



VALIDATION OF SATELLITE DERIVED SST IN THE EASTERN MEDITERRANEAN (2011-2015) USING VARIOUS OBSERVING PLATFORMS



Importance of SST

- **Effect on**

- Air – sea interaction
 - Heat fluxes, e.g. climate (long-term) and hurricanes (short-term)
 - Gas fluxes
- Seawater composition
 - Gas concentration
 - Dissolved material
- Primary productivity

- **Applications**

- Ocean studies
 - Currents and fronts
 - Upwelling and dense water formation regions
- Drive models
 - Restoring terms
 - Assimilation

Obvious in the:

- 23 SST satellite products available in EUMETSAT catalog
- 259 satellite products available in podaac catalog
- Group for High Resolution SST

Aim - Methodology

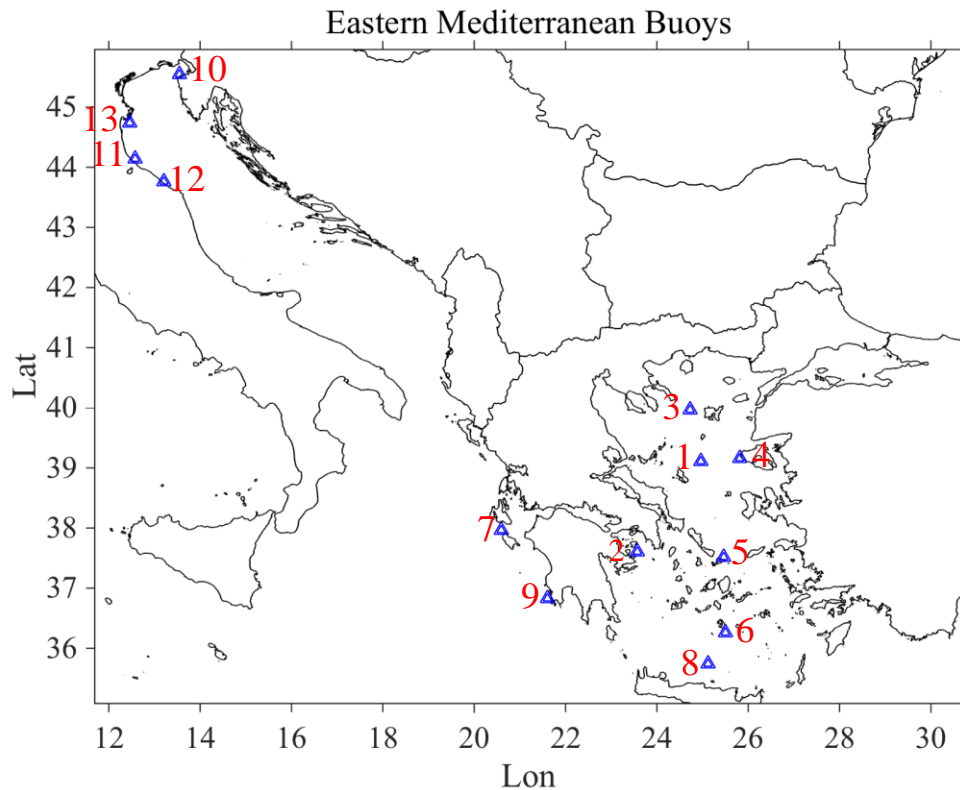
Aim

- Overall validation
- Perform a platform specific comparison
- Identify the relation of error with available parameters
- Check error consistency between platforms
- Identify comparative platform advantages – disadvantages
- Check agreement with bibliography

Methodology

- Create *in situ* database
 - Other parameters, e.g. wind
 - QC, exclude bad data
- Collocate
 - Define a match-up
 - Create match-up database
- Analysis
 - Statistics
 - Scatterplots, boxplots etc

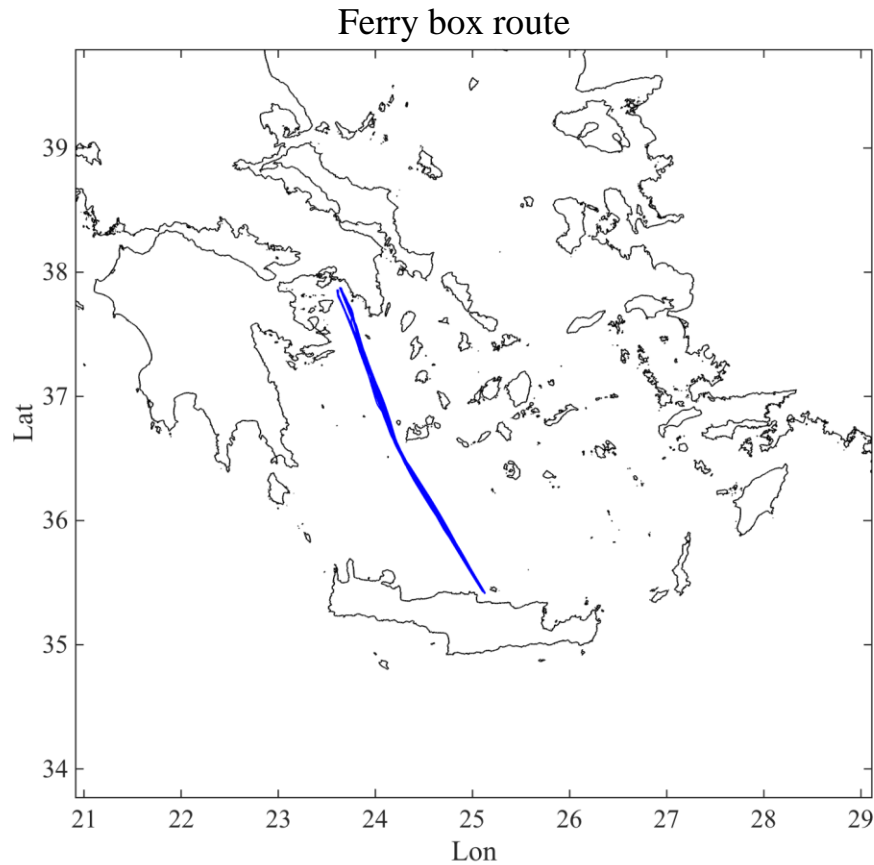
In situ datasets: Buoys



S/N	Sampling rate	Horizontal Coordinates (Nominal)	Water Temperature - Vertical Coordinates (Measured)	Water Temperature - Vertical Coordinates (Nominal)	Air Temperature - Vertical Coordinates (Nominal)	Wind Speed - Vertical Coordinates (Nominal)
1	3hr	24,96°E, 39,11°N	-	3m	0m	0m
2	3hr	23,57°E, 37,61°N*	-	3m	0m	0m
3	3hr	24,73°E, 39,97°N*	-	1m	0m	0m
4	3hr	25,82°E, 39,16°N	-	3m	0m	0m
5	3hr	25,46°E, 37,52°N	-	3m	0m	0m
6	3hr	25,50°E, 36,26°N	-	0dbar	0m	0m
7	3hr	20,60°E, 37,96°N	-	0dbar	0m	0m
8	3hr	25,12°E, 35,74°N*	-	1m	0m	0m
9	3hr	21,60°E, 36,83°N*	-	1m	0m	0m
10	0,5hr	13,55°E, 45,55°N	-	2,5m	3,5m	5m
11	0,5hr	12,57°E, 44,14°N	1,34±0,12dbar (avg±std)	-	N/A	N/A
12	0,5hr	12,46°E, 44,74°N	1,64±0,11 dbar (avg±std)	-	N/A	N/A
13	10min	13,21°E, 43,76°N	1,51±0,18dbar (avg±std)	-	N/A	N/A

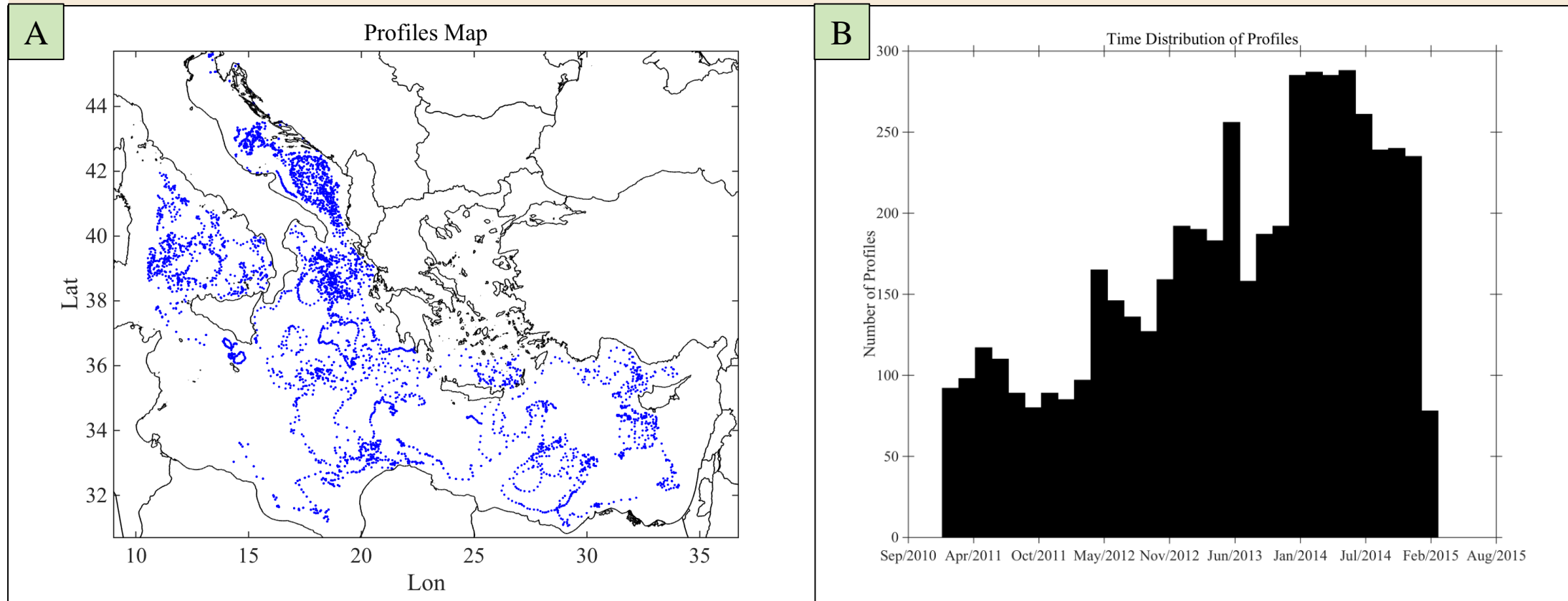
5

In situ datasets: Ferry box

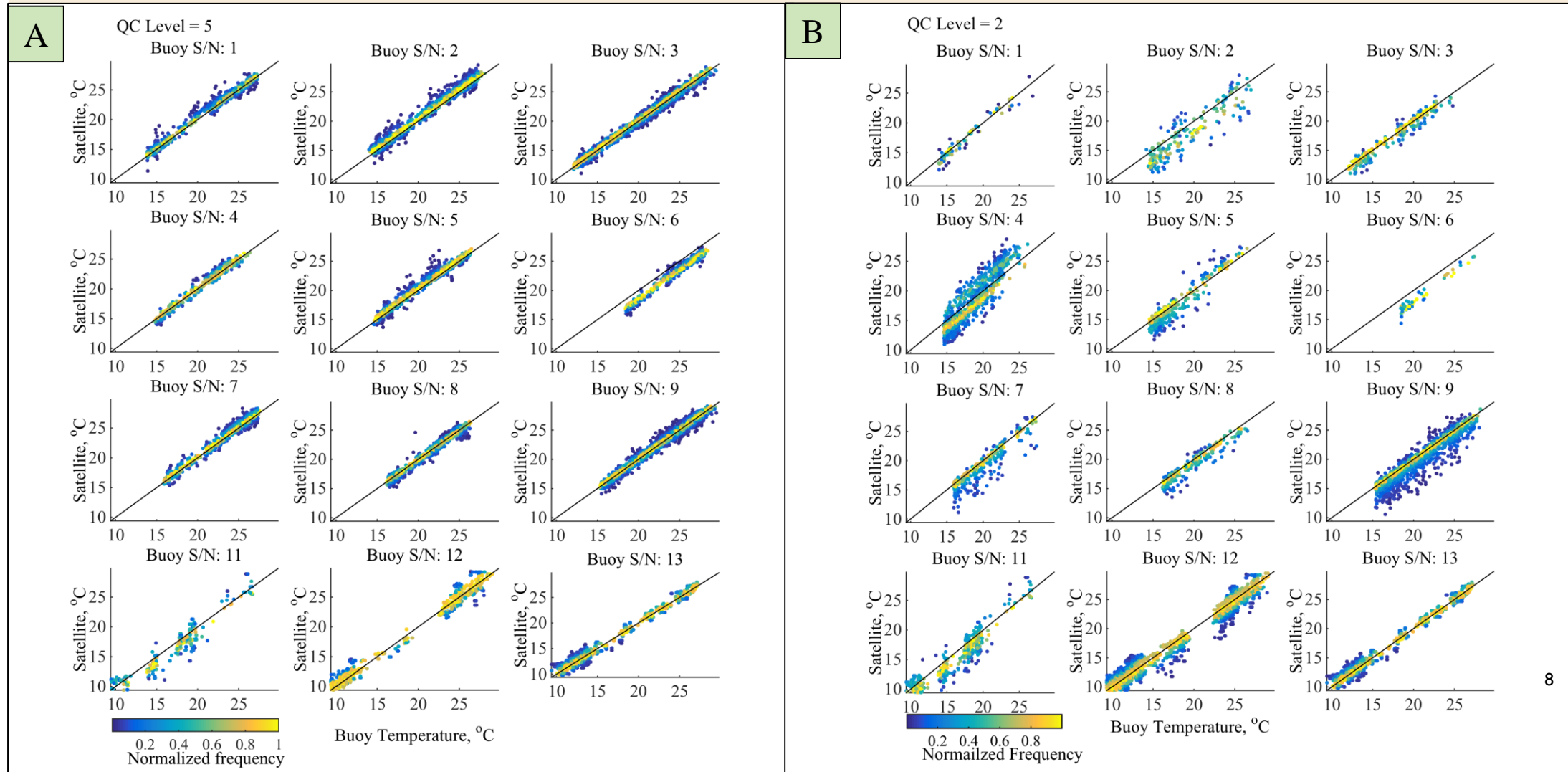


Sampling Rate (Time)	Sampling Rate (Space)	Transect Points (Average)	Number of Transects	Time Coverage	Water Temperature - Vertical Coordinates (Nominal)
1min	600m	450	290	9months	2m

In situ datasets: Profiles (Argo mostly)

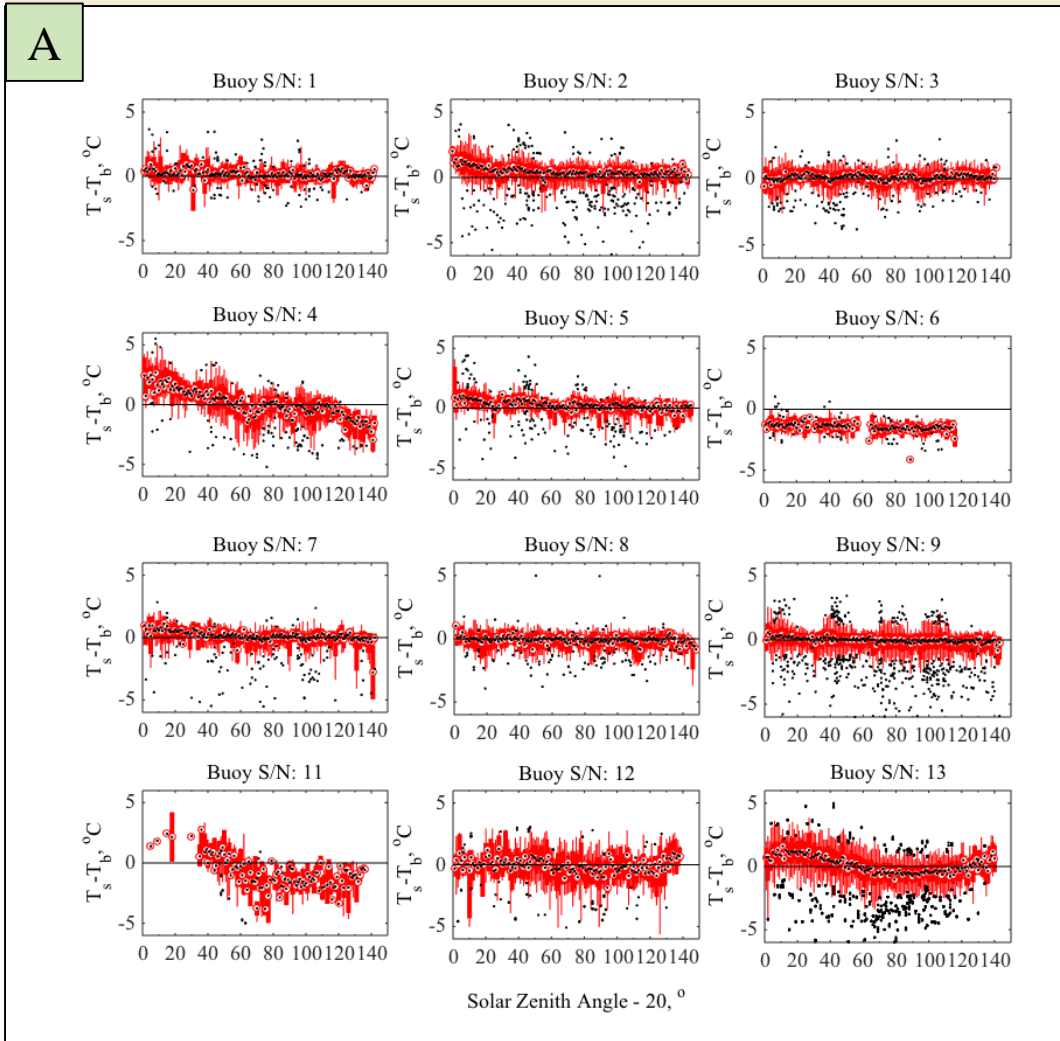


Results & Discussion: Buoys

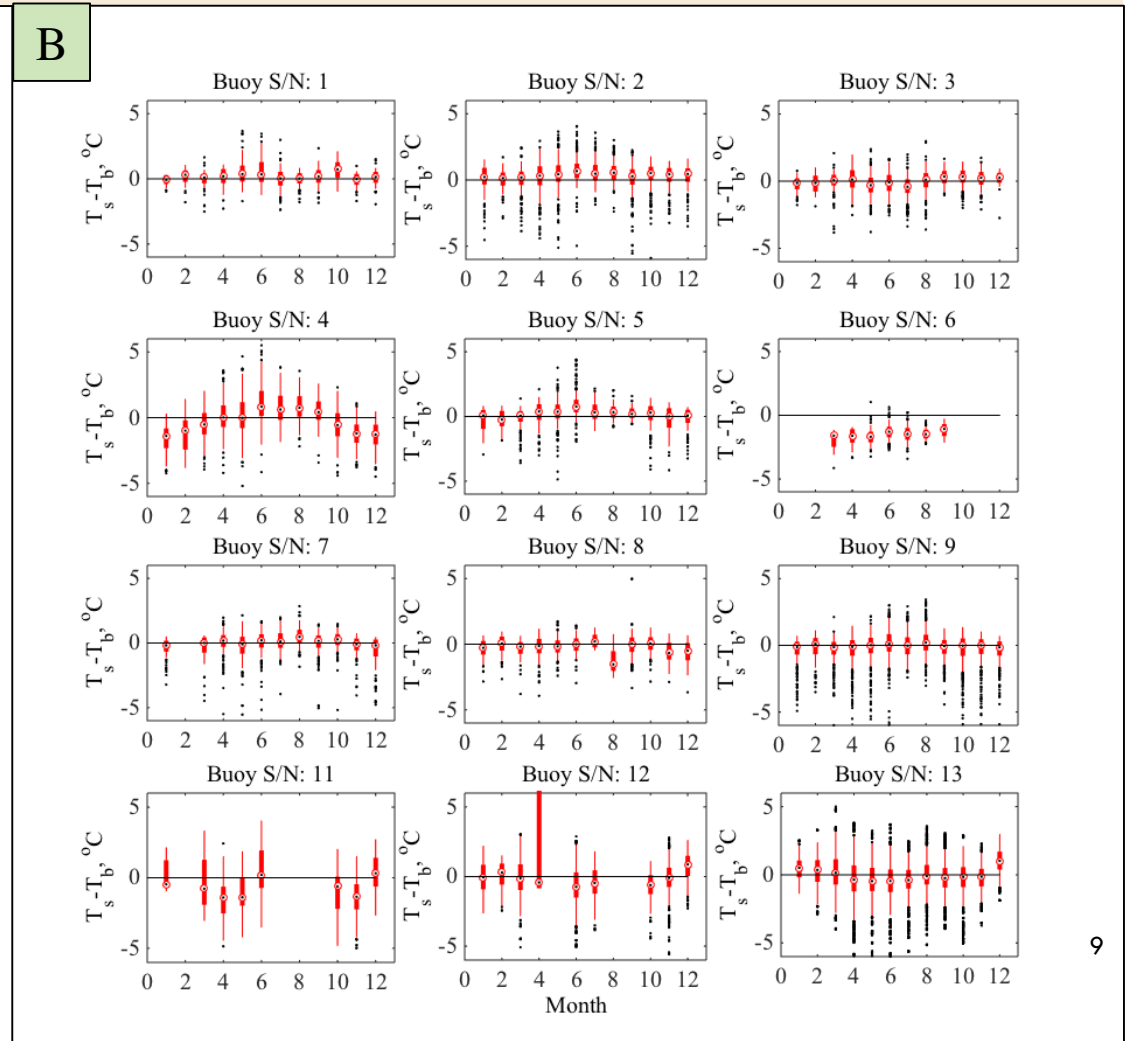


Results & Discussion: Buoys

ΔT vs SZA

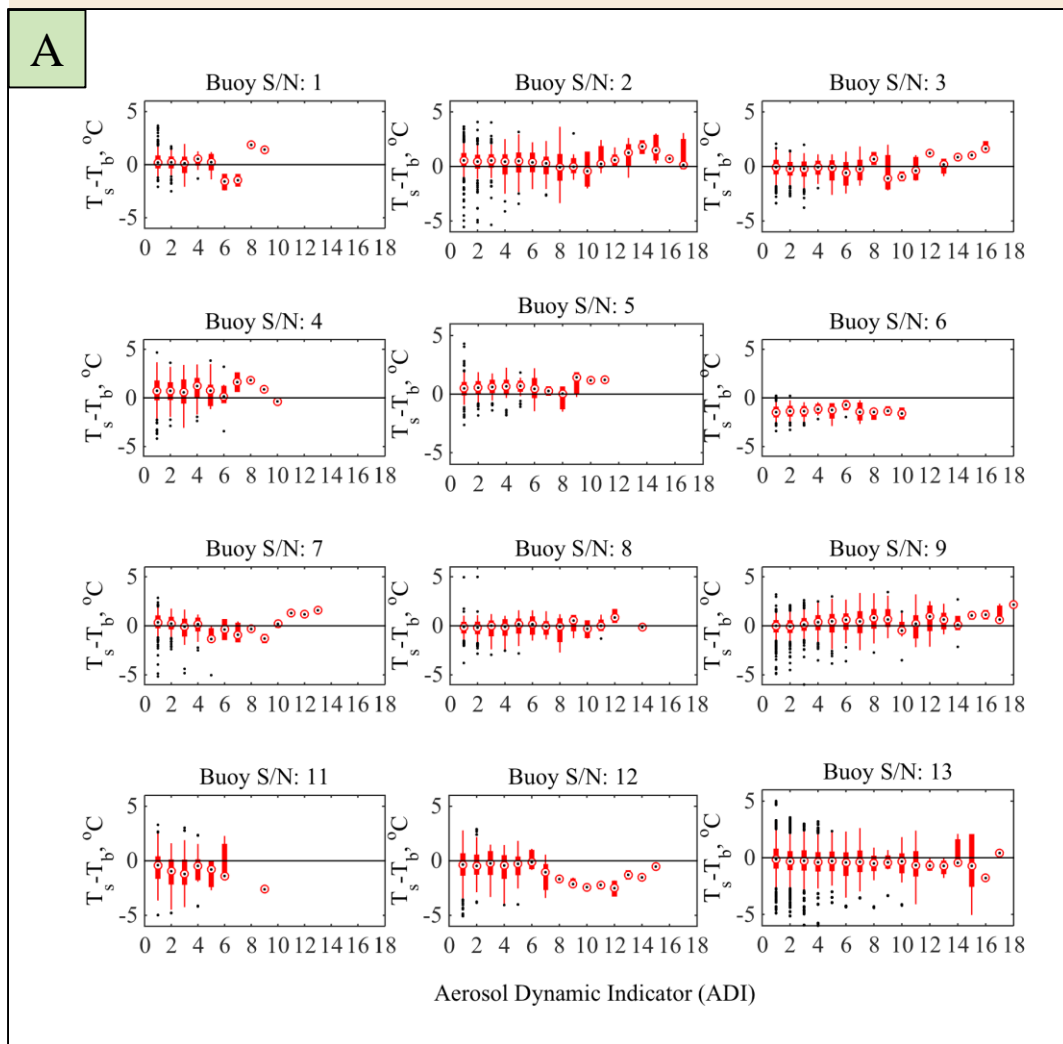


ΔT vs Month

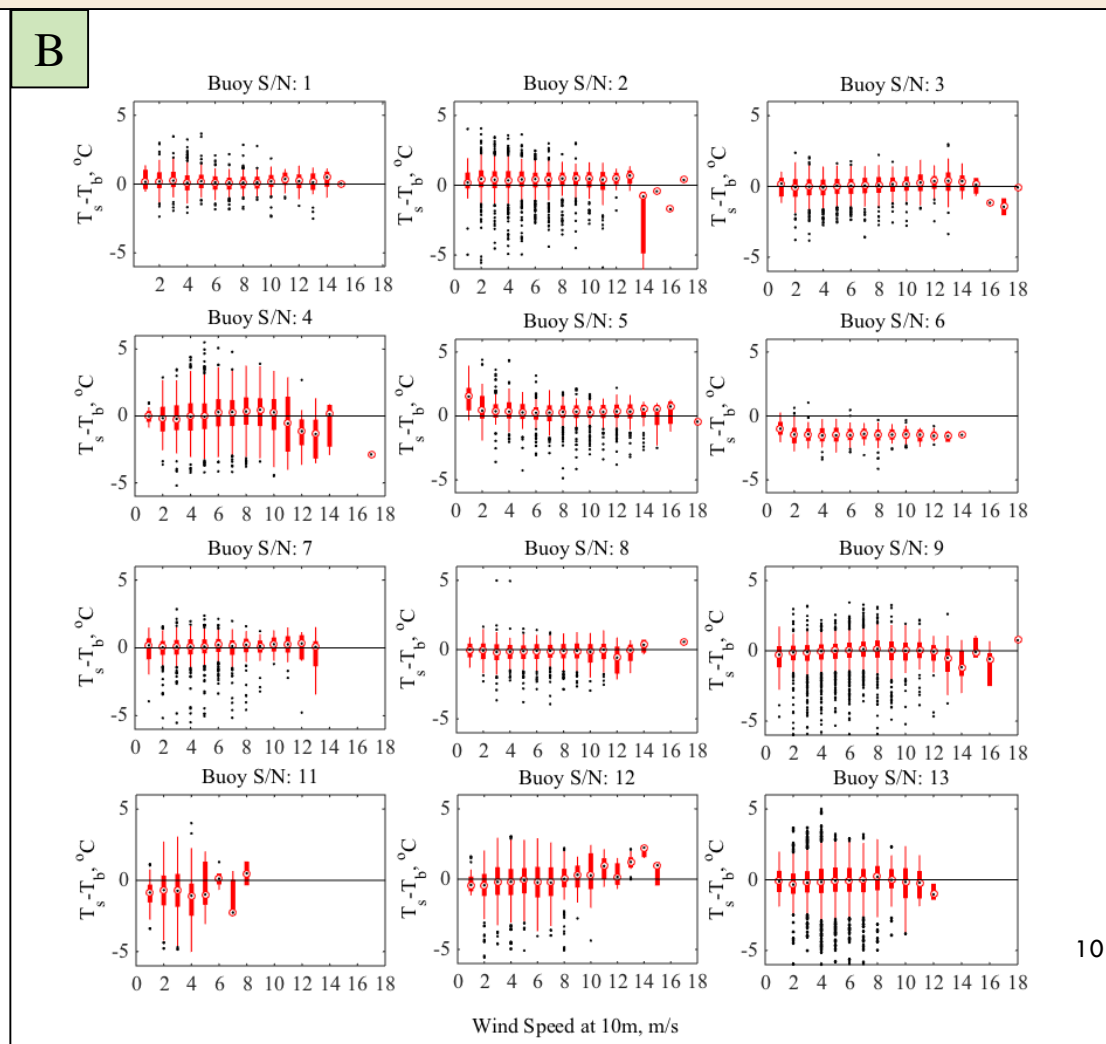


Results & Discussion: Buoys

ΔT vs ADI



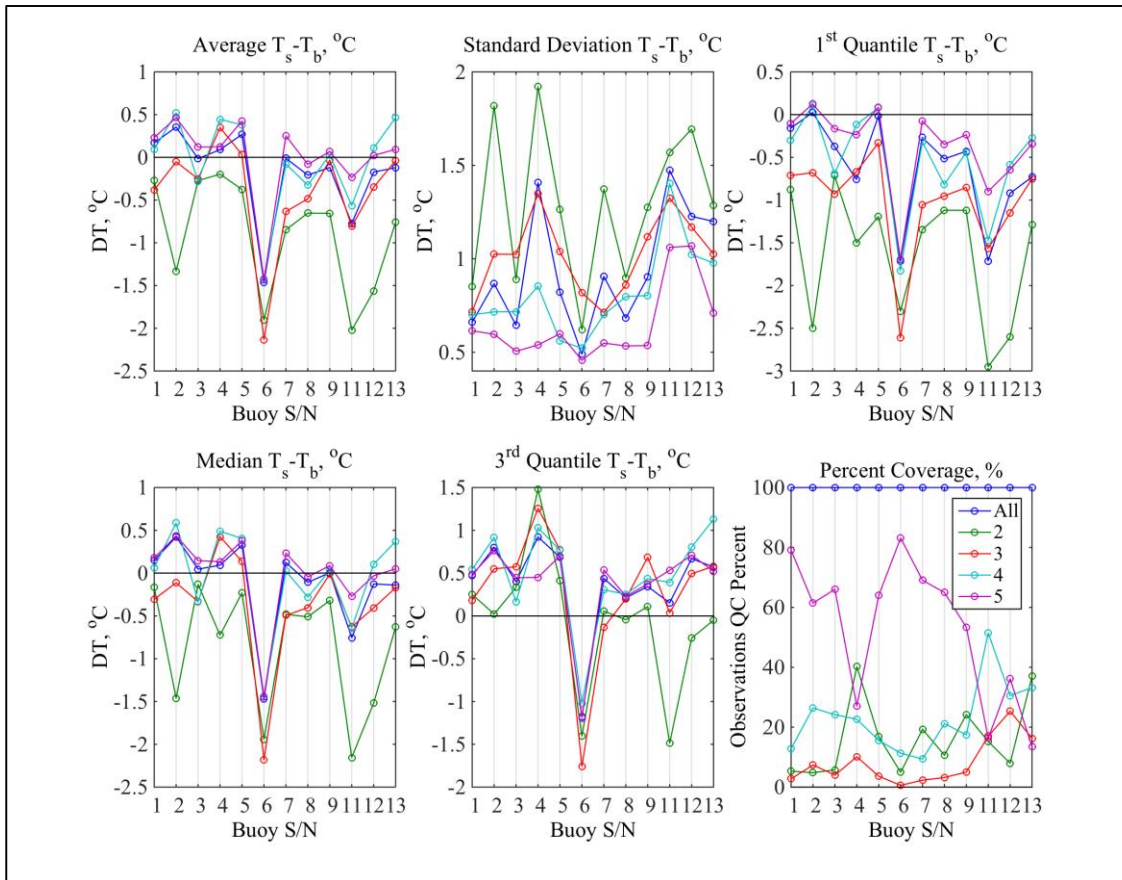
ΔT vs Wind



Results & Discussion: Buoys

ΔT statistics per satellite QC level

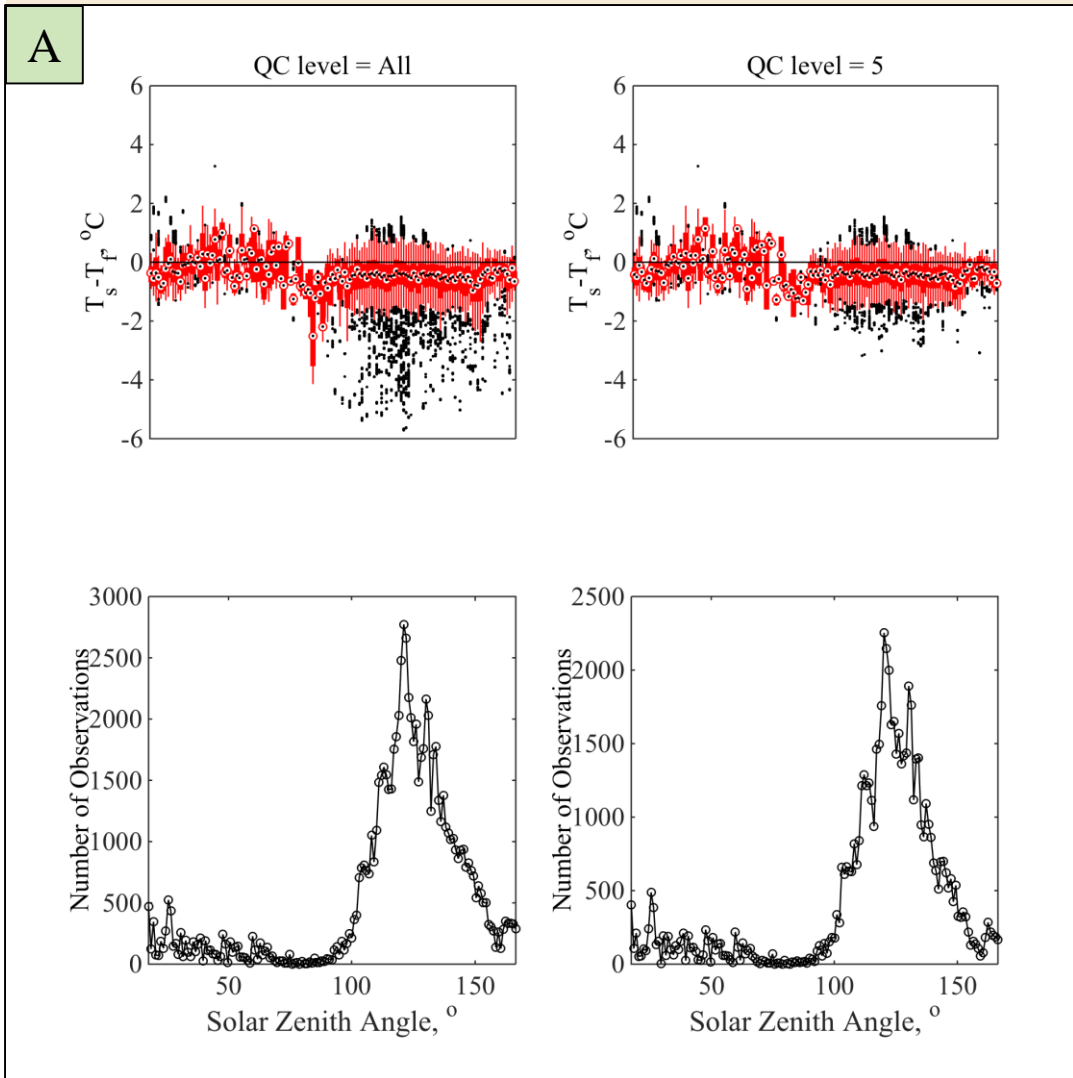
Table results are calculated using satellite data of all quality levels (2, 3, 4, 5)



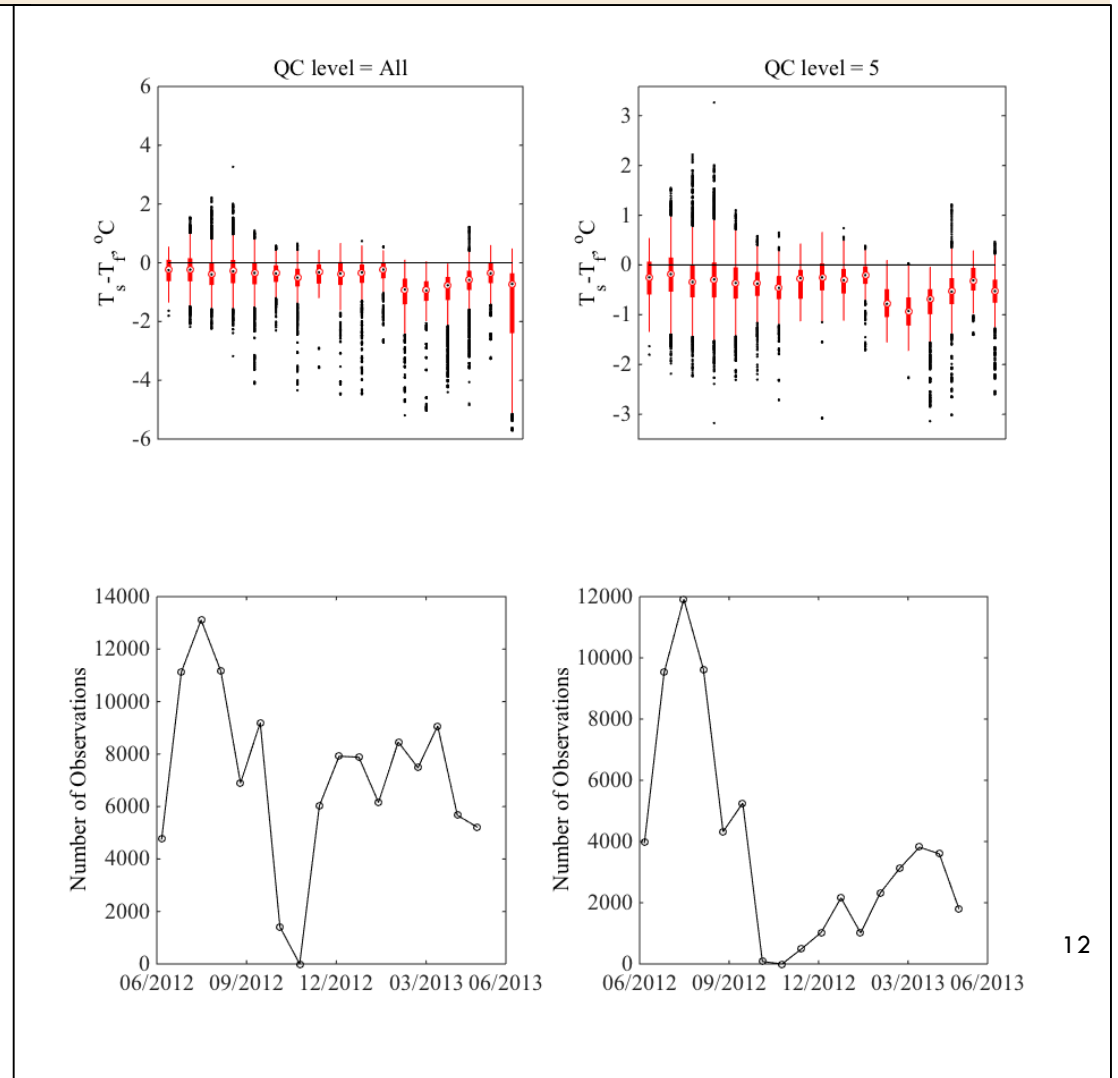
S/N	Bias (°C)	Standard Deviation (°C)	1 st Quantile	Median	3 rd Quantile	Number of match-ups	Match-up Coverage (%)
1	0,169	0,660	-0,160	0,147	0,470	1448	51
2	0,354	0,868	0,024	0,424	0,800	4086	53
3	-0,015	0,645	-0,372	0,046	0,399	4243	46
4	0,090	1,408	-0,759	0,094	0,922	2412	66
5	0,268	0,822	-0,016	0,328	0,687	2147	64
6	-1,462	0,489	-1,716	-1,469	-1,180	1052	50
7	-0,011	0,906	-0,267	0,124	0,438	1689	71
8	0,053	1,318	-0,517	-0,107	0,211	2513	37
9	-0,119	0,902	-0,429	0,004	0,343	6366	60
10	N/A	N/A	N/A	N/A	N/A	0	0
11	-0,775	1,473	-1,713	-0,756	0,153	742	9
12	-0,172	1,227	-0,920	-0,126	0,670	3118	30
13	-0,121	1,200	-0,730	-0,140	0,570	31365	40

Results & Discussion: Ferry box

ΔT vs SZA

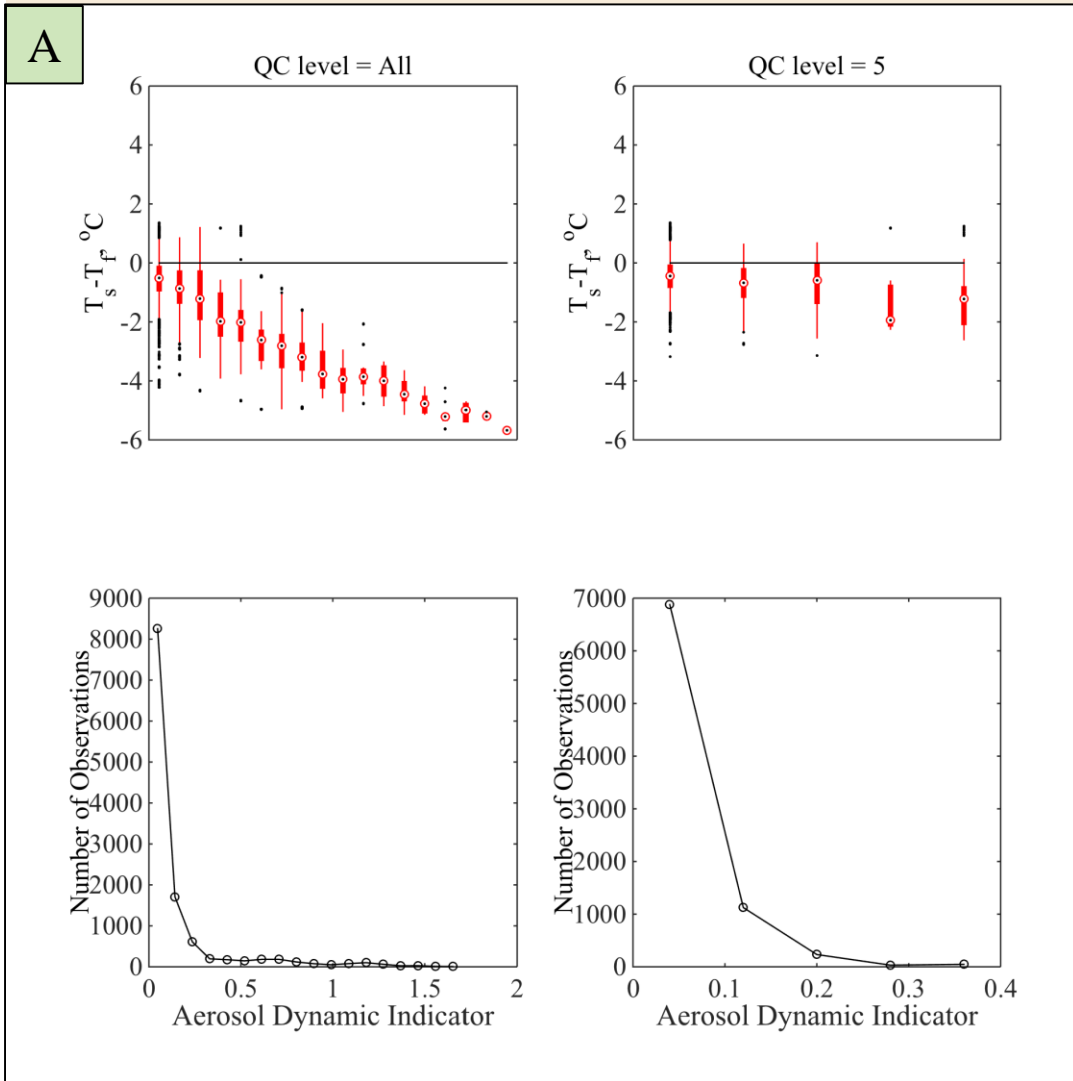


ΔT vs Date

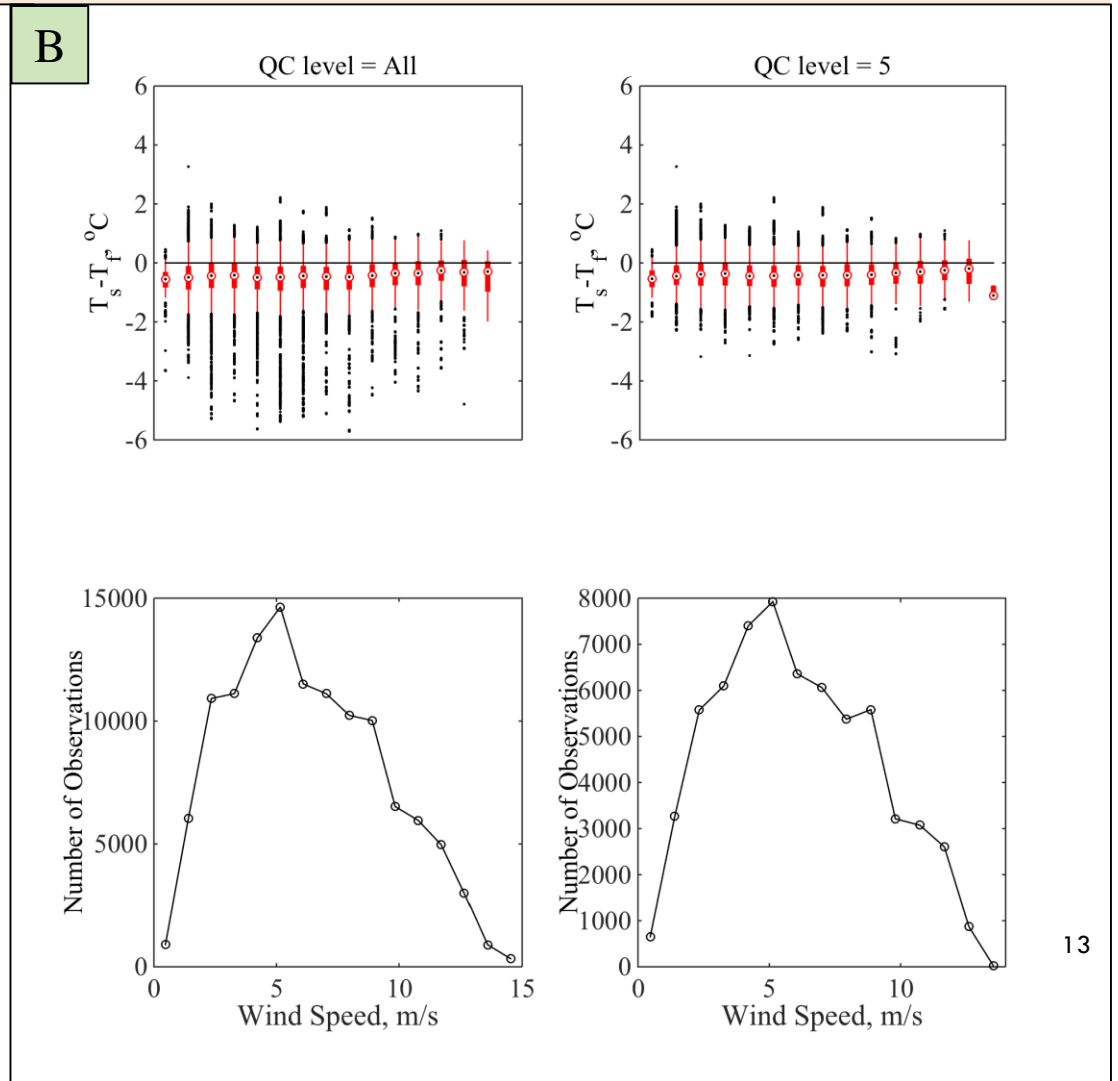


Results & Discussion: Ferry box

ΔT vs ADI

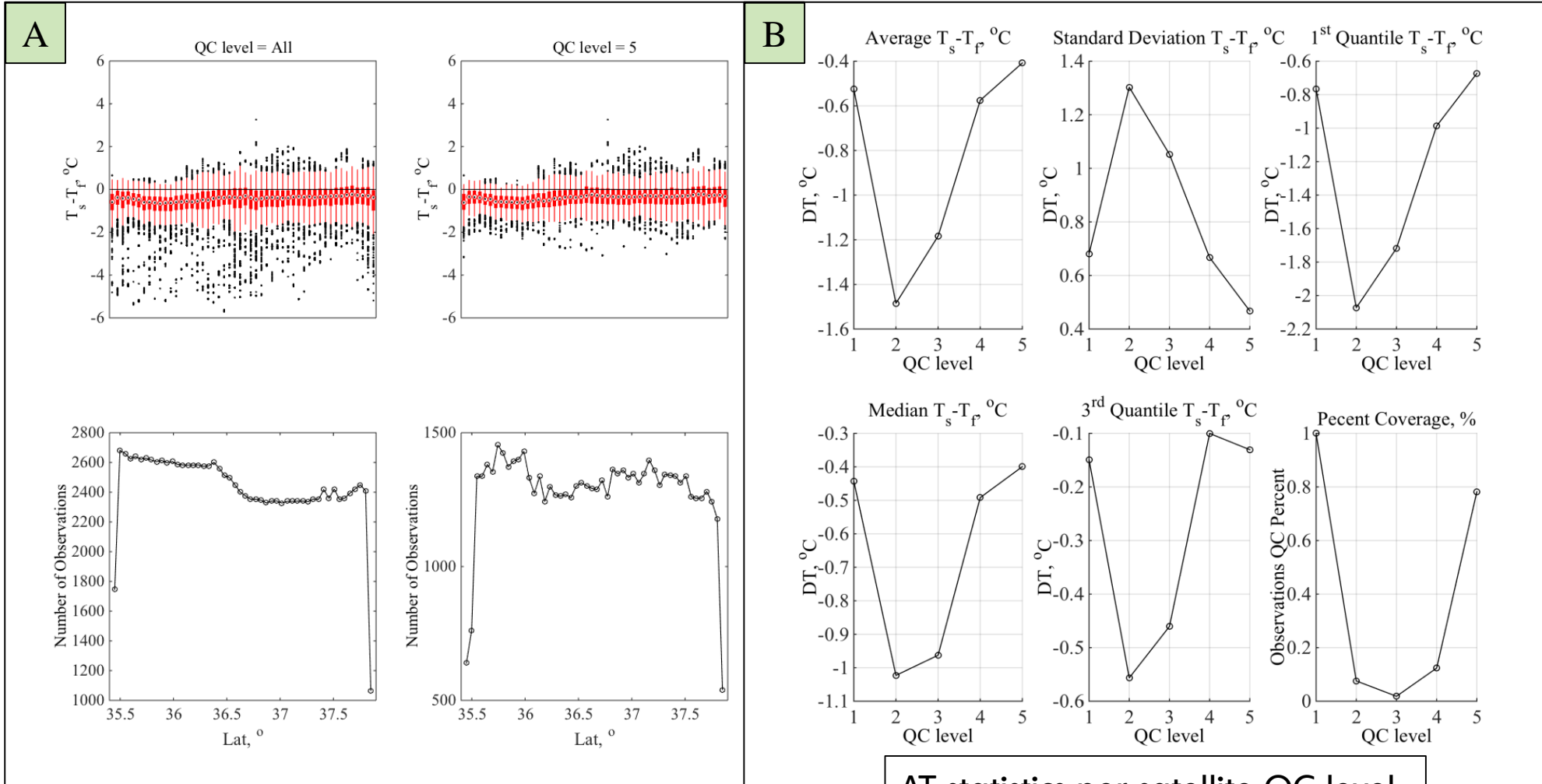


ΔT vs Wind



Results & Discussion: Ferry box

ΔT vs Lat



Number of
match-ups

81928

6200

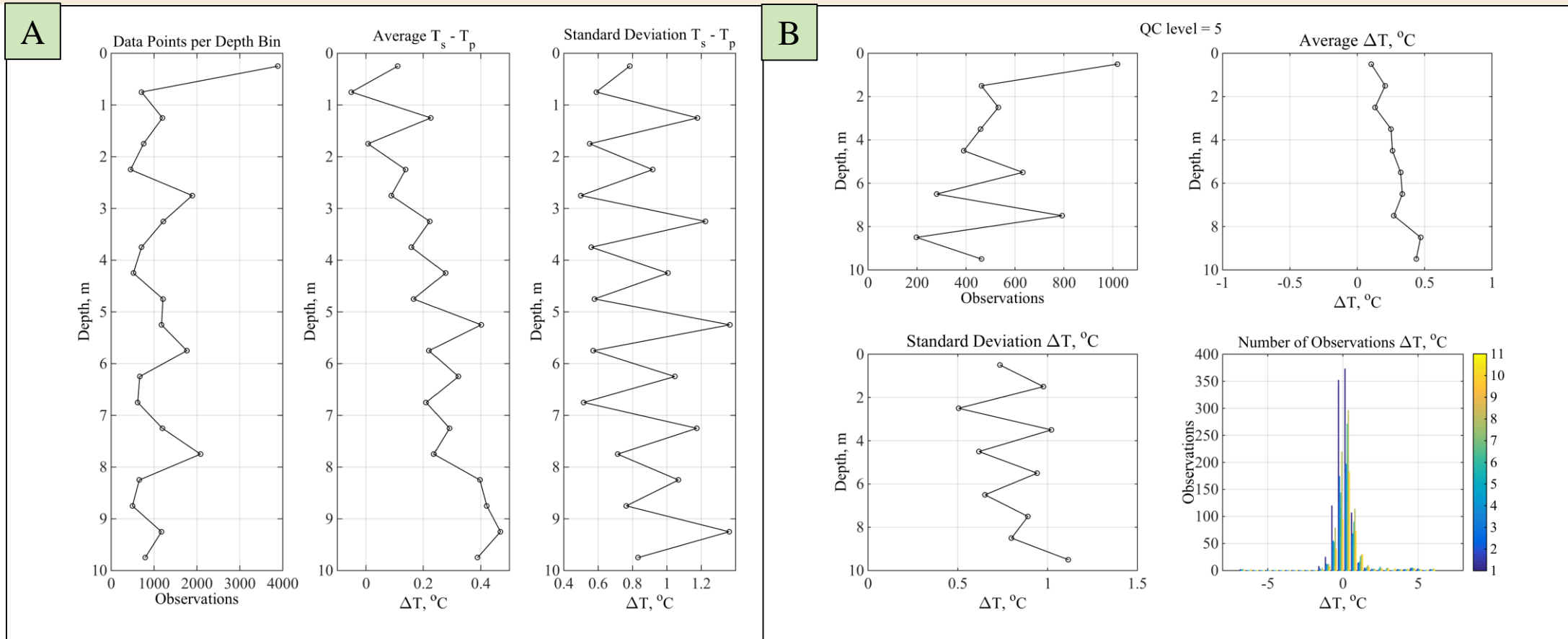
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10146

64059

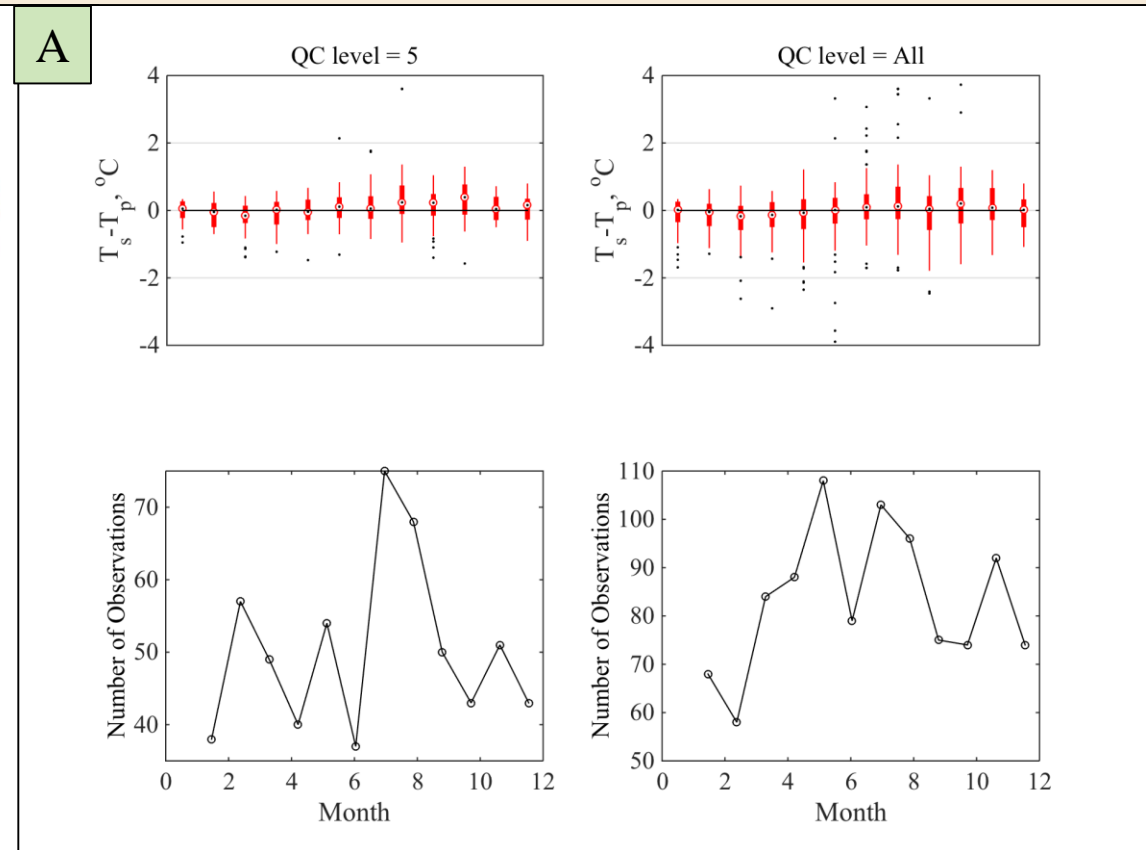
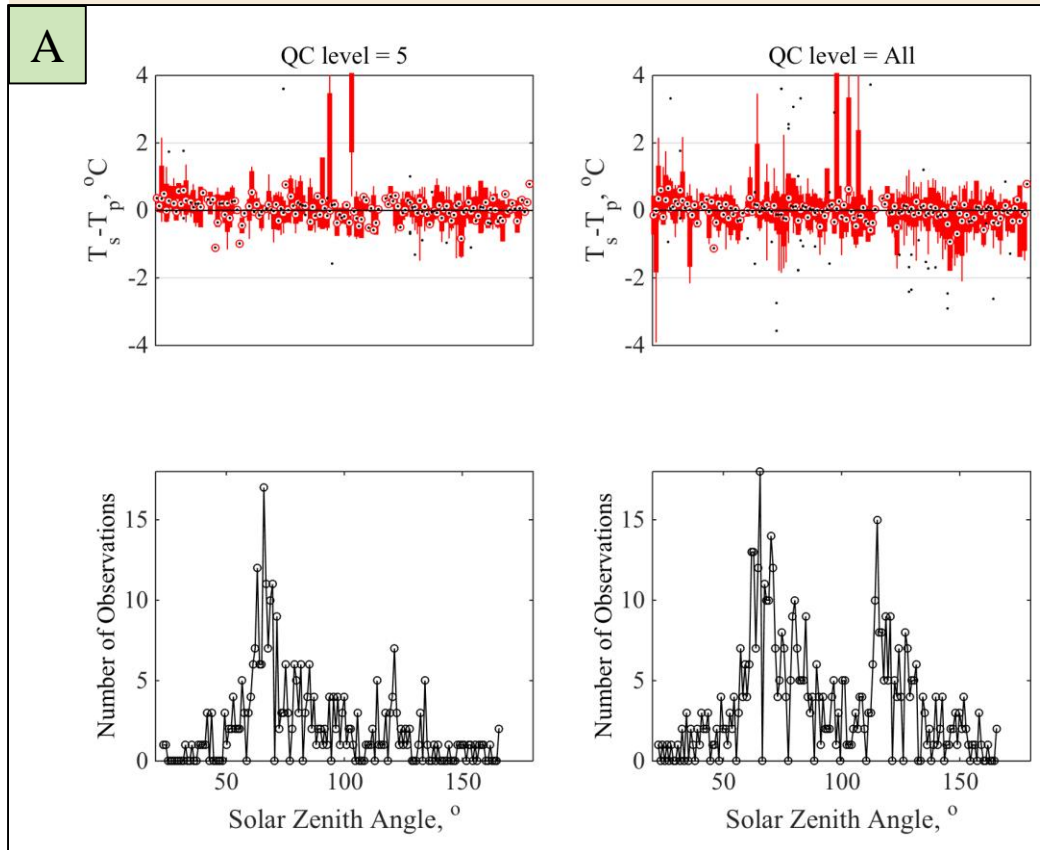
ΔT statistics per satellite QC level

Results & Discussion: Profiles



Results & Discussion: Profiles

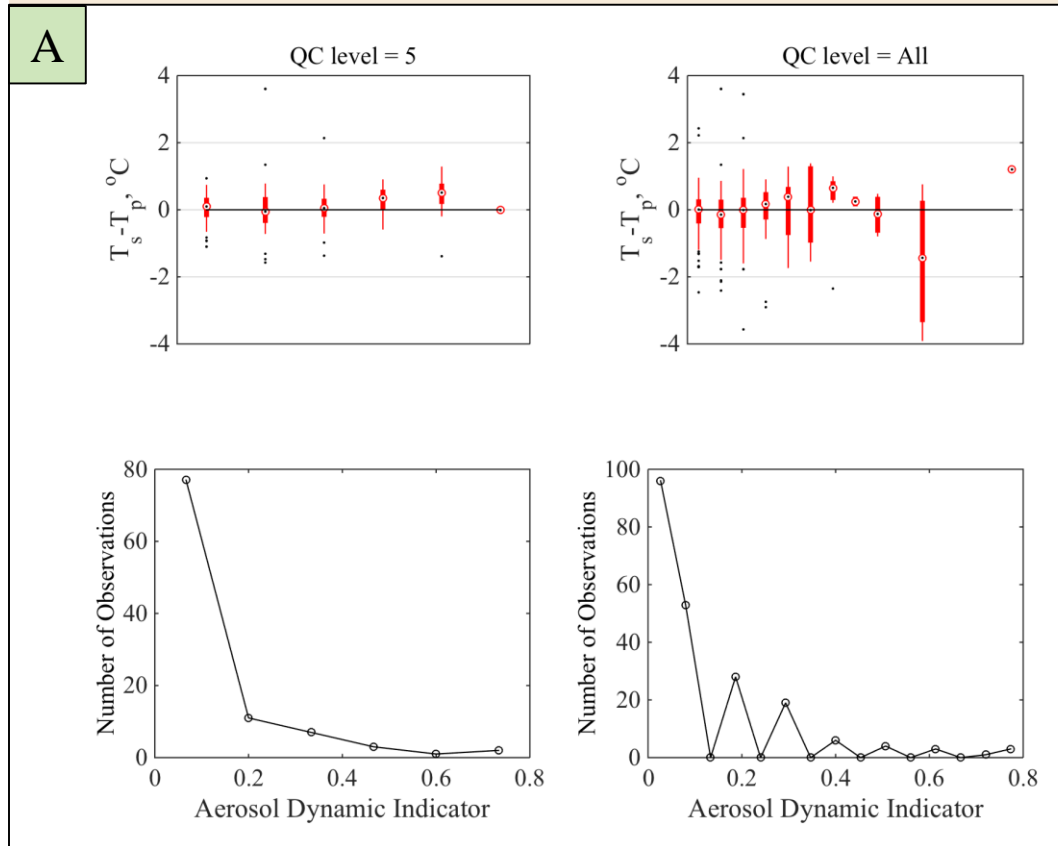
ΔT vs SZA



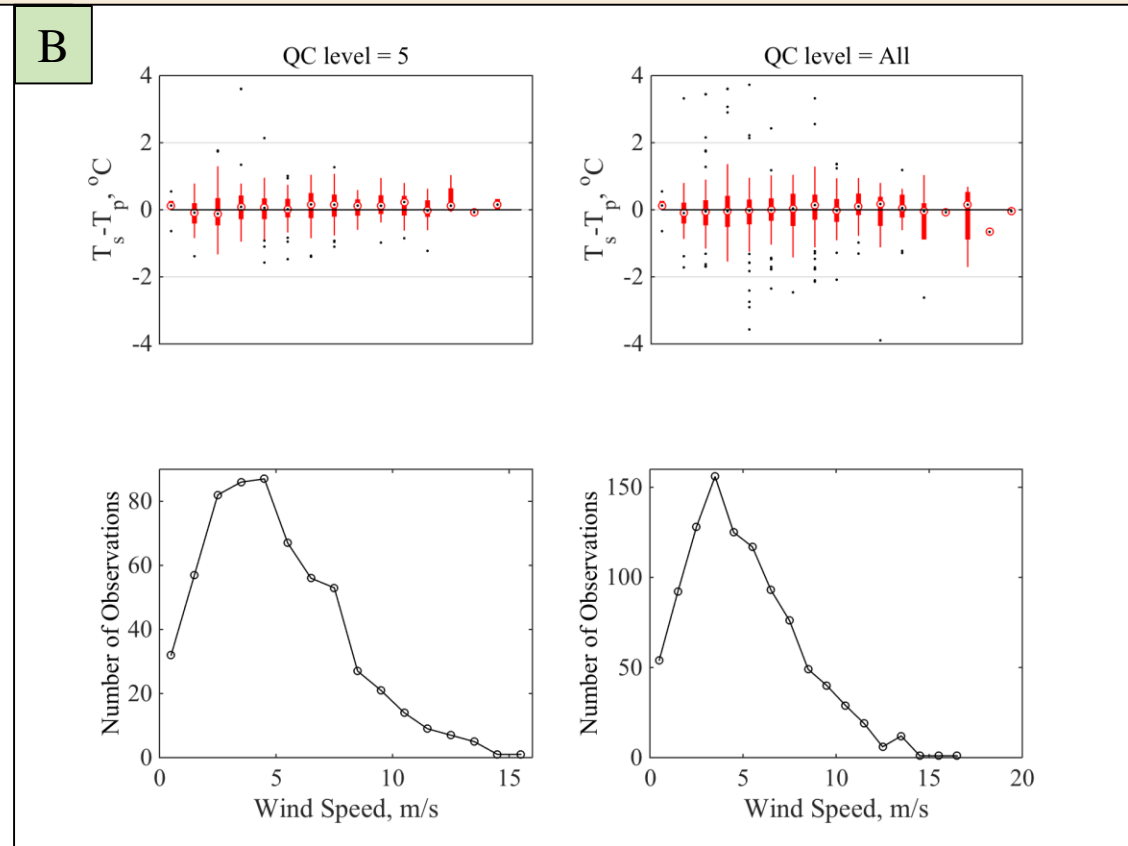
ΔT vs Month

Results & Discussion: Profiles

ΔT vs ADI



ΔT vs Wind



Conclusions

- **Typical Bias $< 0,2^{\circ}\text{C}$ ($\sim 0,1^{\circ}\text{C}$ for most suitable *in situ* data sets and best satellite data)**
- **Typical Standard Deviation $< 1,5^{\circ}\text{C}$ ($\sim 0,5^{\circ}\text{C}$ for most suitable *in situ* data sets and best satellite data)**
- **Well structured seasonal error. Cold bias during winter and warm during summer. Consistent results for all platforms, the seasonal error range varies only slightly.**
- **Well structured daily error. Proximity to shore and wind conditions are important.**
- **Small meridional variation of satellite performance (not monotonic).**
- **Consistent dependence of error on wind between all platforms. Cold bias under light wind conditions (2-6m/s).**
- **Inconsistent dependence of error on aerosol. No obvious relation for profiles and buoys. Strong linear relation for ferry box.**
- **The great unknowns in validation: biased *in situ* sampling and metadata QC and accuracy.**