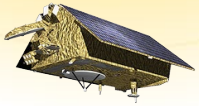
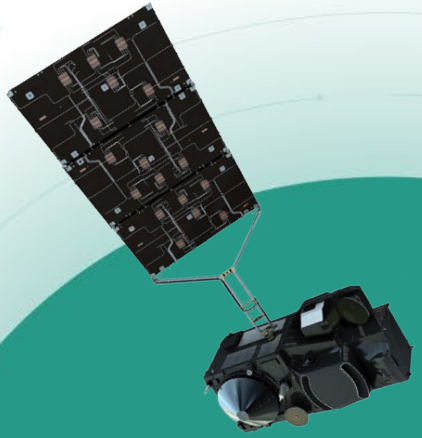
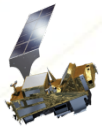


Validation of Copernicus SLSTR SSTs with HRSST drifters

Gary Corlett, Anne O'Carroll, Igor Tomazic

35th DBCP Session: S&T Workshop



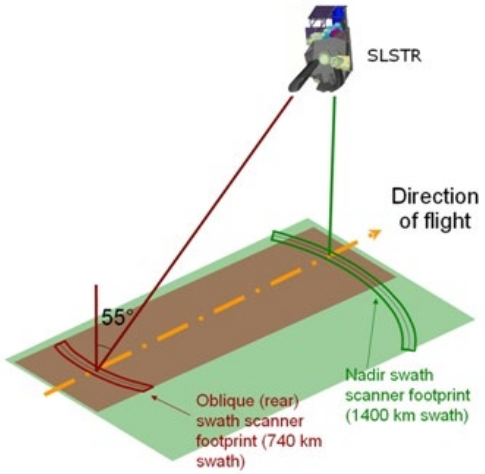


Conclusions

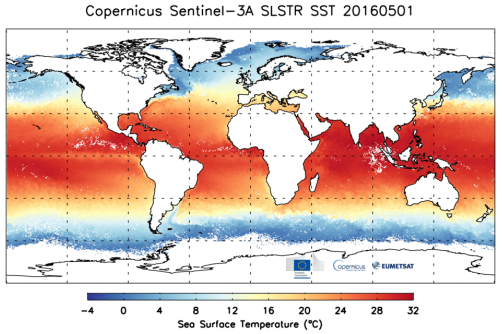
- HRSST drifters (TRUSTED and non-TRUSTED) evaluated using SLSTR for February 2019 to September 2019
- Preliminary results show
  - TRUSTED drifters compare very well with heritage platforms (analogue sensor)
  - No notable difference between analogue and digital sensor results (TRUSTED)
- **In general, the quality of the drifting buoy network is much improved in 2019 compared to previous**
- Future work
  - Include more TRUSTED matchups
  - Include depth (pressure) provided with TRUSTED measurements
  - Look in more detail at other drifter manufacturers

Copernicus Sentinel 3: SLSTR

- The first Sea and Land Surface Temperature Radiometer (SLSTR) was launched on Sentinel 3A on 16th February 2016.
- S3B launched on 26 April 2018
- Dual-view self-calibrating radiometer following the ATSR class of sensors



Nominal Channel Centre	Primary Application
S7: 3.7 μm	SST Retrieval
S8: 11 μm	SST/LST Retrieval
S9: 12 μm	SST/LST Retrieval



- SST Retrievals by radiative transfer modelling of the form:

$$a_0 + \sum_{1}^{n} a_n BT_n$$

where n is the number of channels

- For SLSTR we use 2 channels during day and 3 during night
  - 3.7 μm not used during day owing to solar contamination
- We have two views, so we have four SST retrievals in total

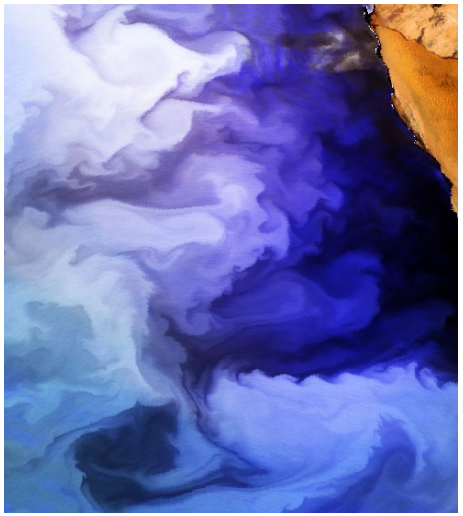
Four Possible Retrievals:

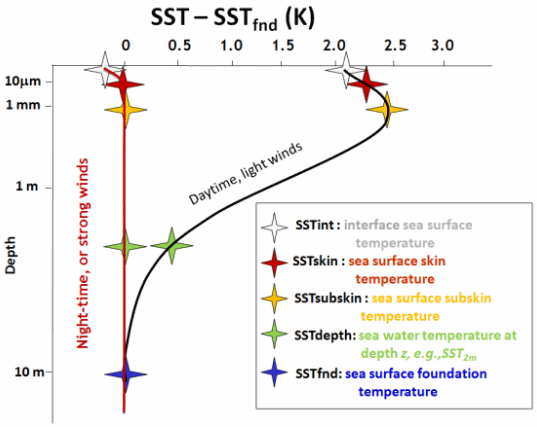
Nadir 2-channel N2
Nadir 3-channel N3
Dual 2-channel D2
Dual 3-channel D3

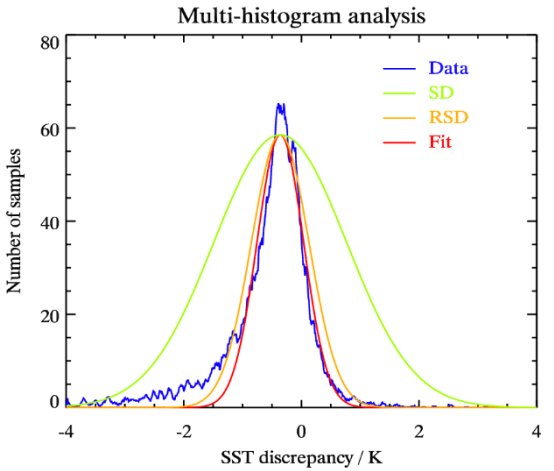
Methodology… the validation uncertainty budget

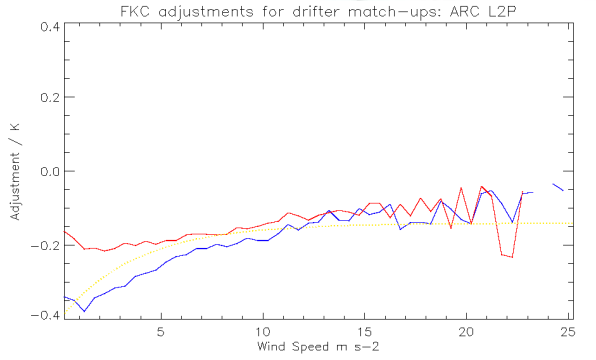
$$\sigma_{Total} = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \sigma_4^2 + \sigma_5^2}$$

- Satellite (σ_1)
  - Varies pixel by pixel
- Reference (σ_2)
  - Generally unknown; Estimate of *O*(0.1 K) for GTMBA moorings and radiometers; *O*(0.2 K) for drifters; negligible for Argo
- Geophysical: spatial – surface (σ_3)
  - Systematic for single match-up; pseudo-random for large dataset
  - Can be reduced through pixel averaging (e.g. sample 11 by 11 instead of 1 by 1)
  - Includes uncertainty in geolocation (may be systematic even for large numbers)
- Geophysical: spatial – depth (σ_4)
  - Systematic for single match-up for different depths; pseudo-random for large dataset at different depths (with diurnal & skin model)
- Geophysical: temporal (σ_5)
  - Systematic for single match-up; may be reduced for large dataset (if match-up window small enough)
  - Can be reduced with diurnal & skin model









Fairall et al.1996; Kantha and Clayson 1994

Results

- Match-up results are shown on the subsequent slides
- Results are shown for TRUSTED and non-TRUSTED drifters (in similar spatial and temporal location)
- Four types of results
  - Dependence of differences
    - Day time results in red, night time in blue (2-channel) and green (3-channel); single view in dashed line dual-view in solid line
  - Spatial variability of differences
    - N2 (daytime), N3 (nighttime), D2 (daytime), D3 (nighttime)
  - Histograms of differences
    - N2 (daytime), N3 (nighttime), D2 (daytime), D3 (nighttime)
  - Uncertainty validation

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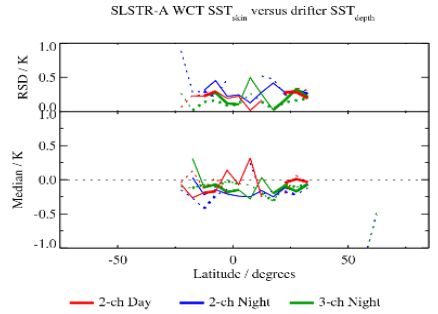
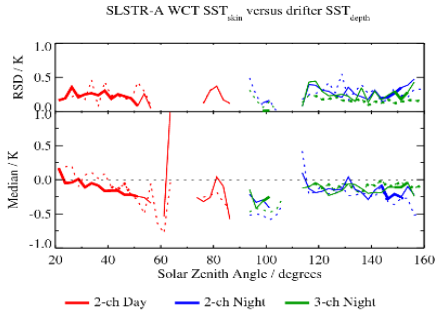
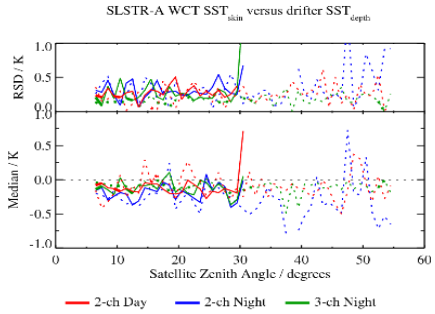
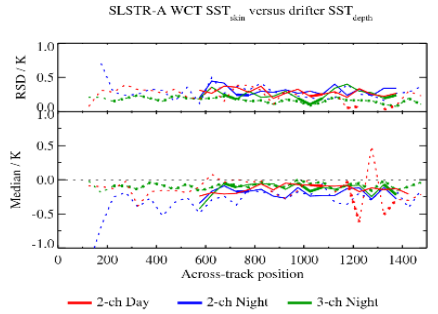
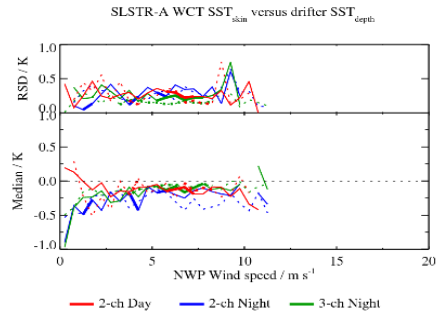
○QL = all ○QL = 2 ○QL = 3 ○QL = 4 ◉QL = 5
☐Apply SSES

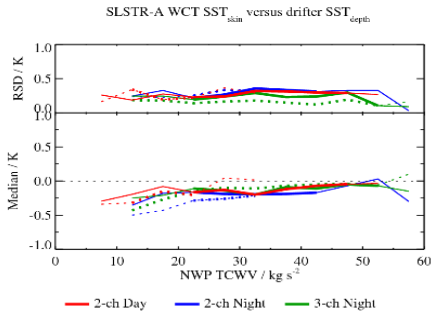


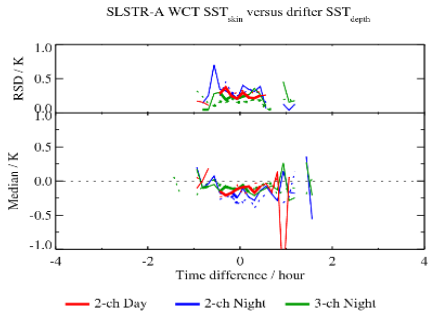


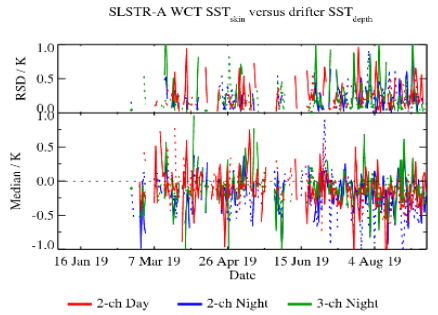












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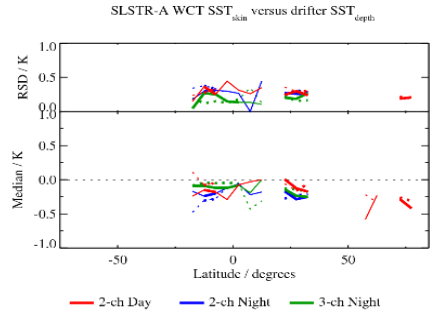

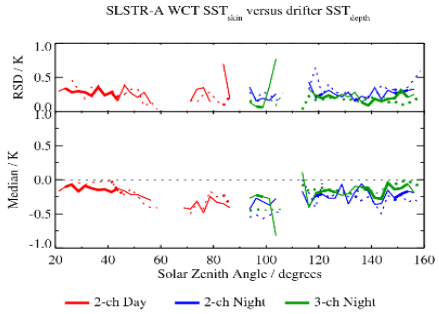

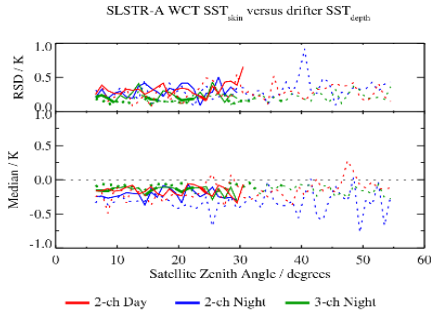

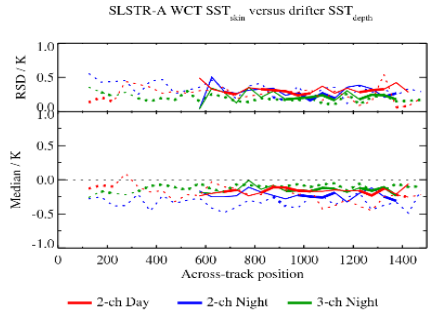

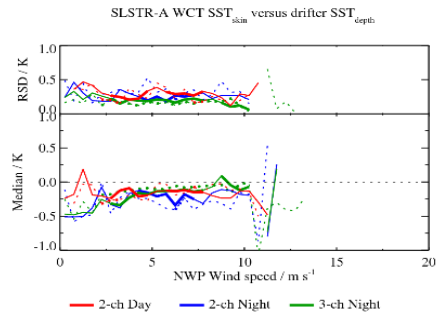

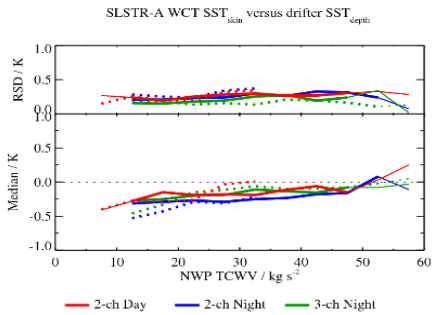

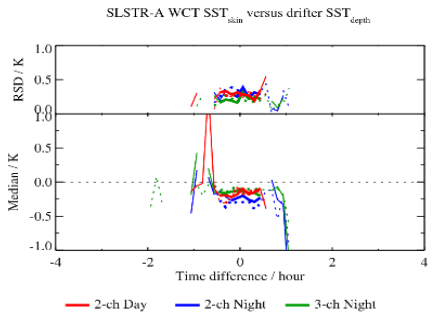

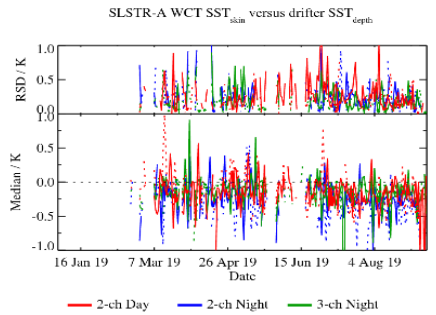

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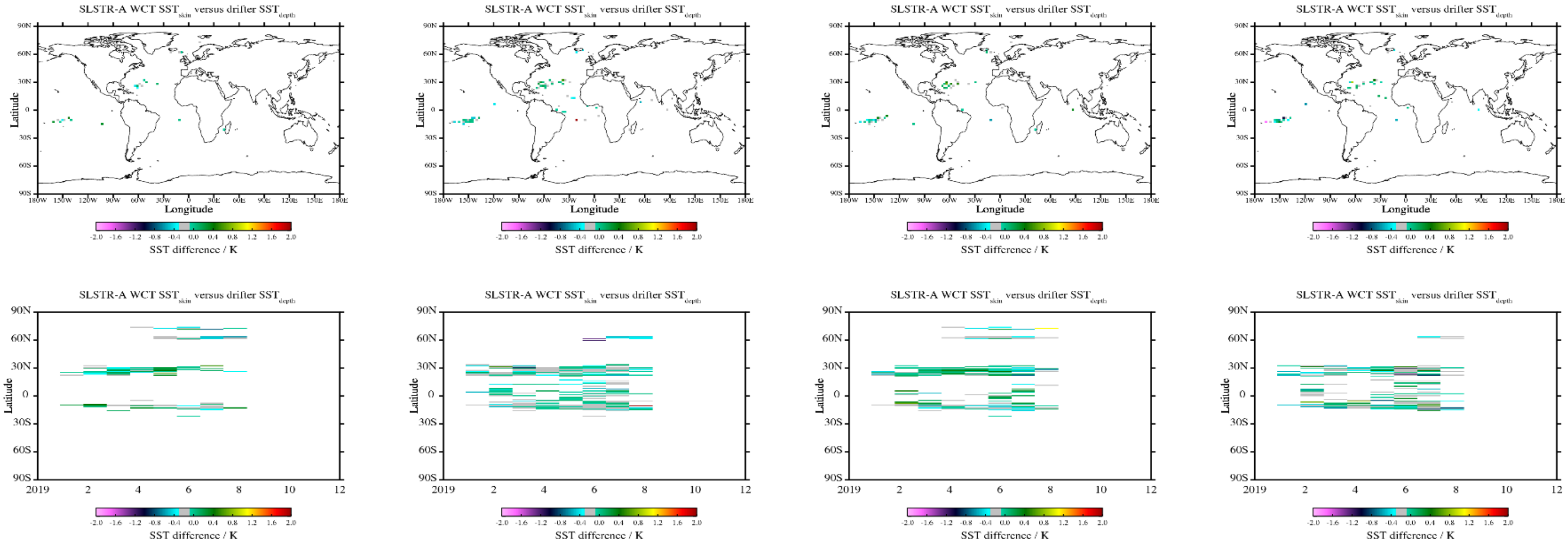

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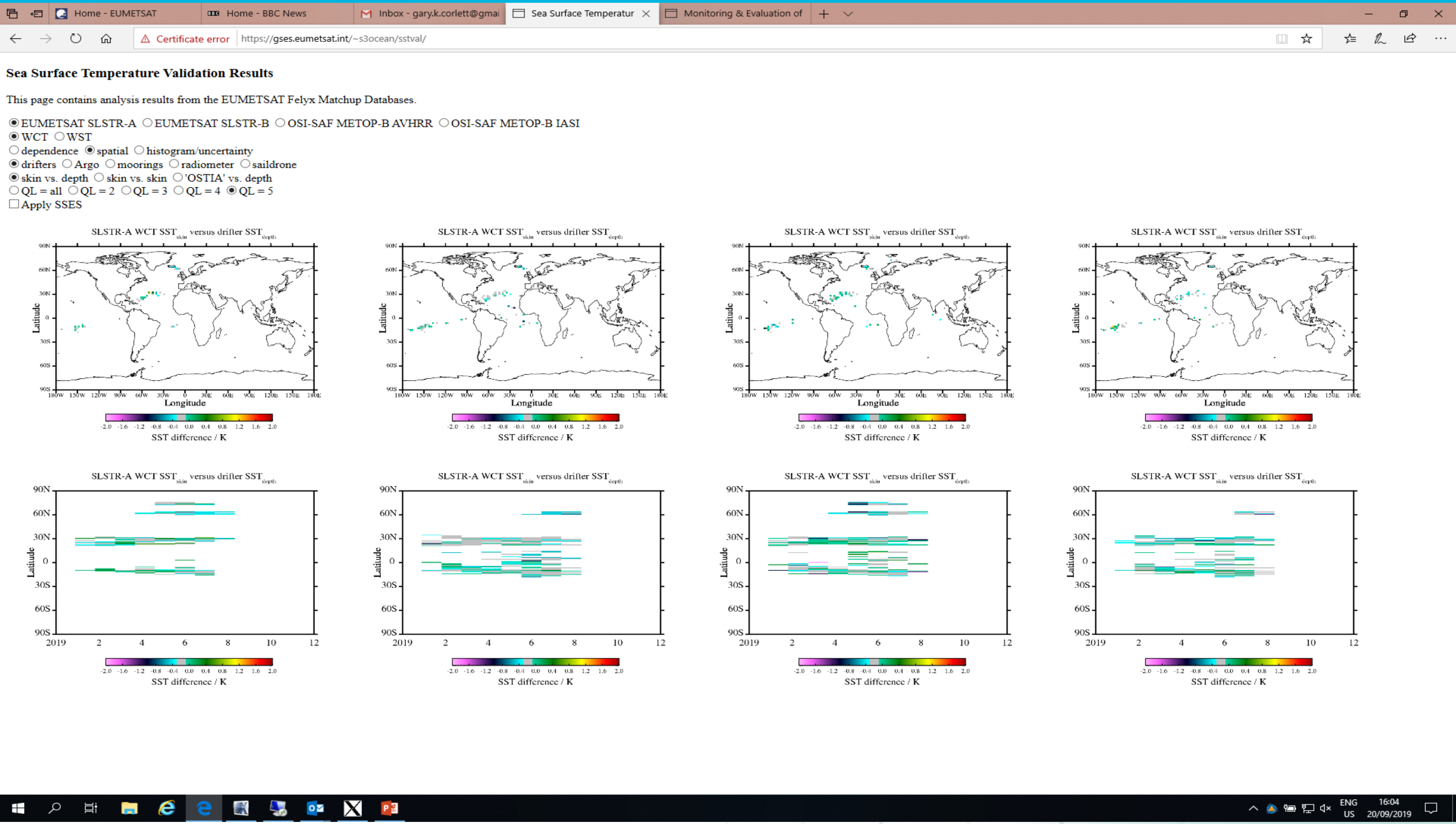
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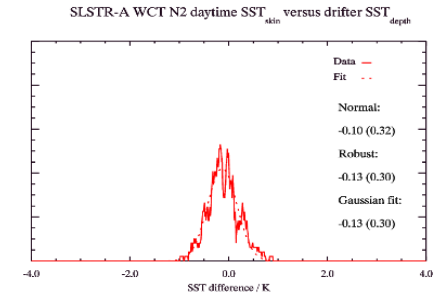

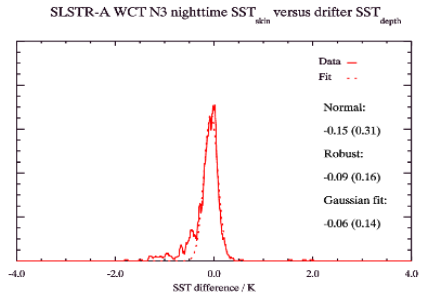

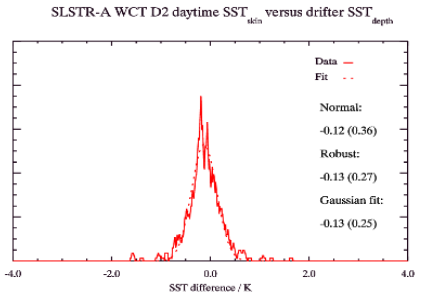

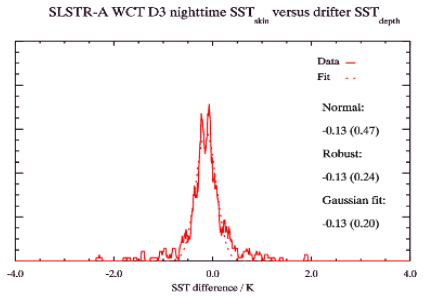

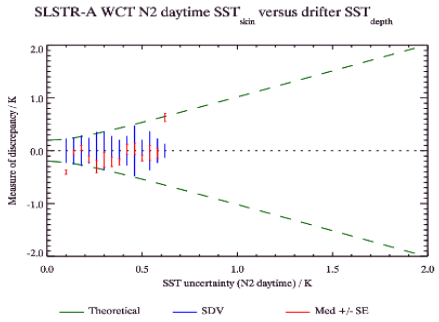

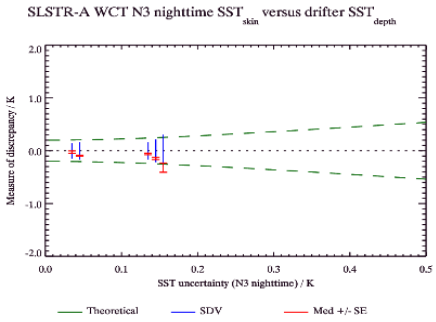

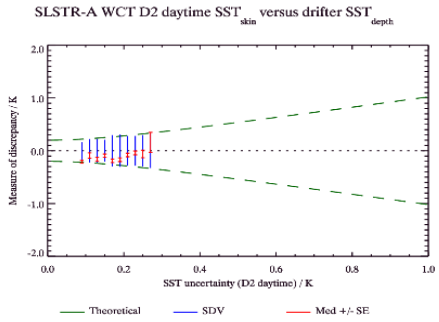

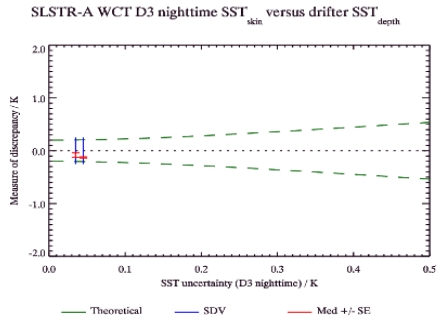

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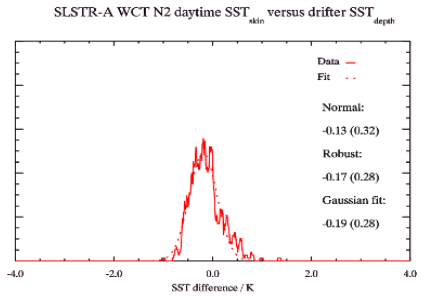

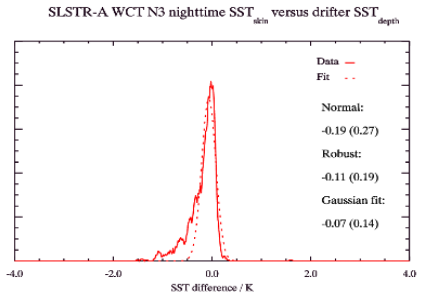

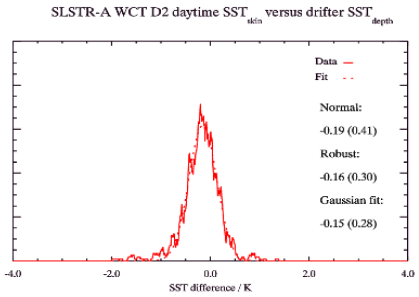

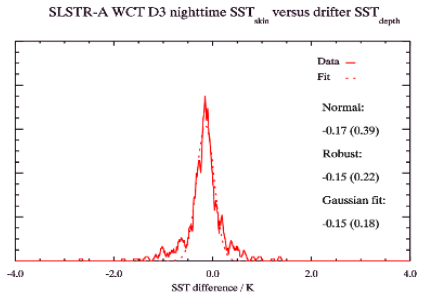

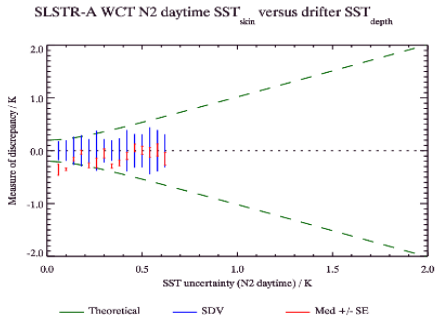

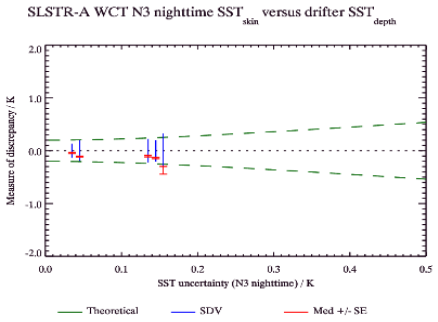

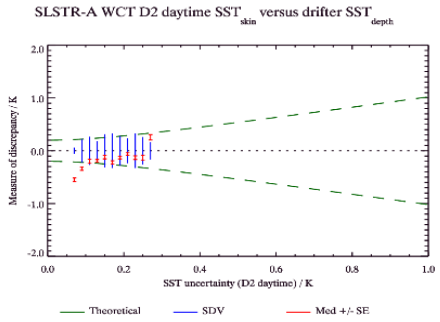

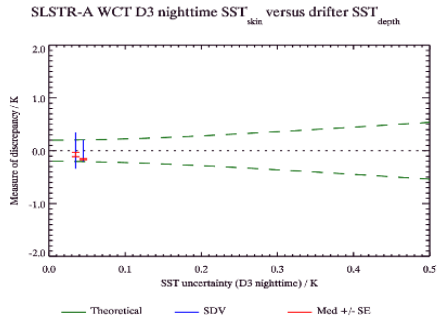

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Conclusions

- HRSST drifters (TRUSTED and non-TRUSTED) evaluated using SLSTR for February 2019 to September 2019
- Preliminary results show
  - TRUSTED drifters compare very well with heritage platforms (analogue sensor)
  - No notable difference between analogue and digital sensor results (TRUSTED)
- **In general, the quality of the drifting buoy network is much improved in 2019 compared to previous**
- Future work
  - Include more TRUSTED matchups
  - Include depth (pressure) provided with TRUSTED measurements
  - Look in more detail at other drifter manufacturers