

Evaluation of SVP type drifters reporting through Iridium

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Series of Iridium SVP drifters

(Meteo-France experience)

Series of Iridium SVP-B drifters (1)

*All buoys described in the present document
have alkaline batteries and report through Iridium SBD.
Their data are systematically sent onto the GTS if reliable*

- **Oct. 2006 to March 2007**
 - 14 SVP-B prototypes purchased by Meteo-France to 3 manufacturers (Marlin, Metocean and Pacific Gyre)
 - Deployed in various areas (North Atlantic, Indian Ocean, Black Sea and Arctic)
 - All fitted with a GPS
 - Results were mixed but at least they prove the Iridium transmission is valid for drifting buoys
 - One Metocean still operating (in the Labrador Sea) after 18.5 months (WMO 44620)

Series of SVP-B drifters (2)

- **December 2007 to Now**
 - 125 SVP-B drifters purchased to [Metocean](#)
 - For operational purposes (E-SURFMAR)
 - 100 deployed ⁽¹⁾ (in North Atlantic, exclusively)
 - No GPS
 - 38 stopped operating – 62 still in operation ⁽¹⁾
 - **Excellent results.** Presented further



(1) Status on September 22th, 2009

Series of SVP-B drifters (3)

▪ Nov. 2008 to March 2009

- 5 SVP-B prototypes purchased to [Marlin](#) by Meteo-France
- Deployed in North Atlantic and Indian Ocean
- All fitted with a GPS
- **Disappointing results**

▪ March to May 2009

- 5 SVP-B prototypes (new design) provided by [Metocean](#) free of charge
- Deployed in North Atlantic (4) and in the Pacific Ocean (1)
- All fitted with a GPS
- **Disappointing results**

Other SVP type series...

▪ **SVP-BS (Salinity)**

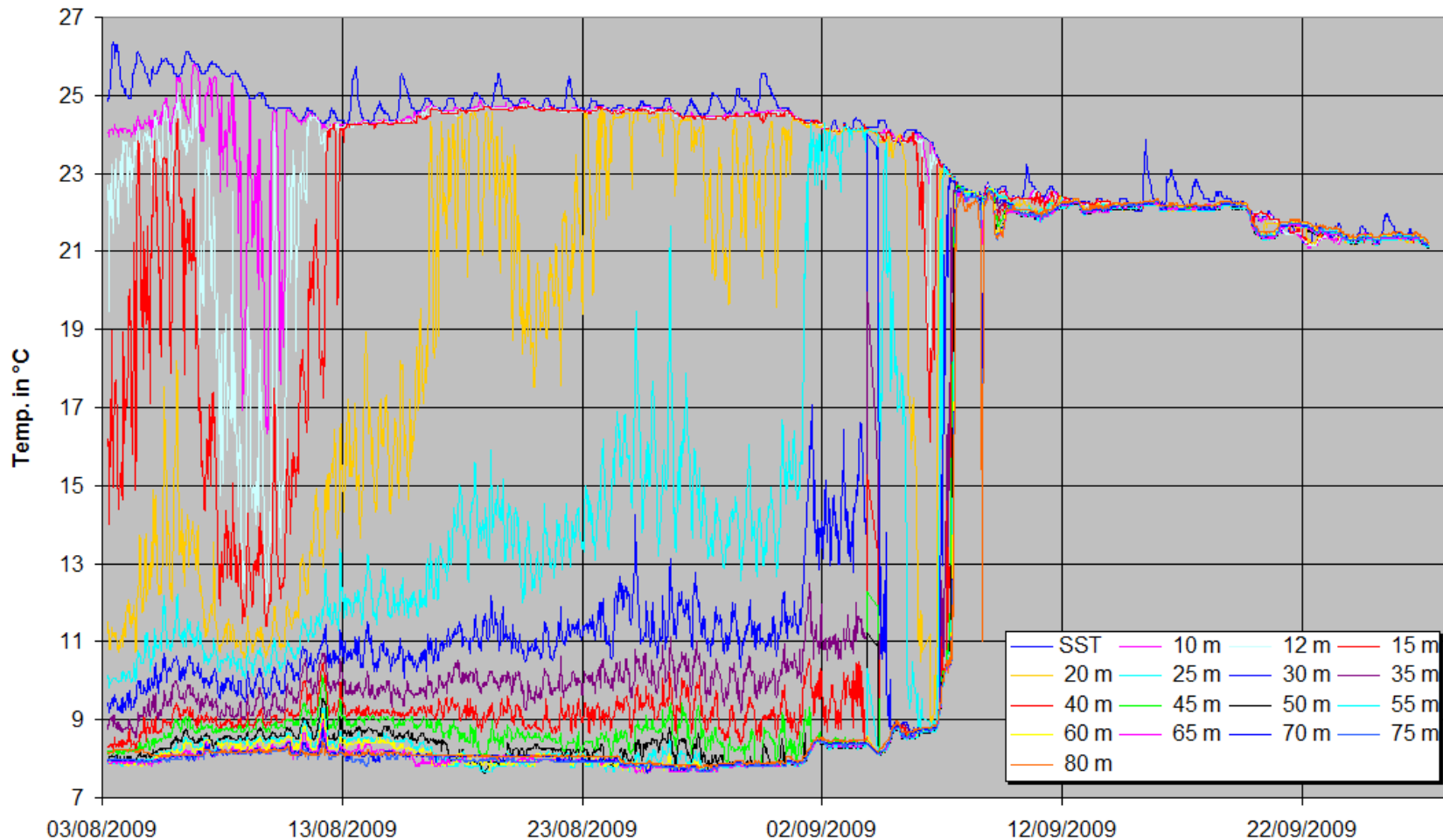
- 5 SVP-BS prototypes purchased to Metocean for Gloscal (SMOS Cal/Val)
- Fitted with a GPS (3-hourly fixes)
- One deployed off France in May 2009
- **Failed after 52 days**. Recovered. Should be expertised soon
- A second one should be deployed next month

▪ **SVP-BTC (thermistor strings)**

- 3 SVP-BTC prototypes from Marlin, deployed in the Black Sea in August 2009 (80-metre strings, 17 probes including surface)
- Monitored by Meteo-France – data sent onto the GTS
- **Excellent results** during the first weeks
- Unfortunately, the buoys ran on shallow waters (less than 25 metres) after one month
- **One buoy failed after 40 days**

Marlin SVP-BTC drifters

Marlin SVP-BTC drifter WMO 61690
Sea temperature in depth and surface



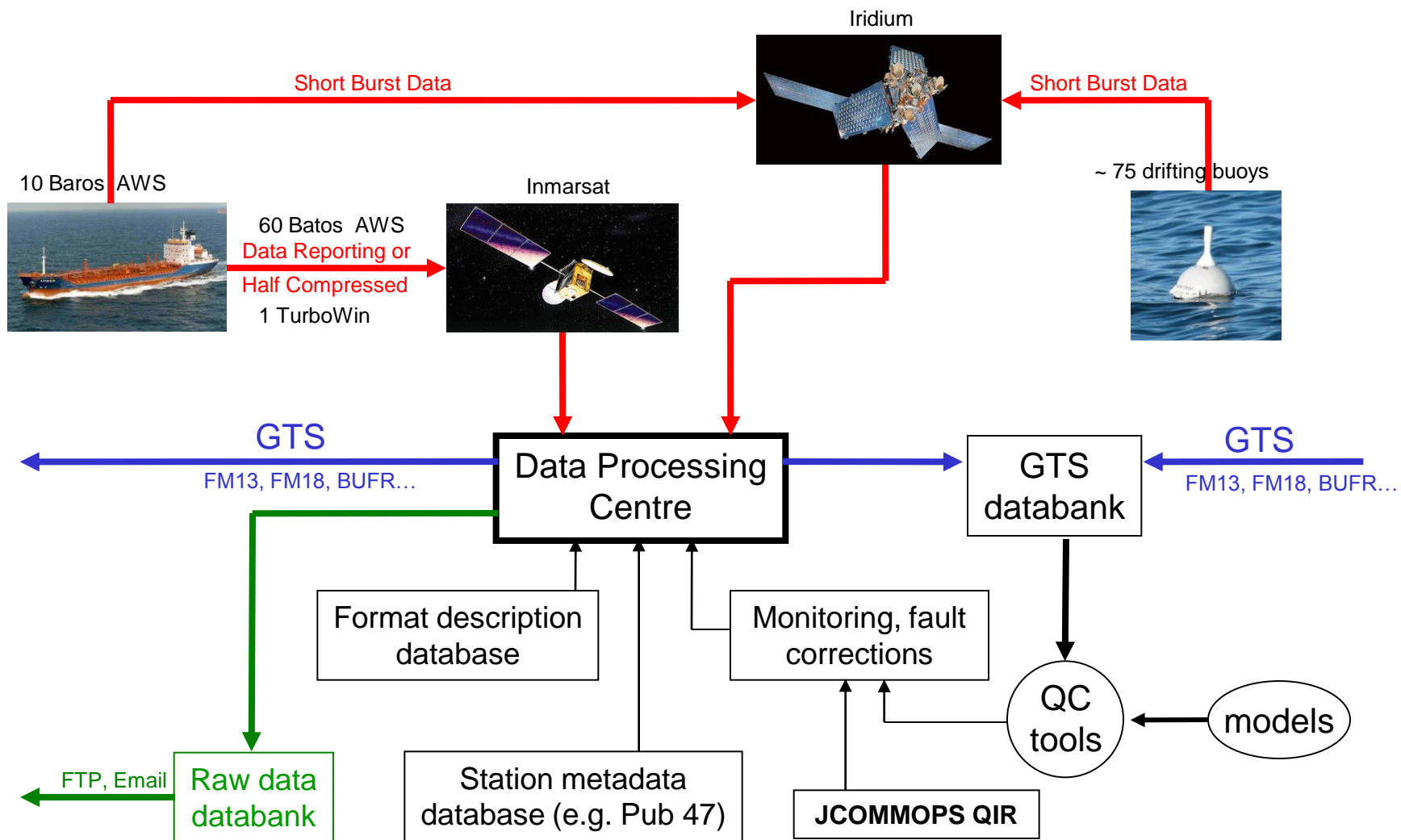
Marlin SVP-BTC drifters

Marlin SVP-BTC drifter WMO 61690
Depth of the end of the thermistor string



Iridium Data Transmission

Data transmission (Iridium SBD + Inmarsat-C DR)



GTS data transmission (Meteo-France)

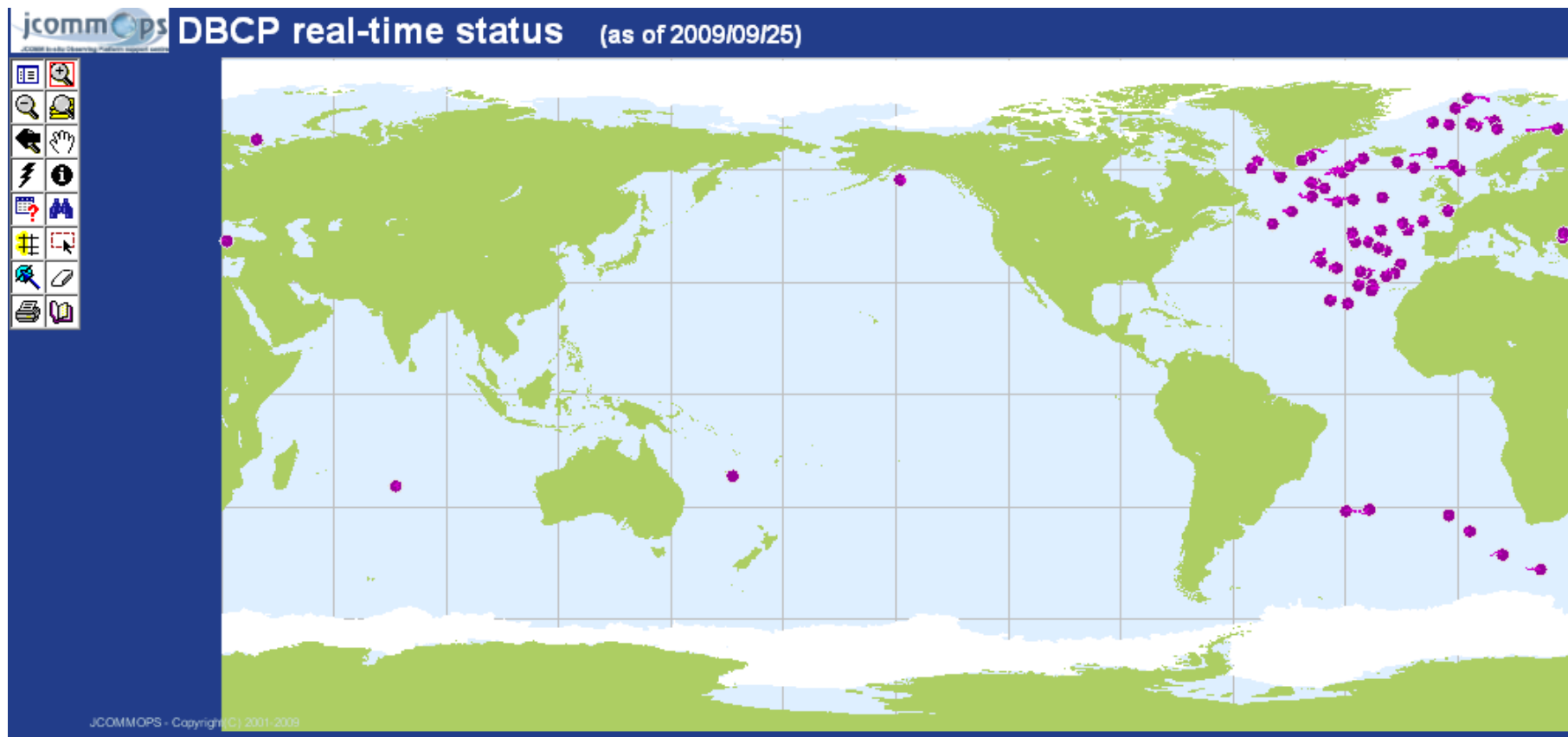
*Full transparency. Any meteorological service may check the data.
QC-Tools may be used to assess the performances*

▪ **Status on September 21st, 2009**

- 62 E-SURFMAR SVP-B (North Atlantic)
- 5 Met Office SVP-B (South Atlantic)
- 2 Marlin SVP-BTC (Black Sea)
- 1 Canadian SVP-B (North Pacific)
- 1 Australian SVP-B (Indian Ocean)
 - => Total 71 drifting buoys (i.e. ~100% of Iridium-PP buoys reporting onto the GTS)

- 9 Baros AWS (E-SURFMAR)
- 2 Deck drifters (Met Office)
 - => Total 11 Shipborne AWS

GTS data transmission



Iridium station dataformats (1)

- SVP-B => Version 4 (published on the Iridium-PP website)
- Two derived formats: for SVP-BS and SVP-BTC (also published)
- The processing chain at Meteo-France may process **any formats** having a similar structure. Softness:
 - Other parameters may be easily added (e.g. wind speed and direction)
 - Resolutions and ranges may be modified
 - Each parameter refers to its BUFR identifier
 - « Pilot file » containing the format description as well as calibration values (offset and slope) and two limits for each parameter if different from a standard template
 - « Metadata file » containing metadata not reported by the station but necessary to the GTS (e.g. type and depth of the drogue)
 - Missing parameters => all bits to « 1 »

Real-time data QC for GTS (1)

Control	Argos	Iridium SBD
Duplicate obs. times	Necessary in most of the stations since the exact time of observation is not reported with the data	Not required. The exact time of observation is reported with the data
Old location	Data with location more than 48 hours old not transmitted	Applied at Meteo-France. Possibility to use Iridium positions in case the GPS fails.
Multiplexing errors	Necessary if one observation is sent over several messages	Not required. The maximum length for a single message (300 bytes) meets most of the usual applications
Land/Sea test	Applied.	Could be applied at Meteo-France but the experience showed an infinitesimal occurrence (close to zero) of having a position on land.
Position 0-0	Applied.	Should be applied
Gross error check User limit check	Applied	Applied

Real-time data QC for GTS (2)

Control	Argos	Iridium SBD
Checksum, CRCc	Necessary	Ensured by the communication system: the data received are exactly those transmitted by the station
Compression Index	Specific to Argos	Not required
All bits identical	Applied to some parameters	DBCP convention: all bits to « 1 » means « missing value »
Sensor blockage	Applied to air pressure (to be checked)	Should be applied.
Bad associated compensating sensor	Applied	Should be applied at Meteo-France for dew point on ships AWS - computed thanks to air temperature and humidity.

Buoy lifetimes

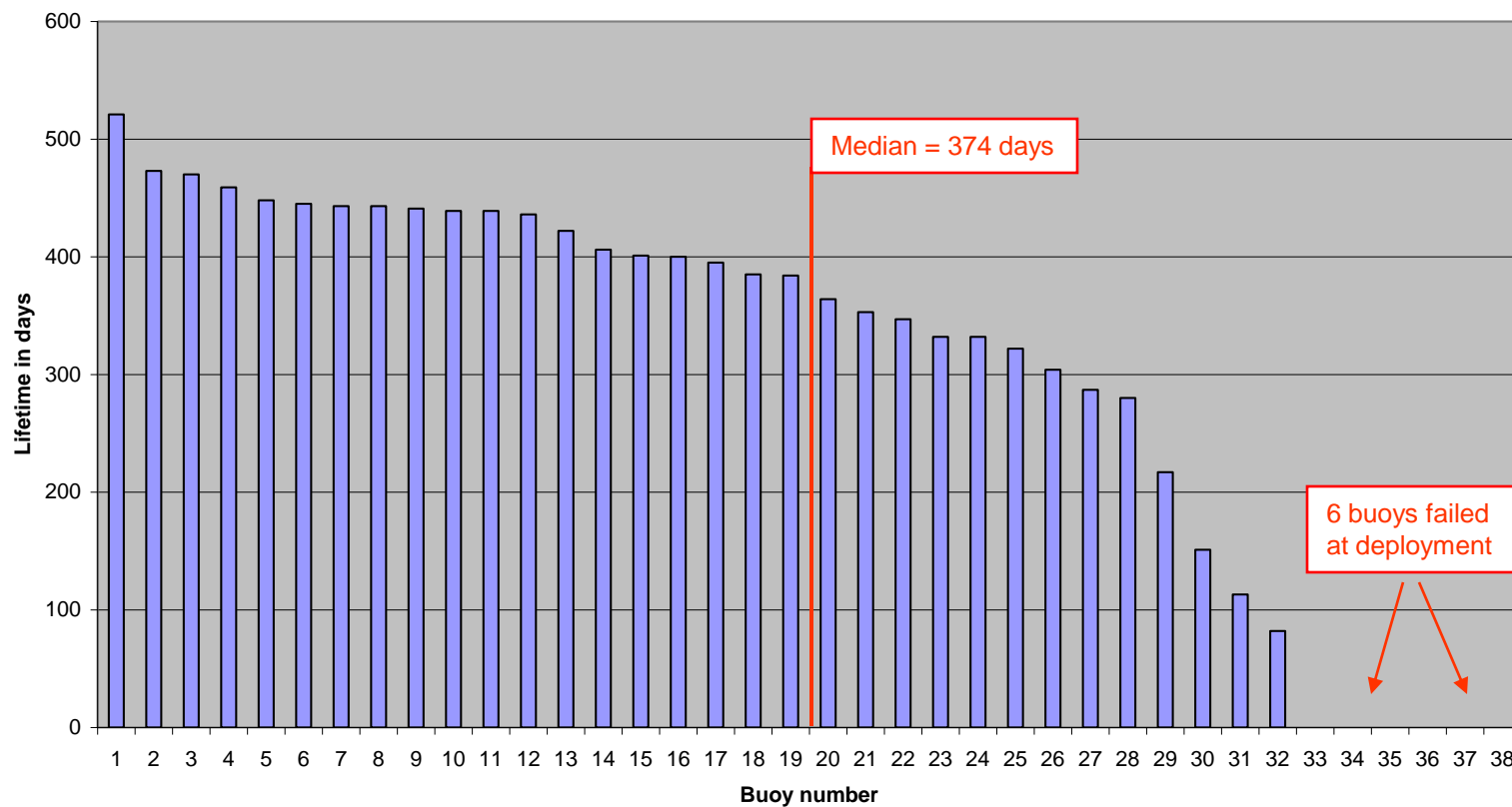
Preliminaries

- **Lifetime measurements may be biased**
 - **Assumption 1:** We stop to use a type of buoy
 - One year later, only old buoys are remaining for that type
 - Their mean lifetime will increase at the end of the programme
 - **Assumption 2:** We start to use buoys of a new type
 - During the first months, only buoys having quick failures are stopping
 - Their mean lifetime is short at the beginning of the programme

- **Average and median lifetime**
 - The cost per observation is linked to the **average** lifetime but this latest is strongly influenced by the age of the programme (problem explained here above)
 - The **median** should represent the mean lifetime for buoys which emptied their batteries in normal conditions. It is less influenced by the age of the programme

Iridium SVP-B lifetimes (SLP)

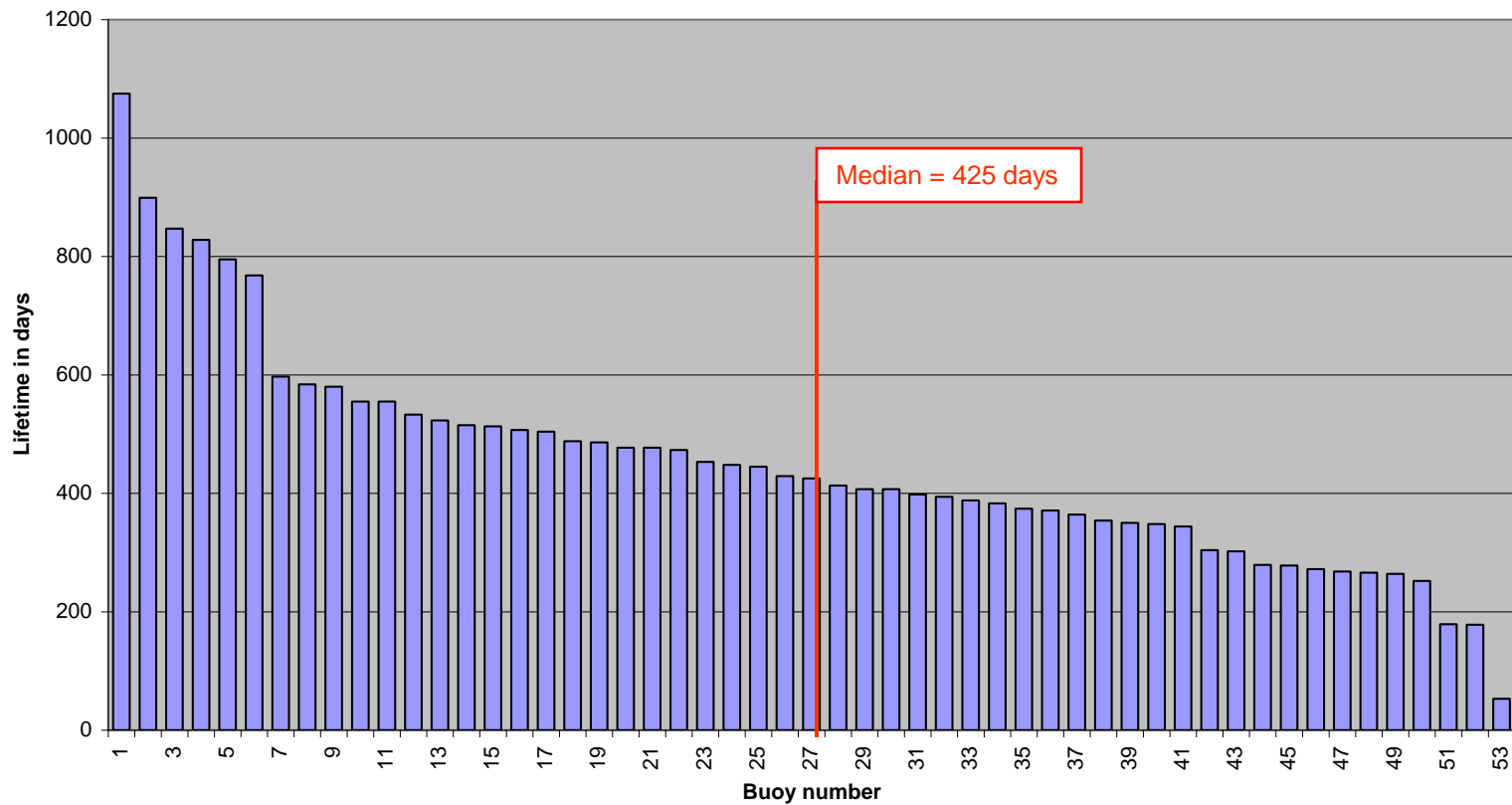
Iridium SVP-B lifetimes - 38 operational E-SURFMAR buoys
which stopped transmitting (out of 100 deployed)



NB : These buoys had no GPS

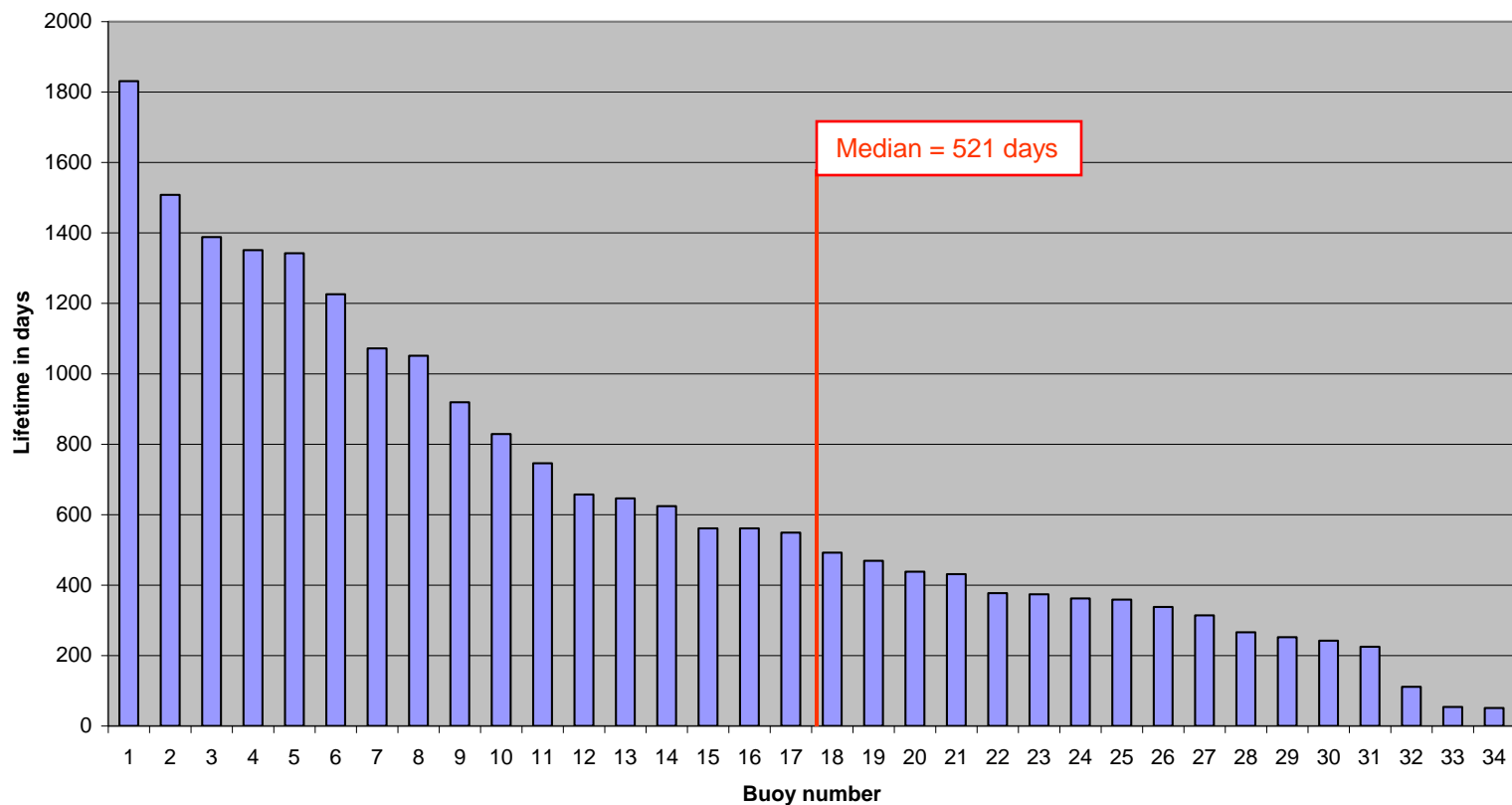
Argos SVP-B lifetimes (Metocean)

Argos SVP-B lifetimes - 53 operational E-SURFMAR buoys (Metocean)
which stopped transmitting after January 2008



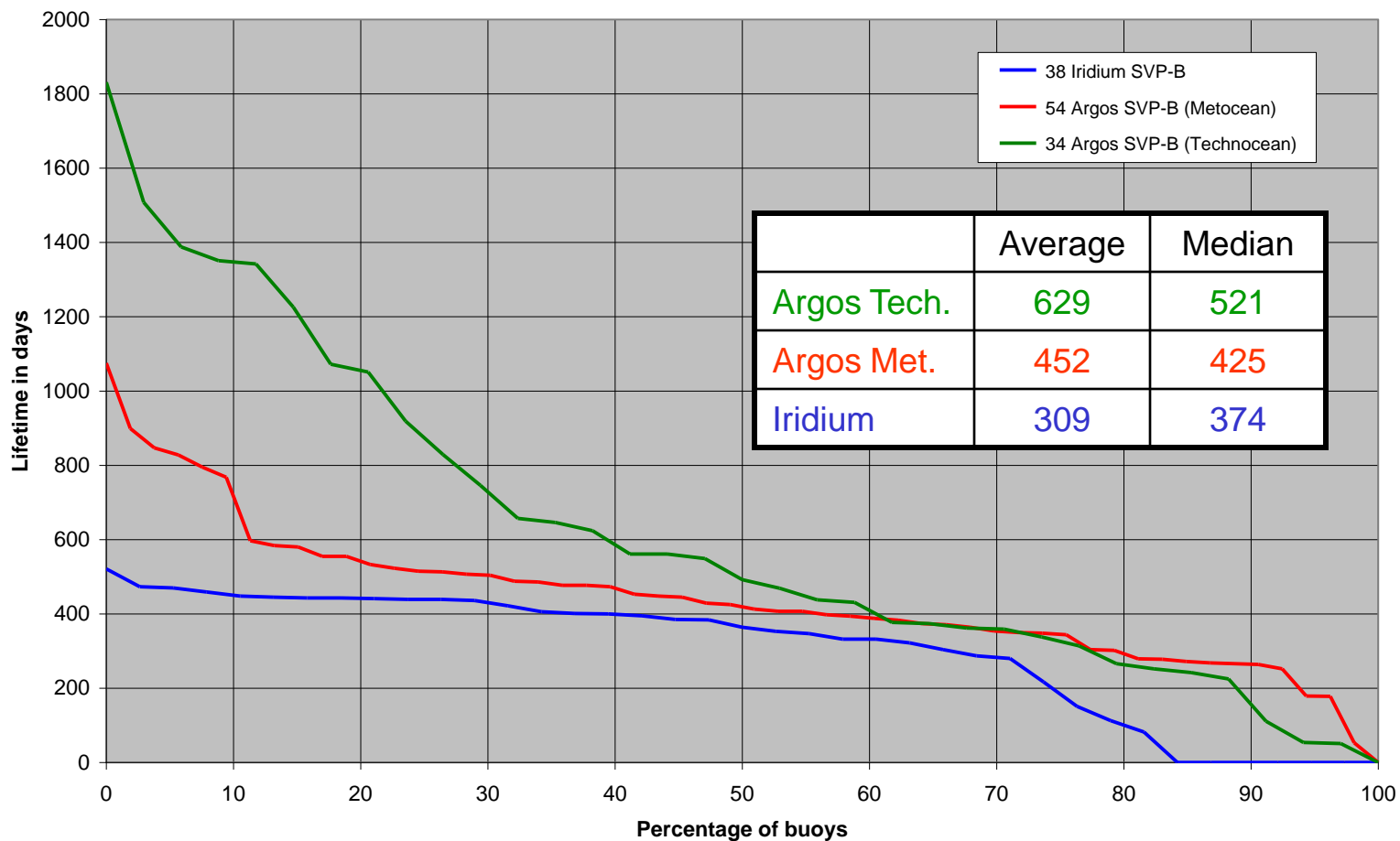
Argos SVP-B lifetimes (Technocean)

Argos SVP-B lifetimes - 34 operational E-SURFMAR buoys (Technocean)
which stopped transmitting after January 2008

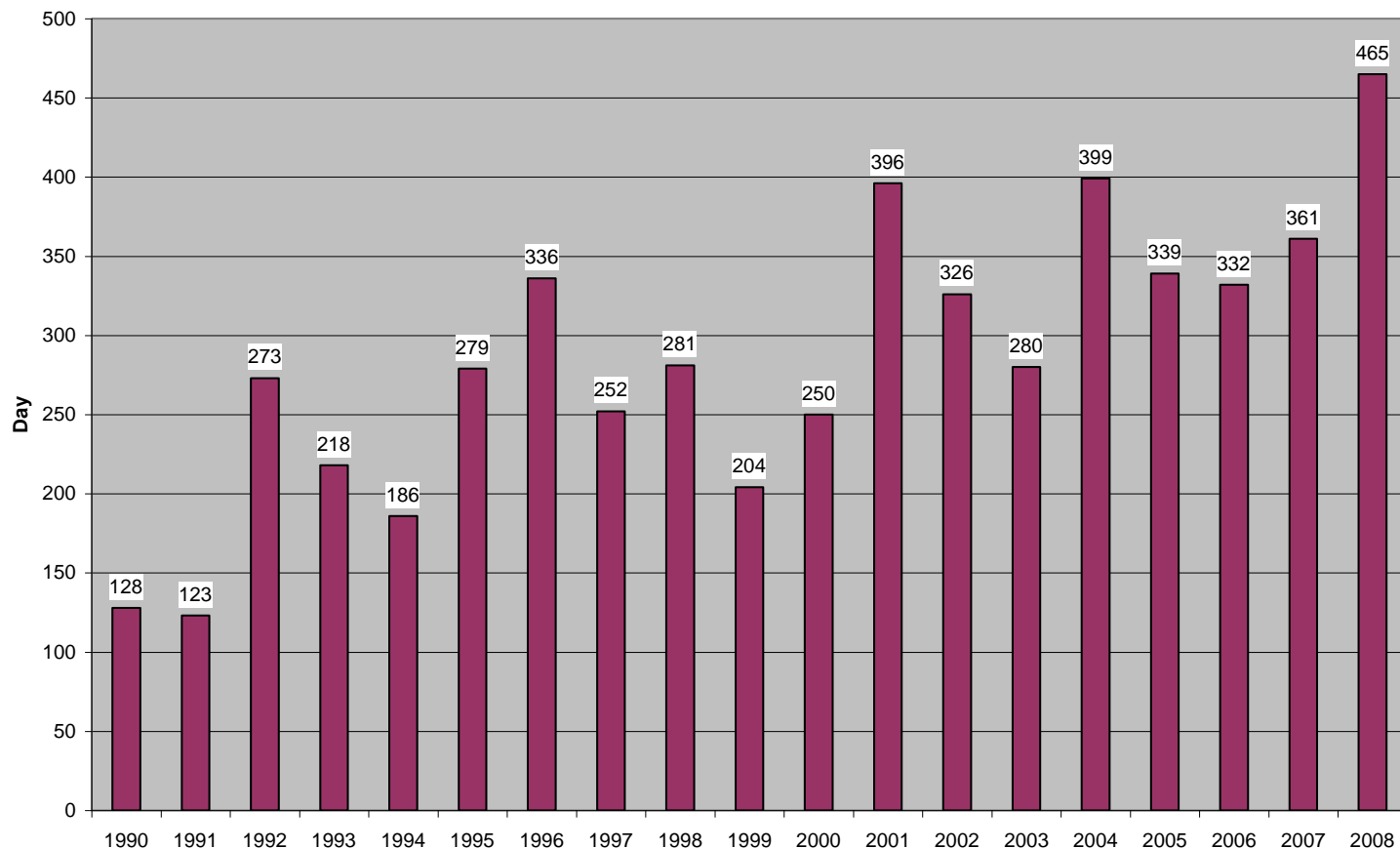


SVP-B lifetimes (synthesis)

E-SURFMAR SVP-B normalized lifetimes
for buoys which stopped transmitting after January 2008



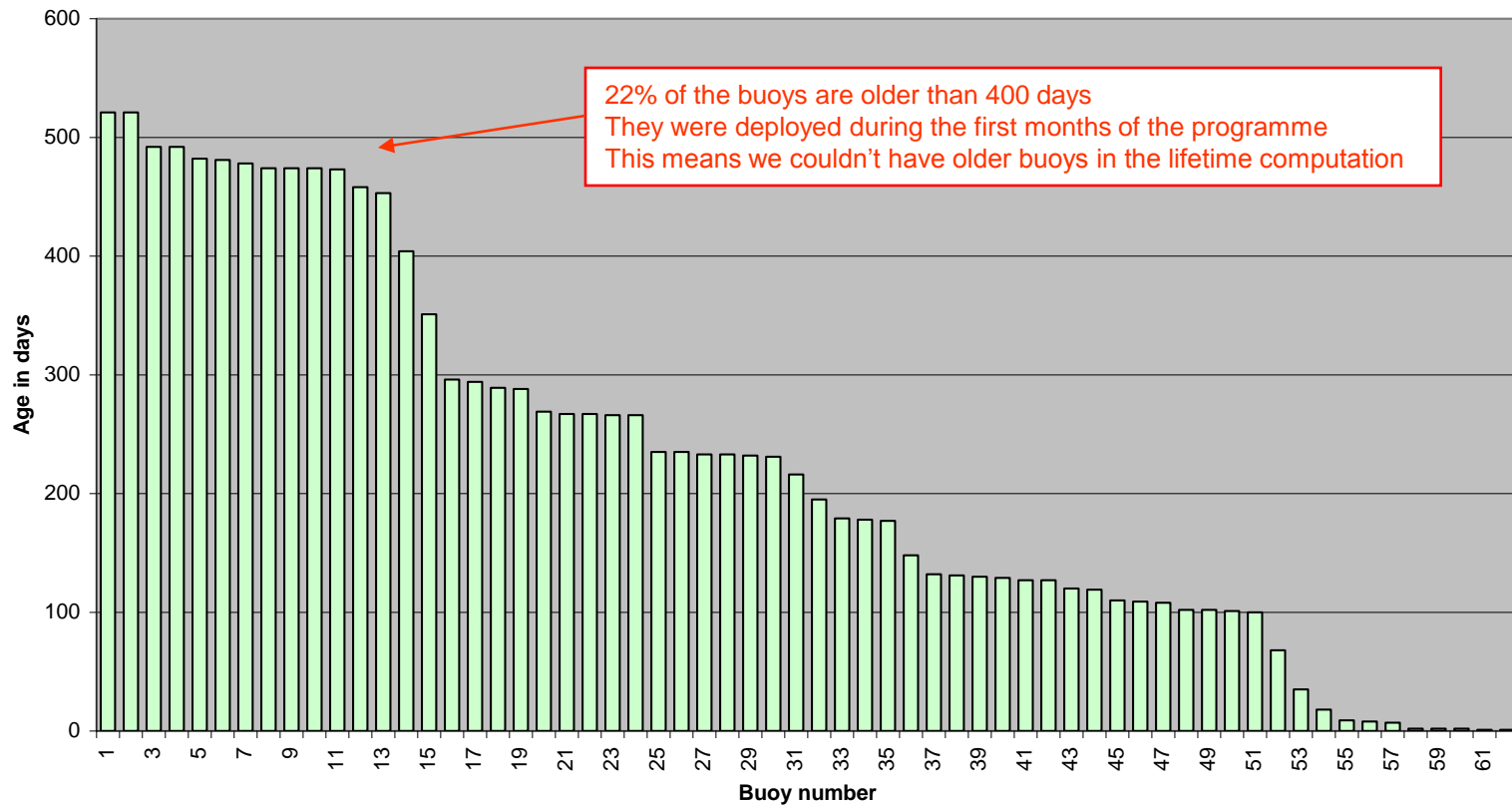
Mean drifting buoy lifetimes (E-SURFMAR)



100% Argos until the end of 2007

Ages of Iridium buoys in operation

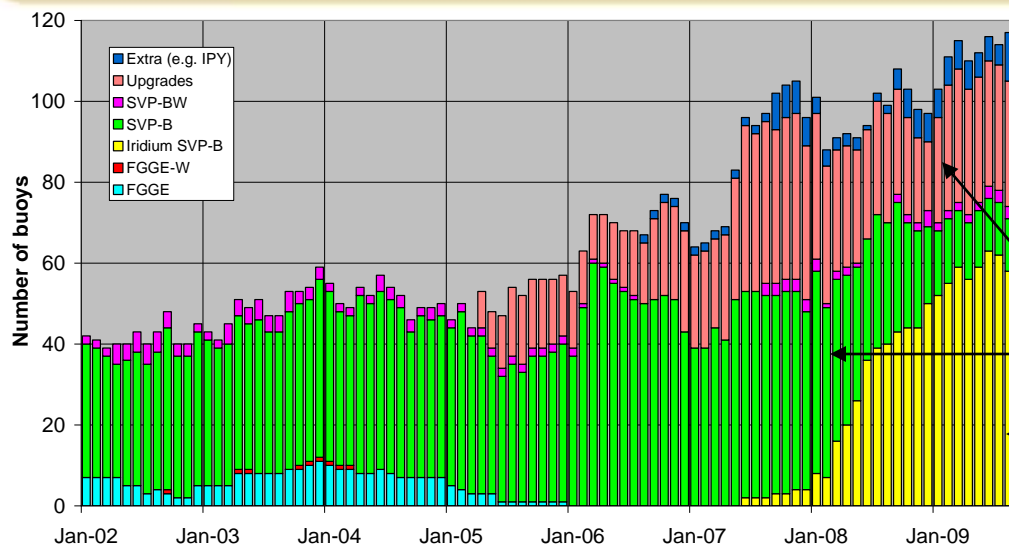
Age of deployed Iridium SVP-Bs
62 E-SURFMAR buoys in operation at Sept. 22nd, 2009



NB : These buoys have no GPS

Transmission delays

Transmission delays (E-SURFMAR network)

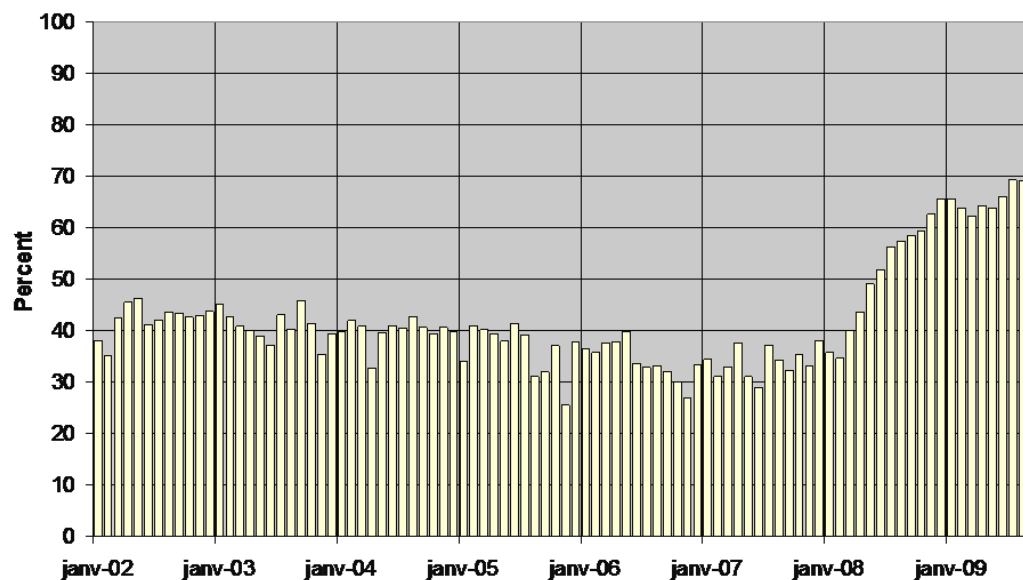


Number of operating drifting buoys according to their type

Argos (Technocean upgrades)

Argos (Metocean)

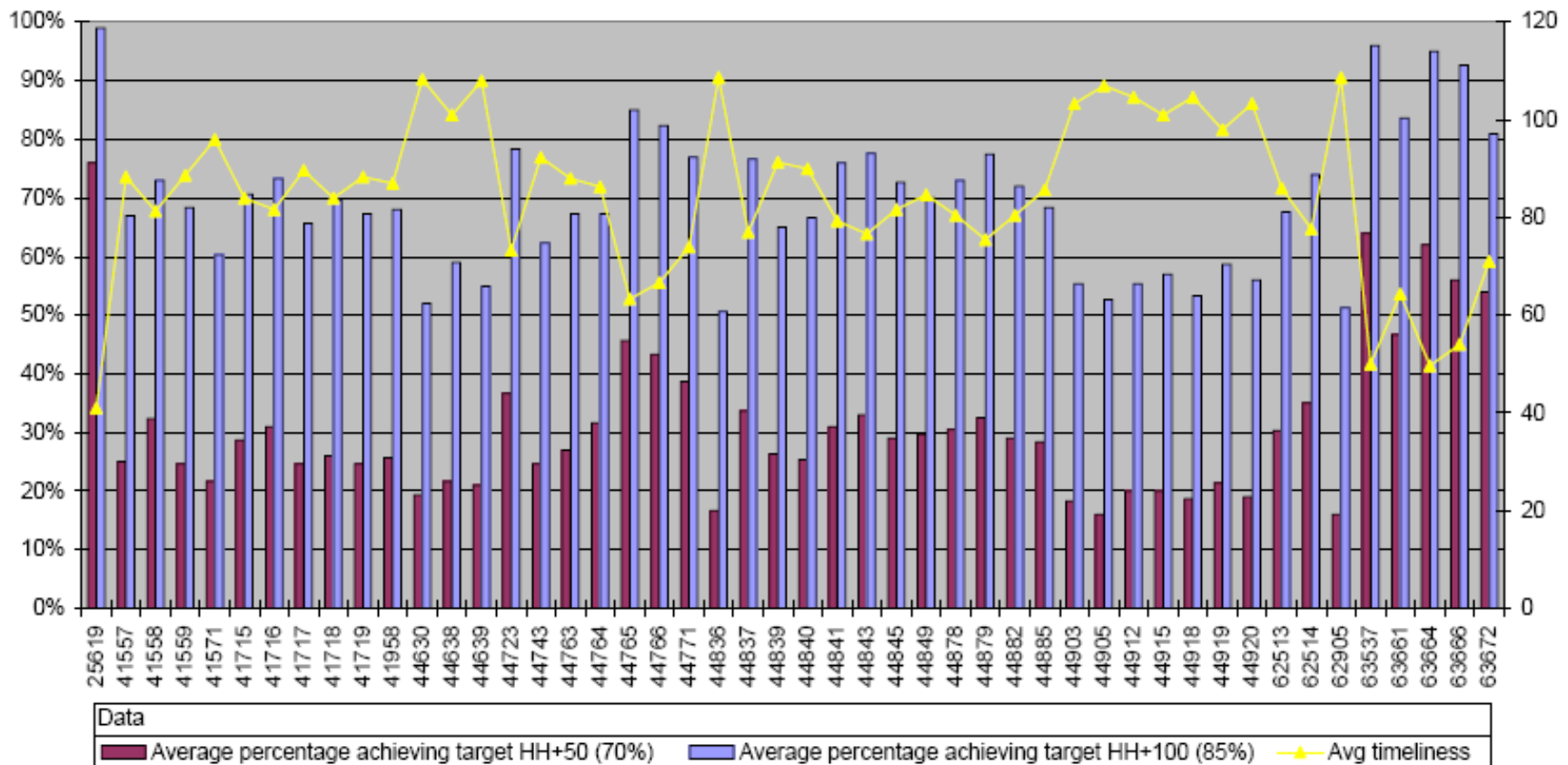
Iridium (Metocean)



Percentage of GTS data received within 50 minutes

Transmission delays (Argos buoys)

Quarterly performance of Argos drifting buoys achieving timeliness target HH+50/HH+100 and average timeliness - Q2 2009



Transmission delays (Iridium buoys)

Quarterly performance of Iridium drifting buoys achieving timeliness target HH+50/HH+100 and average timeliness - Q2 2009



Cost comparisons

Transmission costs (one year)

	Iridium (Vizada)	Argos ⁽¹⁾ (OCO rate)	Argos ⁽¹⁾ (non-OCO rate)
SVP-B, SVP-BS... (less than 30 bytes)	431 €		
SVP-BTC (60 bytes) Hourly observations	694 €	810 €	2005 €
SVP-BTC (60 bytes) 2 obs. per hour	1219 €		

(1) Proposed rates for 2010

All prices are VAT excluded

SVP-B observation cost *(transmission included)*

	Iridium (Vizada)	Argos ⁽¹⁾ (OCO rate)	Argos ⁽¹⁾ (non-OCO rate)
SVP-B cost (including GPS for Iridium ones)	2,400 €	2,100 €	2,100 €
Actual SVP-B lifetime ⁽²⁾	12 months	15 months	15 months
SVP-B cost for one year	2,400 €	1,680 €	1,680 €
Communication cost for one year	431 €	810 €	2,005 €
Total cost / (365 * 24)	0.32 €	0.28 €	0.42 €

(1) Proposed rates for 2010

(2) Air pressure lifetime

SVP-B prices are an estimate. They may vary from a manufacturer to another. All prices are VAT excluded

Future plans and conclusion

Future plans

▪ **For E-SURFMAR**

- 45 SVP-Bs with GPS (3-hourly fixes) have been ordered to Metocean
- 45 more (same design) will be ordered before the end of 2009
- Operational use. Deployments will start in 2010.

▪ **For Meteo-France**

- Evaluation of 3 SVP-Bs from Technocean (Indian Ocean and North Atlantic) – NOAA buoys upgraded by Meteo-France
- One SVP-BTC has been ordered to Marlin (deployment planned in Spring)

▪ **For SMOS Cal/Val**

- 5 more SVP-BSs should be ordered to Metocean soon

Thank you for your attention

Questions ?