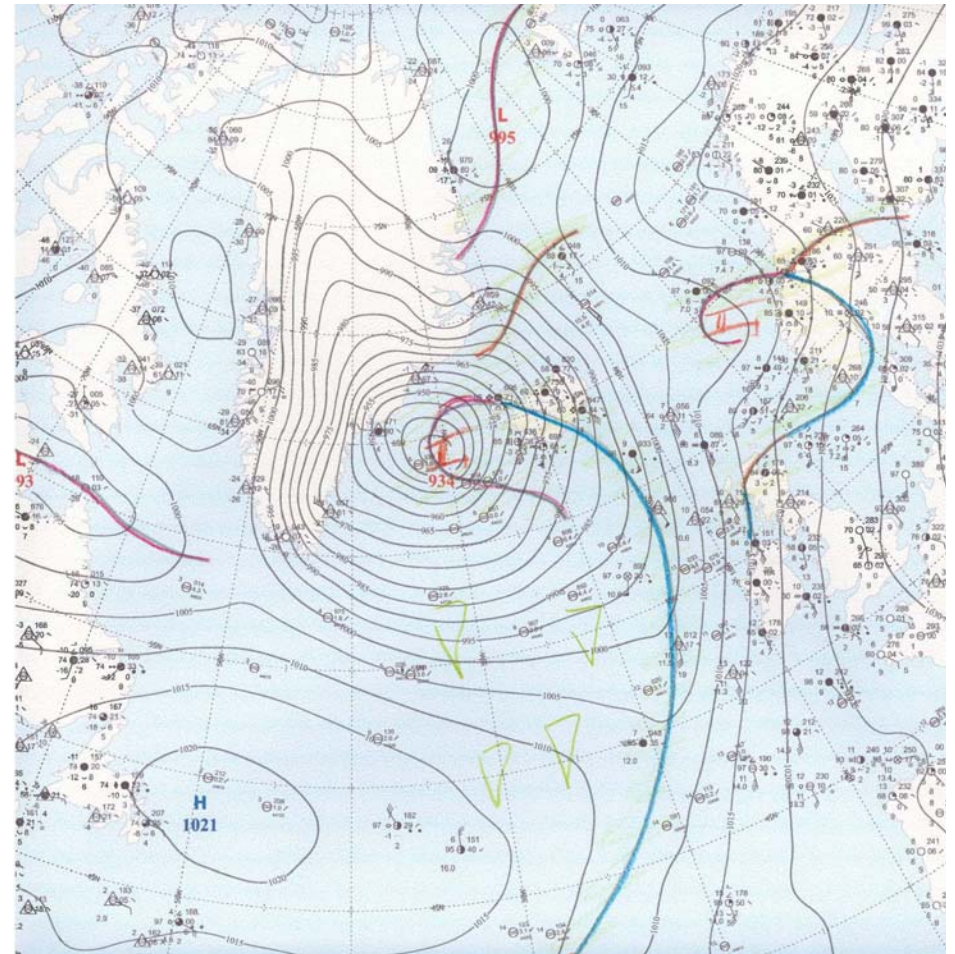
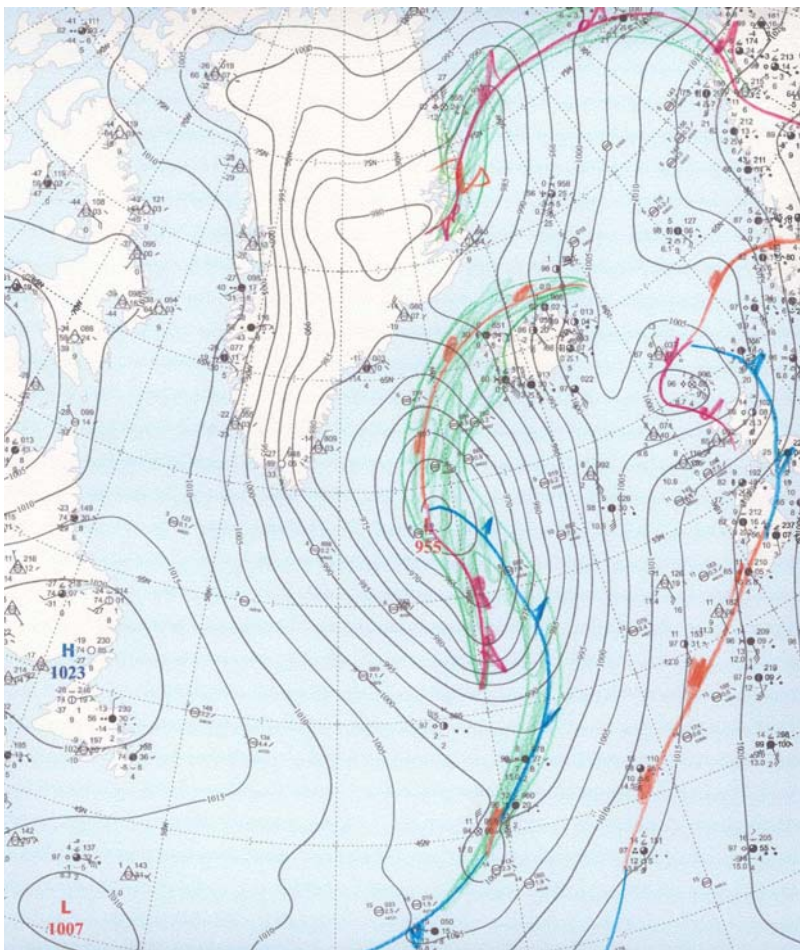
- 1) Buoys SLP score higher than GPSRO from (0-24h), lower from 24h onward);
- 2) large impact of SLP ocean data on forecast accuracy, (48 to 72 hours), especially w/out GPSRO, and for the Southern Ocean,
- 3) there is little need to enhance the North Atlantic array, which presently serves the forecast needs of Europe and North America;
- 4) SLP ocean data are significant in improving the forecast of large storms;
- 5) need to run longer OSE to evaluate the impact of such data in rain forecast;

What do we (oceanographers) know so far...

IMO FORECAST

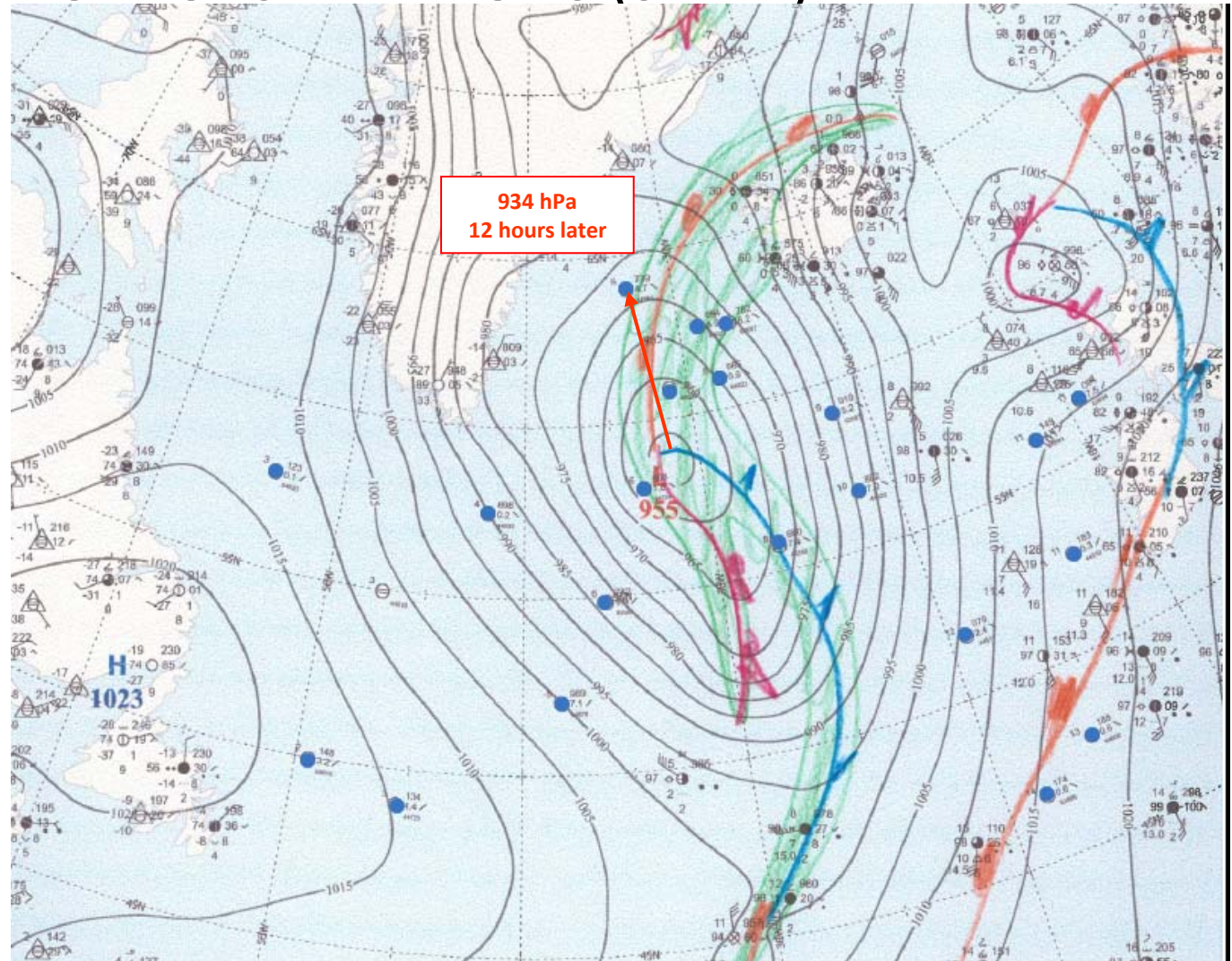
FEBRUARY 8, 2008, 12:00 UTC

FEBRUARY 9, 2008, 00:00 UTC



FROM OBSERVATIONS (SVP-B)

- Even if the forecasts are good, they must be confirmed by observations later, more especially when they concern explosive deepening cyclones as this presented here



February 8th, 2008
at 12:00 UTC

Pierre Blouch, E-SURFMAR
Programme Manager
Meteo-France

By courtesy of the Icelandic Met Office

Practical questions of interest to the GDP:

- 1) How many barometer drifters are really needed in the array (wish list & minimal requirements)?
- 2) Where do they need to be located?
- 3) What SLP accuracy is required (impacts budget, currently we use Honeywell HPB, +- 1mbar)?
- 4) What data timeliness is really required (impacts choice of satellite provider, i.e. Iridium or Argos)?

Purpose & outcomes of this workshop (the nitty gritty...)

- 1: assess the state of the art on the impact of sea-level air pressure data from drifters on NWP quality:
- 2: evaluate the need, based on 1, for commissioning new OSEs & OSSEs to refine our understanding (the DBCP PP has some funds, ~\$40K, for it)
- Isolate drifters SLP from other platforms and also do geographical segregation;
- Who is designing the experiments?
- Can we engage in OSSEs' validation?
- What are the best metrics to evaluate the impact of the data (for example low level wind, directly linked to human activities and linked to wave forecast models). Another is surface energy, i.e. change the range of integration
- Write a report on this workshop (LC);
- Write a BAMS paper on the issue (This workshop participants'? Yes, Lead author tbd by end of this week)
- May need post-doc or WS staff to start a phase 2 on more articulated investigation on expanding the SVPB array. TBD again by end of week?