



ISAR – Denmark

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04/03/2025

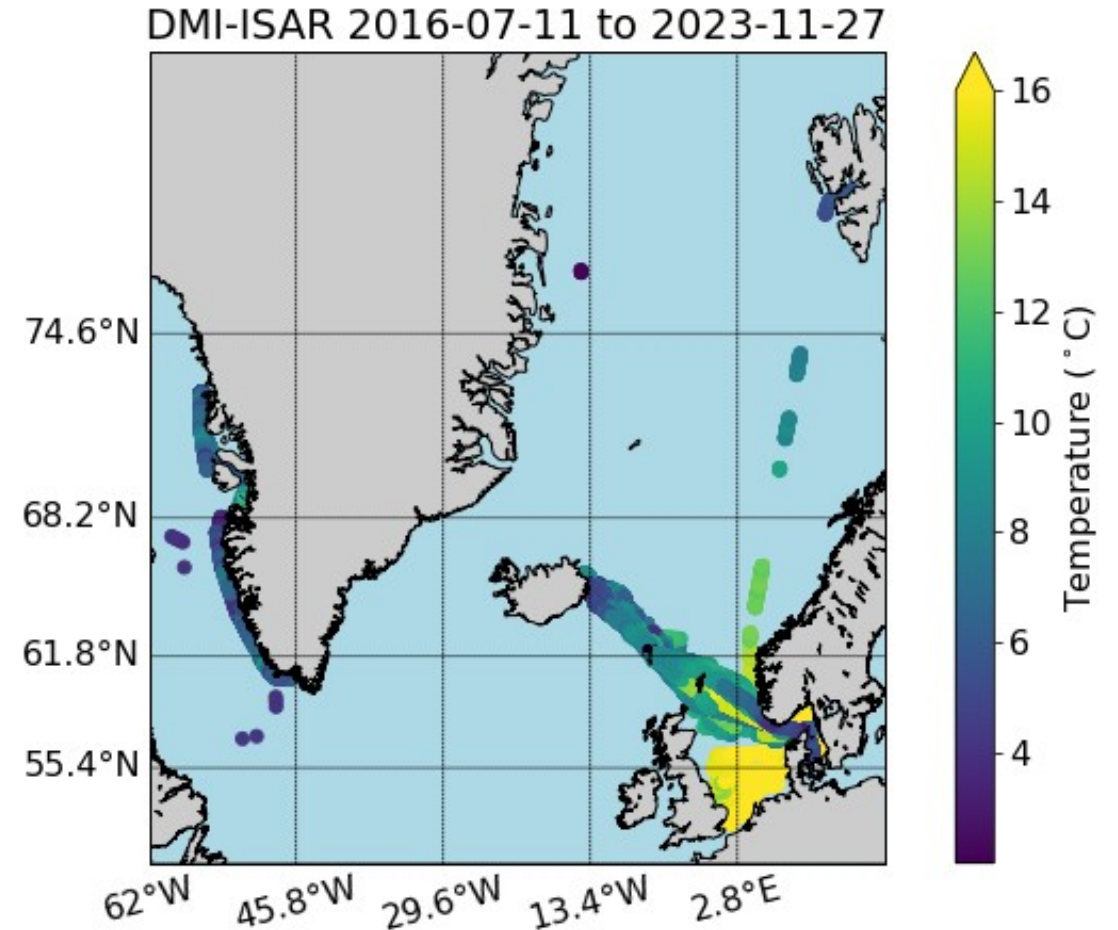
Satellites and the Arctic Unit
National Centre for Climate Research (NCKF)



Danish Meteorological Institute

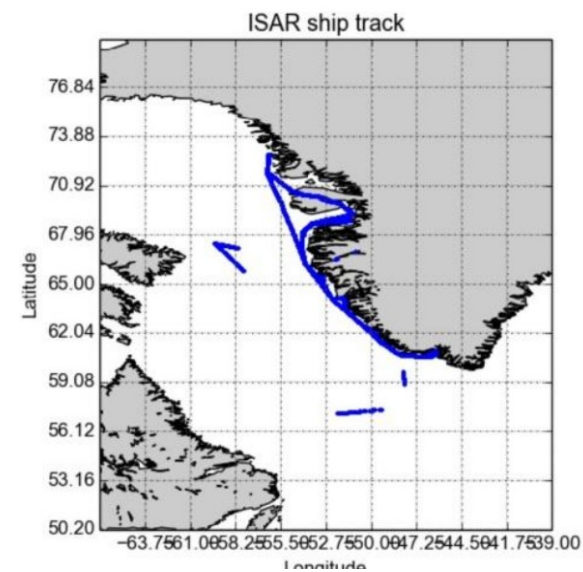
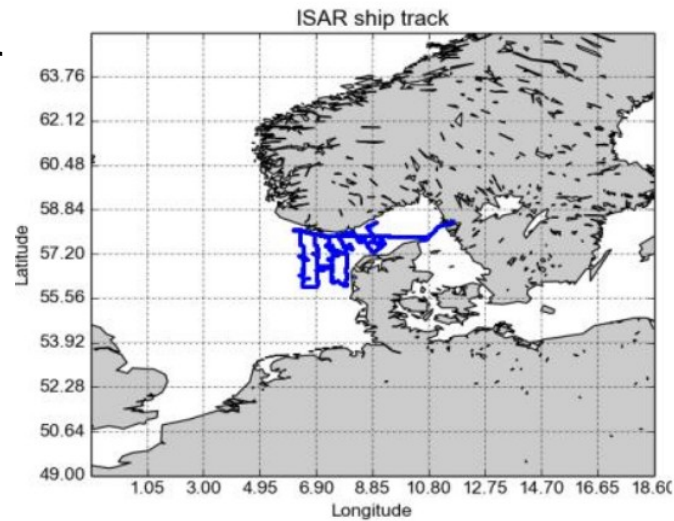
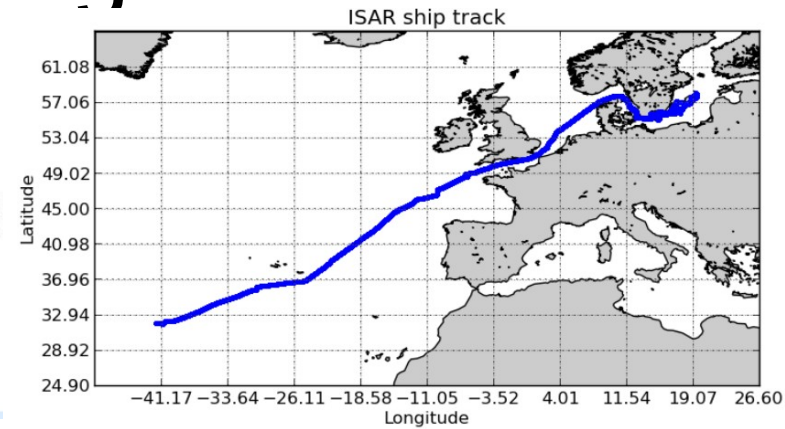
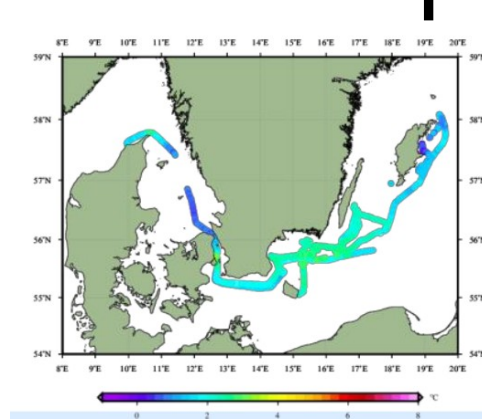
Motivation and Scope

- Need for FRM SST at high latitudes
 - Uncertainty
 - Cloud cover
 - Sparse in-situ observations (drifting buoys and Argo floats)



Past scientific campaigns:

- RAL vessel: Irena Arctica
- Danish research Vessel, DANA
- Oden Icebreaker
- Danish Defence Vessel: Einar Mikkelsen

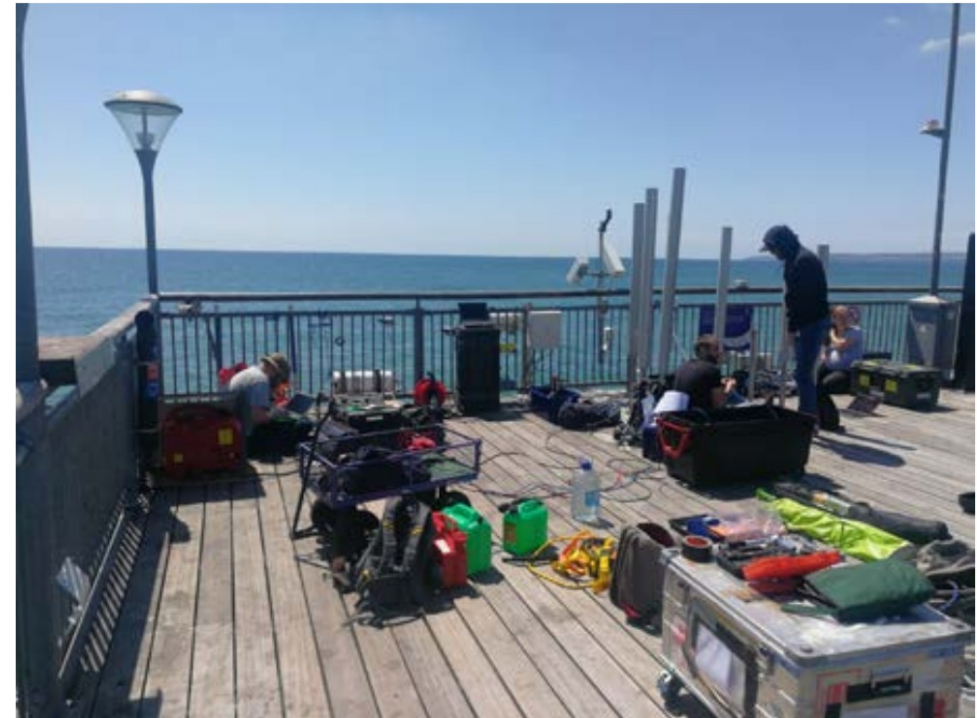


FRM4STS water inter-comparisons

- 2016 CEOS Laboratory IR Intercomparison, NPL, Hampton UK:



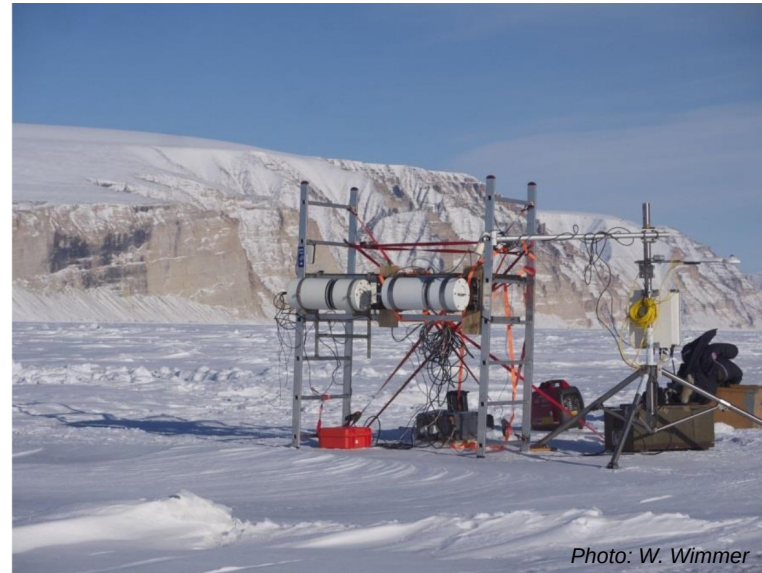
- 2022 CEOS WGCV intercomparison campaign:



FRM4STS sea ice inter-comparison

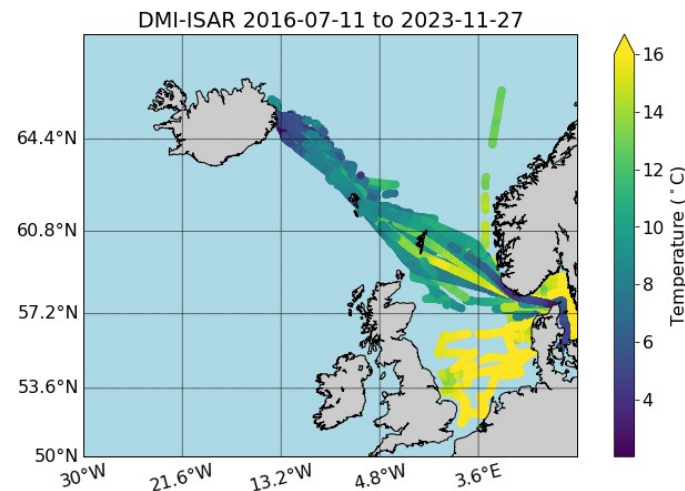
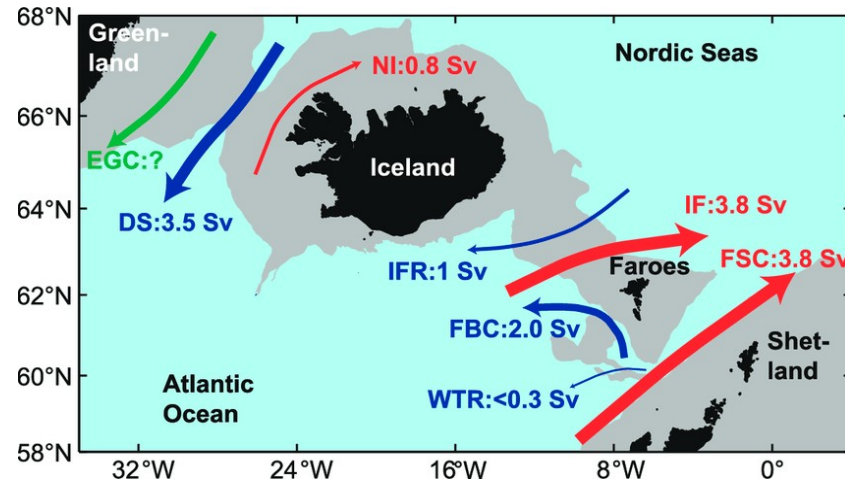
March 30 – April 7, 2016

- 3 research teams and 6 TIR radiometers
- Other instruments:
 - Automatic Weather stations
 - Ice Mass balance buoys
 - Ocean buoys (T,S, Currents)
- Additional experiments:
 - Spatial variability
 - Freeze up experiment
 - Angular emissivity experiment



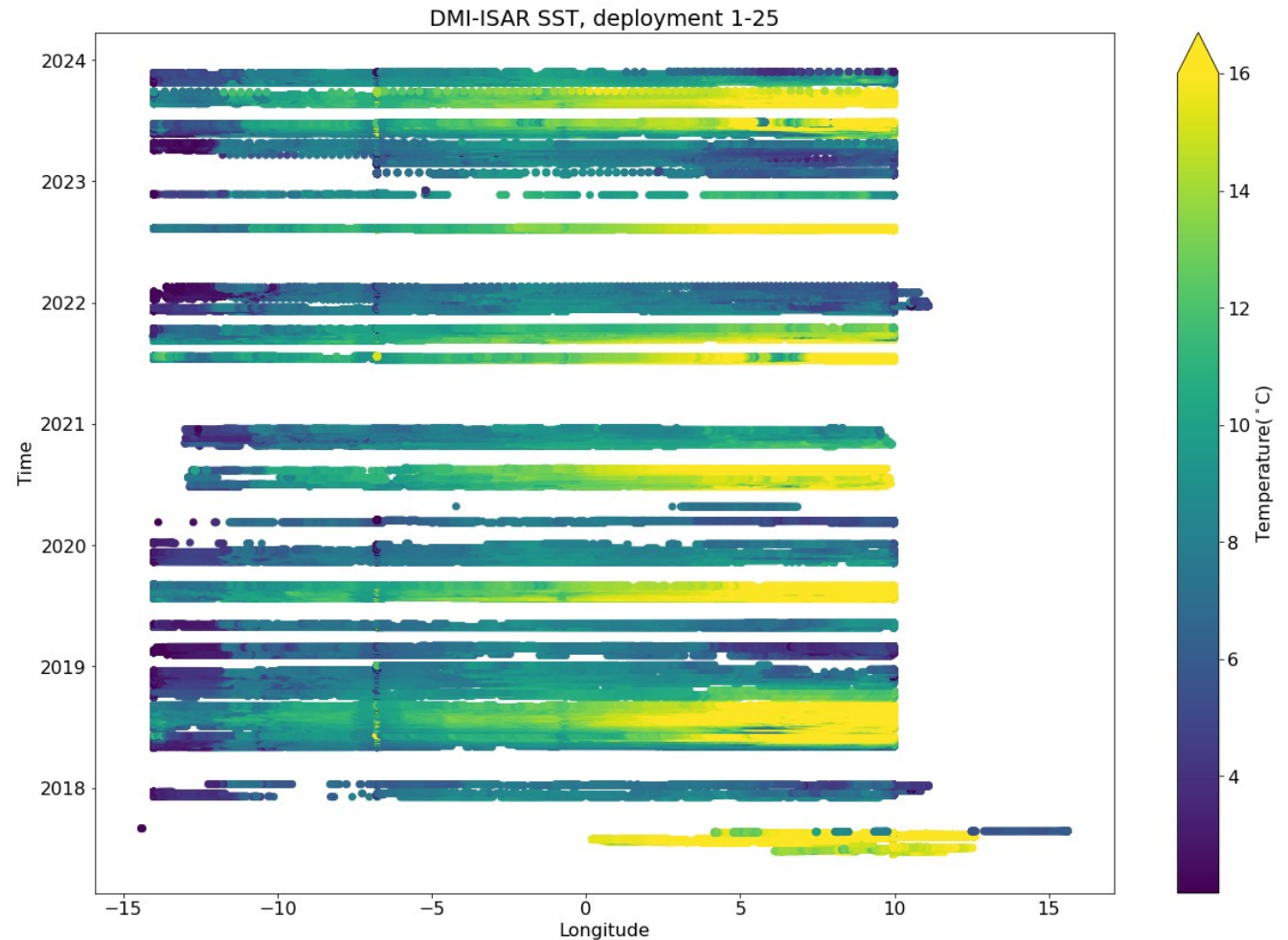
Ships4SST – Operational Deployments

- Ongoing since December 2017
- DMI ISAR installed on Smyril line ferry Norröna
- Routine operations between Denmark, The Faroe Islands and Iceland
- Monitoring the Atlantic inflow to the Nordic Seas, AMOC



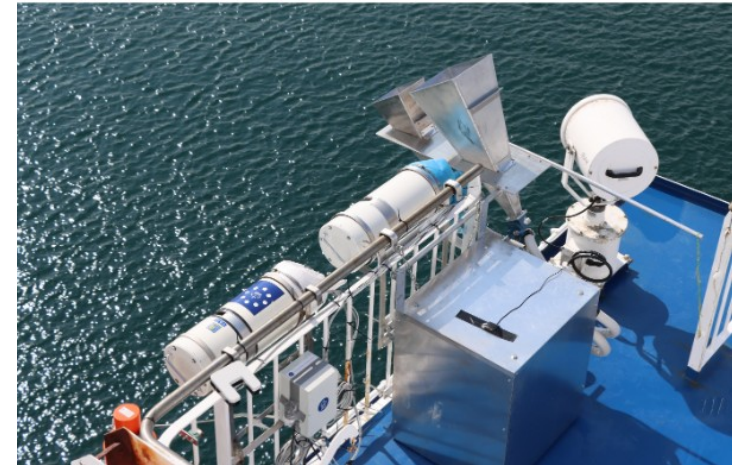
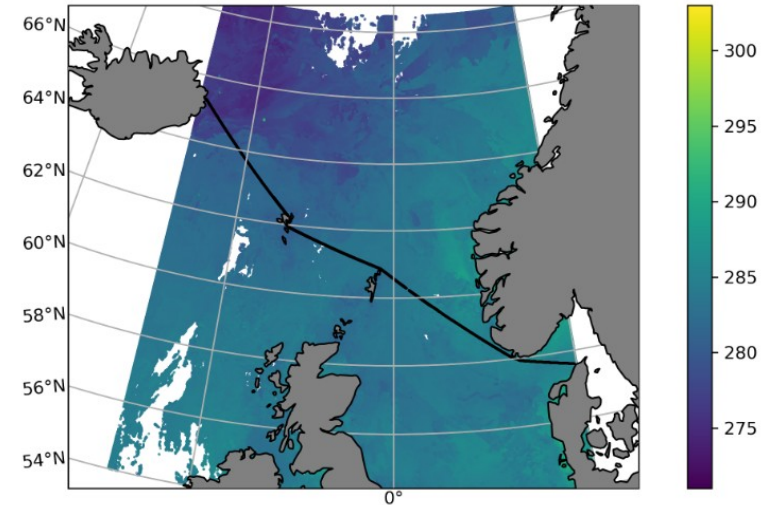
Ships4SST – Operational Deployments

- Round time: 1 week
- Year round service
- Servicing and calibration: 2-3 months
- 26 deployments to date
- Routine calibration and data processing
- Deliver to Ifremer ftp server



TIR-PMW inter-comparison

- Important for existing CDRs and for homogenisation of future reference missions (e.g. SLSTR vs CIMR)
- TIR and PMW → Skin vs. subskin
- Special focus on cold waters
- Analyzed data characteristics and uncertainty estimations of SST_{MW}
- Made recommendations for future intercomparison campaigns



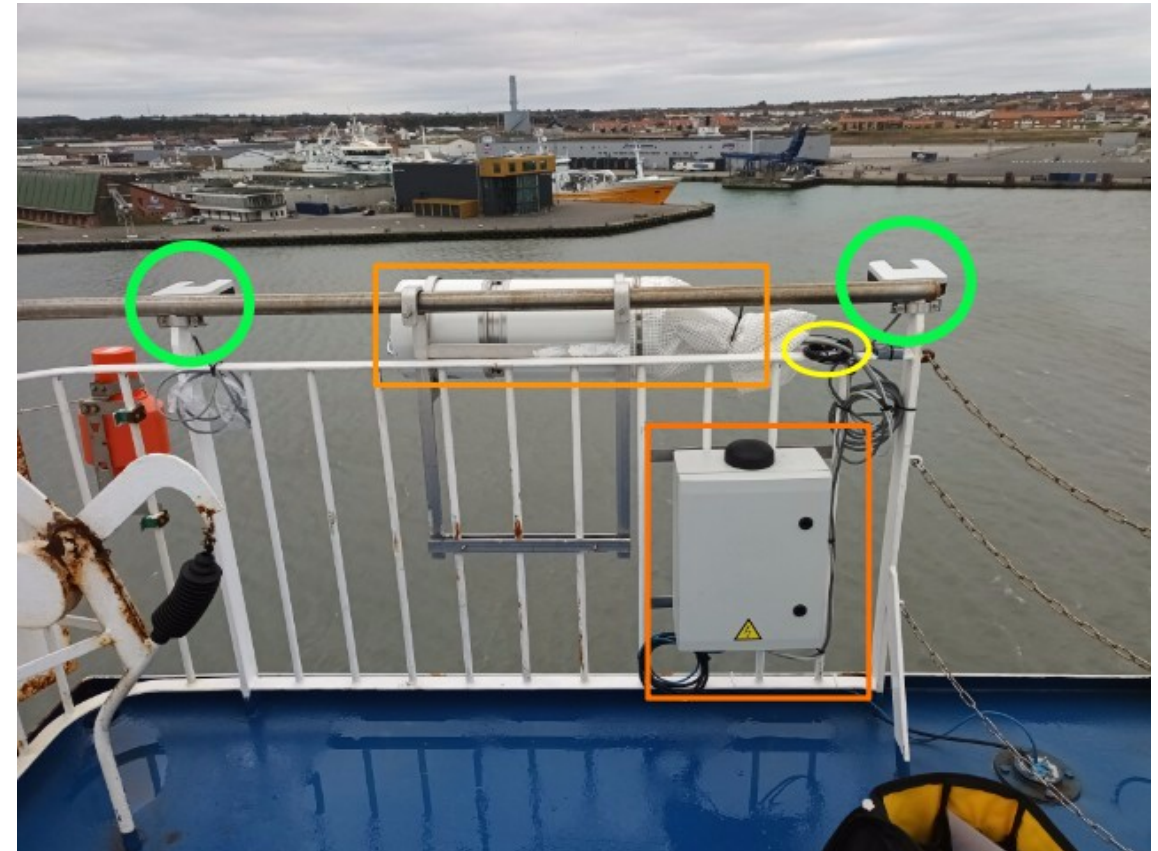
Qty.	Radiometer type	Name	Wavelength μm	Frequency GHz	Bandwidth	Sea-view angle
2	TIR	ISAR	10.55	–	9.6–11.5 μm	25°
1	PMW	EMIRAD-C	–	7.05	7.0365–7.0635 GHz	55°
1	PMW	EMIRAD-X	–	10.69	10.59–10.79 GHz	55°

Gacitúa, G., et al. (2024). *Geoscientific Instrumentation, Methods and Data Systems*, 13 (2)

Current setup and operational challenges

ISAR ID	Conditions	Status	Successfully operated
08	Memory/electronics	Not working	2017-2020
18	electronics/shutter	Not working	--
19	Deployed	In maintenance	2021-present*

- Rough weather conditions
- Communication to the instrument available only near land
- Deployments are usually interrupted due to technical issues
- Regular maintenance following procedures



Future plans

- Continue the high latitude FRM SST collection contributing to validation of the SLSTR SST products
- Working on optimizing DMI ISARs
- Collect more data from scientific campaigns for other ship routes and for IST
- Spatial temperature variability assessments and inter-comparison with other methods

Thank you



Danish Meteorological Institute