



shipborne radiometers for sea surface temperature

### **Experiences : ISAR - UoS**

Werenfrid Wimmer

Raymond Holmes, Ian Robinson, Craig Donlon, Gary Fisher, Kelvin Aylett, Ray Collins, ...











### **Overview**

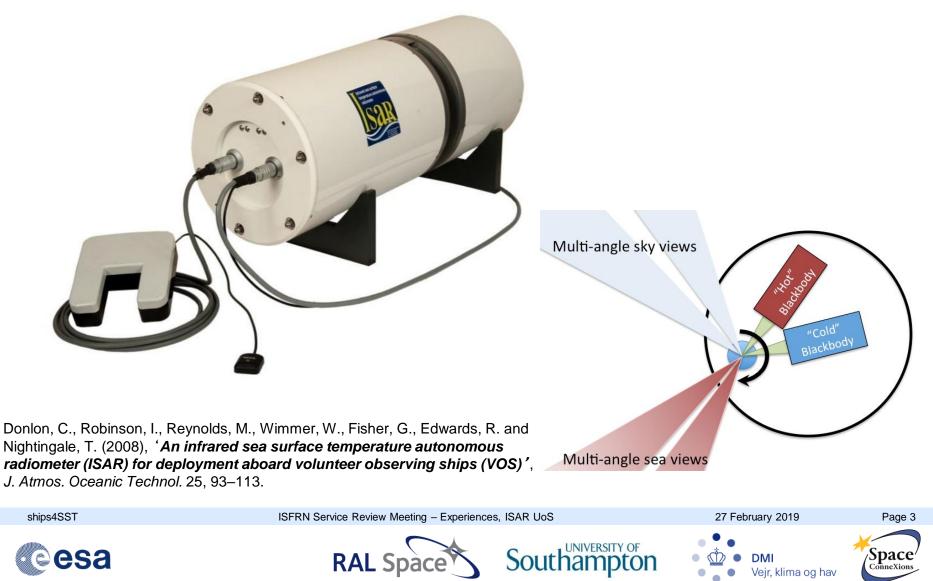
- The ISAR
- Bay of Biscay and English Channel deployments
- Other deployments and projects
- Summary



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### **ISAR**

Infrared Sea surface temperature Autonomous Radiometer



### **ISAR installed on Pride of Bilbao**

2004 - 2010



- Ancillary instrumentation;
  - Anemometer
  - Short- /Long wave Radiation
  - Hull temperature (5m)
  - Air temperature, Humidity
  - FerryBox, CPR

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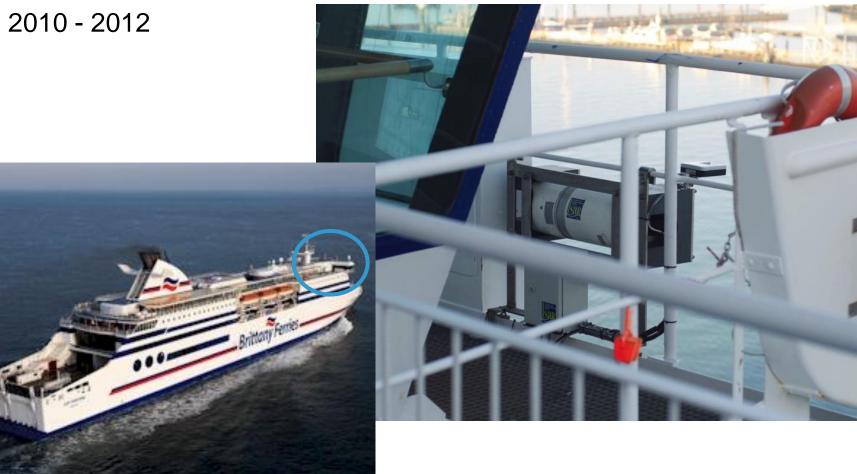
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### **ISAR installed on Cap Finistere**

2010 - 2012



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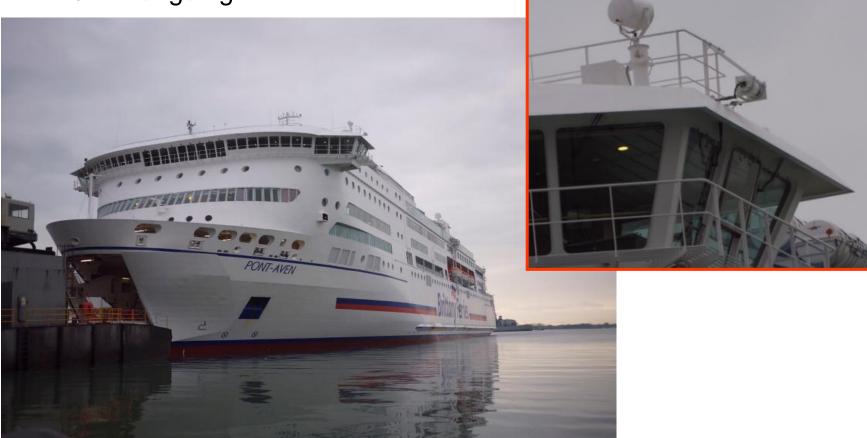






### **ISAR installed on Cap Finistere**

2012 - ongoing



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- Bay of Biscay and English Channel
  - 65 deployments •
  - ~ 4600 days at sea •
  - ~ 905000 SST measurements •
  - ~ 200 SST /day
  - 11 failures: •
    - 6 electronics issues, \_
      - 3 related to new electronics trails, 1 ٠ thermistors

- 4 shutter failures
  - 3 ٠

	2004			ISA D1	R-02	ISAR-02 D2	-	ISAR D3	-03		ISAF D4	-02	
<b>ments</b>		Jan PoB refit	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
IIIGIIIG	2005		ISAR-03 D5	ISAP D6	-02		IS. D	AR-03		IS/ D8	AR-02		ISAR-03 D9
		Jan PoB ref	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
nglish	2006			5AR-02		ISAR- D11	03		ISAR-0 D12	2		ISAR-03 D13	1
- <u></u>		Jan PoB refi	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2007	I C	ISAR-0 D14	02		ISAR-0 D15	03 ISAR-02 D16		ISAR-03 D17	3			ISAR-03 D18
		jan PoB re	Feb	Mar	Apr	May	Jun	Jul	Aug ISAR-0	Sep	Oct	Nov	Dec
а	2008			SAR-03			ISAR-03 D20		ISAR-U	D21	ISAR-03 D22		
		Jan PoB ref	Feb	Mar	Apr	Мау	Jun	jul .	Aug	Sep	Oct	Nov	Dec
asurements	2009		ISAR-0	3	ISAF D24	R-02	ISAR-0 D25	)3	SAR-02 D26	SAR-03			
		Jan Ban rafit	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2010	PoB refit	lS/	AR-03	IS	5AR-02 D29	ISAR-03 D30					PoB to CpF SAR-03 031	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
es,	2011		CpF refit		ISAF D32	R-03		IS/	R-03			ISAR-03 D34	ISAR-03 D35
new electronics trails, 1		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2012		CpF refit	ISAR-03 D36			ISAR-03		sfer CpF to	o PtA ISAR	-02 D38	PtA refit	ISAR-02 D39
	LUIL	Jan	Feb	Mar	Apr	Мау	Jun	jul	Aug	Sep	Oct	Nov	Dec
	2013		ISAR D40	-03		ISAR-02 D41		ISAR-0 D42	3				ISAR-02 D43
	2015	Jan P	Feb tA refit	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2014			ISAR-02 D44	ISAR-03 D45			ISAR-02 D46			AR-03	ISAR-02	<sub>048</sub>
	2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	1	Dec
	2015	PtA refit	R-03		ISAR D50	-02	ISAR D51	-03		ISAR-02 D52		ISAR-0	з
	2015	Jan	Feb	Mar	Apr	May	Jun	1	Aug	Sep	Oct	Nov	Dec
	2016	PtA refi	t	_	ISAR	-02		ISA	R-03	ISAR-02 D56			ISAR-03 D57
	2010	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2017				ISAR-02			ISAR-0	D59	ISAR-02 D60			ISAR-03 D61
	2017	Jan	Feb	Mar	D58 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov PtA ref	· · · · · ·
	2010			IS	AR-02		ISA	R-03		ISAR-02 D64		PLA rei	ISAR-03 D65
	2018	Jan	Feb	Mar	Apr	May	Jun	jul	Aug	Sep	Oct	Nov	Dec
ISFRN Service Review Meeting	2019	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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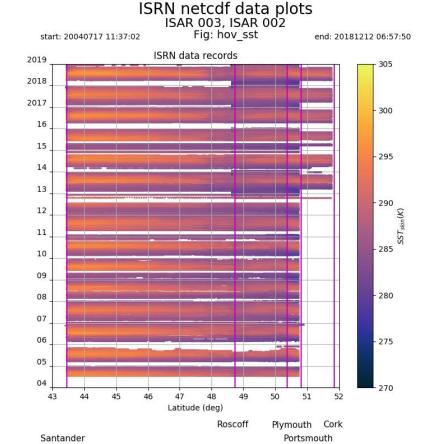


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Bay of Biscay and English Channel data

> ISRN netcdf data plots ISAR 003, ISAR 002 Fig: track sst start: 20040717 11:37:02 end: 20181212 06:57:50 305 ISRN ship track 52 300 51 50 -295 49 48 290 SST<sub>skin</sub>(K) Latitude 47 285 46 45 - 280 44 43 - 275 42 -10 -9 -8 -7 -6 -5 -4 -3 -2  $^{-1}$ Longitude 270

> > processed 20190225 18:03:29 (c) 2019 ISAR team - v1.7 - sst: v4.0, 3.8



processed 20190226 11:22:46 (c) 2019 ISAR team - v1.7 - sst: v4.0, 3.8

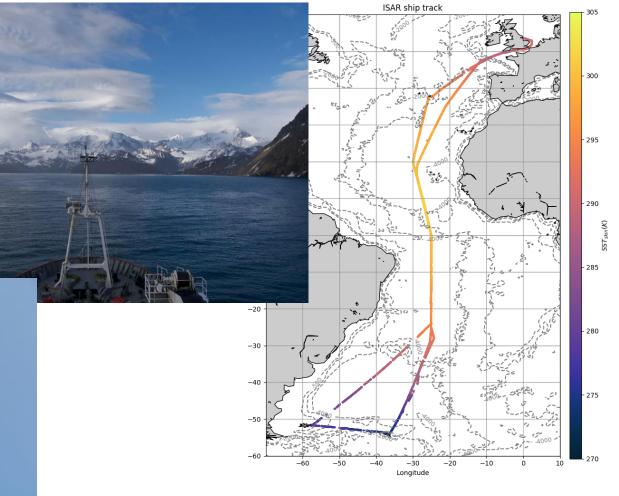








- 3 cruises
- 124 days
- ~ 30 000 SST
- ~ 250 SST /day



processed 20190225 (c) 2019 ISAR team - v1.1



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**RAL** Space

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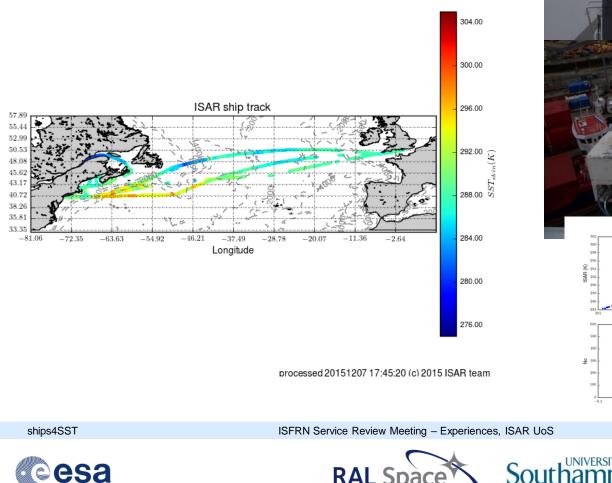


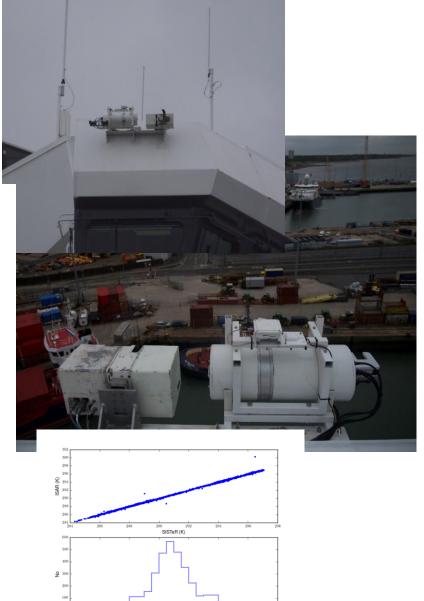


#### QM2

#### ISAR – SISTeR side by side inter-comparison

ISAR time: 20150920 11:35:03 to to 20151105 09:11:31



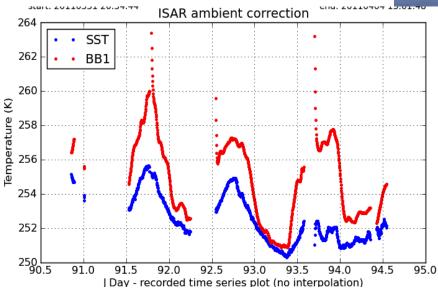


I - S (K)



FRM4STS - ICE





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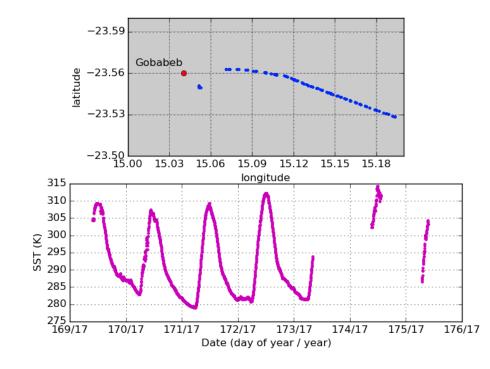








FRM4STS - Land





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esa

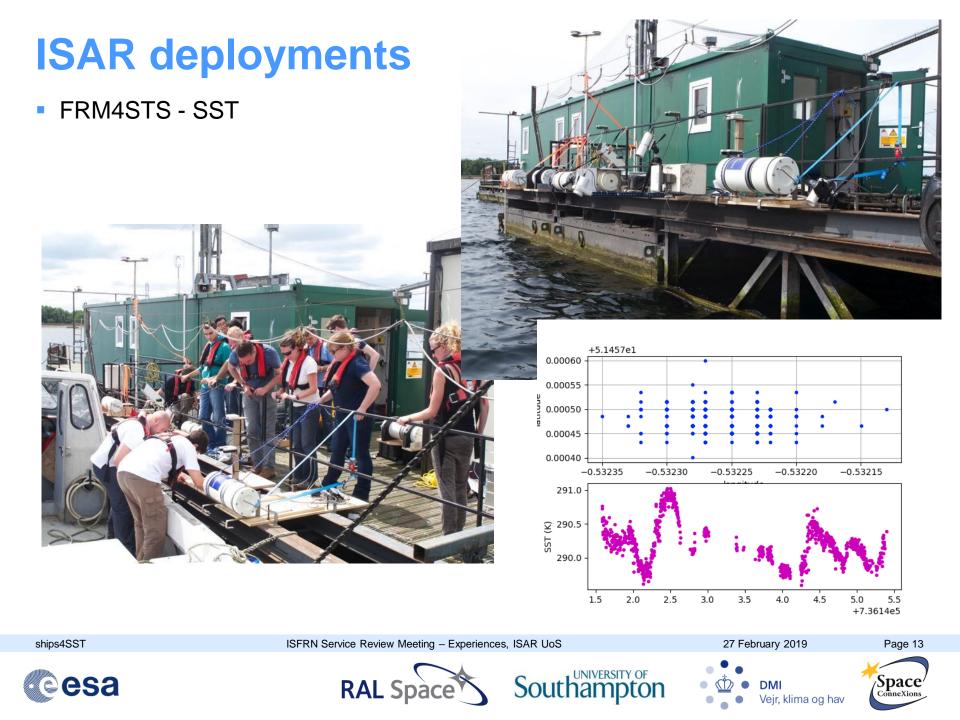
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**RAL** Spàc









### FRM4STS - NPL





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Space





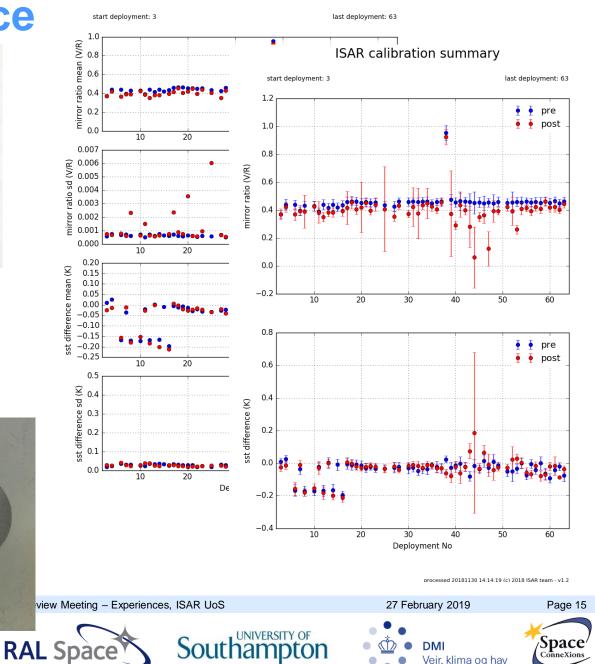


### **ISAR experience**





#### ISAR calibration summary



DMI

Vejr, klima og hav

ConneXions

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# **ISAR experience**

- 15 years of near continuous operations
  - English Channel and Bay of Biscay
- Lots of high quality data
- One of the longest SST skin data records
  - More than 1000000 SST measurements
- Autonomous instrument, works in most environments
  - However needs careful maintenance
- Expansion to other areas AMT
- Protocols for installation
  - Instrumentation
  - Ship owners
- Failures
  - Design changes
  - Improved maintenance and pre-deployment checks



# **ISAR customers**

- University of Miami
- Ocean University China
- JAXA
- Royal Navy
- Danish Metrological Institute
- WHOI
- CSIRO
- Seoul National University
- Vaisala (Australian Antarctic Division)
- National Ocean Technology Center of China
- (MetNo)

