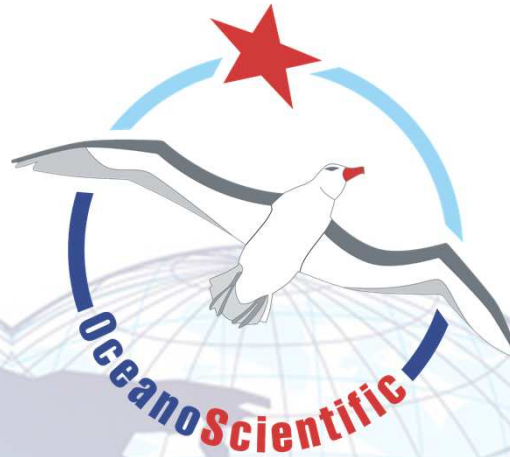


**6<sup>th</sup> FerryBox  
Workshop**

**9 September 2014**



**The *Oceanoscientific*<sup>®</sup> Programme:  
Scientific Data Acquisition by Sailing Ships,  
results from the 2013 and 2014 campaigns**



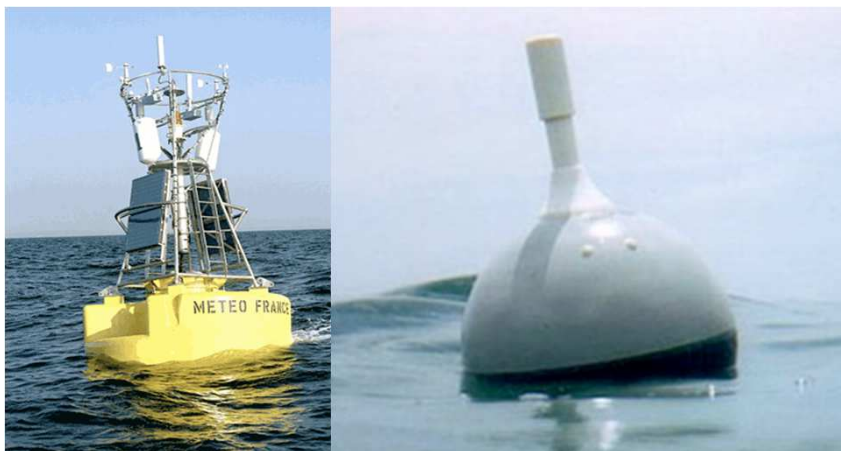


# Contents

- **Review of the current platforms for offshore measurements** **3**
- **Geographical coverage - Founding scientific assessment** **4**
- **What about sailing boats?** **6**
- **Creation of an innovative project: the *Oceanoscientific® Programme*** **7**
- **What do we actually measure and collect?** **9**
- ***Oceanoscientific® Campaign / Bark EUROPA*** **10**
- ***Oceanoscientific® Campaign / NAVOSE® Boogaloo*** **12**
- **Upcoming *Oceanoscientific® Campaigns*** **21**
- **Sailing races and associated engineering challenges** **23**



# Current platforms for sea exploration



**Surface Devices: Moored and drifting buoys**



**Sub-surface Devices: Argo profilers, gliders and XBT's**



**Boats: Research Vessels, Ships of Opportunity**

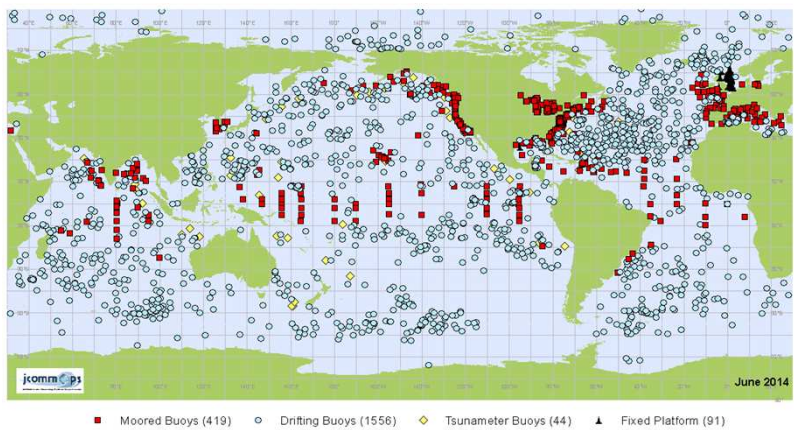


**Remote sensing: Oceanographic satellite observations**

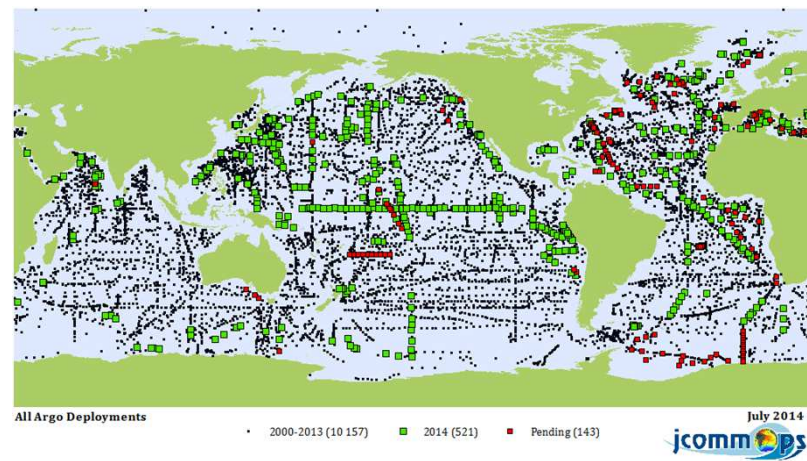




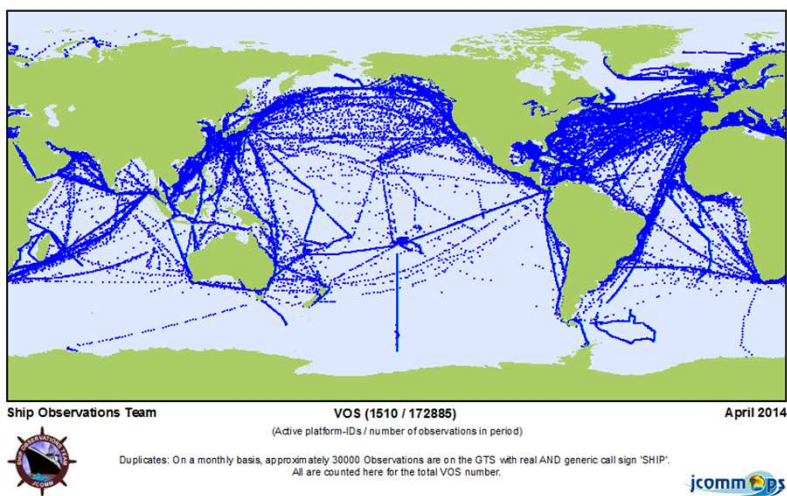
# Geographical Coverage



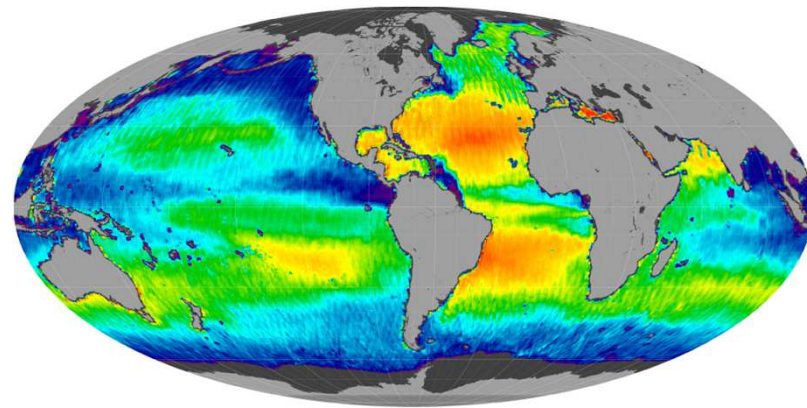
Data Buoys positions - June 2014



Argo Drifters Float - July 2014



Voluntary Observing Ships Routes - April 2014



Aquarius Satellite SSS Data - June 2014



## Founding scientific assessment

**Scientists lack in situ quality data  
at the ocean - atmosphere interface  
on sea routes subject to little traffic,  
especially around the Antarctica**

**This handicaps and slows down the understanding  
of causes and consequences  
of climate change / warming**



## What about Sailing Boats ?

- **Enhanced manoeuvrability thanks to their small size**
- **Guaranteed safety despite high speeds (up to 25 knots)**

**→ This makes sailing vessels highly flexible platforms**

- **Cheaper than a research vessel expedition**
- **Complement the ocean observation performed by ships of opportunity**
- **Green platforms using renewable energy sources**





## Creation of an innovative project

Geographical data gap at high latitudes

Lack of scientific in-situ quality data

Expertise in the sailing field

*Oceanoscientific® Programme*

- **Collecting data at the ocean - atmosphere interface**  
**on sea routes subject to little or no exploration**
- **15 or more-meter sailing yachts as innovative platforms**
- **Transmitting data free of charge to the scientific community**





# ***Oceanoscientific® Programme***

- **Innovative scientific programme initiated in 2006**
- **Unprecedented approach studying climate change**
- **Under the authority of UNESCO institutions (WMO and IOC)**
- **With the support of international scientific research institutes**
- **A unique scientific material: the *Oceanoscientific® System***
- **Recognised results after seven years of R&D (2006 - 2014)**





# Physical and Chemical data acquisition

- **12 physical and chemical parameters logged every 6 seconds**

$T_{air}$ ,  $H_{air}$ ,  $P_{atm}$ , (Speed, Dir) $_{Wind}$ , PAR,  
SSS, SST,  $SSpCO_2$ , Chl a, pH, Turbidity

- **Transmission in near real-time, as per one file an hour**
- **Permanent scientific contact with the shore**
- **Plug and Play material: extra parameters can be added**



# Antarctic Campaign 2013 / Bark EUROPA



- Three-master *Bark EUROPA*
- Ushuaia - Antarctic Peninsula
- Ushuaia - South Shetland Islands
- Weddell Sea - South Georgia
- Tristan da Cunha - Cape Town

**In use for 96 days**

**Two 19-day sails**

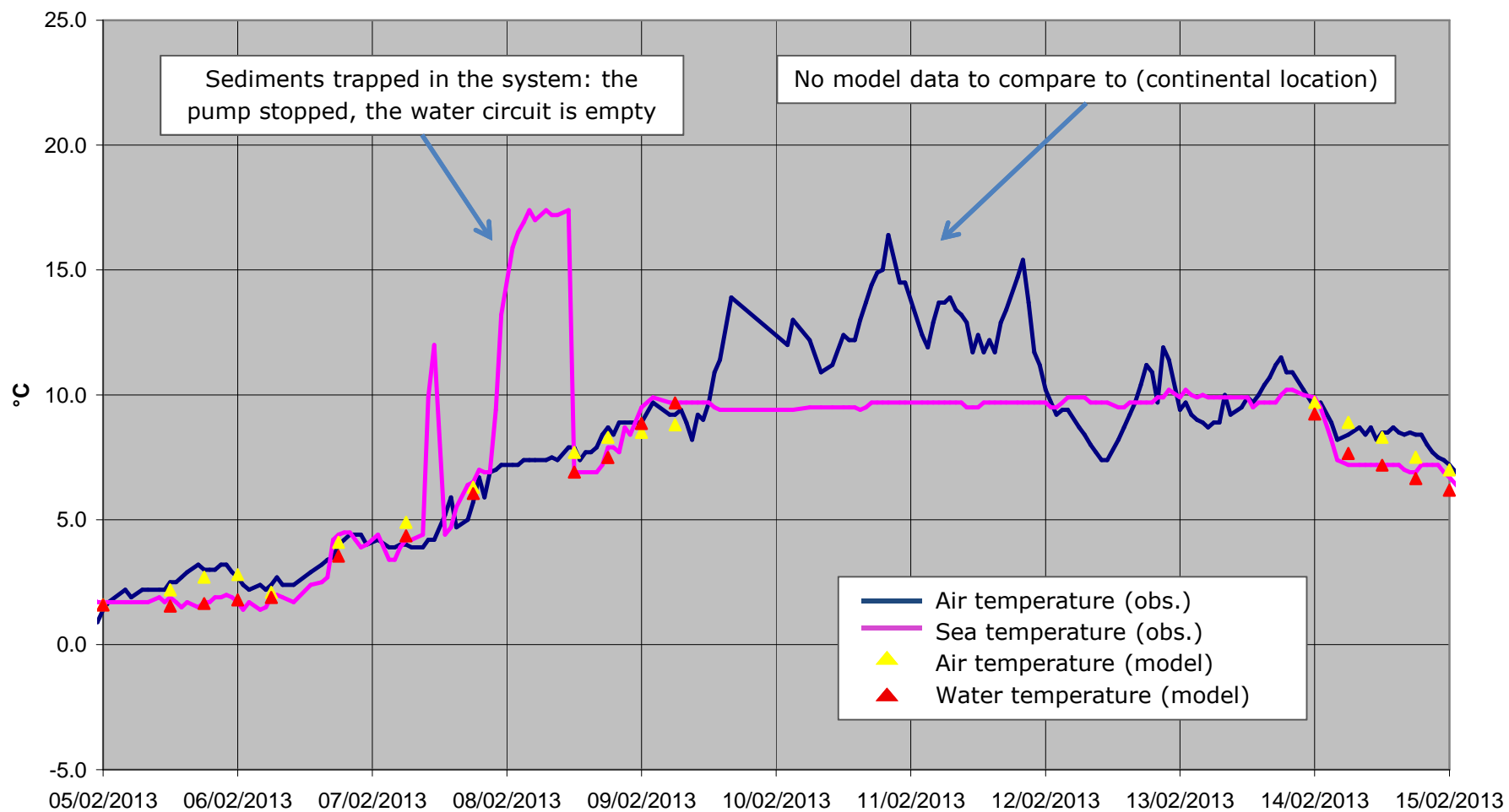
**One 52-day sail**





# Antarctic Campaign 2013 / Bark EUROPA

## Air and Sea Surface Temperatures

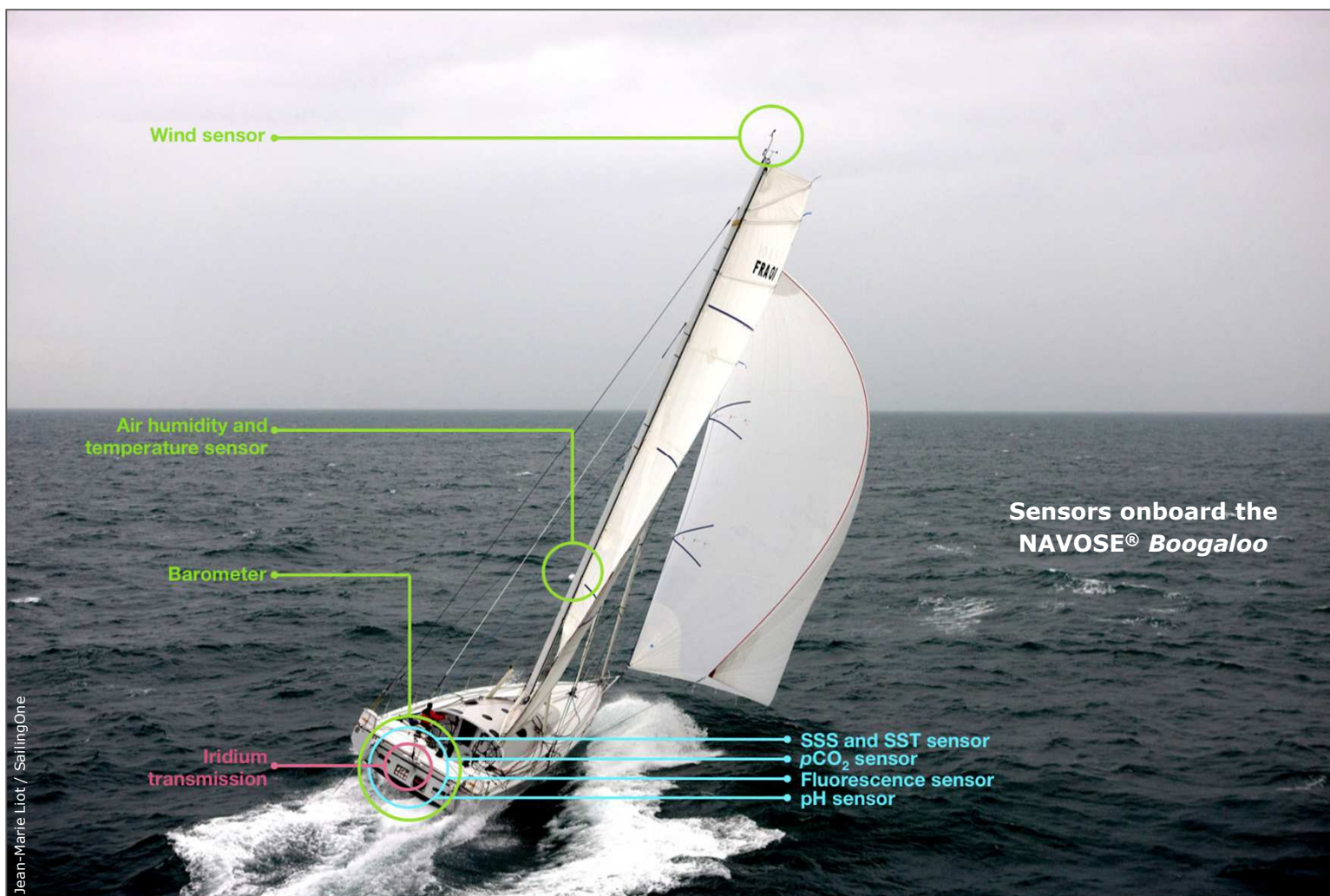


Comparisons between in-situ measured data and Arpège Model - Comparison realised by Météo-France





# Navire A Voile d'Observation Scientifique de l'Environnement - NAVOSE®





# Navire A Voile d'Observation Scientifique de l'Environnement - NAVOSE®

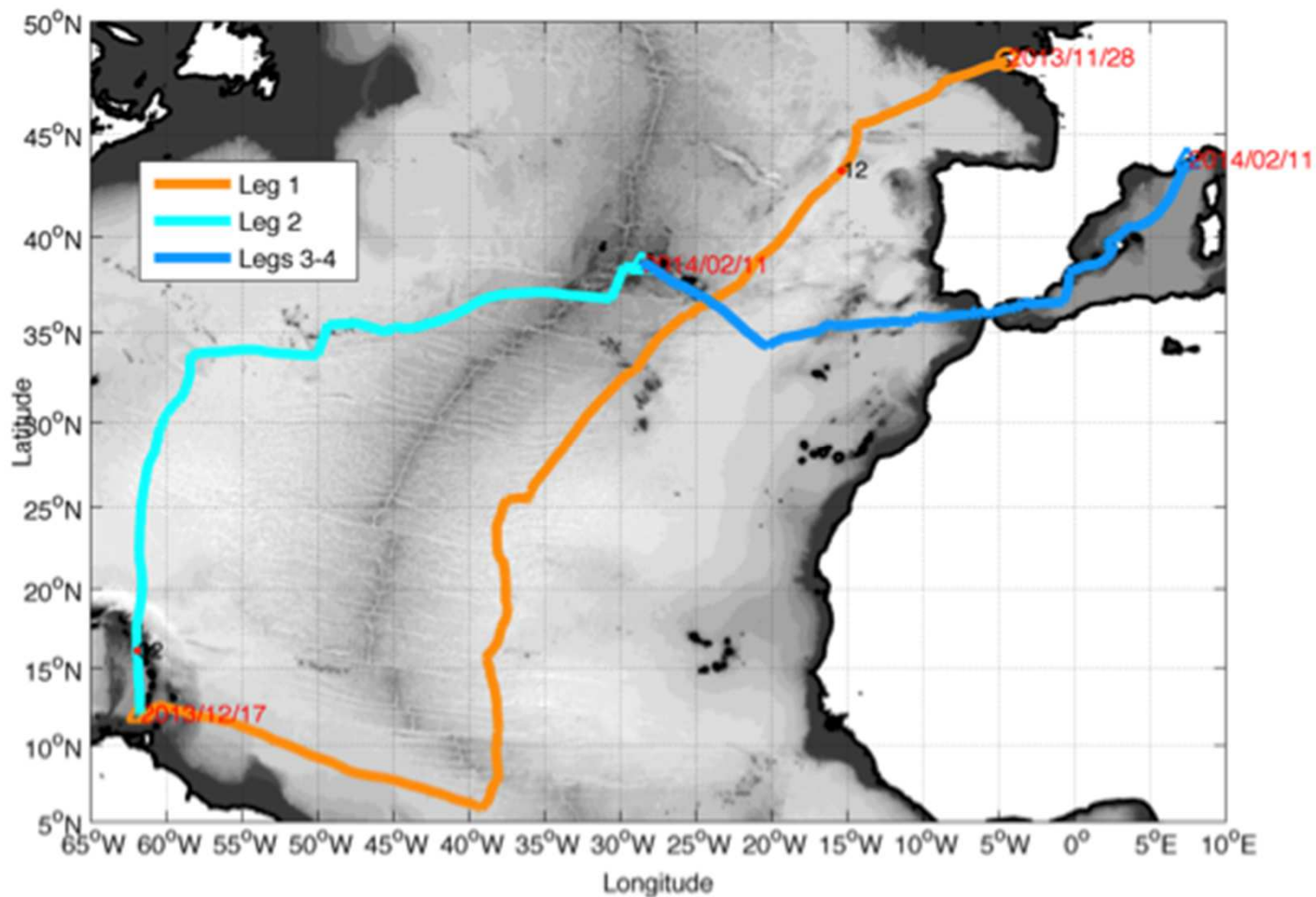


OSC System modules and sensors onboard the NAVOSE® *Boogaloo*



# Atlantic Campaign 2013 - 2014

## NAVOSE® - Boogaloo



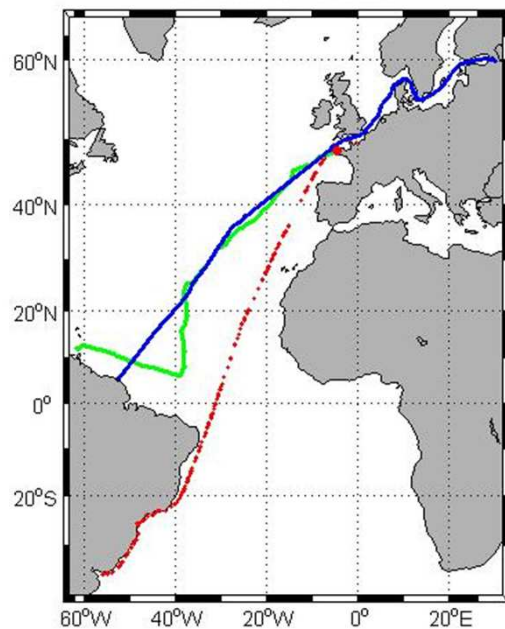
North Atlantic and Mediterranean expedition November 2013 to April 2014  
Chart LPO - IFREMER





# Atlantic Campaign 2013 / NAVOSE® Sea Surface Temperature & Salinity

Cruise: Santa Cruz



- NAVOSE® *Boogaloo*
- Colibri
- Santa Cruz

Santa Cruz	47° 45'N 07° 01'W	29/11 - 06h13	SST = 13.233	SSS = 35.555
NAVOSE® <i>Boogaloo</i>	47° 45'N 07° 00'W	30/11 - 07h50	SST = 13.225	SSS = 35.565

Santa Cruz and the NAVOSE® *Boogaloo* SSS and SST data comparisons  
at a single crossing point

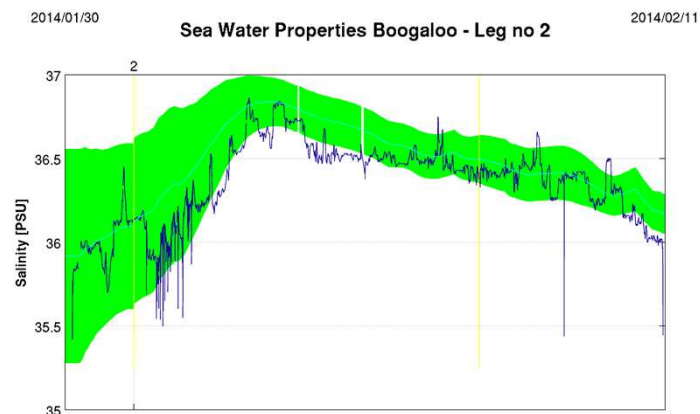
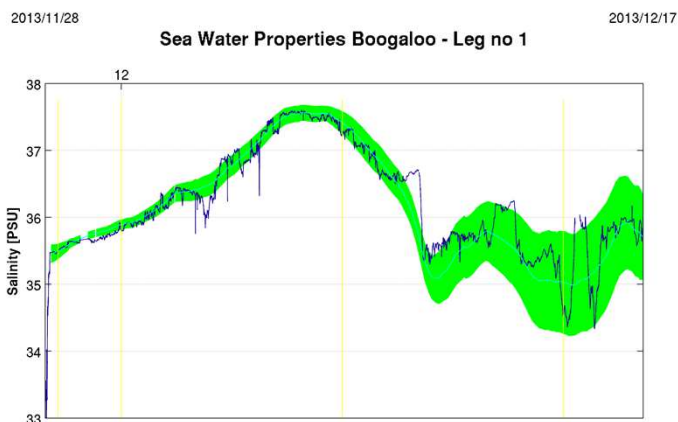
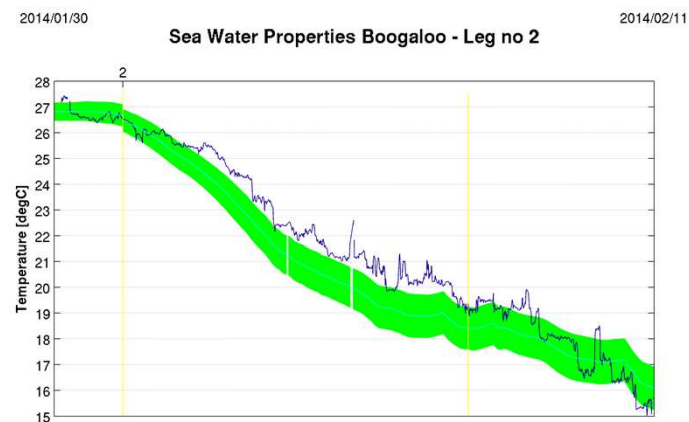
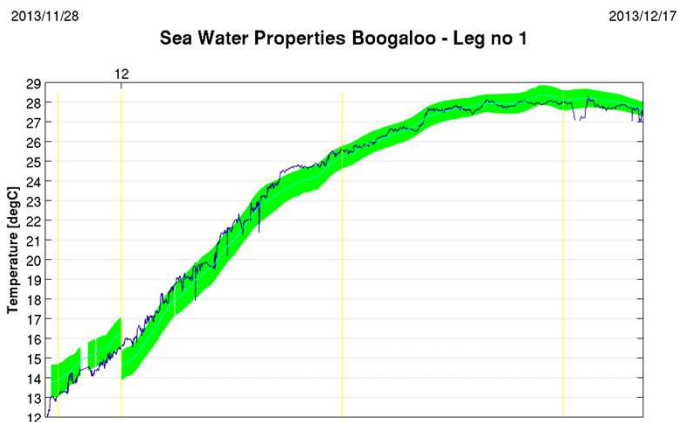
Colibri	9° 04' N 49° 36'W	13/12 – 00h22	SST = 28.22	SSS = 34.914
NAVOSE® <i>Boogaloo</i>	9° 04' N 49° 31'W	14/12 – 21h22	SST = 27.97	SSS = 35.101

Colibri and the NAVOSE® *Boogaloo* SSS and SST data comparisons  
at a single crossing point

The NAVOSE® *Boogaloo*, Colibri and Santa Cruz trajectories across the Atlantic



# Atlantic Campaign 2013 / NAVOSE® Sea Surface Temperature & Salinity



SST and SSS compared to ISAS-13 monthly climatology and annual variance



# Atlantic Campaign 2013 / NAVOSE® Atmospheric data comparisons

29/11/2013						
11H UTC			12H UTC			
	NAVOSE® <i>Boogaloo</i>	Brittany	Mercator	NAVOSE® <i>Boogaloo</i>	Brittany	Mercator
Pressure (hPa)	1037,4	1037,5		1036,7	1036,9	
Air Temperature (° C)	11,75	12,1		11,95	11,9	
Dew Point (° C)	8,35	8,3		8,35	8,4	
SST (° C)	13,94	13,6		13,77	13,5	
SSS (PSS)	35,63		35,58	35,64		35,58
Wind Direction (° )	20	360		15	350	
Wind Speed (m.s <sup>-1</sup> )	8,5	5,1		7,6	6,7	

The NAVOSE® *Boogaloo* data comparisons with the Brittany moored buoy (47° 25' N - 6° 25' W) and Mercator model output

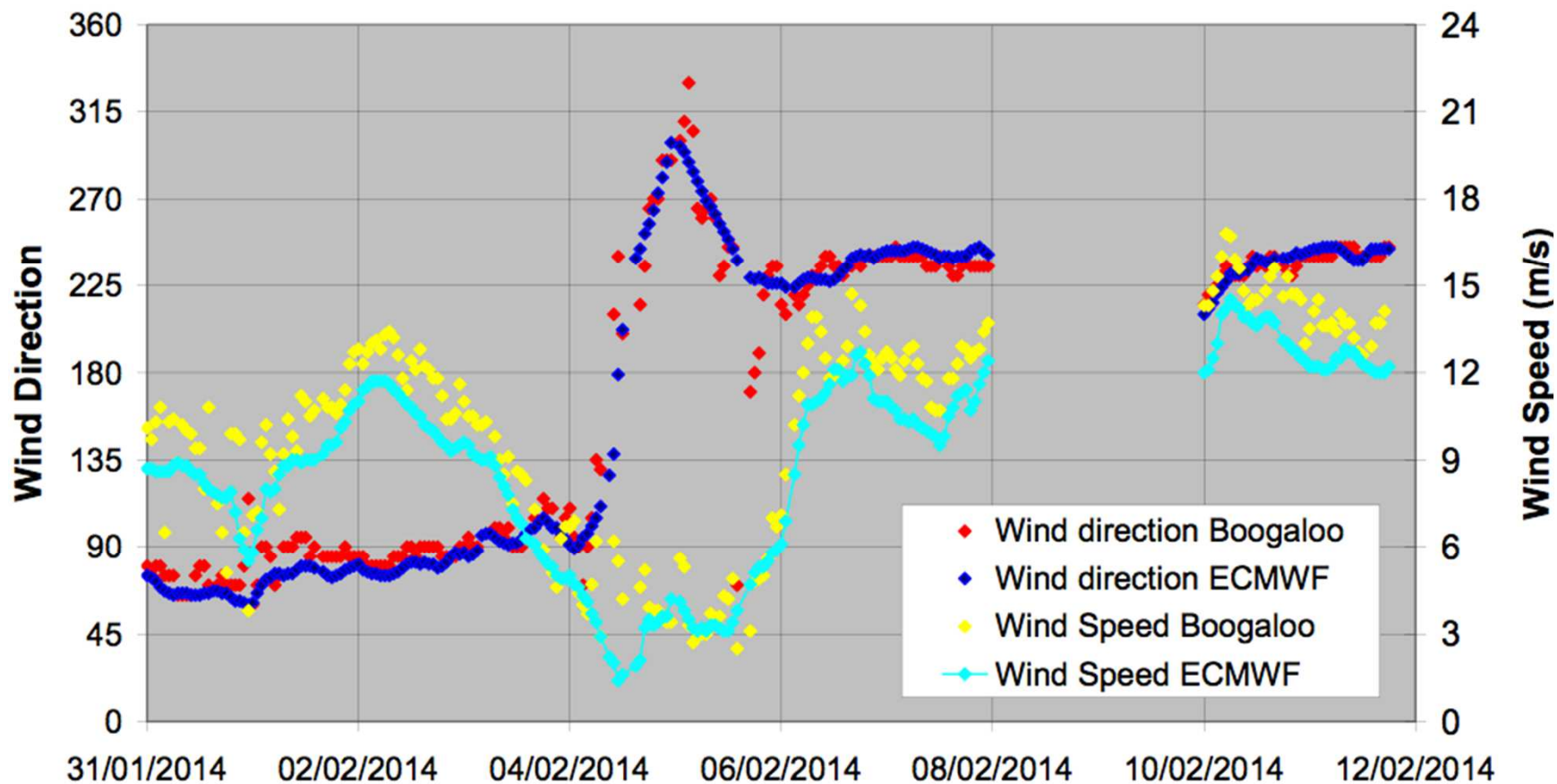
12/12/2013						
15H UTC					11H UTC	
	NAVOSE® <i>Boogaloo</i> (Average 14-16h)	Buoy 41734	Mercator	ECMWF	Buoy 13009	Buoy 13009
Pressure (hPa)	1013,2	1013,2		1013		
Air Temperature (° C)	28,15			26,3	26,9	
Humidity (%)	81%			82%	82%	
Dew Point (° C)		8,3				
SST (° C)	28,11					27,51
SST Buoy hull (° C)		28,05		27,8		
SST Seabird (° C)		28,047				
SSS (PSS)	35,64	35,659	35,24			

The NAVOSE® *Boogaloo* data comparisons with a drifting and a moored buoys and Mercator and ECMWF models output





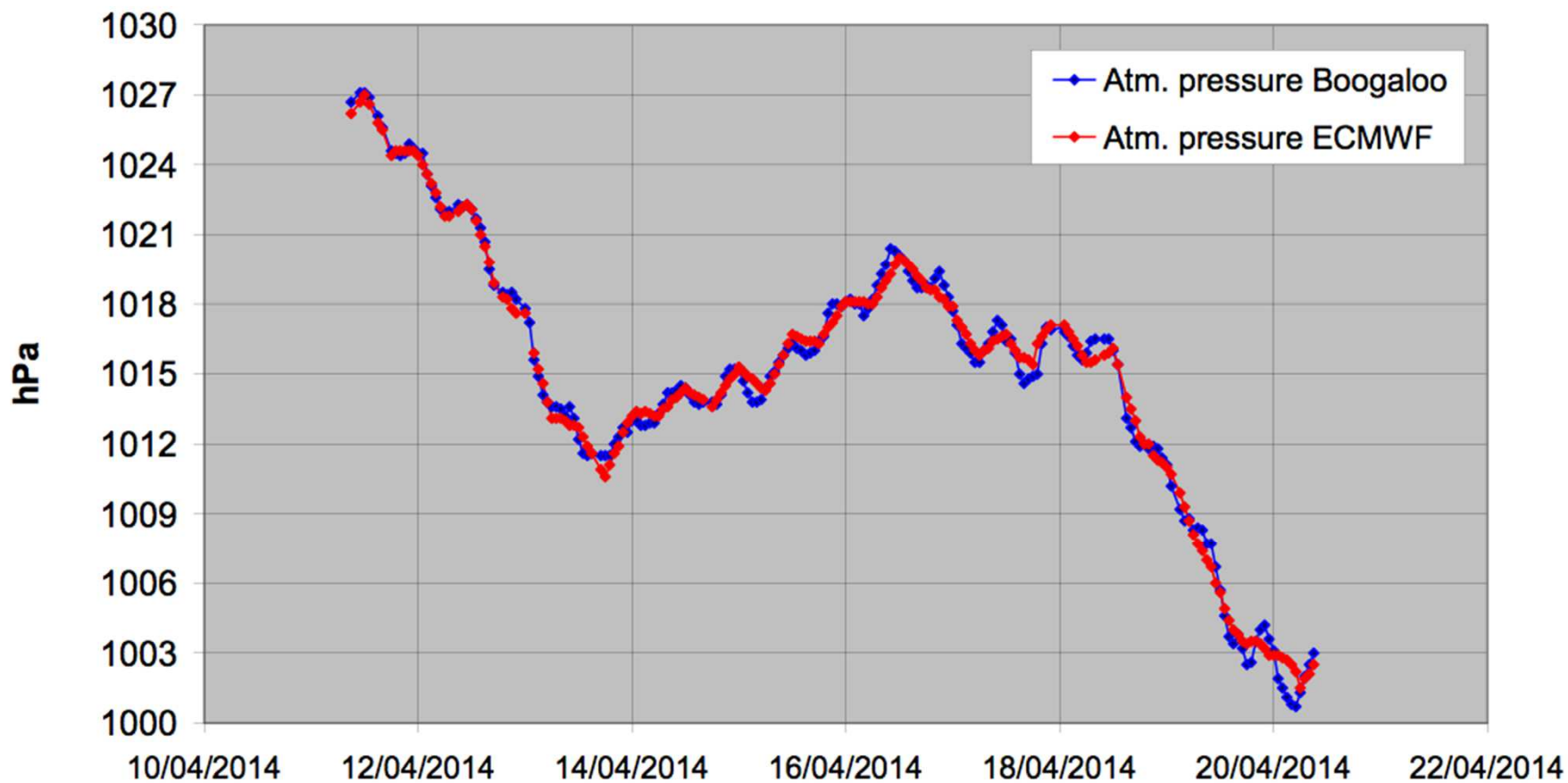
# Atlantic Campaign 2013 / NAVOSE® Atmospheric data comparisons



The NAVOSE® *Boogaloo* - Leg Grenada / Horta  
Wind Direction and Speed, Comparisons with ECMWF analysis



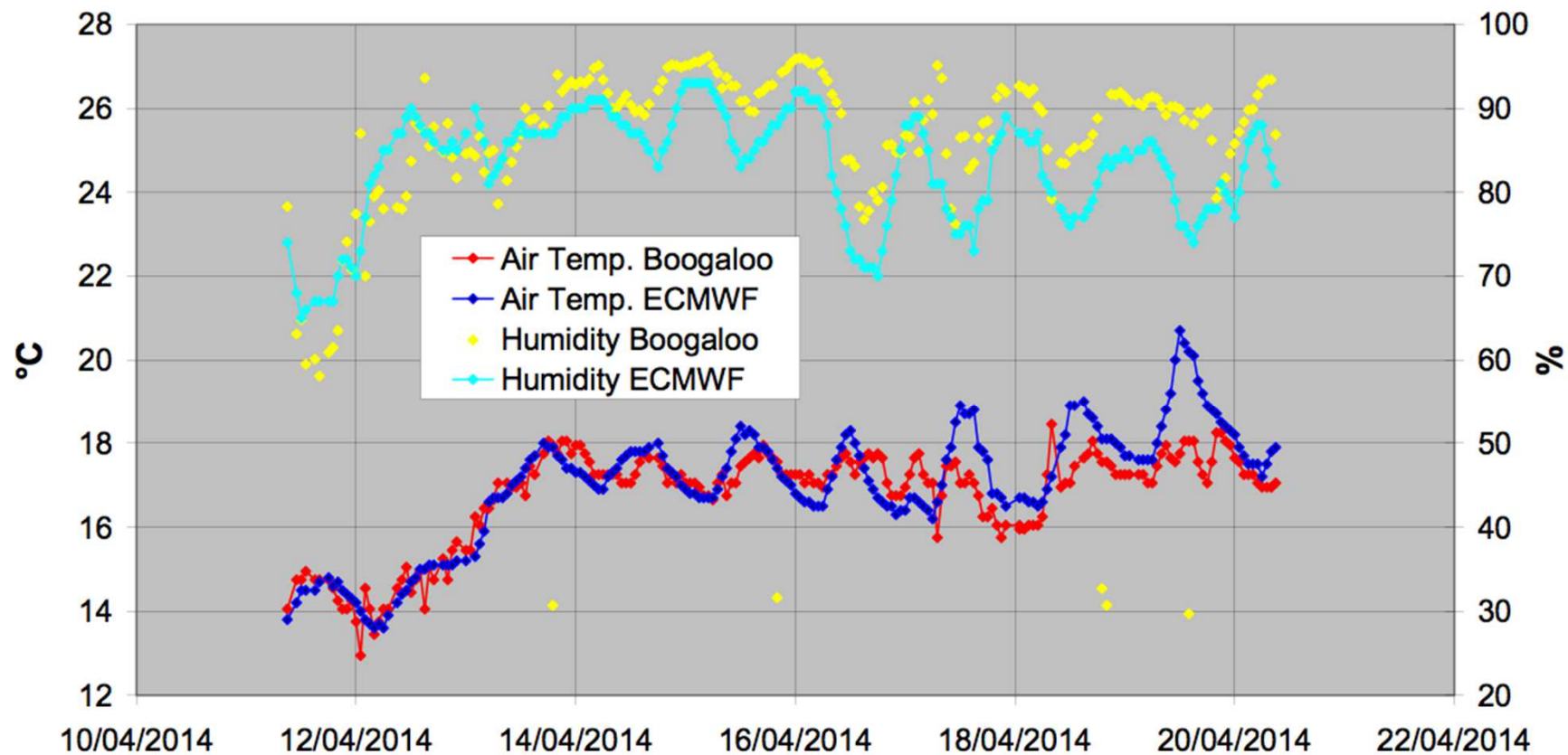
## Atlantic Campaign 2013 / NAVOSE® Atmospheric data comparisons



Atmospheric pressure measured onboard the NAVOSE® *Boogaloo* and compared to the ECMWF values



# Atlantic Campaign 2013 / NAVOSE® Atmospheric data comparisons

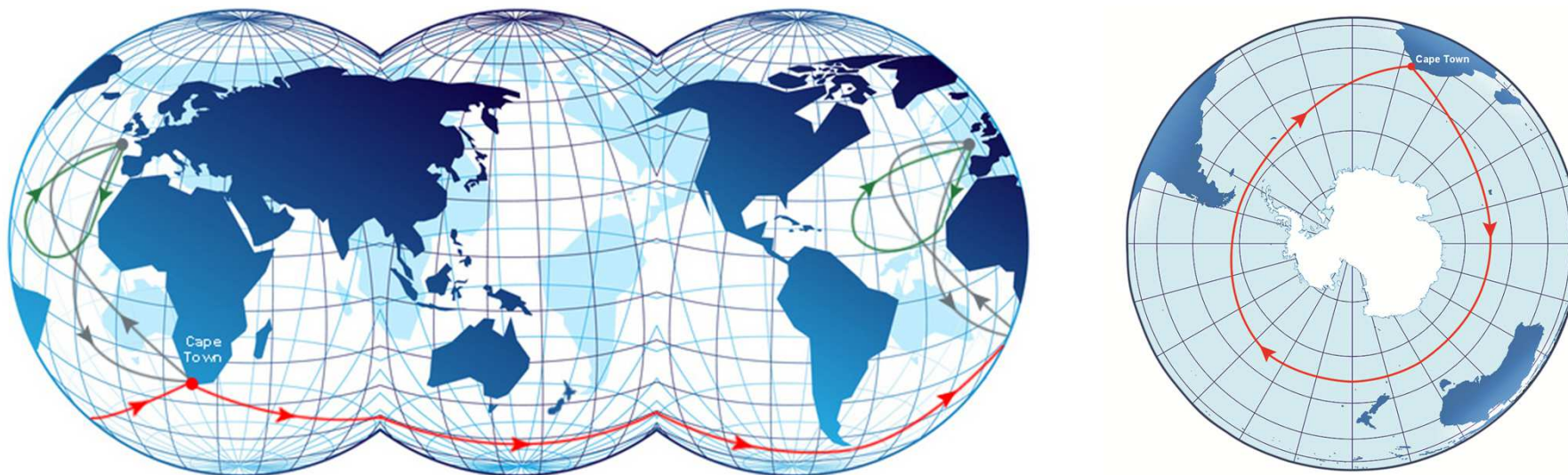


Air temperature and humidity measured onboard the NAVOSE® *Boogaloo* and compared to the ECMWF values





## Around the Atlantic / Around the Antarctic



**Navigation around the Atlantic during Northern Hemisphere Summer**  
**Around the Antarctic Campaign during Southern Hemisphere Summer**

**Shore team in liaison with the scientific partners will provide routings based on weather and scientific phenomenon of interest as they arise.**

***OceanoScientific® Campaigns will sail into these hostile areas every year.***



## Antarctic Campaigns / NAVOSE® *Boogaloo*



▪ ***Oceanoscientific® 2013 - 2014***

***A single NAVOSE®: Boogaloo***

▪ ***Oceanoscientific® 2014 - 2015***

▪ ***Then 2015-16, 2017-18, etc...***

**Two NAVOSE®:**

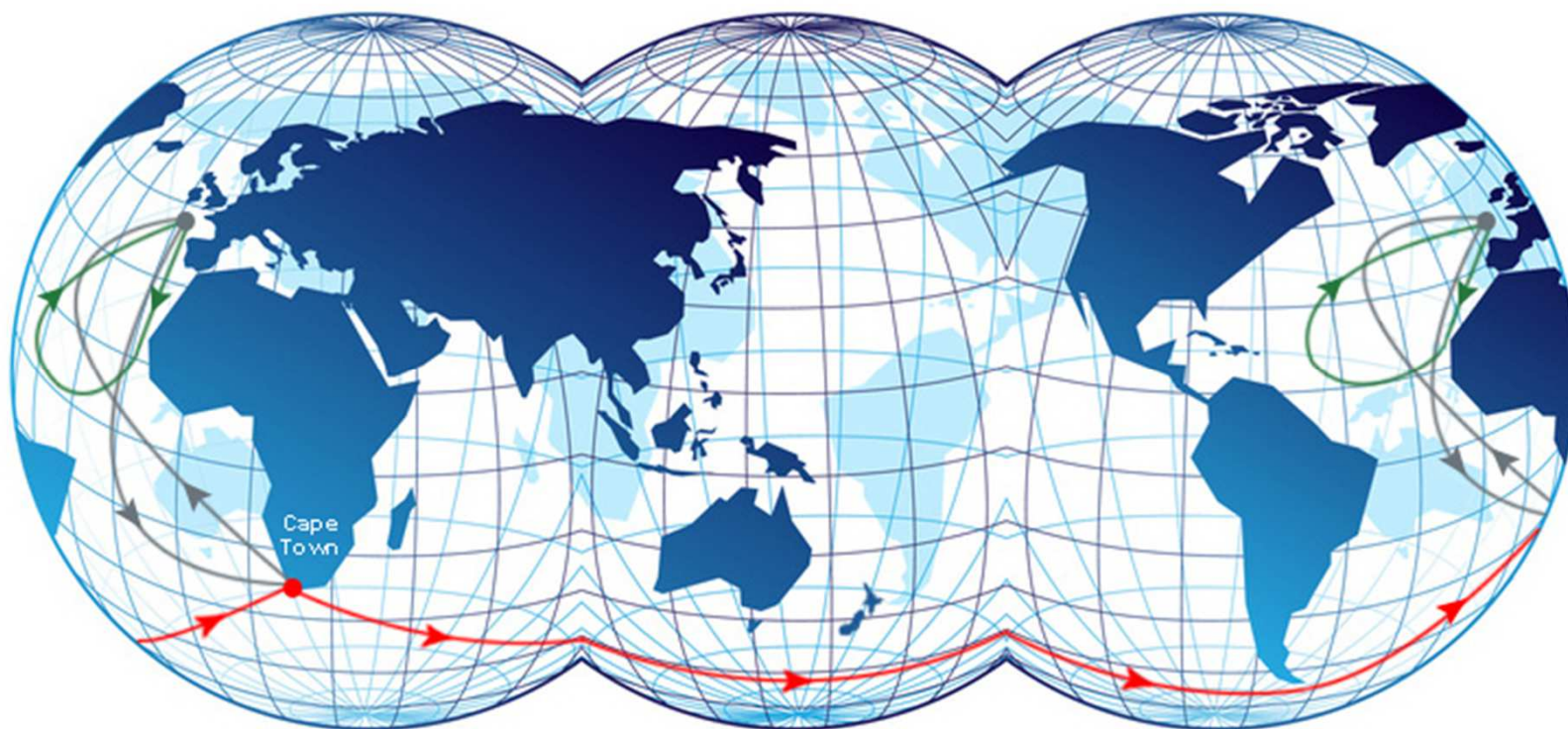
- **Scientific data redundancy**

- **Enhanced security**





# Around the Globe Sailing Races



**The *Oceanoscientific*<sup>®</sup> Programme targets all the sailing boats entering the next offshore races through the Southern seas: *Barcelona, Volvo, Vendée Globe*...**

**Down the Atlantic - through Indian and Pacific Oceans - Up the Atlantic**





## Current engineering challenges to meet demanding racing requirements

- **Volume and weight reduction to fit onboard in small compartments**
- **Power consumption limitation to keep fuel volume required down**
- **Improved resistance to shocks and vibrations**
- **Enhanced water tightness**
- **More hydrodynamic water intake pipes not to impact performances**
- **More efficient electro-mechanical parts for a 100% unattended system**



**Any question?**

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