PP-HRSST

Pilot Programme for High Resolution Sea Surface Temperature

- Review objectives
- Review progress during year
- Next steps: workplan

Collaboration between DBCP and GHRSST

- Drifter SST vital for satellite SST validation and algorithm development (GHRSST group)
- Hampered by lack of accuracy, resolution and metadata
- Reasonable set of requirements for HRSST drifters agreed
- Deployments rolled out over last 24 months
- ESA funding being sought (Sentinel-3 campaign)
- Model for collaboration with other specialised observation groups, e.g. for pCO_2, pH

Result of a dialogue: GHRSST requirements for drifters

GHRSST recommendations agreed in 2008 + 1

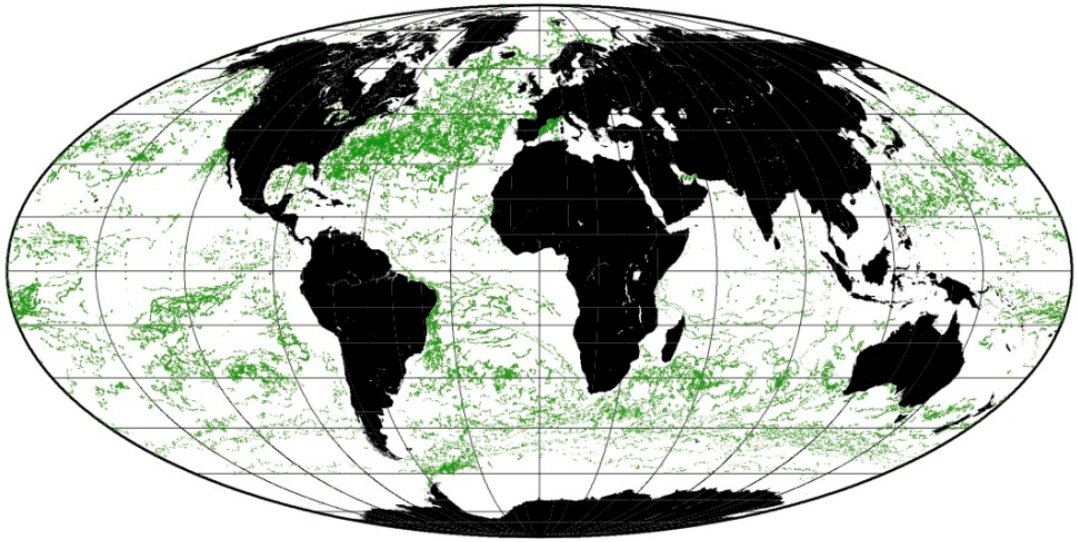
- (1) Make hourly reporting universal
- (2) Report design depth in calm water to ±5 cm
- (3) Report of geographical location to ±0.5 km or better
- (4) SST accuracy to ±0.05 K or better, resolve 0.01 K
- (5) Use NetCDF CF-1.3
- (6) Report of the time of SST measurement to ±5 minutes
- (7) No requirement to report on or close to integer hours

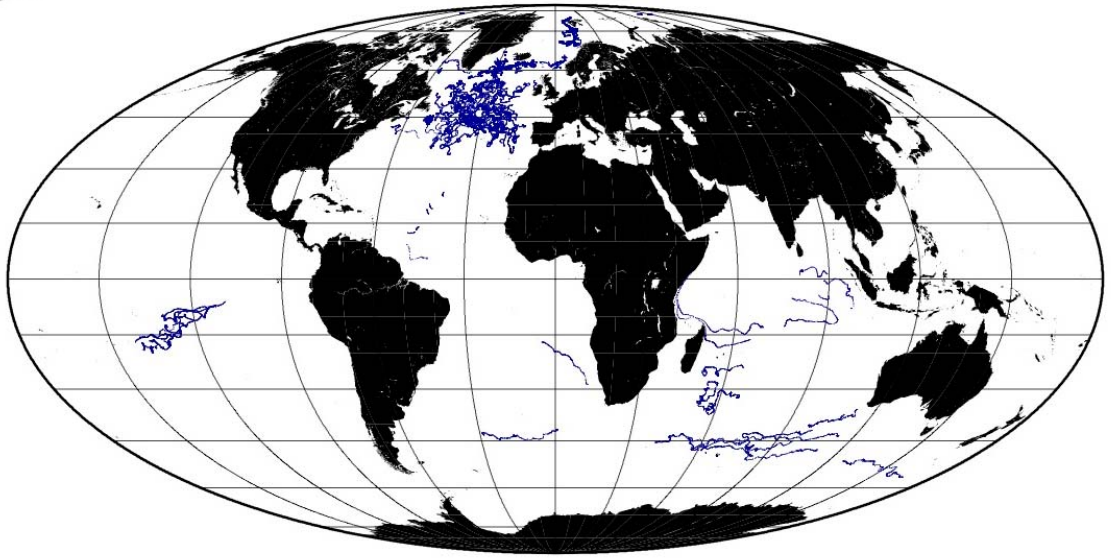
- *(8) (Extra) Report estimate of absolute accuracy*

Progress to date

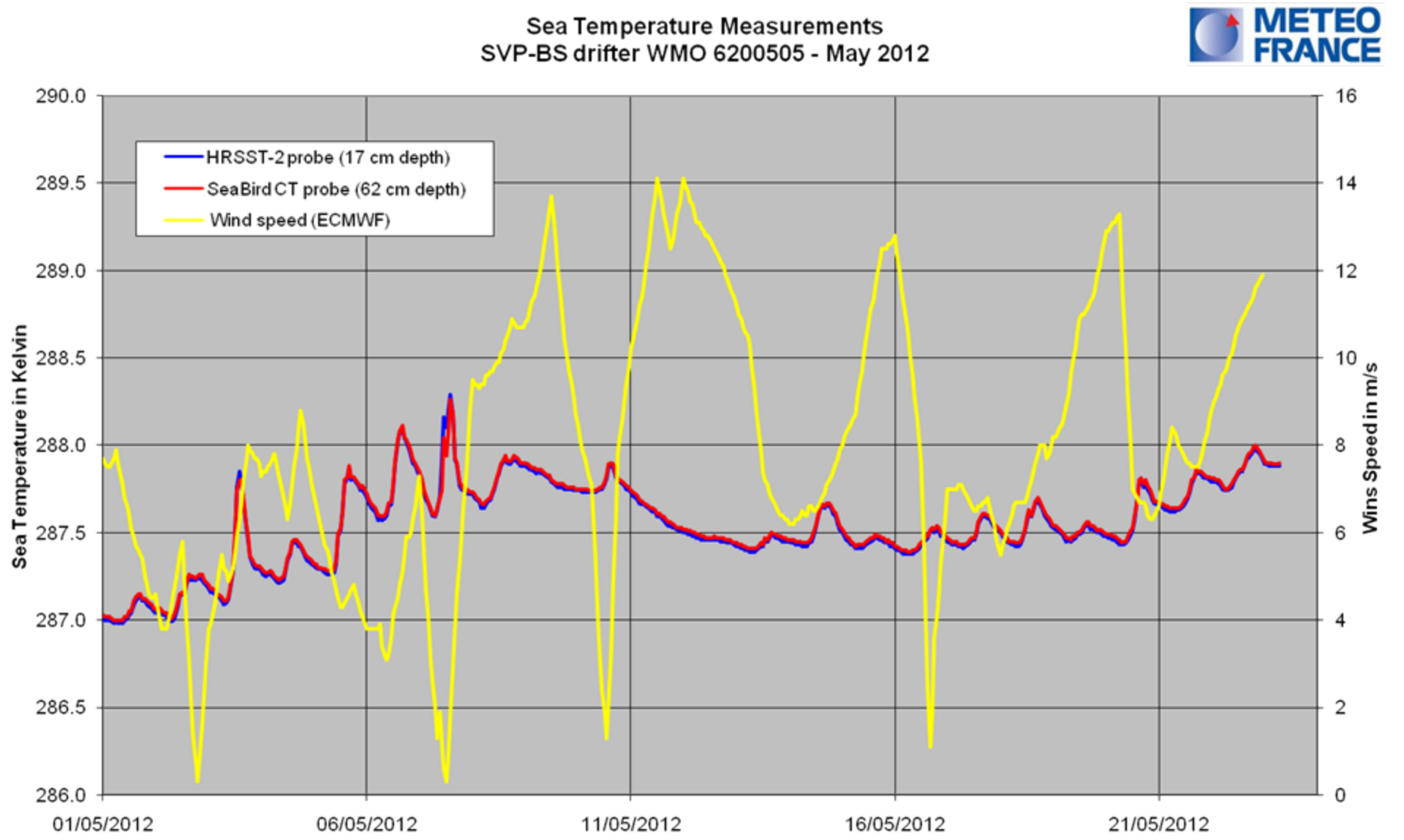
- Over 300 HRSST drifters have been deployed
  - Mainly by ESURFMAR and Meteo France
  - Report SST to 0.01C using BUFR
- Mostly HRSST-1s
  - Same SST sensor as before, just report to higher resolution
- HRSST-2s now being deployed
  - Better digital sensor module: demountable to facilitate traceable calibration
  - USD1k upgrade cost at present
- SPURS drifter fleet being recruited

Non-HRSST via HRSST

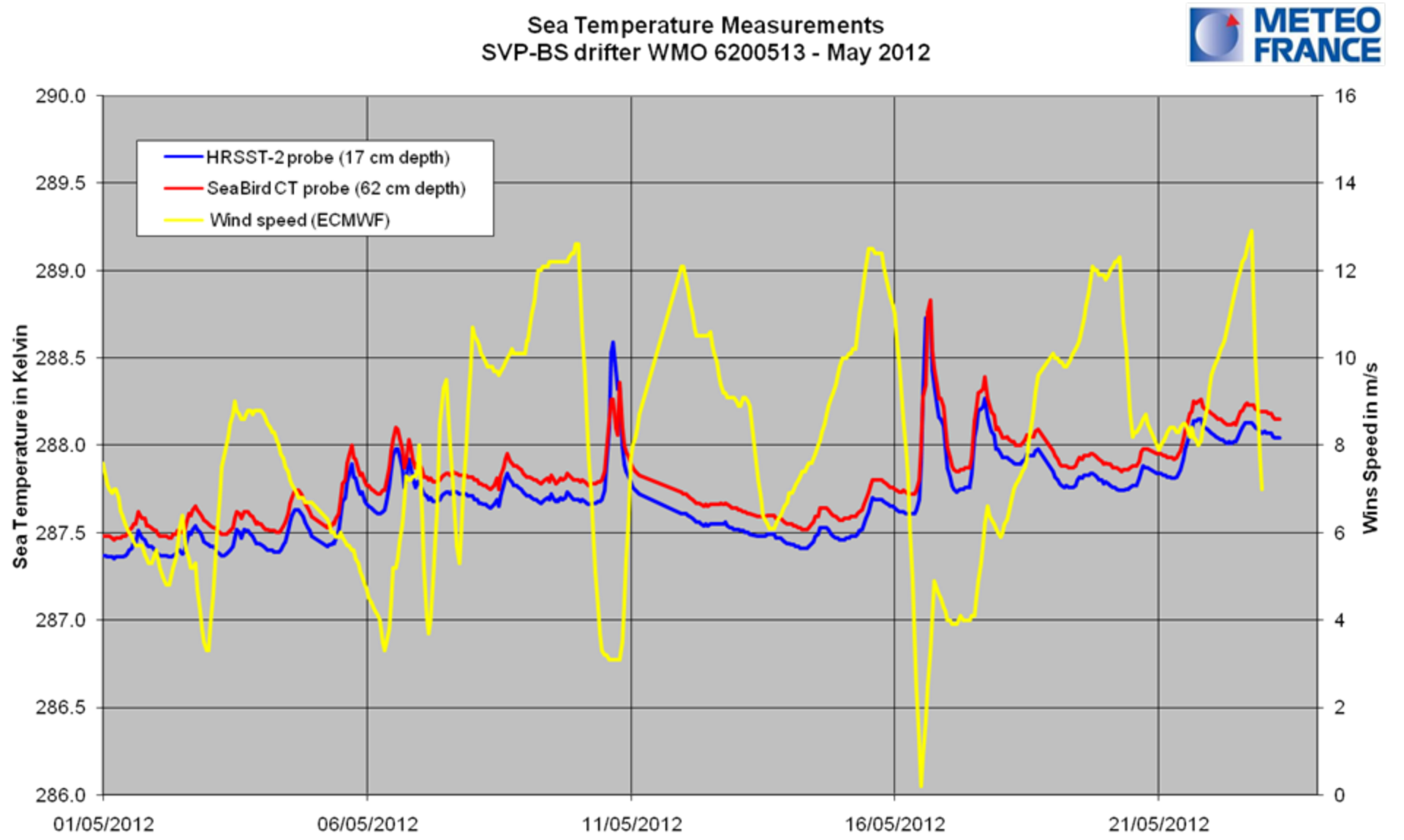




HRSST-2 calibration issues



HRSST-2 calibration issues



GHRSST meeting (Mar 12): DBCP response and next steps

- Agreed to establish joint pilot project (PP-HRSST), ends 2014
- Need to identify areas that will provide large number of matchups in shortest possible time
- These areas to be of interest to existing buoy operators as they will pay most of the cost
- ESURFMAR now routinely deploying HRSST-1 drifters
  - More than 180 deployed to date, mostly in N Atlantic, some in Indian Ocean
  - Report with increased resolution but not accuracy
  - Report in BUFR
- PP-HRSST funds being used to help Met Office to upgrade to high accuracy HRSST-2 drifters
- Need to get feedback from GHRSST asap
- Need to get follow-on funding through joint GHRSST/DBCP proposals

HRSST buoys: Initial GHRSST analysis

Gary Corlett, Sasha Ignatov, Matt Martin, Chris Merchant and Peter Minnett

Activities so far

- Matt Martin (Met Office) : matchups with FOAM/OSTIA
  - Model/analysis foundation SST
- Gary Corlett (University of Leicester): matchups with AATSR v2.1
  - Satellite skin SST
- Sasha Ignatov (NOAA) and Peter Minnett (RSMAS): matchups with VIIRS v5.3
  - Satellite skin SST

OSTIA/FOAM

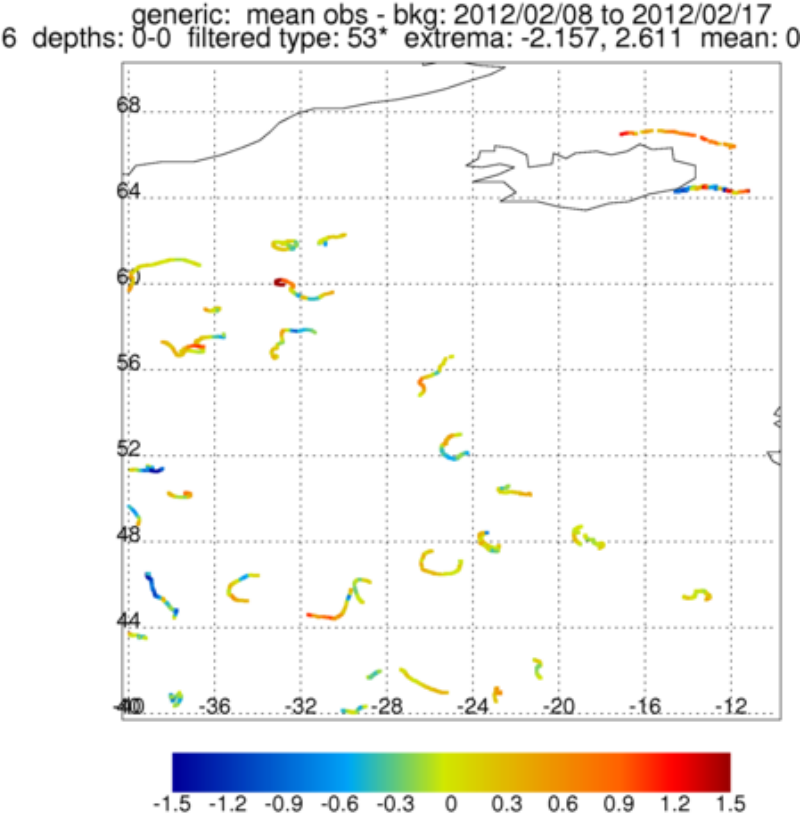
Matt Martin

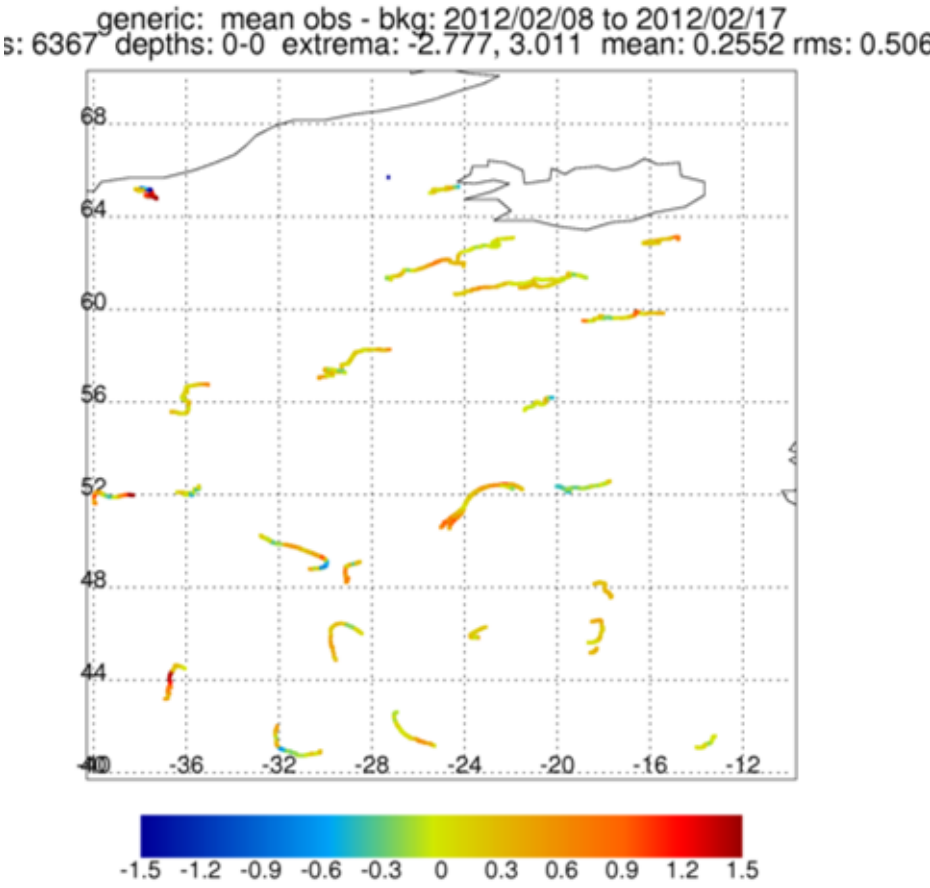
Preliminary comparison of SST from the new and old type of surface drifters with operational FOAM output

- Data used in the comparison:
  - Comparing the operational FOAM model output 1-day SST forecast (before assimilation) with the surface drifters.
  - For a 10 day period (8th – 17th Feb 2012).
  - Selected a region where most of the new type of drifters are:
    - 70W -> 10W, 40N -> 70N.

- Caveats to bear in mind when looking at the results:
  - Despite reasonable numbers of obs (~9300 of the old type, ~6400 of the new type), the number of independent obs is fairly small (only a limited number of actual drifters, each of which reports many times).
  - Difficult to distinguish model errors from observation errors.

- Overall summary:
  - old drifter obs types have a much smaller mean error than the new types (+0.02 vs +0.26).
  - new drifter obs types have a slightly smaller standard deviation than the old type (0.42 vs 0.44).





AATSR Validation

Gary Corlett

AATSR Validation

- Compare AATSR SST-skin to drifter SST-depth
- Nearest pixel within 3 hrs. (correct for time difference using Embury et al., 2012)
- AATSR mission ended on 8th April 2012
  - Loss of communication with Envisat
- Limit analysis to:
  - 70W -> 10W, 40N -> 70N.
  - 1st September 2011 to 1st April 2012

AATSR Results

Best retrieval

	Number	N2	N3	D2	D3
Non-HRSST					
Day	3176	-0.17 (0.29)		-0.14 (0.30)	
Night	3138	-0.28 (0.23)	-0.26 (0.22)	-0.23 (0.29)	**-0.26 (0.26)**
HRSST					
Day	404	-0.44 (0.34)		-0.37 (0.30)	
Night	555	-0.48 (0.35)	-0.43 (0.25)	-0.40 (0.27)	**-0.41 (0.26)**

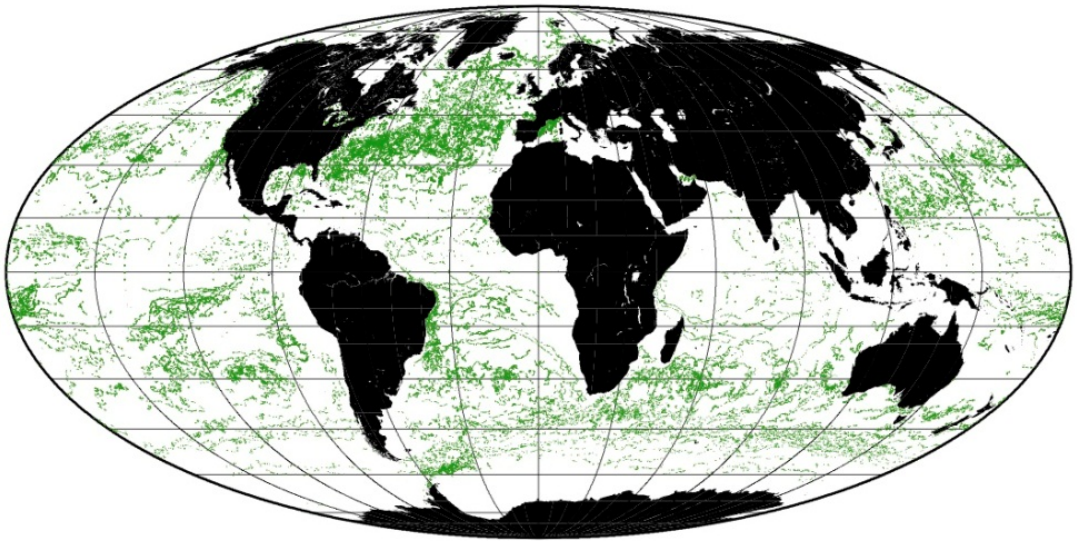
Skin to depth so expect difference of roughly -0.17 K

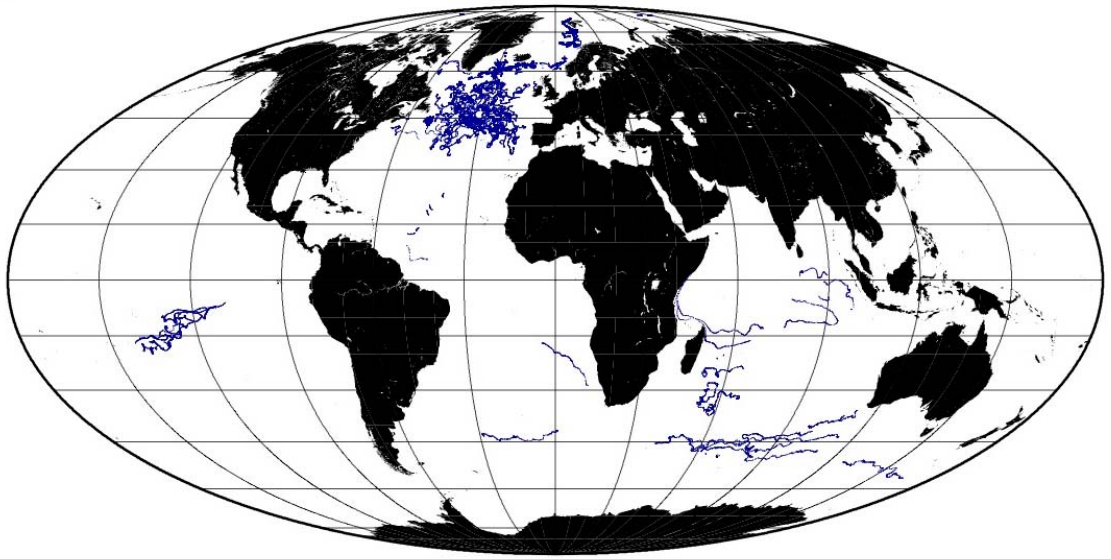
HRSST buoys warmer by 0.15 ^{0}C in North Atlantic; 0.2 ^{0}C for all regions

VIIRS Validation

Sasha Ignatov, Peter Minnett

Non-HRSST vs HRSST distributions





VIIRS – drifter statistics

	v5.3 non-HRSST buoys
IDPS SST2b night	
median	-0.292
sd	0.601
mad	0.414
count	50561
IDPS sst3b night	
median	**-0.156**
sd	0.531
mad	0.282
count	50561

	V5.3 HRSST buoys
IDPS SST2b night	
median	-0.543
sd	0.702
mad	0.346
count	2404
IDPS sst3b night	
median	**-0.363**
sd	0.590
mad	0.234
count	2404

Best retrieval

Skin to depth so expect difference of roughly -0.17 K

Summary

- Very small number of match-ups so far
- Initial results show warm bias of 0.15-0.2 ^{o}C compared to existing drifters
  - Lower noise
- Work ongoing to
  - Expand number of matchups (add MODIS & AVHRR)
  - Compare to ARC SSTs (best satellite SSTs)
  - Compare HRSST and non-HRSST drifters
  - Investigate other features (e.g. drogue)

Where would be the most important deployment areas?

1. Canary Islands: area of the Aquarius surface salinity validation campaigns (SPURS); effects of Saharan Air Layer and aerosols on infrared SSTs
2. SE-Asia: high water vapor and periodic smoke aerosols from forest fires
3. Upwelling areas: anomalous air-sea temperature differences; surface flow divergence tends to reduce buoys drifting into upwelling areas
4. High Latitudes: very low water vapour content; anomalous air-sea temperature differences)

The effects of the higher quality might be best seen in the connection with the SPURS campaign

Next steps

- Build the PP-HRSST team
  - Panel needs to appoint chair and vice-chair
  - Recruit members from science, industry and GHRSST
- Attempt to resolve calibration issues
  - Fully demountable sensor module to allow user calibration, in first instance at least
  - Request further GHRSST diagnostic analyses
  - Refine requirements definitions to manufacturers
- Seek additional funding from space community
  - At this stage no additional funding above agreed amount sought from Panel

Sentinel-3 E1: HRSST Drifter Project Phase 1

Launch - 3 to Launch + 15 months

	keuro
Item 1 - upgrade drifters being bought by other agencies	
300 upgrades to HRSST x 1keuro	300
Item 2 - outright purchase of drifters for own purpose	
100 HRSST drifters x 3.5keuro	350
Deployment costs 100 x 0.5keuro	50
Satcoms costs for 1.5 yrs: 100 x 1.5 x 0.2	30
Item 3 - staff costs for implementation and analysis	
120 days x 0.35keuro	42
Institute overhead @120%	50
Travel and subsistence	8
Item 4 - phase 1 workshop at ESA	
Costs for local host (ESA)	40
Total (all items selected)	**870**