Sentinel-3 SLSTR SST Validation using a Fiducial Reference Measurements (FRM) Service

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[1]University of Southampton , [2]RAL Space, [3]DMI, [4]Space ConneXions, [5]Ifremer, [6]ESA

Fiducial Reference Measurements

- Essential to have traceable and stable measurements for validation
  - Routinely calibrated (before and after every deployment)
  - Traceable to SI
  - Verified trough inter-comparisons
  - A per pixel uncertainty
  - Bridging the AATSR - SLSTR gap

Point of contact

- Web-page

http://www.shipborne-radiometer.org

http://www.ships4sst.org

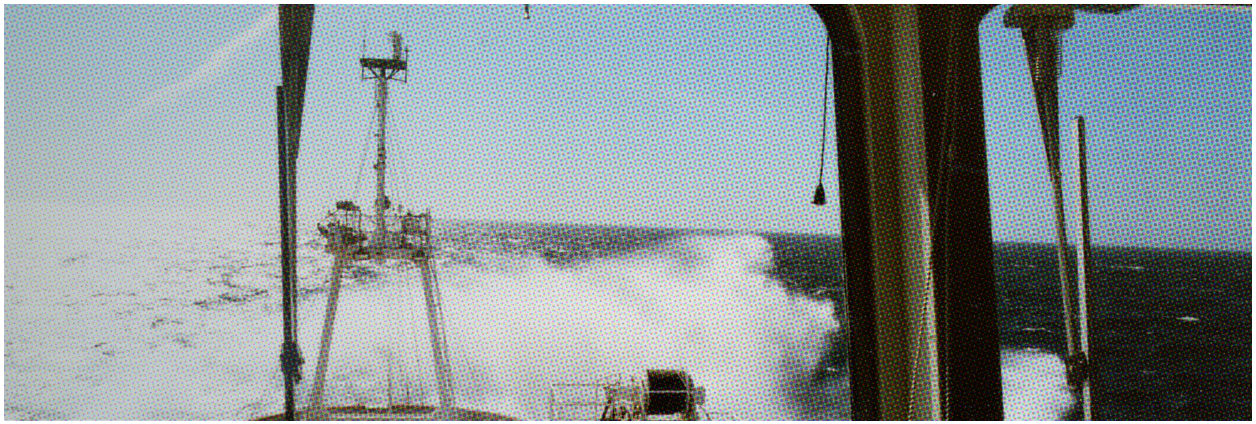
- Centralized Archive
  - Ifremer
  - Upload eftp.ifremer.fr
    - User/pass: i0318c6 / 5Lh3a4Ku23jFMh
  - Download ftp.ifremer.fr
    - User/pass: ext-isfrn / B33M9qqFWr8y8n
- Protocols, data format …

Tools

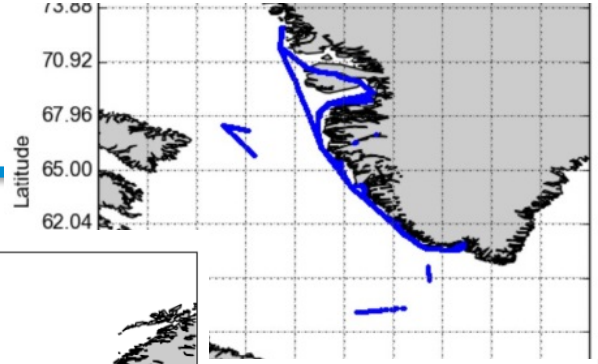
- L2R translator
  - ftp://ftp.noc.soton.ac.uk/pub/isfrn_ftp/software/ascii_to_l2r/v1.0/
  - User handbook on how to use it
  - Example for processing
  - Based on csv format as input
  - Configuration file for meta data and input data format

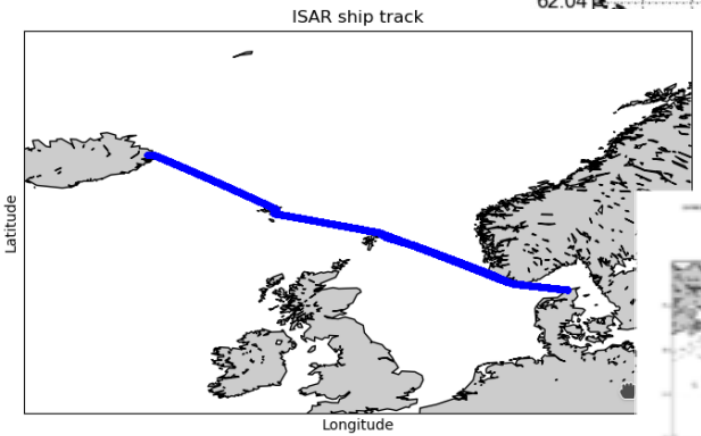
In-situ Radiometers

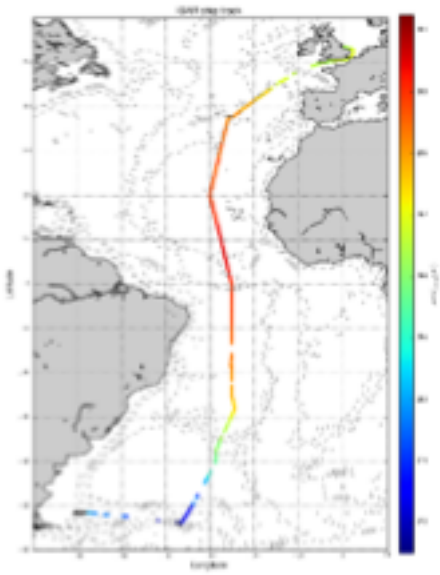
- Small group of operators and instruments:
  - ISAR - University of Southampton, University of Miami, Ocean University China, Jaxa, Royal Navy, DMI, CSIRO, WHOI
  - SISTeR – RAL
  - M-AERI (mk1, mk2, mk3) – University of Miami
  - Others ..

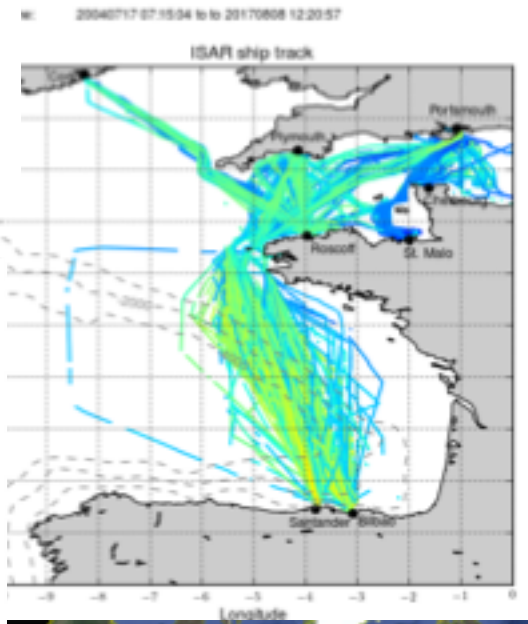


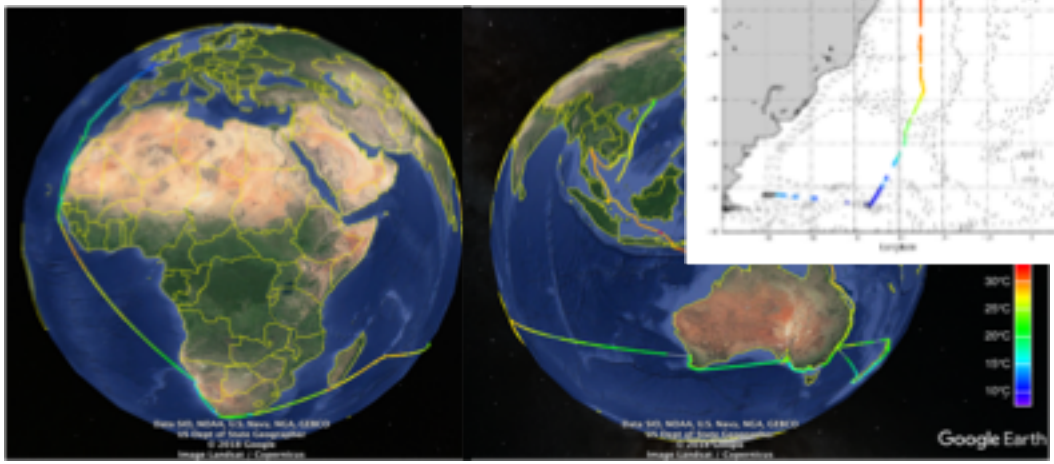
Typical data



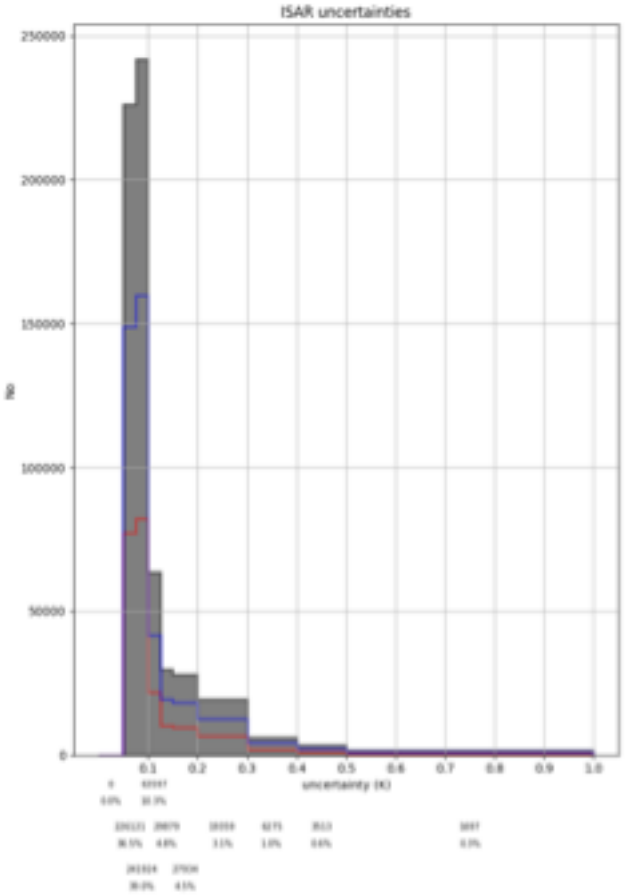


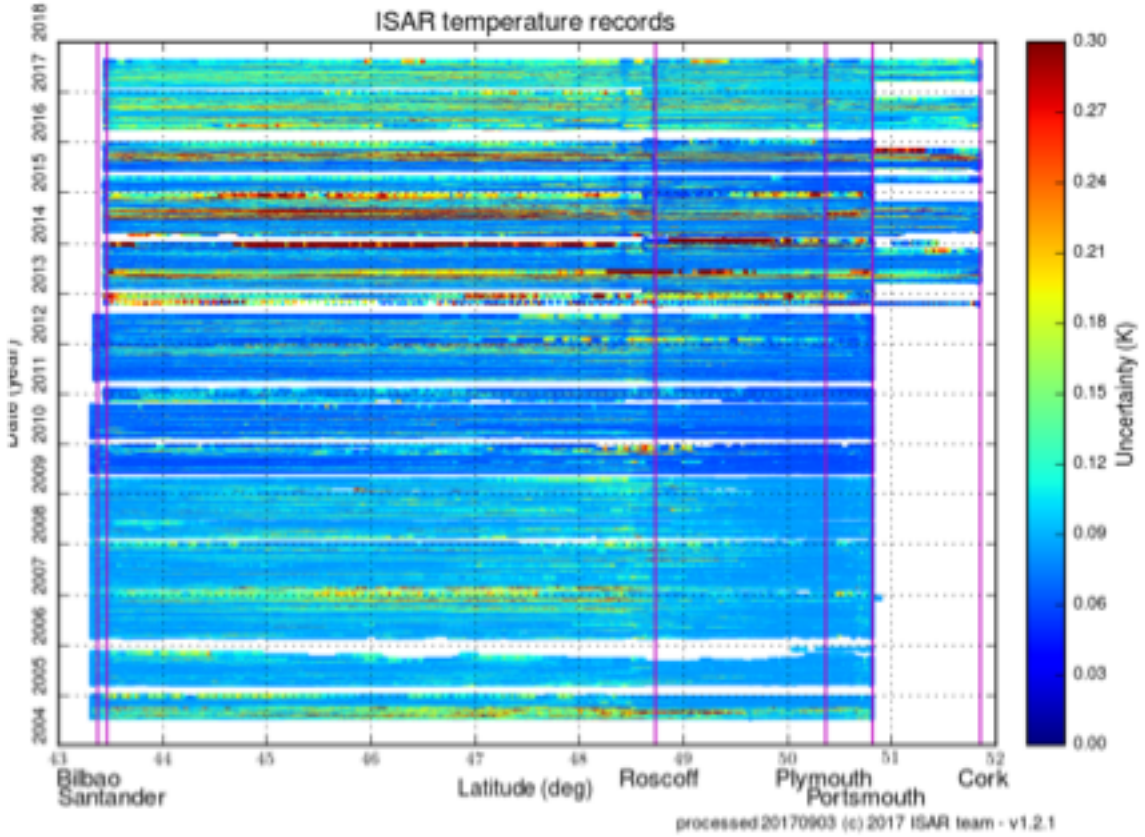




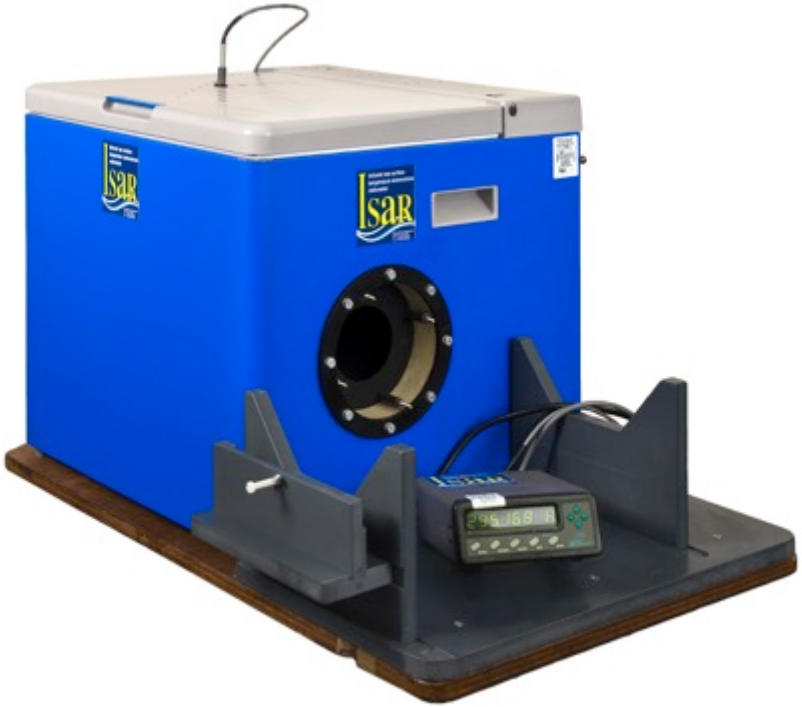


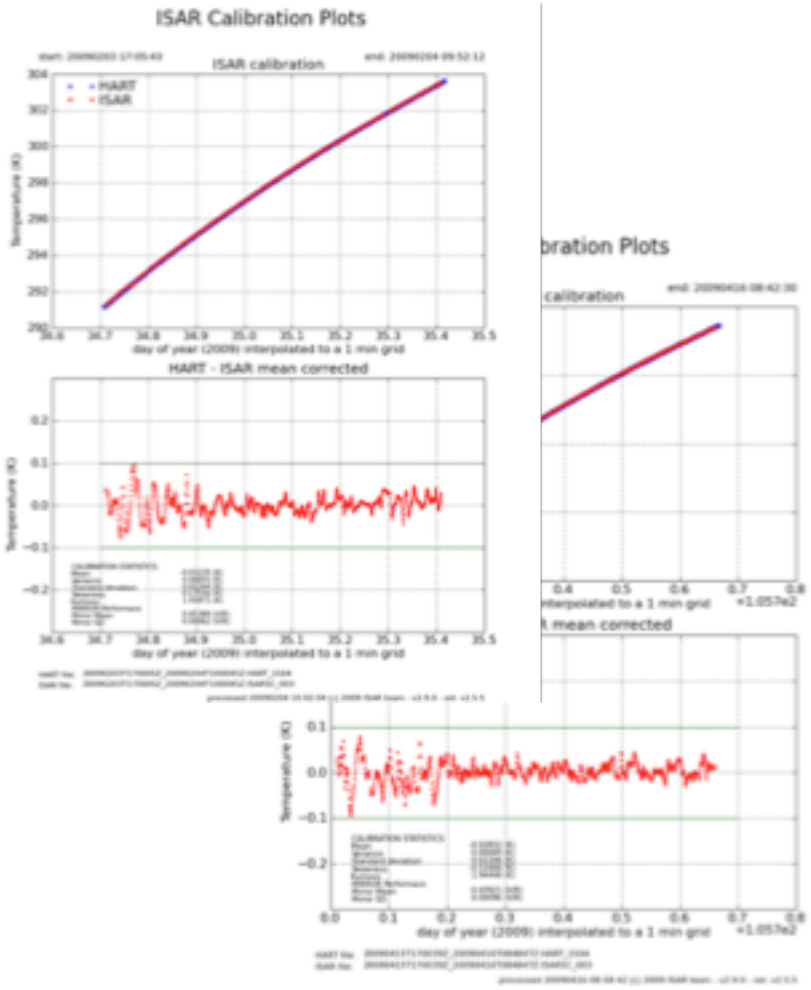
Typical data





Validation of the ISAR instrument





Before and after each deployment
Traceable to NIST and NPL

Craig J. Donlon, W. Wimmer, I. Robinson, G. Fisher, M. Ferlet, T. Nightingale, and B. Bras, 2014: ***A second-generation blackbody system for the calibration and verification of seagoing infrared radiometers****. J. Atmos. Oceanic Technol., 31, 1104–1127.*

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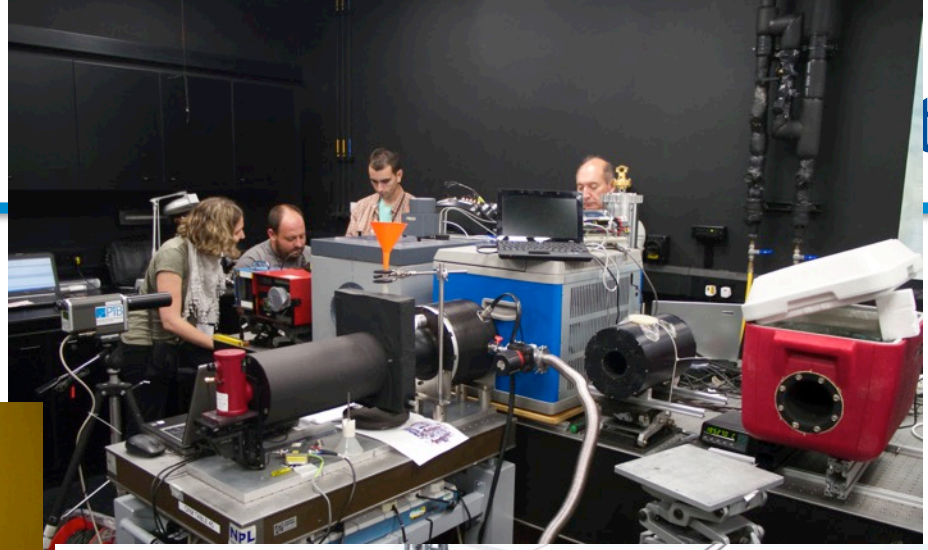
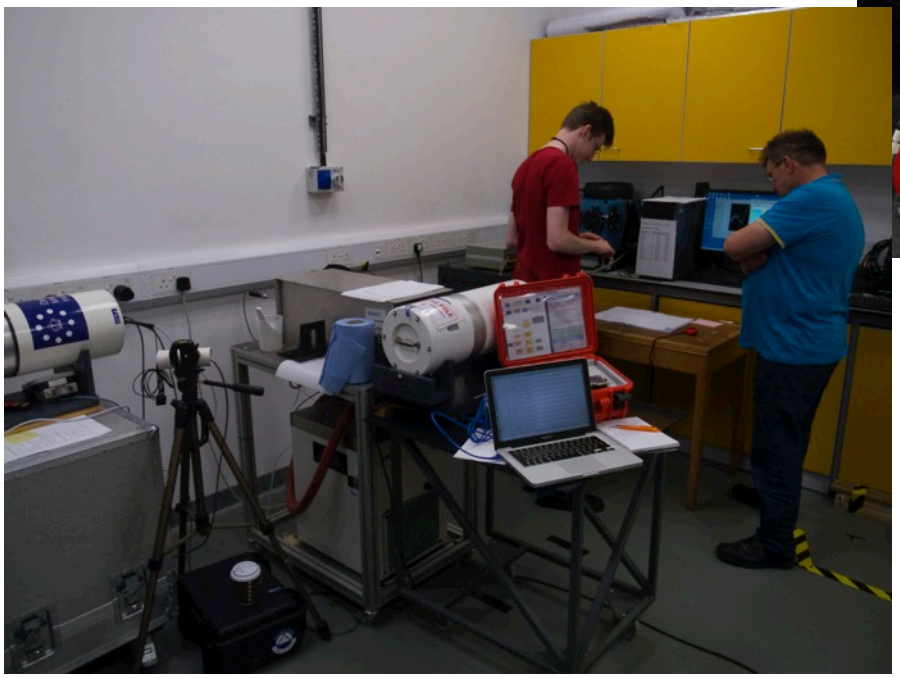
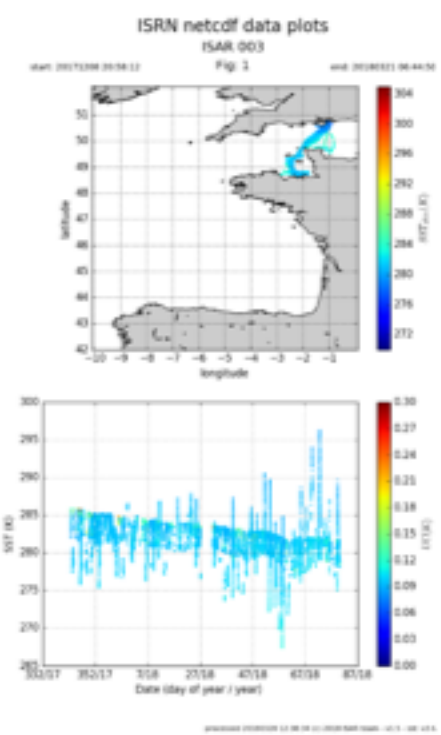
- *FRM4STS NPL*

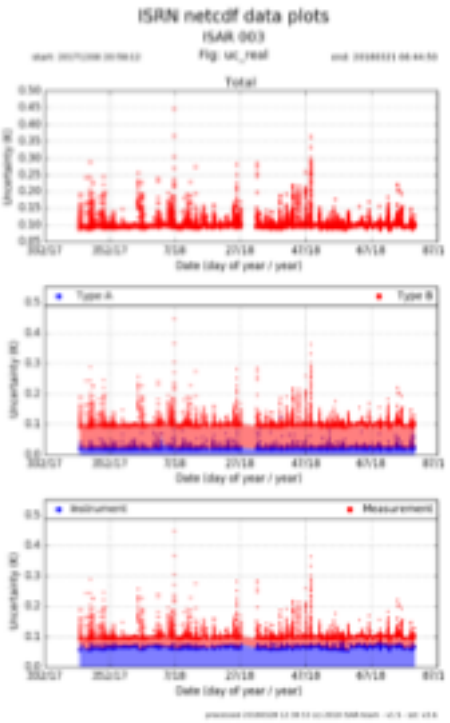


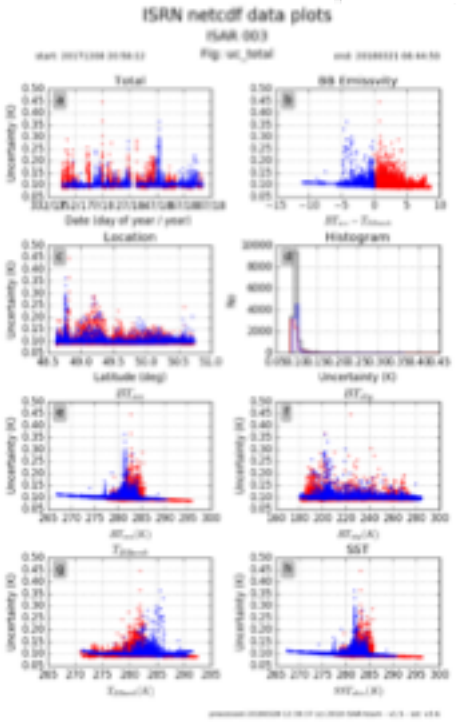


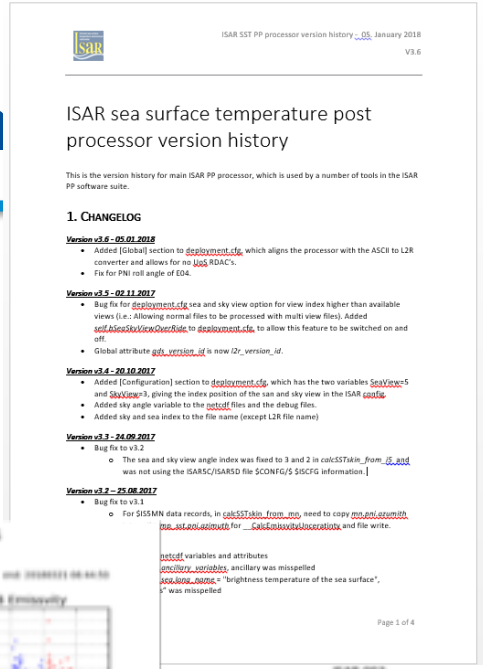
Data QA a g

- ISAR post processing
  - QA realises RAW data
  - Deployment validation data
  - Processing of uncertainties and data to L2R v1.1








ISAR SST PP processor version history _ 05. January 2018

V3.6

ISAR sea surface temperature post processor version history

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 v3.6 - 05.01.2018

- Added [Global] section to deployment.cfg, which aligns the processor with the ASCII to L2R converter and allows for no L1oS RDAC's.
- Fix for PNI roll angle of E04.

Version v3.5 - 02.11.2017

- Bug fix for deployment.cfg sea and sky view option for view index higher than available views (i.e.: Allowing normal files to be processed with multi view files). Added *self.bSeaSkyViewOverRide* to deployment.cfg, to allow this feature to be switched on and off.
- Global attribute *gds_version_id* is now *l2r_version_id*.

Version v3.4 - 20.10.2017

- Added [Configuration] section to deployment.cfg, which has the two variables SeaView=5 and SkyView=3, giving the index position of the san and sky view in the ISAR config.
- Added sky angle variable to the netcdf files and the debug files.
- Added sky and sea index to the file name (except L2R file name)

Version v3.3 - 24.09.2017

- Bug fix to v3.2
  - The sea and sky view angle index was fixed to 3 and 2 in *calcSSTskin_from_IS* and was not using the ISAR5C/ISAR5D file $CONFG/$ $ISCFG information.

Version v3.2 – 25.08.2017

- Bug fix to v3.1
  - For $ISMN data records, in calcSSTskin_from_mn, need to copy *mn.eni.azumith* *mn_ist.eni.azimuth* for *CalcEmissivityUncertainty* and file write.

netcdf variables and attributes
ancillary_variables, ancillary was misspelled
sea_long_name = "brightness temperature of the sea surface",
s" was misspelled

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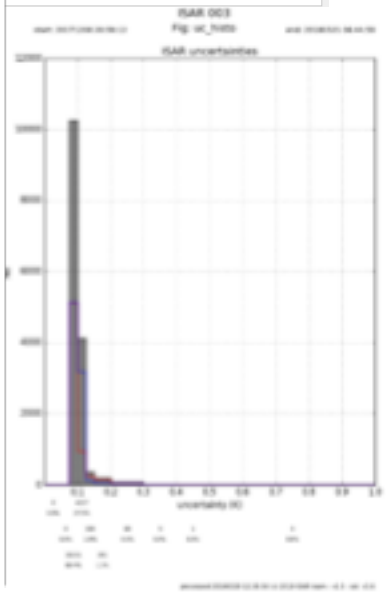
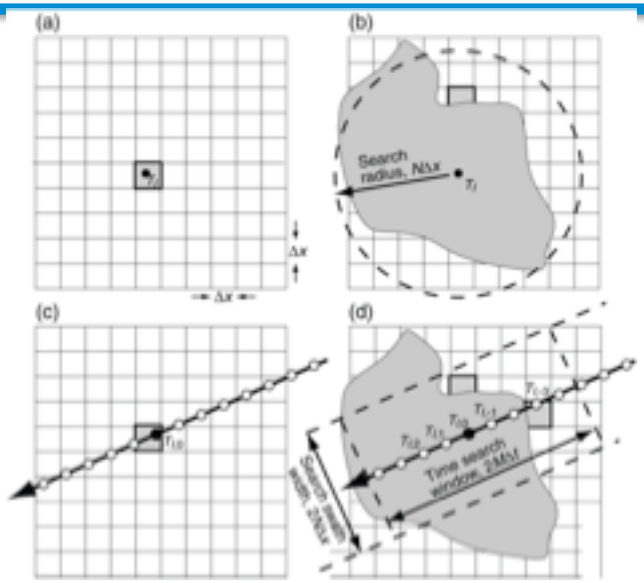


Matching the data

- $E = T - V$
- $E = V_S - V_I$



- *The MDB files are produced by Felyx*
  - *SLSTR L1b and L2 data within 400x400 pixels of matchup*
  - *L2R data within 6hrs of matchup*
- *MDB files analysed ISFRN*
  - *Follow the Wimmer et.al 2012 approach*

Wimmer, W., Robinson, I. S., & Donlon, C. J. (2012). Long-term validation of AATSR SST data products using shipborne radiometry in the Bay of Biscay and English Channel. Remote Sensing of Environment, 116, 17-31. DOI: 10.1016/j.rse.2011.03.022

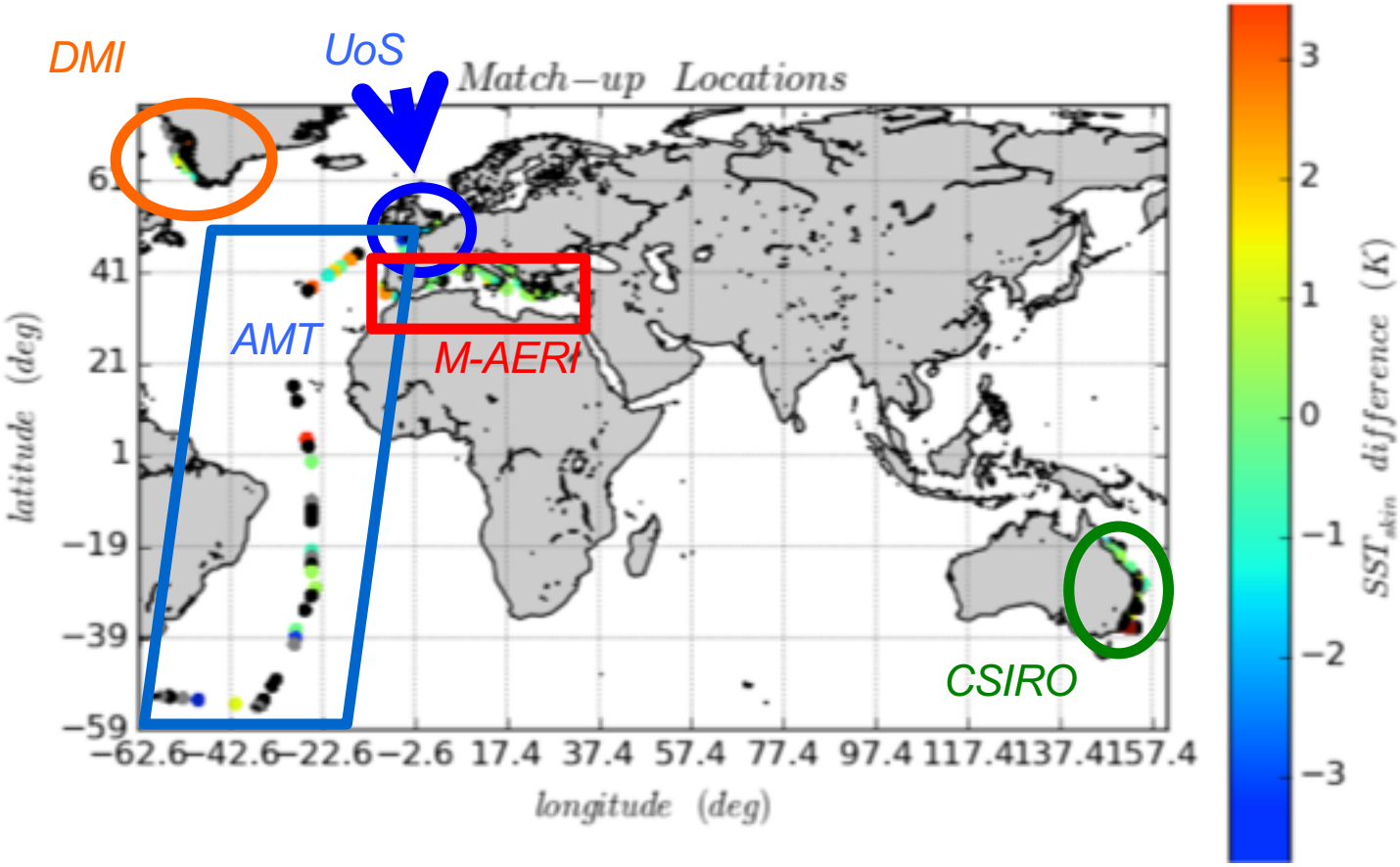
Grade	Time	Spatial
1	±0.5 h	±1km
2a	±0.5 h	±20km
2b	±2 h	±1km
3	±2 h	±20km
4	±6 h	±25km

Validating SLSTR

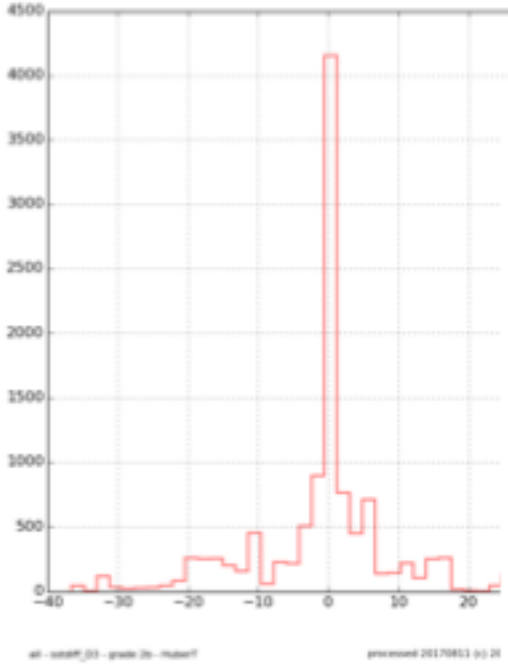
- *Reprocessed SLSTR data in Felyx (v4.1)*
  - *July to December 2016*
  - *Grade 2b, Robust, DN filtered, all (ISAR UoS, DMI, CISRO, JCR, M-AERI)*

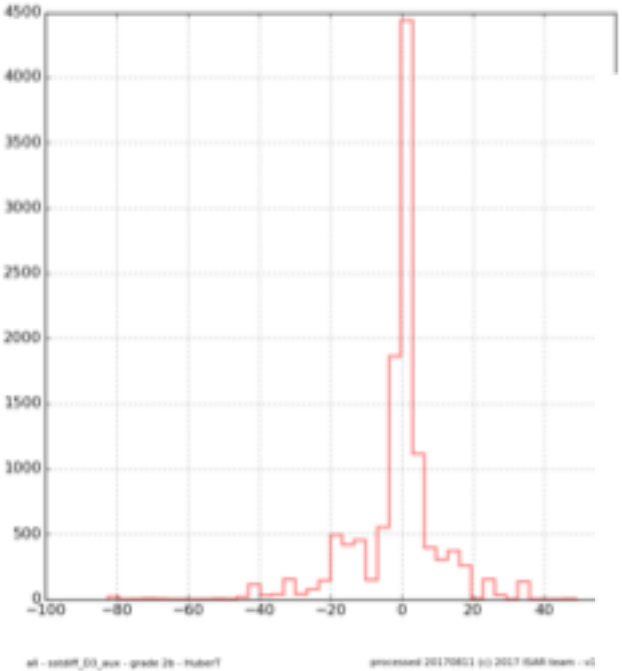
SST ID	median	RSD	match no	overpass no
D3	-0.27	3.93	12177	343
D2	-0.01	1.92	12743	343
N3	-0.01	2.94	24240	343
N2	-1.13	2.31	25090	343
AUX data				
D3_aux	-0.1	4.33	12690	343
D2_aux	-0.07	2.23	13459	343
N3_aux	-0.03	2.97	23916	343
N2_aux	-1.24	2.35	24800	343
WST data				
WST_SST	-0.29	1.42	13060	343

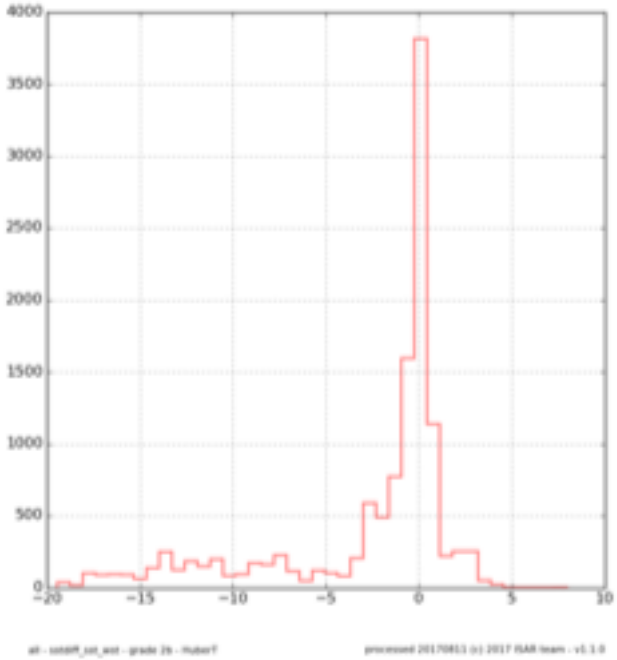
Matchup locations



Histograms







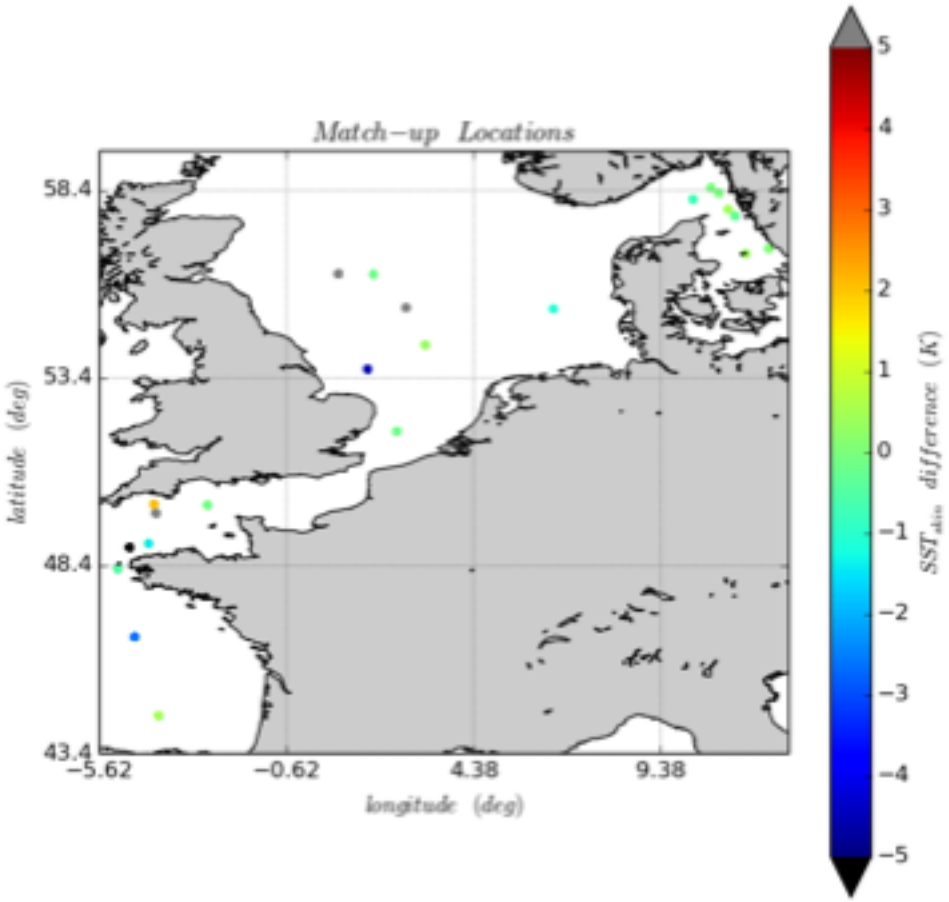
D3, D3 aux, WST

European results

- *Reprocessed SLSTR data in Felyx (v5.0)*
  - *July to September 2017*
  - *Grade 2b, Robust, DN filtered, all (ISAR UoS, DMI)*

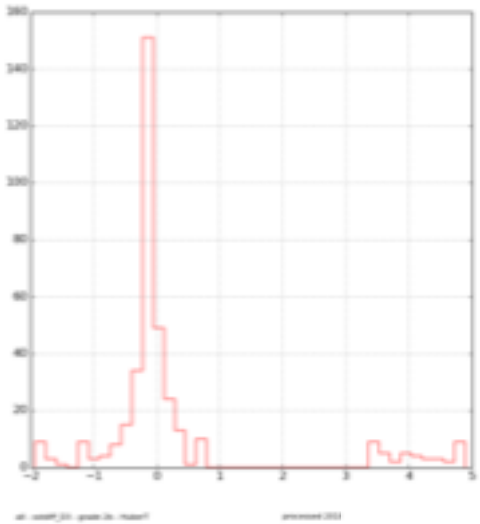
SST ID	median	RSD	match no	overpass no
D3	-0.08	0.23	376	20
D2	-0.02	0.38	376	20
N3	-0.03	0.4	1062	20
N2	-0.33	0.52	1121	20
WST data				
WST_SST	-0.38	0.4	963	20

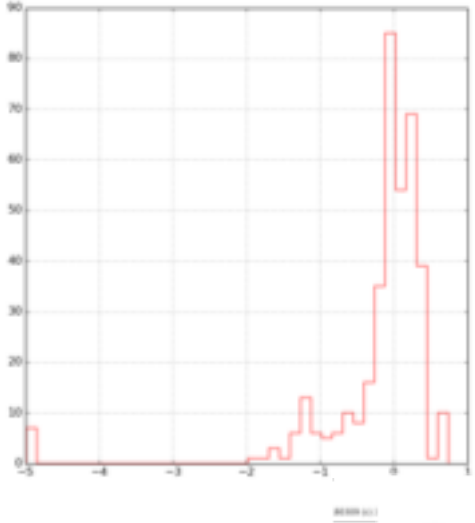
Matchup locations

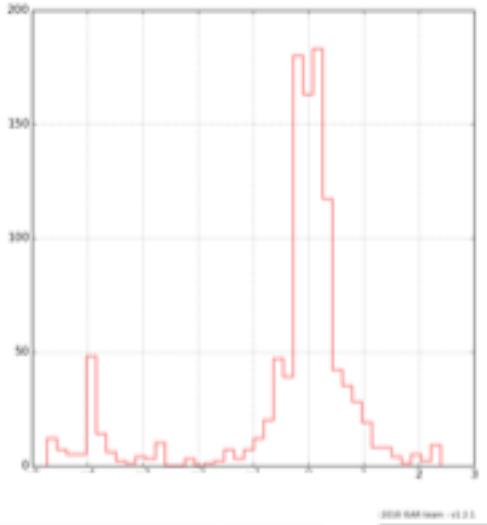


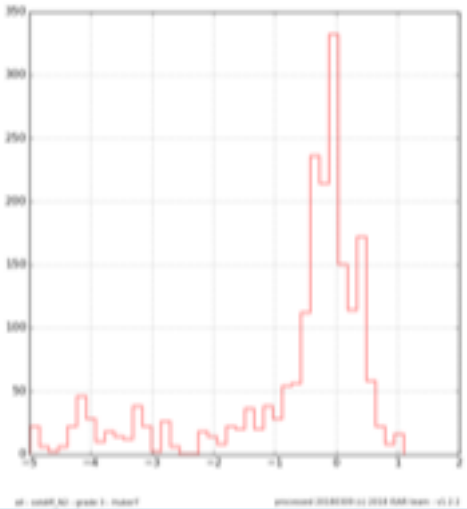
Grade 2b, robust, dn filtered, N3

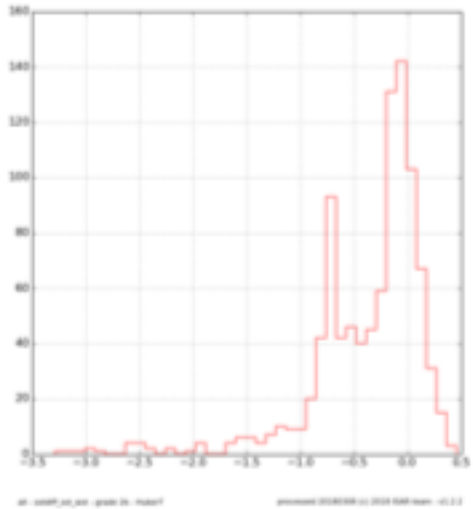
Histograms





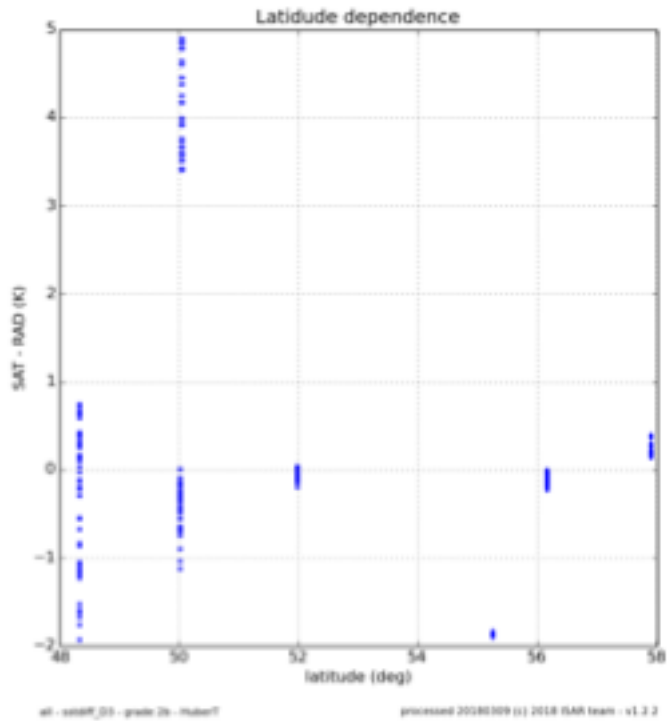


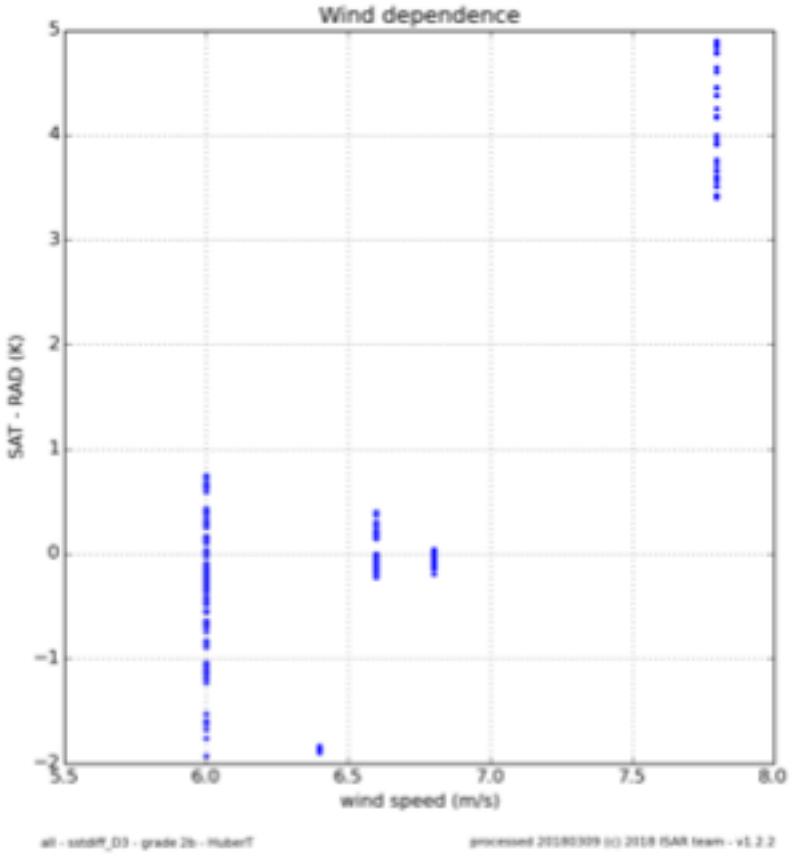




D3, D2, N3,
N2, WST – grade 2b

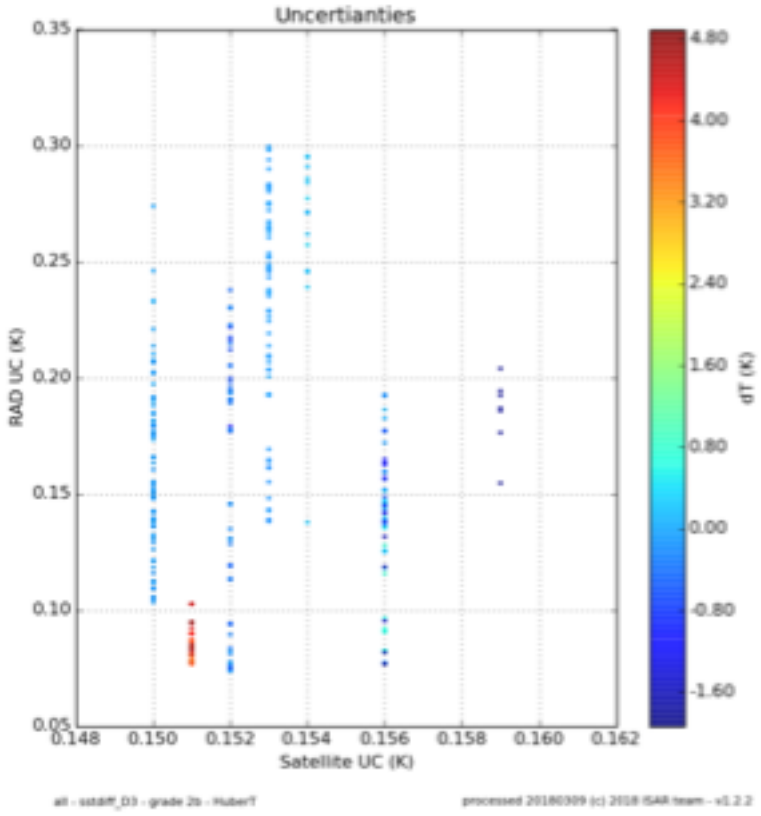
Latitude and wind speed dependance

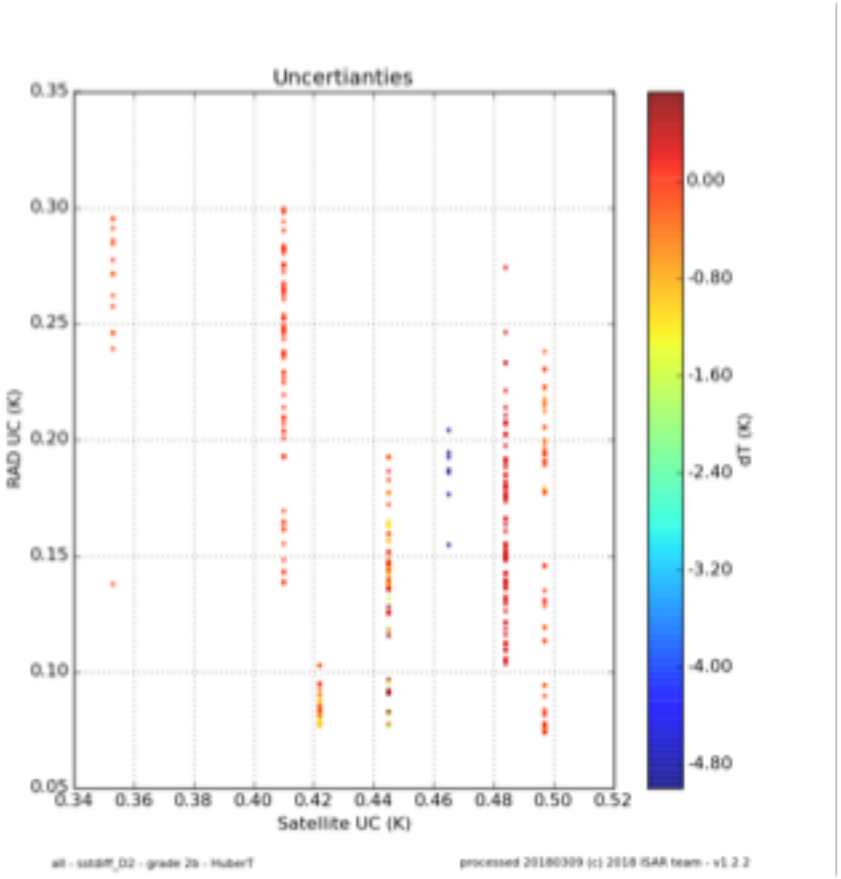




Grade 2b, robust, dn filtered, D3

Latitude and wind speed dependence





D3, D2 – grade 2b

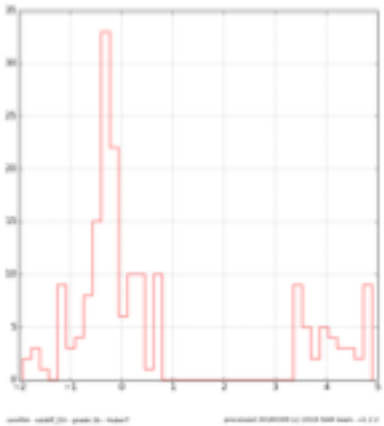
Regional data

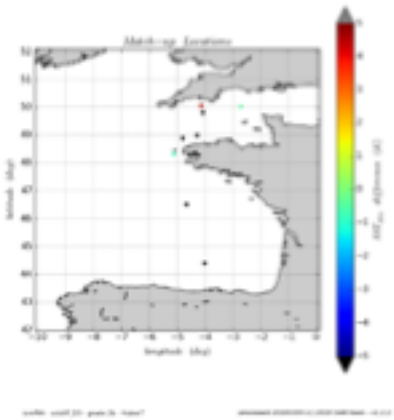
UoS, grade 2b, DN filtered, robust

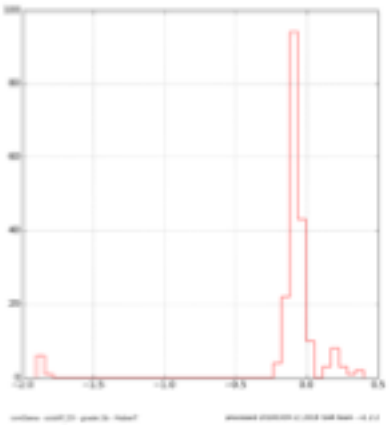
SST ID	median	RSD	match no	opass no
D3	-0.15	0.71	179	8
D2	-0.28	0.43	179	8
N3	0.11	0.49	328	8
N2	-0.55	0.71	387	8
WST data				
WST_SST	-0.88	0.91	318	8

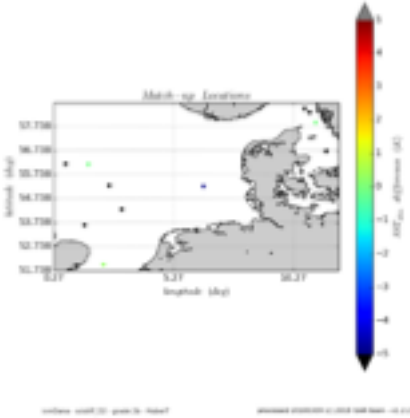
DMI, grade 2b, DN filtered, robust

SST ID	median	RSD	match no	opass no
D3	-0.07	0.12	197	9
D2	0.13	0.36	197	9
N3	-0.04	0.36	504	9
N2	-0.15	0.48	504	9
WST data				
WST_SST	-0.22	0.27	415	9







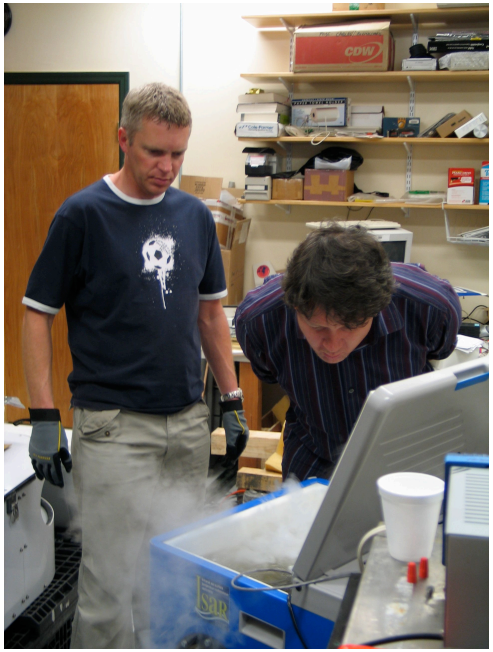


Review Meeting

- Project Review meeting
  - 27/28 February 2019
  - NOCS Southampton
  - Attendee list (w.wimmer@soton.ac.uk)

Informal Meeting

- Thursday lunchtime this week
- Mainly Radiometer operators
- Anybody who is interested is welcome



Conclusions

- In situ Radiometer are essential for a SI traceable validation with per pixel uncertainty
  - Global coverage but limited areas.
- SLSTR validation shows promising results
  - However the data shows some cloud contamination issues
    - Has been rectified with the most recent version