

# The Sentinel-3 SLSTR Ice Surface Temperature reference buoy – prototype and first results.

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## Abstract

The Sea and Land Surface Temperature Radiometers (SLSTR) flown on the Copernicus Sentinel-3 missions observe and monitor Land-Surface Temperature (LST), Sea-Surface Temperature (SST) and Ice Surface Temperature (IST) with high precision. In order to validate and ensure the quality of the satellite IST retrievals, the observations must be compared with well-calibrated, ground based reference measurements.

To this end, EUMETSAT initiated the TRUSTED project in 2018, on behalf of the European Union Copernicus programme to collect high-resolution in situ measurements with well-characterized and fit-for-purpose uncertainties, referred to as Fiducial Reference Measurements (FRM). Initially the service provided SST measurements and more recently, since 2021, the development of a platform to retrieve reference sea IST measurements was initiated, resulting in currently 2 prototypes of the Trusted Ice Buoy (TIB's), that currently (Winter 2026) are deployed in Qaanaaq, North West Greenland.

A consortium led by CLS, together with the DMI, nke Instrumentation and the Shom, has worked on defining the TIB IST sensor and buoy requirements, designing the sensor, and testing of prototypes. The poster describes the TIB development and design, calibration experiments and first tests performed during laboratory and field experiments in the period from 2024 to 2026.

## Trusted Ice Buoy ("TIB") concept and design

### TIB Concept

- FRM compliant
- Easy to deploy
  - No expert qualifications
- Cost efficient
- Real time data transfer

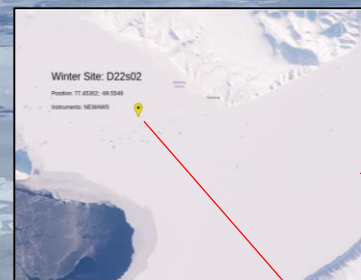
### TIB Design

- 16 vertical thermistors
- Snow/ice interf. to 0.5 m air
- NRT  $T_{skin}$  transmission to GTS



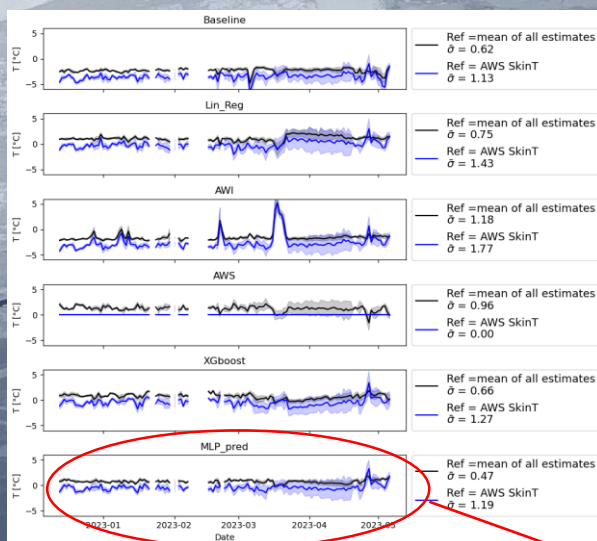
## Current deployment:

- 2 TIBs
- 3 AWS (rad+therm Tref.)
- Simba IMB



## Skin temperature retrieval and model intercomparison

Blue Graphs: Model minus reference. Black Graphs: Model minus Mean\_of\_all\_estimates



**NO TRAINING :**  
Baseline = Coldest

**TRAINING NEEDED:**  
Lin\_Reg = Simple Linear regression

Simba-AWI = AWI Heat cycle analysis (Currently best serial produced ice buoy)

AWS = TIR radiometric temperature from reference AWS(Ref.)

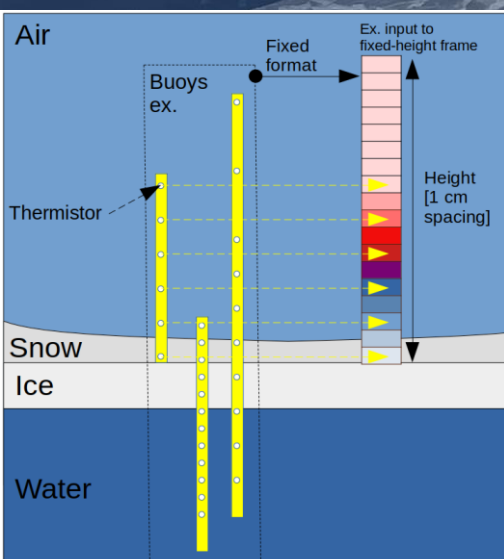
XGBoost = ML-based decision tree algorithm

MLP = ML based linear regression (most advanced)



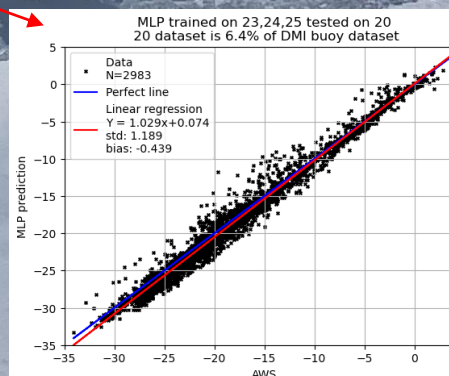
## Tskin retrieval using MachineLearning, Model training Concept

## Performance of MLP model for large vs small training data sets.

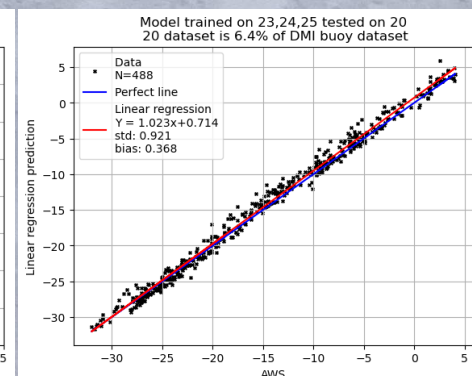


### Skin temperature model training – concept

- Migrated any temperature profile data to a fixed-frame temperature profile
- Interpolate temperatures between observations in the fixed frame temperature profile
- Train model on "fixed-frame" data against reference data, e.g. radiometric skin temperature



MLP: Training on 61 % of data  
Testing on 39 % of data: STD = 1.19 K



MLP: Training on 94 % of data  
Testing on 6 % of data STD = 0.92 K