



shipborne radiometers for sea surface temperature

Experiences : ISAR - UoS

Werenfrid Wimmer

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











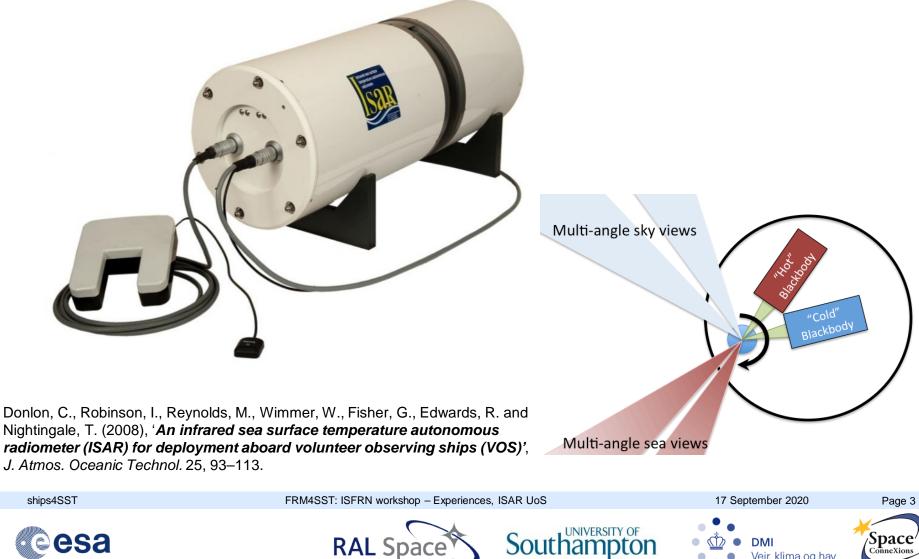
Overview

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



ISAR

Infrared Sea surface temperature Autonomous Radiometer



DMI

Vejr, klima og hav



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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FRM4SST: ISFRN workshop - Experiences, ISAR UoS









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ISAR installed on Cap Finistere



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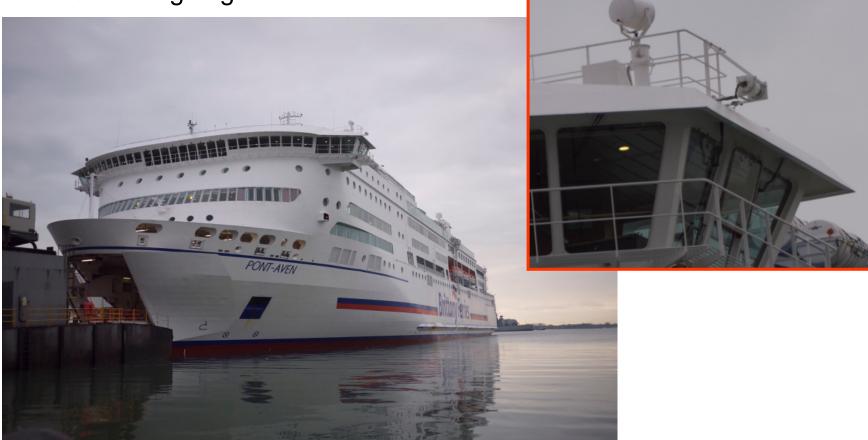
Southampton





ISAR installed on Cap Finistere

2012 - ongoing





- Bay of Biscay and English Channel
 - 69 deployments
 - ~ 5000 days at sea
 - ~ 960000 SST measurements
 - ~ 200 SST /day
 - 11 failures:
 - 6 electronics issues,
 - 3 related to new electronics trails, 1 thermistors

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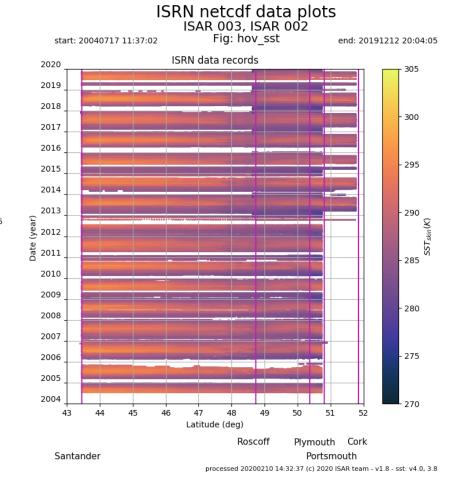
- 4 shutter failures
 - 3

2004			ISA	R-002	ISAR-002		IS/	AR-003		ISAR D4	-002	
2001	Jan PoB refit	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005		ISAR-003	B ISAR	-002			SAR-003		IS/ D8	AR-002		ISAR-003 D9
	Jan PoB ref		Mar	Apr	Мау	Jun	jul	Aug	Sep	Oct	Nov	Dec
2006	_		AR-002		ISAR-0 D11	003		ISAR-0 D12	02	_	ISAR-00 D13	3
	Jan PoB refit	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007	Ров гет	ISAR-0	002		ISAR-0	03 ISAR-0 D16	02	ISAR-00 D17)3			ISAR-003 D18
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	PoB ref	IS	AR-003			ISAR-00	3	ISAR-0	03 D21	ISAR-003		
2008	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	D22 Oct	Nov	Dec
	PoB ref	ISAR-00	3	ISAR	-002	ISAR	-003		ISAR-003			
2009	Jan	Feb	Mar	Apr D24	May .	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	PoB refit		AR-003	•	AB-002	ISAR-003	,			Transfer P		
2010		D2	28	1	D29	D30		-	1	μ L	031	
	Jan	Feb CpF refit	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2011				ISAP D32	-003	_		SAR-003 D33		_	ISAR-003 D34	ISAR-003 D35
	Jan	Feb CpF refit	Mar	Apr	Мау	Jun	jul Tra	Aug nsfer CpF to	Sep	Oct	Nov PtA refit	Dec
2012	_	cpi renc	ISAR-003 D36				5AR-003	insier oprito	ISAR	-002 D38	FLATEIL	ISAR-002 D39
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013		ISAR D40	-003		ISAR-002 D41		ISAR D42	-003				ISAR-002 D43
2015	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	F	PtA refit	ISAR-002	ISAR-003			ISAR-00	2		AR-003	ISAR-002	
2014	lan –	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	47 Oct	Nov	Dec
	PtA refit	AR-003		ISAR	,	,	R-003	j	ISAR-002		ISAR-00	13
2015		Feb	Mar	Apr	May	Jun		Aug	D52 Sep	Oct	D53 Nov	Dec
	PtA refit		Mai	•	-	Jun	-	2		000	NOV	
2016				ISAR- D54	002	1		AR-003	ISAR-002 D56		1	ISAR-003 D57
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2017			_	ISAR-002 D58	2		ISAR	-003 D59	ISAR-002 D60			ISAR-003 D61
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018				AR-002			AR-003		ISAR-002 D64		PtA ref	t ISAR-003 D65
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	ISAR-002			2			SAR-003		ISAR-002			
2019	Jan	Feb	D66 Mar	Apr	Мау	Jun	Jul	Aug	D68 Sep	Oct	Nov	Dec 🗖
)	PtA refit			COVID-19			-	R-002				
2020	Jan	Feb	Mar	Apr	Мах	Jun	Jul	9	Sep	Oct	Nov	Dec
1	Jan	ren	Mai	Apr	Мау	jun	jui	Aug	seh		1107	Dec



 Bay of Biscay and English Channel data

ISRN netcdf data plots ISAR 003, ISAR 002 Fig: track_sst start: 20040717 11:37:02 end: 20191212 20:04:05 305 ISRN ship track 52 300 51 50 295 49 48 290 skin(K) Latitude 42 SSTs 285 46 45 280 44 43 275 42 -10 -9 -6 -5 -3 -2 $^{-1}$ Longitude 270

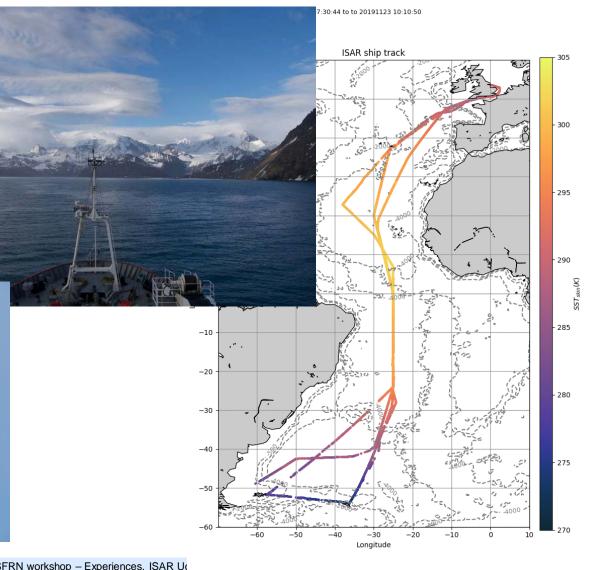


processed 20200210 14:32:49 (c) 2020 ISAR team - v1.8 - sst: v4.0, 3.8



AMT

- 4 cruises
 - 2016, 2017, 2018, 2019
- 166 days
- ~ 40 000 SST
- ~ 250 SST /day
- ISAR side by side comparison





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processed 20200915 (c) 2020 ISAR team - v1.1

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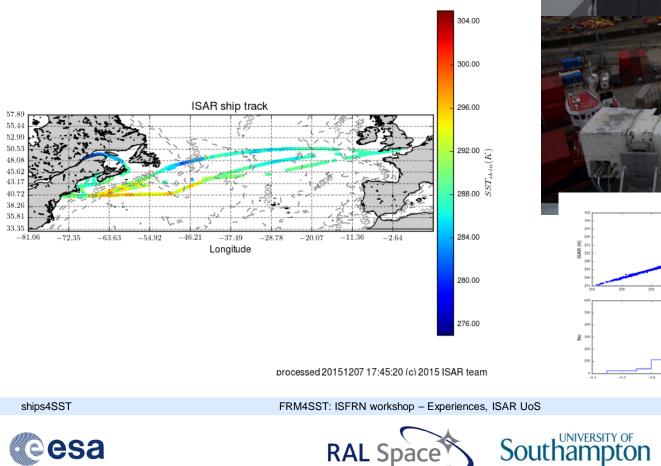
Space

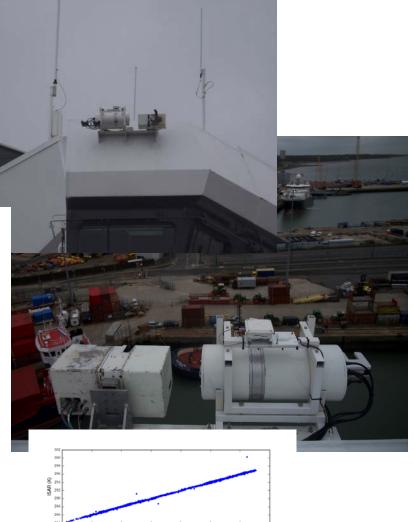
ConneXion

QM2

- ISAR SISTeR side by side inter-comparison
 - 2015

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





SISTeR (K)

I - S (K)

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DMI

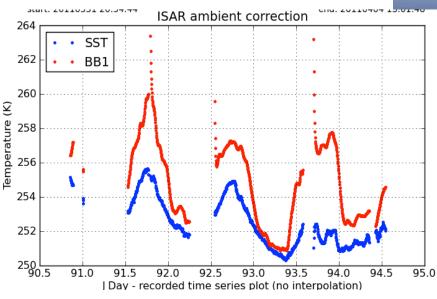
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Space

- FRM4STS ICE
 - ISAR inter-comparison
 - 2016, (2011)





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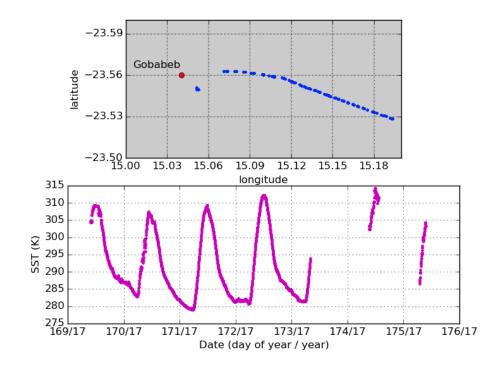


Spac

ConneXion



- FRM4STS Land
 - 2017







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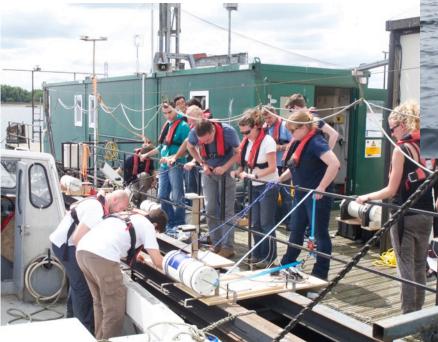


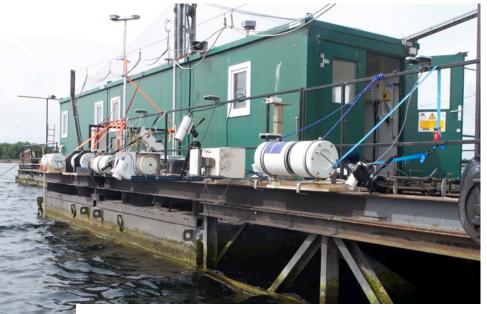


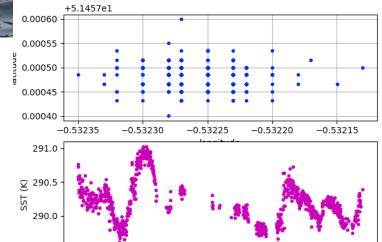


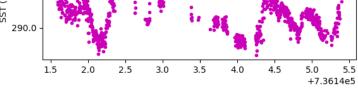
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- FRM4STS SST
 - 2016









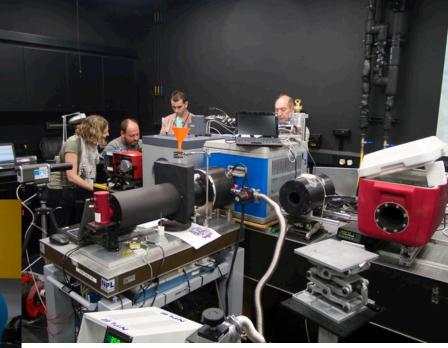






- FRM4STS NPL
 - 2016





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RAL Space









- EUMETSAT LWST
 - Lake Constance
 - ISAR KT15 inter-comparison
 - Started 01.09.2020







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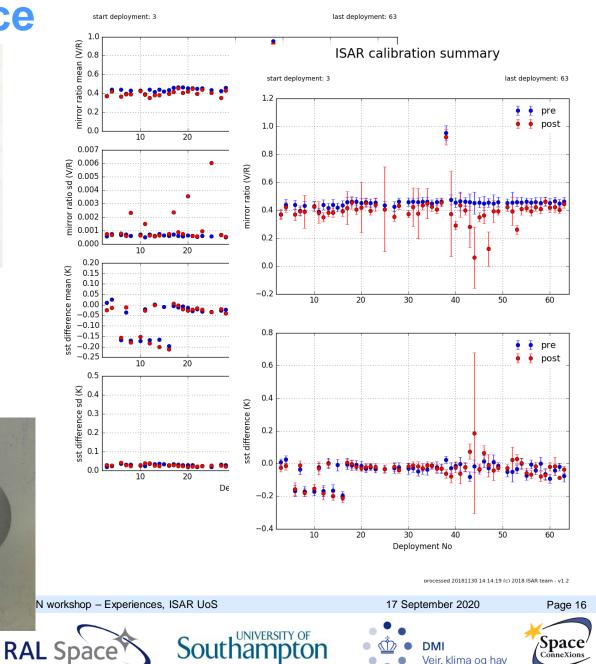
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ISAR experience

-



ISAR calibration summary



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ConneXions



ISAR





W. Wimmer Ocean and Earth Science National Oceanography Centre Southampton University of Southampton Waterfront Campus European Way, Southampton, SO14 3ZH, U.K.

Reference: Procedures_manual_v1.02 Issue: 01 Date of issue: November 2013 Document type Procedure Manua

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ISAR User Manual v2 05

W. Wimmer Ocean and Earth Science National Oceanography Centre Southampton University of Southampton Waterfront Campus European Way, Southampton, SO14 3ZH, U.K. Reference: ISAR-User-Manual-v2 05 2.05 March 2018 Date of issue User Manua Page 1 of 48 © Werenfrid Wimmer & Craig Donlor ships4SST

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Date: 05.08.2004 No · IS-IP-001

AR 002 shutter failure

failed on the 15.06.2004, which left the shutter jammed in a 1 shows the



were carried Figure 1: age of the jammed shu brations in the acilities at the Pride Bilbao as found 15.06.2004 aphic Centre 15.06.2004. If the instrument behaviour under deployment temperature

ach was done for the ambient temperatures of 10, 15 and

2 was jammed in an half open position (see figure 1). atory showed that under certain conditions the shutter ys got jammed in the position shown in figure 1. This be overcome with helping to push the shutter along from thorough investigation of the problem the instrument had to as the next step.

d that the sprocket which drives the drive belt and ad some of broken off teeth (see figure 2). Furthermore it had worn down quite substantially because of the wear ket. As a result of the wear and the broken off teeth the iluminium dust and some bigger parts form the teeth (see h was used on the sprocket drive belt interlink collected all drive belt and consequently increased the wear on the

a certain extent able to drive through these particles, ight tolerances on the shutter door the amount of torque st by the motor indefinitely. This eventually led to the urrent limiting electronics on the shutter motor limited the way that the shutter motor could not provide the torque riction (Note that the shutter motor suffered no harm).

1 of 2

processor version history ISAR Procedures Manual v1.02 This is the version history for main ISAR PP processor, which is used by a number of tools in the ISAR PP software suite.

1. CHANGELOG

Version v4.0- 14.11.2018 Bug fixes to v3.9_{Author}

o ____CalcEPrissvityUncEAthmetyPranglergrowmustelf.c_ufMissing, self. was missing. ShutterState added in for ISAR5D shutter disabled codes 10 and 11). Astral location() initialisation has been moved from SetNCFlags to init to speed up © Werenfrid Wimmer, Craig Donion, the processor. Minor speed improvements in the uncertainty estimation routines. Deployment.cfg changes: Page 1 of 62 Config file ("deployment.ctg") is now command line configurable o New function SetDepInfoDefault for default (UOS) values in case they are not defined in deployment.cfg. o bSeaSkyViewOverRide has new value 2, which allows for angels instead of array positions for the sea and sky view angles. Added new function GetSkySeaViewIndex()

ISAR post processing manual

ISAR sea surface temperature post

W Wimmer

- to convert angles to index in the processing. No deployment.cfg reader in the write isar sst v4.0.py anymore, all configuration
- values are read inti isar_v40.py. New variables for three skyviews: SkyViewUpper, SkyViewLower and
- SeaWaterEmissivity. These override ISAR header information.
- Actual Skyview and Seaview angle added to the L2R file.
- write_isar_sst_v4.0.py can process multiple sky angles in one step. To achieve this new variables in deployment.cfg, see above.

Version v3.9- 20.08.2018

- Bug fixes to v3.8:
 - Fix to to BB thermistor differences for Engineering plots so plotting still works by not resetting sample[0,1] number to zero in calcSSTskin_from_i5.
- · Changed view_angles and target_sample field size from 10 to 20 in isar_struct_ua for isaros v2.6.2 20 scan samples update.

Version v3.8 - 30.04.2018





ISAR experience

- 16 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 (shutter, mirror, electronics)
 - 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)

