Capacity of HRSST-2 buoys to measure SST with a high degree of accuracy

Pierre Blouch

E-SURFMAR Operational Service Manager

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Background

- **DBCP Pilot Project** for High Resolution SST

- **Requirements:**
  - Hourly measurements
  - Report design depth in calm water to ± 5 cm
  - Report of geographical location to ± 0.5 km or better
  - SST accuracy to ± 0.05K or better, resolve 0.01K
  - Report of time of SST measurements to ± 5 minutes

Metocean HRSST-1 and HRSST-2 buoys

- **HRSST-1:** standard SVP-B (or SVP-BS) Iridium drifters
  - Fitted with a GPS
  - Using dataformat #000 (or #021) => resolution 0.01K
  - Fitted with an analog SST probe on the drifter hull
    => digitalization made by the buoy electronics
    Claimed accuracy: ± 0.2K
  - More than 400 buoys deployed since the end of 2010

- **HRSST-2:** same but…
  - Fitted with a digital SST probe on the drifter hull
    Claimed accuracy: ± 0.05K
  - 36 buoys deployed: 24 SVP-B and 12 SVP-BS

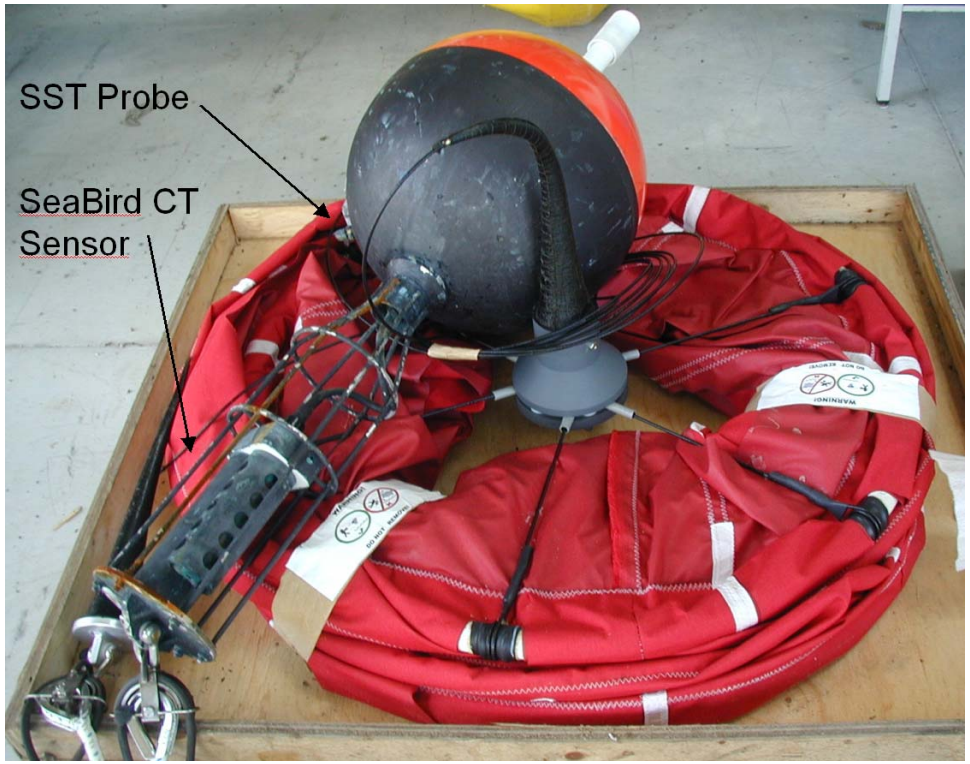
Accuracy of HRSST-1 vs HRSST-2 buoys

- **How to proceed ?**
  - Comparisons to model outputs (interpolations) ?
  - Comparisons to satellite products (match up) ?
  - Comparisons to moored buoys in the vicinity of drifters ?
  - Comparisons to measurements carried out by an already accurate temperature sensor on the same buoy !!

Fortunately we have what we need with salinity drifters

- **Salinity drifters** (i.e. SVP-BS) have two temperature probes:
  - This of the buoy hull (subject of the study - 17 cm depth)
  - This of the SeaBird conductivity sensor (centered at 45 cm depth)
    Its accuracy is garanteed because it is required to compute salinity from conductivity and temperature

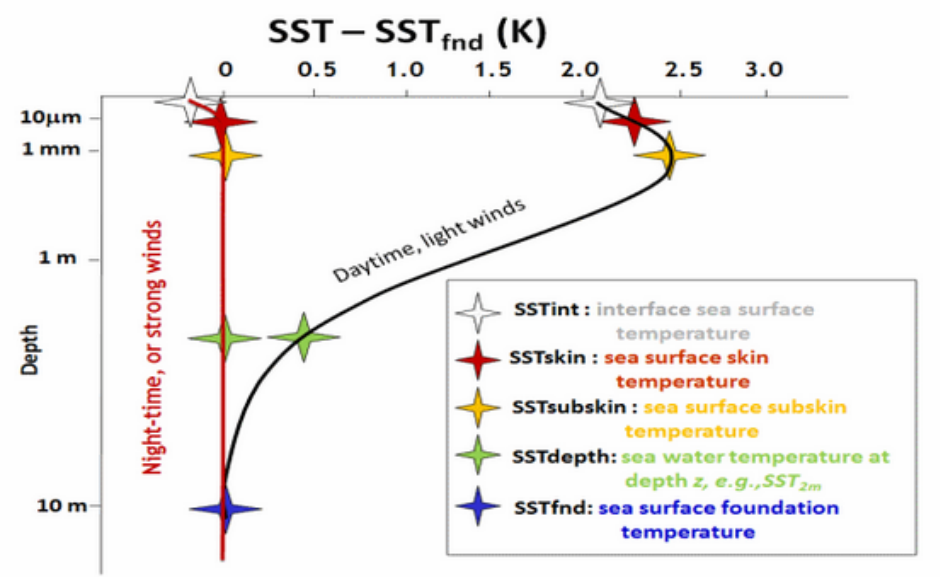
Metocean Salinity Drifters



Collaboration with LOCEAN

Methodology

- Computation of monthly mean ‘hull – SeaBird’ temperature differences for each buoy
- Temperature probes being at a different depth, night observations are exclusively used. This allows to remove cases of a possible stratification (upper layer warmed by the sun above a colder water at the level of the SeaBird sensor)



From GHRSST SST definitions

HRSST-1 Salinity Drifters

Monthly mean ‘hull – CT probe’ temperature differences

IMEI	WMO	Month	N	Bias	Sd
10729990	4100735	May-2012	120	0.137	0.005
10729990	4100735	Oct-2012	344	0.104	0.006
10729990	4100735	Mar-2013	217	0.144	0.006
10729990	4100735	Aug-2013	217	0.115	0.006
11758720	6200502	Oct-2012	371	0.200	0.008
11758720	6200502	Mar-2013	216	0.260	0.006
11758720	6200502	Aug-2013	174	0.140	0.011
11758700	6200503	Oct-2012	326	0.249	0.009
11758700	6200503	Mar-2013	225	0.321	0.004
11758700	6200503	Aug-2013	221	0.216	0.007
11755720	6200506	Oct-2012	327	0.253	0.012

Mean differences up to 0.35K
(i.e. worse than the claimed accuracy)

- All positive
- More or less constant for a given buoy

but

Standard deviations < 0.015K

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HRSST-2 Salinity Drifters

IMEI	WMO	Month	N	Bias	Sd
11977530	1300899	Aug-2013	211	-0.052	0.005
60446020	2300587	Aug-2013	217	-0.027	0.005
60476190	2300588	Aug-2013	141	-0.051	0.005
11544080	3100739	Dec-2012	217	-0.043	0.005
11544080	3100739	Mar-2013	101	-0.046	0.005
11976470	3100740	Dec-2012	98	-0.008	0.005
11129760	4100736	May-2012	162	-0.007	0.005
11129760	4100736	Oct-2012	333	-0.008	0.006
11589510	6100524	Mar-2013	208	-0.003	0.004
11583510	6100525	Mar-2013	200	-0.035	0.010
11549070	6100530	Mar-2013	184	0.000	0.013
11547080	6100788	Oct-2012	302	-0.043	0.008
11540090	6200501	Oct-2012	63	-0.046	0.008
11972540	6200504	Aug-2013	92	-0.059	0.006
11120780	6200505	May-2012	159	-0.018	0.004
11120780	6200505	Oct-2012	326	-0.023	0.006
11120780	6200505	Mar-2013	213	-0.019	0.004
60343390	6200509	Aug-2013	205	-0.058	0.005
11127760	6200513	May-2012	154	-0.112	0.004
11127760	6200513	Oct-2012	327	-0.103	0.005

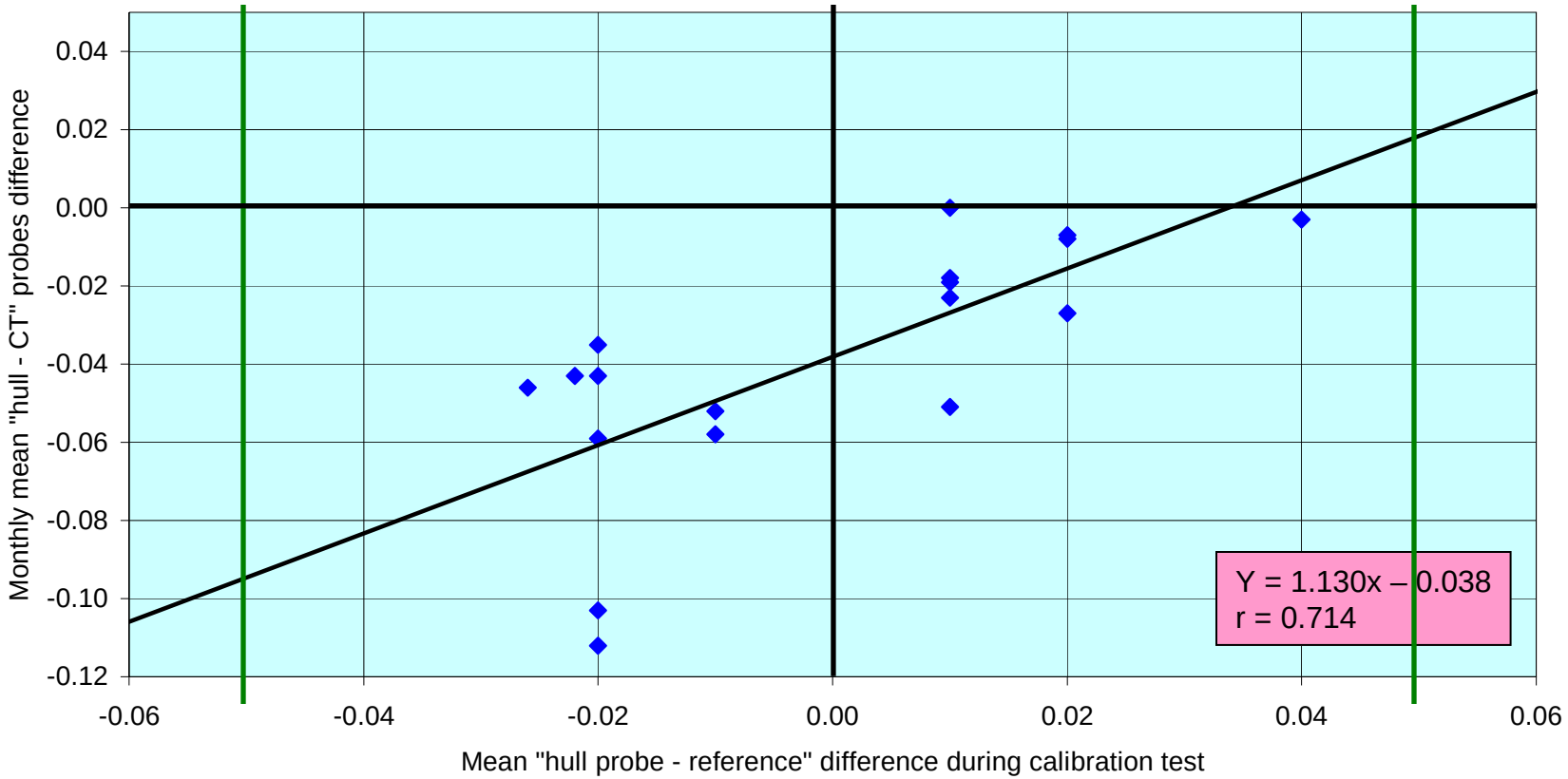
Standard deviations < 0.015K

Mean differences up to 0.06K for all buoys but one (i.e. ~ the claimed accuracy)

- All slightly negative
- Constant for a given buoy

HRSST-2 Salinity Drifters

HRSST-2 buoys - Observed biases at sea (Kelvin)
against diffrences with reference during calibration tests (Kelvin)



± 0.05K tolerance interval (calibration)

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HRSST-2 Salinity Drifters

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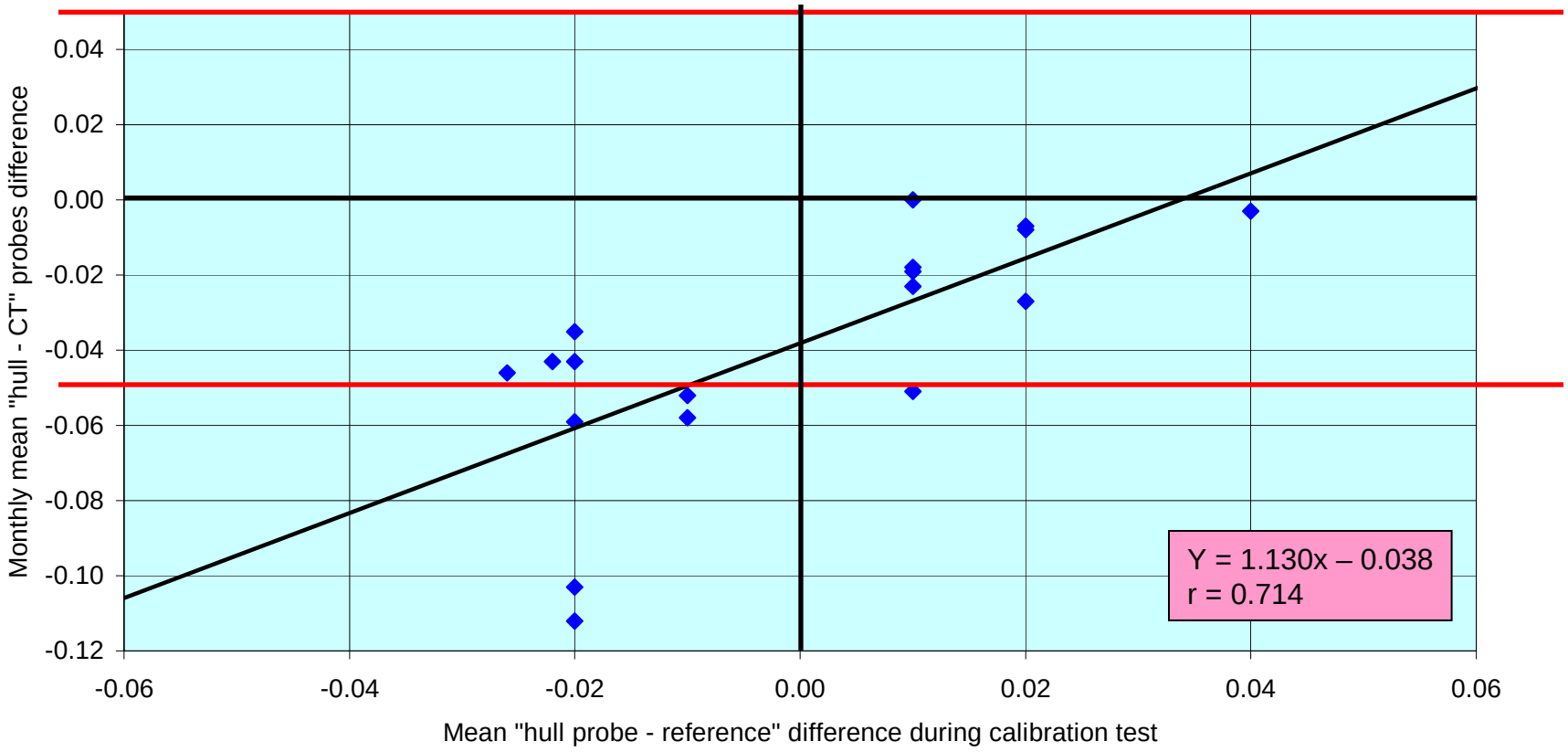

± 0.05K tolerance interval (measured at sea)

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Conclusion

- HRSST-2 buoys measure SST with a better accuracy than HRSST-1 buoys
- This is probably due to the fact that digital probes are better calibrated. The standard deviation of differences with CT SST probes is similar with HRSST-1 or HRSST-2 buoys (< 0.015 K)
- HRSST-2 buoys meet the accuracy requirement (0.05K) during calibration tests but some do not meet it at sea
- The most part of the « HRSST-1 to HRSST-2 » upgrade cost is due to the probe calibration
- Data users requiring such accuracy (satellite SST community) should contribute to borne the extra cost: EUMETNET does not plan to purchase more HRSST-2 buoys at its own expenses

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