ships4sst

shipborne radiometers for sea surface temperature

Radiometer Inter-comparison

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Overview

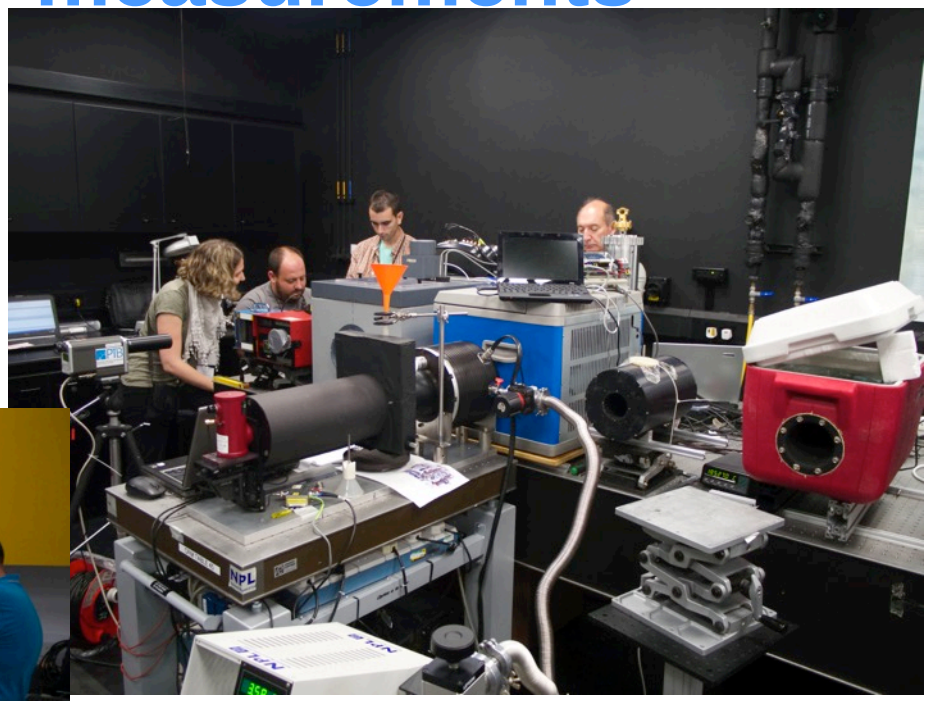
- FRM4STS
  - Lessons Learned
- Plans for next inter-comparison

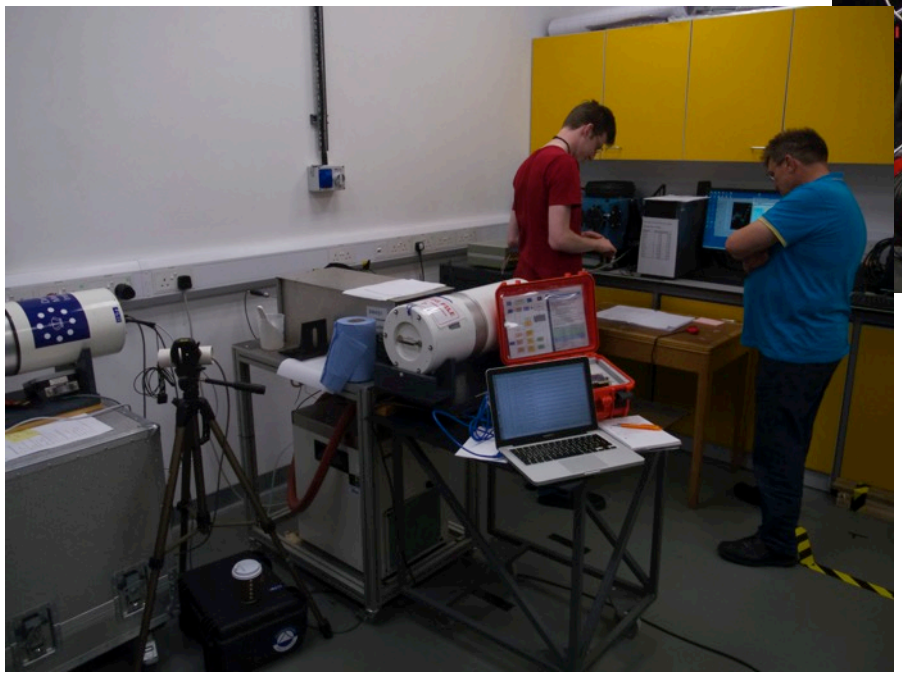
Plan

- Lessons learned document
  - Circulated amongst 2016 participants – late 2020
- Laboratory based measurements
  - Spring 2022 (late March) at NPL
  - Similar format as 2016 (with lessons learned)
- Field measurements
  - Wraysbury
    - Again with improvements/lessons learned from 2016
    - After the laboratory based measurements (the week after)
  - Wider experiments as for FRM4STS – Land, ICE
    - Not planned at the moment (mainly due to funding)
    - Bilateral (QM2, AMT, …) in discussions

FRM4STS laboratory measurements

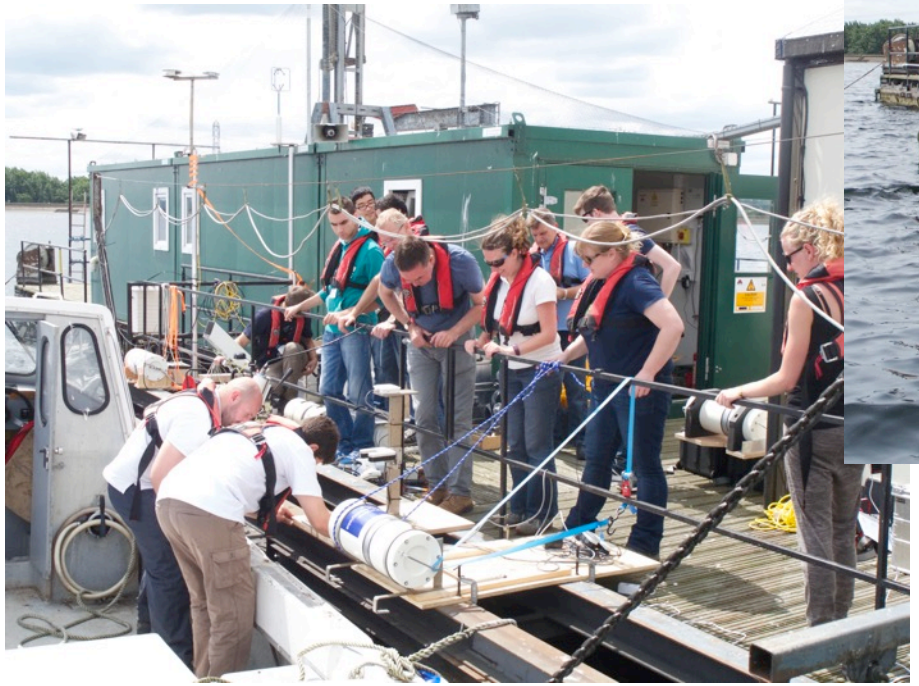
- NPL
  - 2022





FRM4STS – Field measurements

- Wraysbury
  - 2022



FRM4STS – lessons learned - BB

- FoV
  - The FoV of the reference radiometers being used should be small enough to ensure that they are well overfilled by the aperture of the cavity of the blackbodies participating in the comparison.
- Positioning/FoV coverage
  - Because different reference radiometers being used could have different FoVs, it is recommended that in future reference radiometers should be placed at different distances from the apertures of the participating blackbodies to ensure that the FoVs of the radiometers “cover” the same (identical) area of the back walls of the blackbodies. The aim of this is to ensure that the same temperature non-uniformities of the blackbodies are seen (and averaged out) by every reference radiometer.
  - In cases where the reference radiometers cannot be placed close to the aperture of the cavity of a participating blackbody, the extra distance between the blackbody 102 cavity aperture and the radiometer should be included in the calculations to ensure that the blackbody aperture still overfills the FoV of the reference radiometers.
  - When two or more reference radiometers are used to measure the participating blackbodies, the areas of the cavity of the blackbody observed by the different radiometers should be the identical. Furthermore, the areas viewed should be large enough to average out possible spatial non-uniformities in the temperature present in the blackbody cavities.

FRM4STS – lessons learned - BB

- Temperature
  - Participating blackbodies whose cavity temperatures are not actively stabilised but are allowed to drift should endeavour to keep the magnitude of the drifts as low as possible in order to minimise any differences which could arise due to the timing of the measurements.
  - The temperature of the cavity of participating blackbodies being viewed by the reference radiometers should be as spatially uniform as possible. The reference radiometer should be measuring and reporting the temperature along the optical axes of the participating blackbodies.

FRM4STS – lessons learned – radiometers

- FoV / Aperture
  - The aperture of the reference blackbody should be large enough to enable the FoV of the participating radiometers to be well overfilled by the reference blackbody aperture. The temperature of the cavity of participating blackbodies being viewed by the reference radiometers should be as spatially uniform as possible. The reference radiometer should be measuring and reporting the temperature along the optical axes of the participating blackbodies.
- FoV / Positioning
  - In cases where the radiometer cannot be placed close to the reference blackbody aperture, the extra distance between the reference blackbody and the radiometer should be included in the calculations to ensure that the reference blackbody aperture still overfills the FoV of the radiometer.
  - Because different radiometers have different FoVs, it is recommended that in future participating radiometers should be placed at different distances from the reference blackbody so that the FoVs of the radiometers “cover” the same (identical) area of the back wall of the reference blackbody. The aim of this is to ensure that the same temperature non-uniformities of the blackbody cavity are seen (and averaged out) by every participating radiometer.

FRM4STS – lessons learned – radiometers

- FoV / Positioning
  - The area of the reference blackbody observed by the different radiometers should be large enough to average out possible spatial non-uniformities in the temperature of the cavity of the blackbody.
- Temperature
  - The temperature of the reference blackbody which is viewed by the radiometers should be as spatially uniform as possible.
- Emissivity
  - The emissivity of the reference blackbody should be provided to all participants in order to enable them to calculate the corrections which will account for the reflections from the blackbody cavity.
- Timings to align and measure
  - During the 2016 radiometer comparison, a 30 minute period was allocated to each participant to allow for the alignment of the radiometer to the reference blackbody aperture and the making of the measurements at a particular blackbody temperature. Some participants reported that 30 minutes was not enough.
  - **The 30 minute time limit was pre-determined by the number of participants and allocated time for laboratory measurements, extending it make the laboratory measurements longer than a week and increase cost.**

FRM4STS – lessons learned – Wraysbury

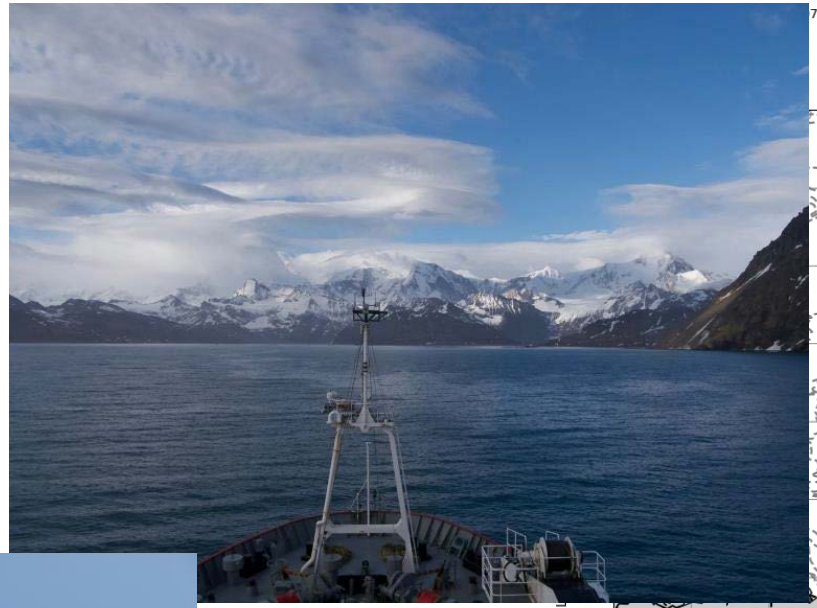
- FoV / Positioning
  - Because different radiometers have different FoVs, it is recommended that in future WST comparisons, radiometers should be placed at different distances from the target being monitored so that the FoVs of the radiometers “cover” the same (identical) area of the water. The aim of this is to ensure that the same temperature non-uniformities on the surface of the water are seen (and averaged out) by every participating radiometer.
  - The area of the water observed by the different radiometers should be large enough to average out possible water surface temperature non-uniformities of the target.
  - Care should be taken to ensure that all participating radiometers are observing the same area of the surface of the water.
- Emissivity
  - Ideally, each participant should either measure or obtain the emissivity of the sea/water from tables and use these emissivity values in calculating the surface temperature of the targets by taking into account the angle between the FoV of the radiometer and the surface of the water, as well as the wavelength band over which the radiometer has a finite response. However, it was recommended by some participants that in future comparisons, participants should be provided with a common emissivity estimate which could be used by the participants to calculate the WST of the targets.

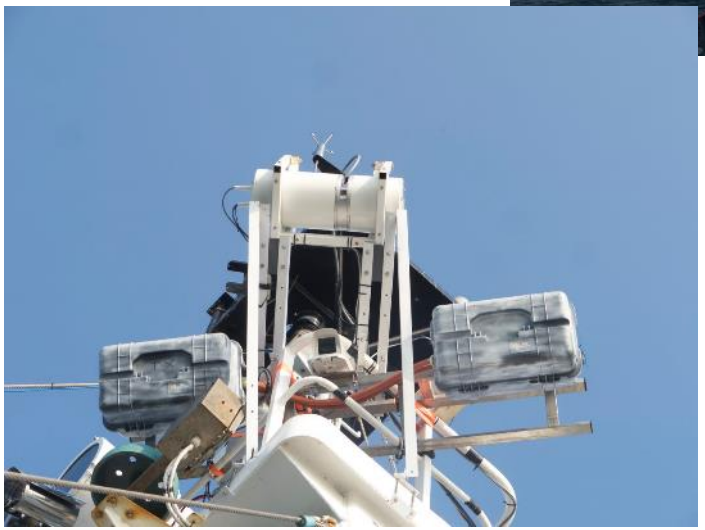
FRM4STS – lessons learned – Wraysbury

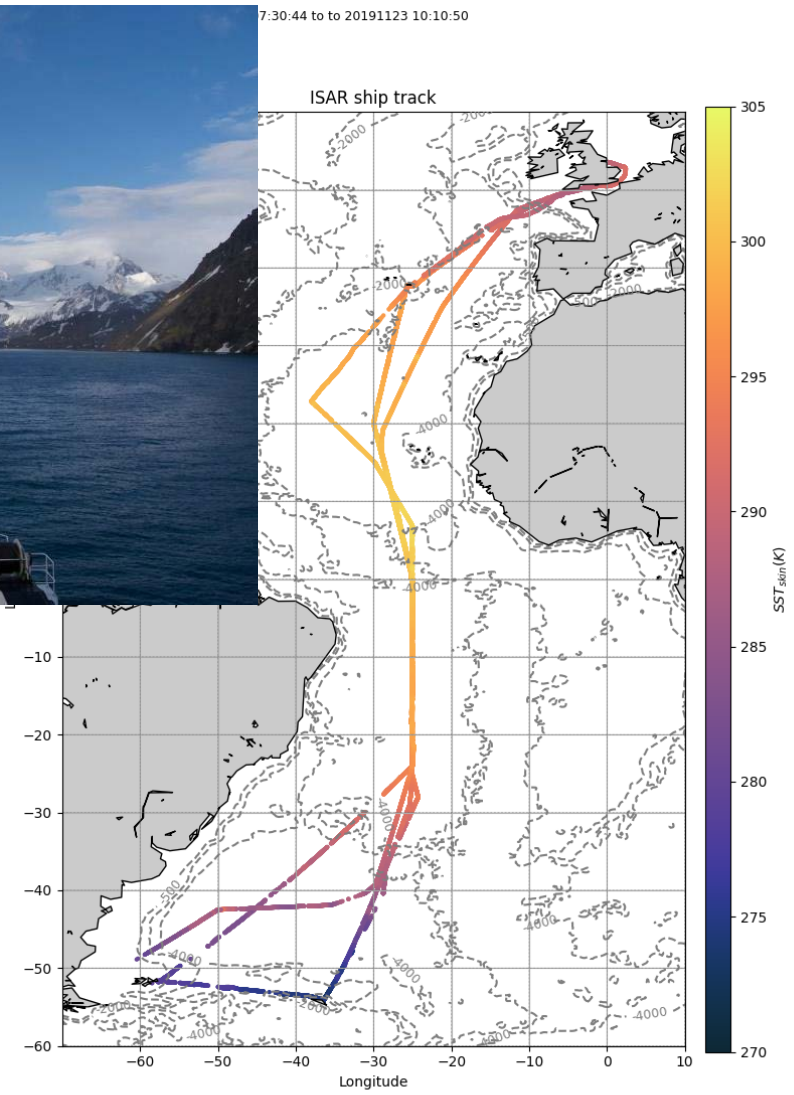
- Sky conditions
  - WST/SST measurements should ideally be performed in clear sky conditions. Failing that, measurements should be performed when the sky is completely covered in cloud. Measurements performed under partly cloudy conditions should be avoided because of the difficulties in estimating the corrections due to the sky radiance which a partly cloudy condition introduces.
- Surrounding environment
  - The surface temperature of the target should be as spatially uniform as possible, at least in the region covered by the Field of View (FoV) of the participating radiometers. This is usually achieved under no wind and under calm water conditions. The wind speed and the condition of the surface of the water should be continuously monitored during the entire duration of future WST comparisons
  - When WST measurements are performed from platforms, care should be taken to prevent measurements being affected by possible blocking of surface water ripple by the structure of the platform on which the radiometers are mounted.
  - Care should be taken to prevent shadows of objects on the platform (on which the radiometers are mounted) from being in the radiometer viewing footprints. This can be achieved by mounting the radiometers on an extended arm so that they view footprints which are as far as possible away from the area affected by the shadows of the platform structure.
  - The effects of the shadows of the platform structure can be avoided/minimised by mounting the radiometers so that they face in a southern direction.

Ship inter-comparisons

- AMT
  - Possible in early 2021

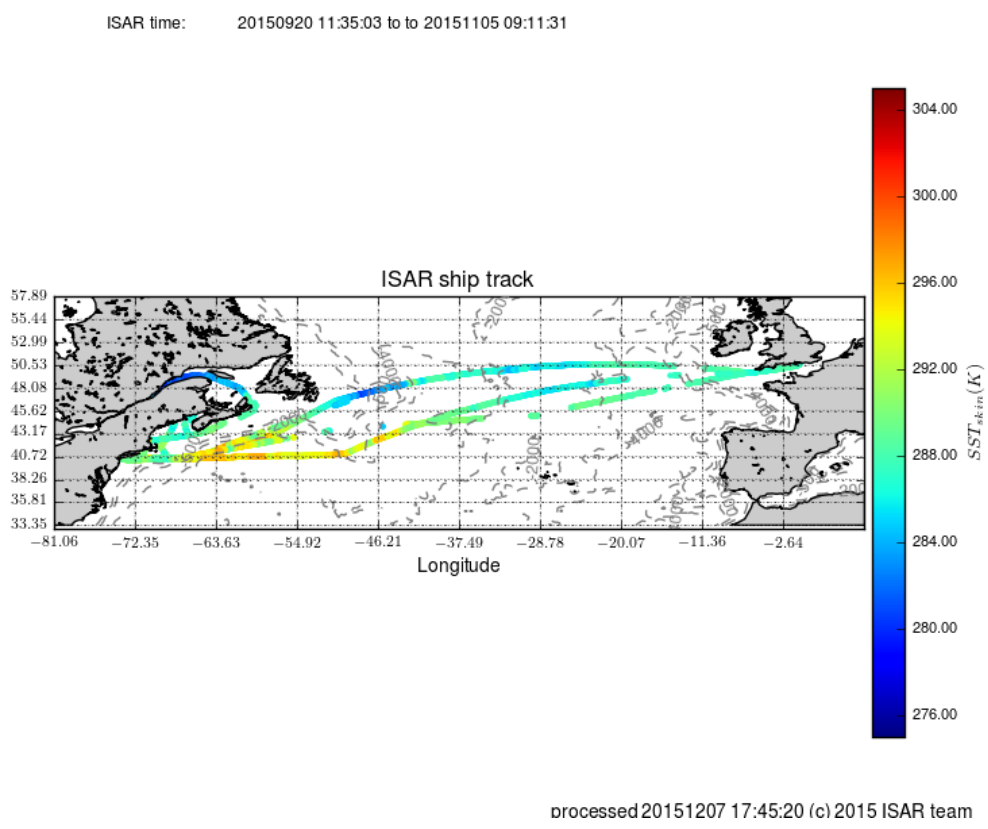


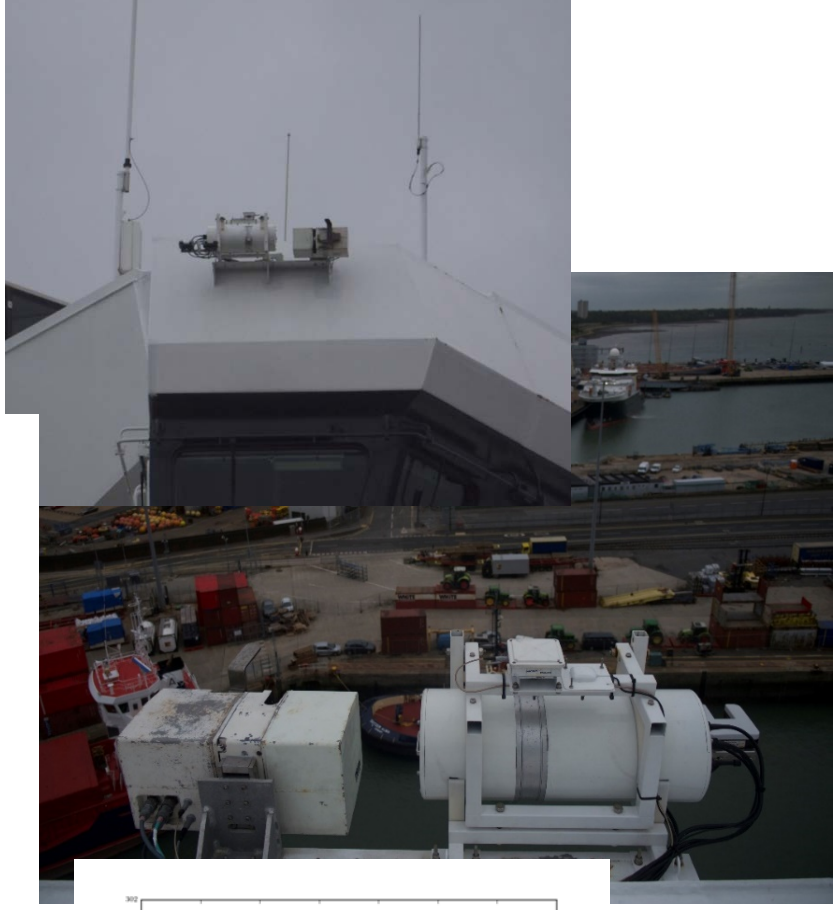


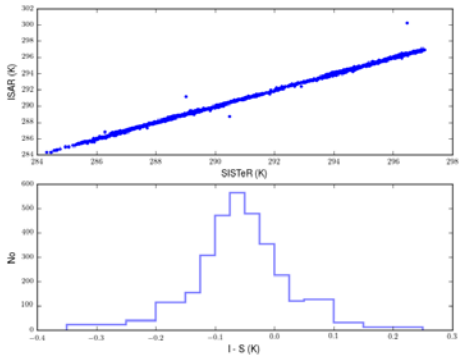


Ship inter-comparisons

- SST
  - Not planned at the moment

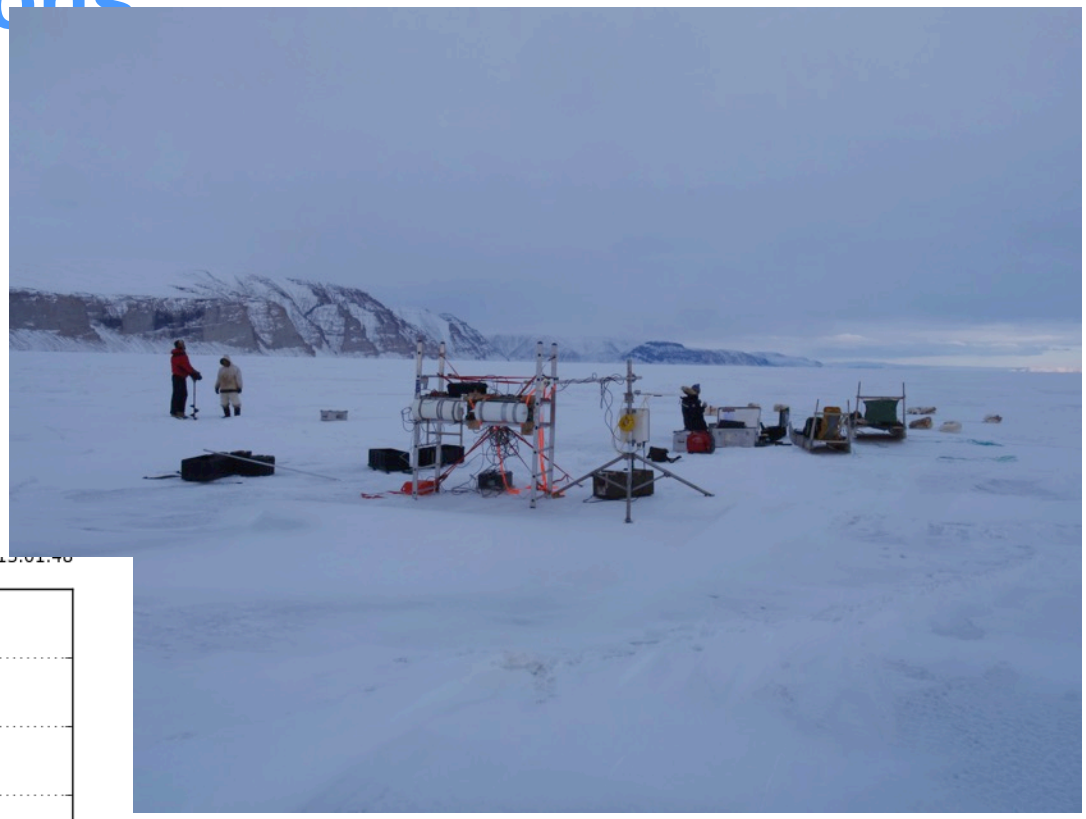


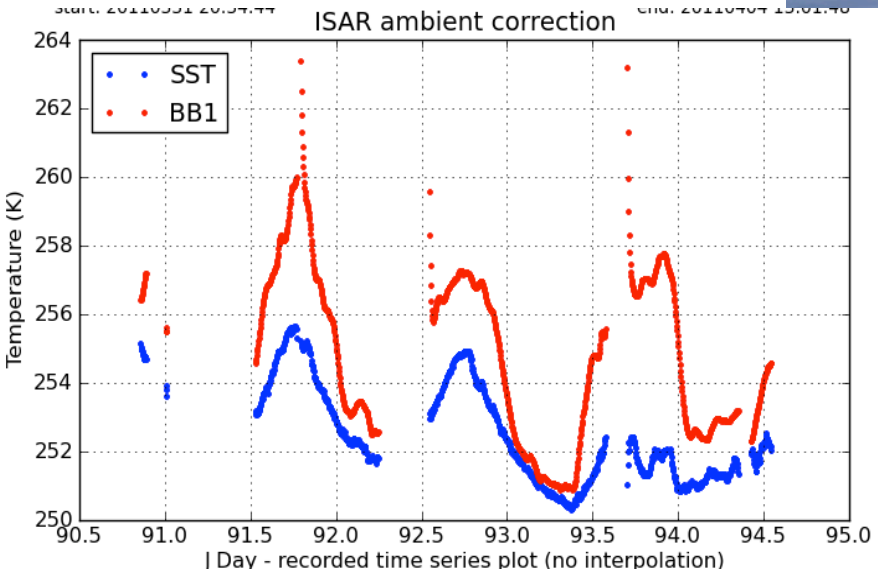




Ice inter-comparisons

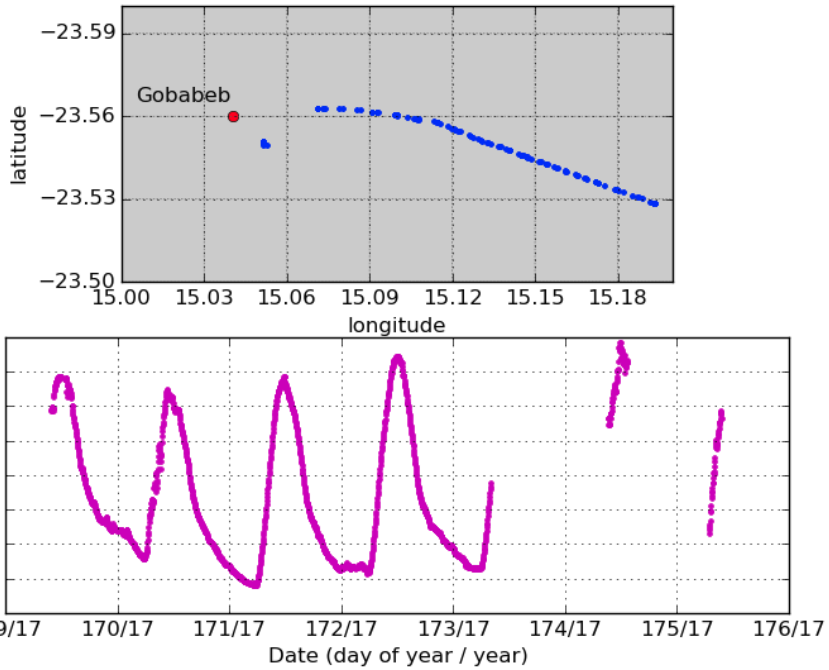
- FRM4STS – ICE
  - Not planned at the moment





Land inter-comparisons

- FRM4STS – Land
  - Not planned at the moment



Ship inter-comparisons

- Lake
  - Not planned at the moment