



shipborne radiometers for sea surface temperature

Southampton RAL Space

High latitude Radiometer activities at DMI

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- Normal ISAR/FRM operational activities at DMI
- MW and IR Inter-comparison experiment



New member of the DMI team

- Welcome to Guisella Gacitua
- New to the DMI radiometer team







Routine Deployments

- DMI ISAR installed on Smyril line ferry Norrøna, December 2017
- Incidence angle: 25 degrees
- Routine operations between Denmark, Faroes and Iceland, also during COVID-19
- Round time: 1 week
- Year round service
- Servicing and calibration: every 2-3 months



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ships4sst: FRM4SST



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Processing and Deployments

- Routine pre and post calibrations. Data uploaded to ships4sst site
- DMI now has 3 ISARs, one old, 2 new (8,18 and 19)
- Challenging environment
- Communication box developed and ready to be installed (2-ways comm)
- Deployment 19 is in progress.

Deployment	Ship	ISAR	Start	End	Days	No of SST	Comment
1	Norröna	8	02/12/2017	31/03/2018	119		Ship in dock 23/12 – 4/1. Issue with GPS and ship power supply.
2	Norröna	8	21/04/2018	09/06/2018	49		GPS problems.
3	Norröna	8	23/06/2018	08/09/2018	78		
4	Norröna	8	29/09/2018	05/01/2019	99		
5	Norröna	8	02/02/2019	30/03/2019	57		Mirror contaminated day 62, SST processed until 4/3.
6	Norröna	8	27/04/2019	10/07/2019	75		Processed data until 11/5.
7	Norröna	8	23/07/2019	12/10/2019	82		Processed data until 4/9.
8	Norröna	8	09/11/2019	18/01/2020	71		Processed data until 8/1.
9	Norröna	8	07/02/2020	23/05/2020	107		Some data lost due to Norröna in COVID19 quarantine.
10	Norröna	8	06/06/2020	21/08/2020	92		GPS problems.
11	Norröna	8	24/10/2020	23/12/2020	60		GPS problems. Mirror contaminated day 334, SST processed until 29/11.
12	Norröna	18	13/03/2021	08/05/2021	56		Instrument shutter failed on second day of deployment. Data loss.
MW / IR experiment	Norröna	19	29/05/2021	04/06/2021	7		
13	Norröna	19	10/07/2021	16/10/2021	99		Mirror contaminated day 276, SST processed until 3/10. Instrument power cut off 23/7 - 7/9.
14	Norröna	8	16/10/2021	04/12/2021	49		Shutter remained close during the whole campaign.
15	Norröna	19	04/12/2021	19/02/2022	77		
16	Norröna	18	19/02/2022				
No data released							
Future deployment							
Ongoing deployment							
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ISFRN workshop, Southampton

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Sep 8-9, 2022



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CEOS WGCV inter-comparison

- Participated in CEOS WGCV intercomparison Campaign, June 2022
 - Lab experiment
 - Field experiment
 - Data delivered to NPL for verification









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ISFRN workshop, Southampton

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MW/TIR Intercomparson experiment

Aim:

- To perform first inter-comparison between MW and TIR SST radiometers
- To asses IR (skin) and MW (subskin) SST relation, prepare for CIMR

- Documentation (available at: ships4sst.org):
- Procedures for MW deployments (FRM4SST-PRD-DMI-001)
- MW (C and X band) Characterisation report (FRM4SST-CR-DMI-001)
- Inter-comparison between IR and MW radiometer observations (scientific paper to be submitted)



Campaign Radiometers

- Infrared radiometer : ISAR (well known)
- Microwave Radiometer
 - DTU EMIRAD
 - C band Frequency (-3 dB: 7.0365 7.0635 GHz)
 - X band Frequency (-3dB: 10.64 10.74 GHz)
 - Refurbished and Characterized.







1st Campaign : Static deployment

- Static installation on a bridge
- Looking at salty waters in Copenhagen
- 1-day deployment in cold and calm waters
- ISAR and MW (C+X band) radiometers
- Results in Characterisation report





2nd Campaign ship deployment

- 10 days deployment on DMI ISAR Ferry: Denmark-Faroes-Iceland
- Side-by-side deployment of:
 - ISAR-08,
 - ISAR-19,
 - **EMIRAD-C** band
 - EMIRAD-X band
 - Thermal Infrared camera
- Good weather, lots of data acquired
- ISAR incidence angle: 25 degrees
- MW indcience angle: 55 degrees





sk/isar/20210529T121722Z_STATUS_OPEN ISARSE_019

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MW observations

- Example of MW observations
- Regular sky observations (55 degrees)





DMI

Vejr, klima og hav

ConneXions



Data processing

- ISAR and EMIRAD observations are collocated
- Auxiliary information added to the matchups
 - SST (L4)
 - Wind speed and direction, TCLW, TCWV (ERA-5 NWP)
 - Salinity (DMI HYCOM model)
 - Simulated surface emissivity





SST comparisons

- Sentinel 3 SSTs overlaid
- Comparison between IR and MW SSTs
- Statistical retrieval, 4 channels MW







Next steps

- Compare with simulated TBs
- Determine spatial and temporal scales of MW TB versus IR TBs
- Understand the MW and IR variability
- Write paper on comparison
- Lessons learned for follow up experiments



Questions?

