

# Dropsonde QC and Processing

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Salt Lake City, UT

# Motivation

- Reason to QC dropsondes independently: V3 data downloaded in February had some issues that prevented us from using the data in a way we wanted.
- We wanted to see if convection and convective environments were different between the three basins - Gulf of Mexico (GOM), Caribbean (CAR), and West Atlantic (ATL).

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**1. Dropsonde QC**

**2. Analysis**

# Dropsonde QC

There were **366** total data records (including times when we activated a dropsonde, but did not release it).

- 1) Remove dropsondes with insufficient data.
- 2) Remove points that were collected before launch, and after landing.
- 3) Focus on QC of temperature, RH, dewpoint temperature, and winds.

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\* On original data collected during CPEX

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## 1) Remove dropsondes with insufficient data.

- There's a launch detection header in the dropsonde data file

```
# Level 1 data products (DropSonde Only)Jun 2 2017, L. Harrison  
# NO LAUNCH DETECTED! Hydrostatic Heights will all be NAN.  
#Level 1 Hydrostatic Altitude Processing Error = -128
```

- but sometimes there's good data in there! **(7)**
- Remove dropsondes that contain less than 10-20% valid data points. **(24)**
- Remove dropsondes that were never launched, based on a minimum pressure difference threshold. **(57)**

This leaves us with **285** dropsonde data records.

\* On original data collected during CPEX

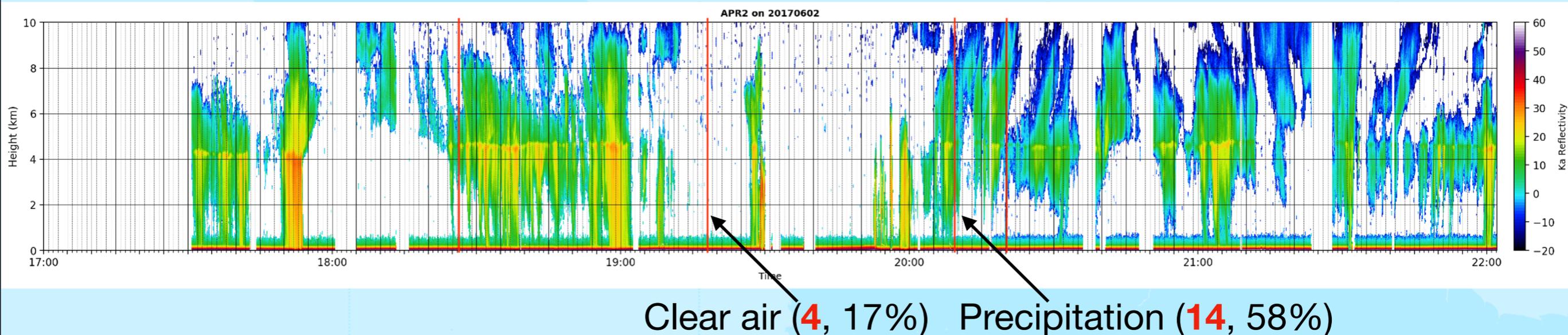
# Dropsonde QC\*

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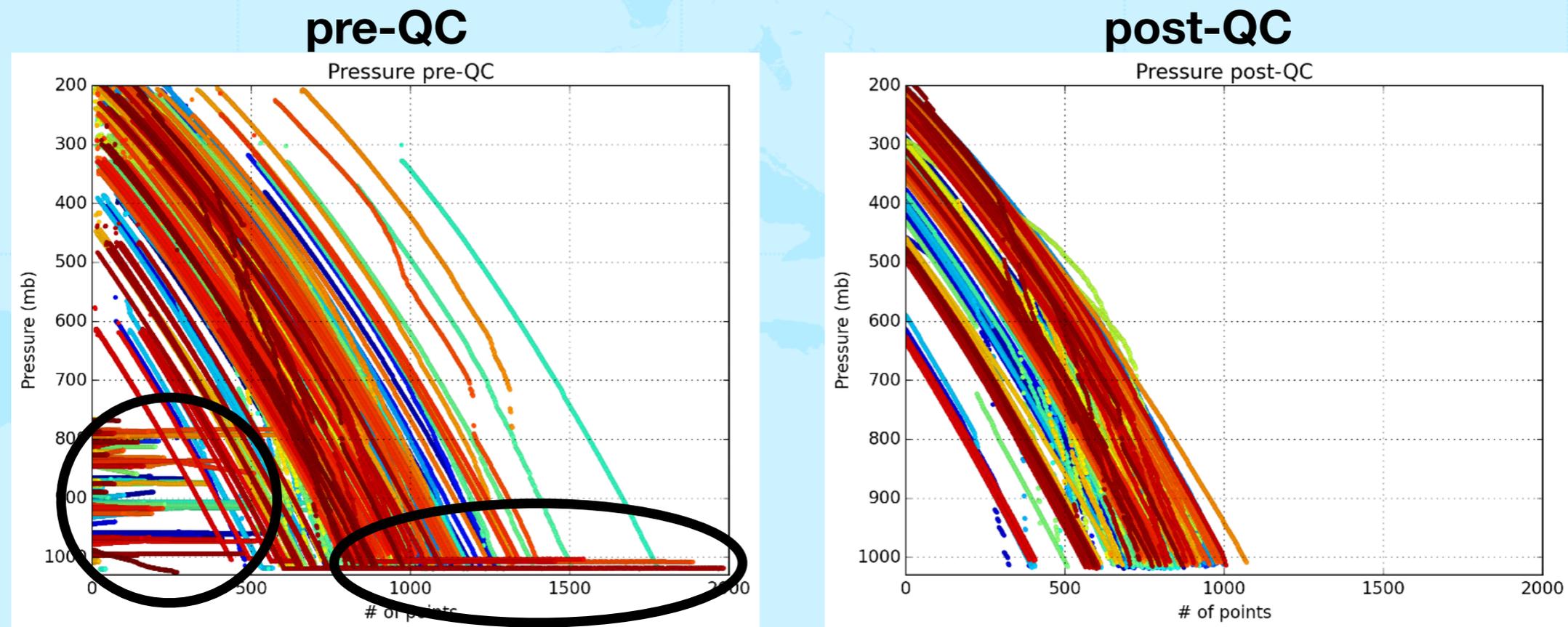
- but sometimes there's good data in there! (7)
- Remove dropsondes that contain less than 10-20% valid data points. (24)



\* On original data collected during CPEX

# Dropsonde QC\*

2) Remove points that were collected before launch, and after landing.



- Remove dropsondes that contain less than 100 data points. **(3)**

This leaves us with **282** dropsonde data records.

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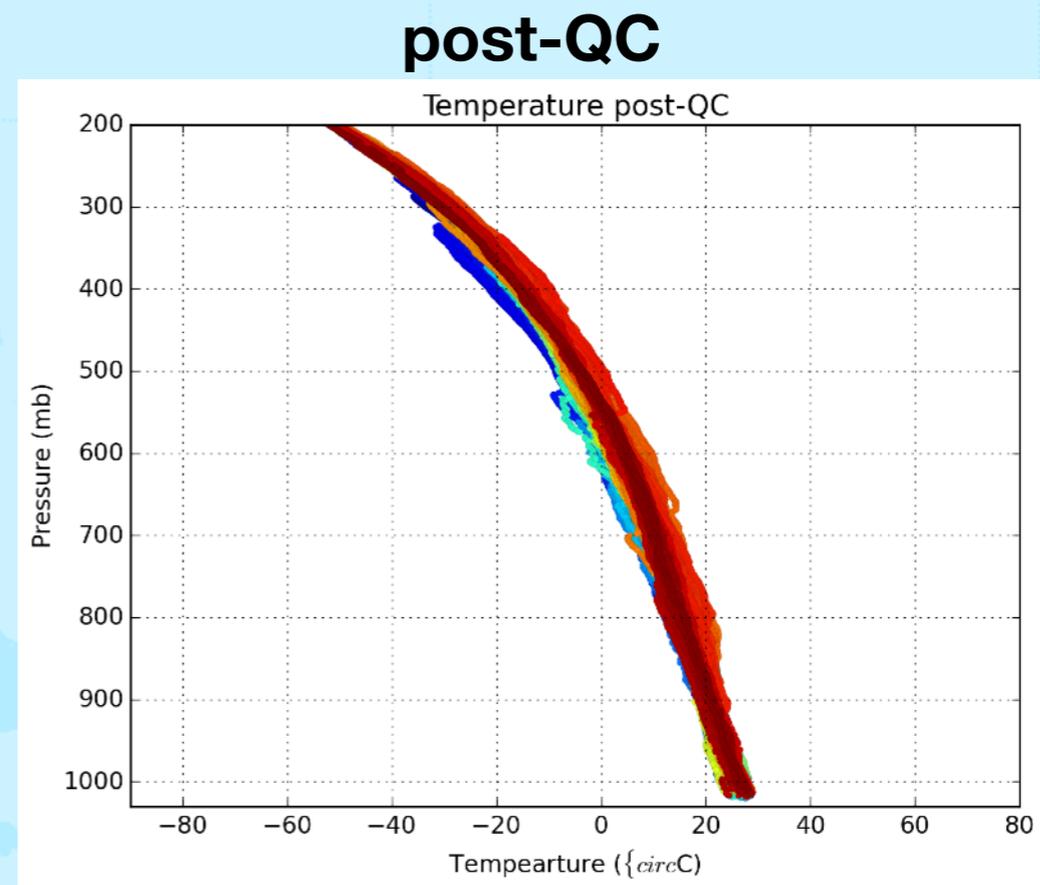
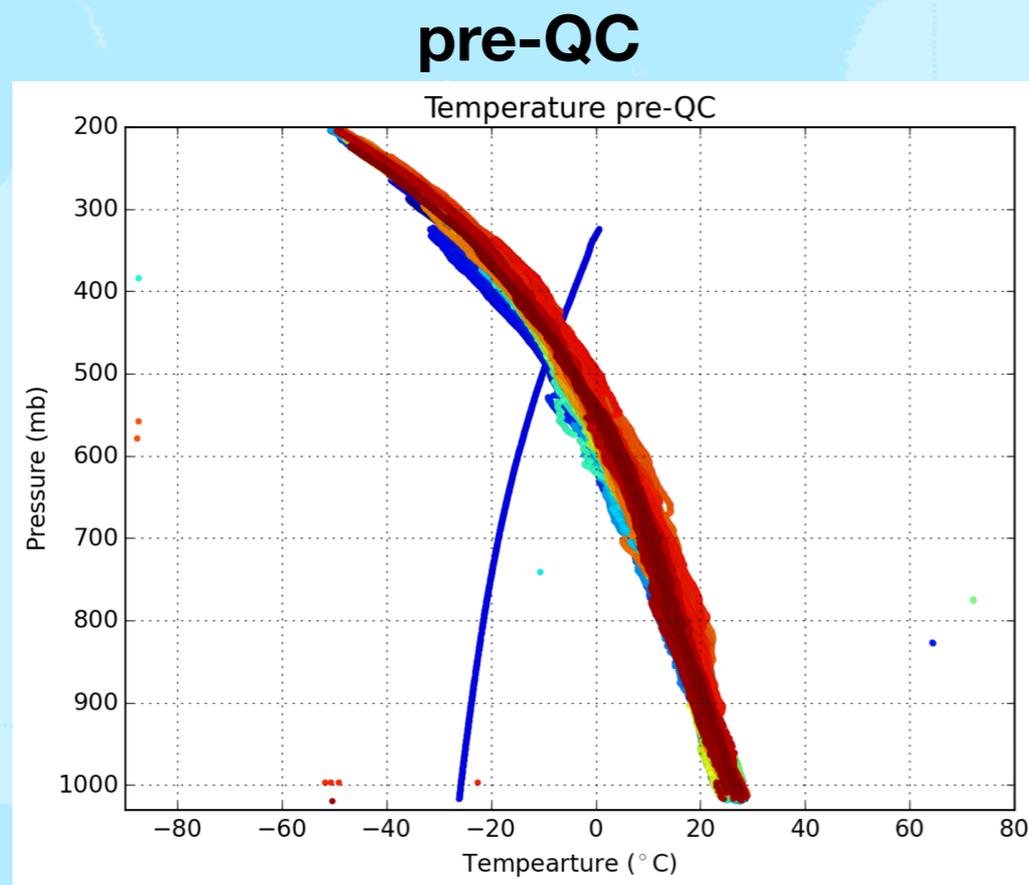


2) Remove points that were collected before launch, and after landing. **(282)**



3) Focus on QC of temperature, RH, dewpoint temperature, and winds.

# Dropsonde QC\* - temperature

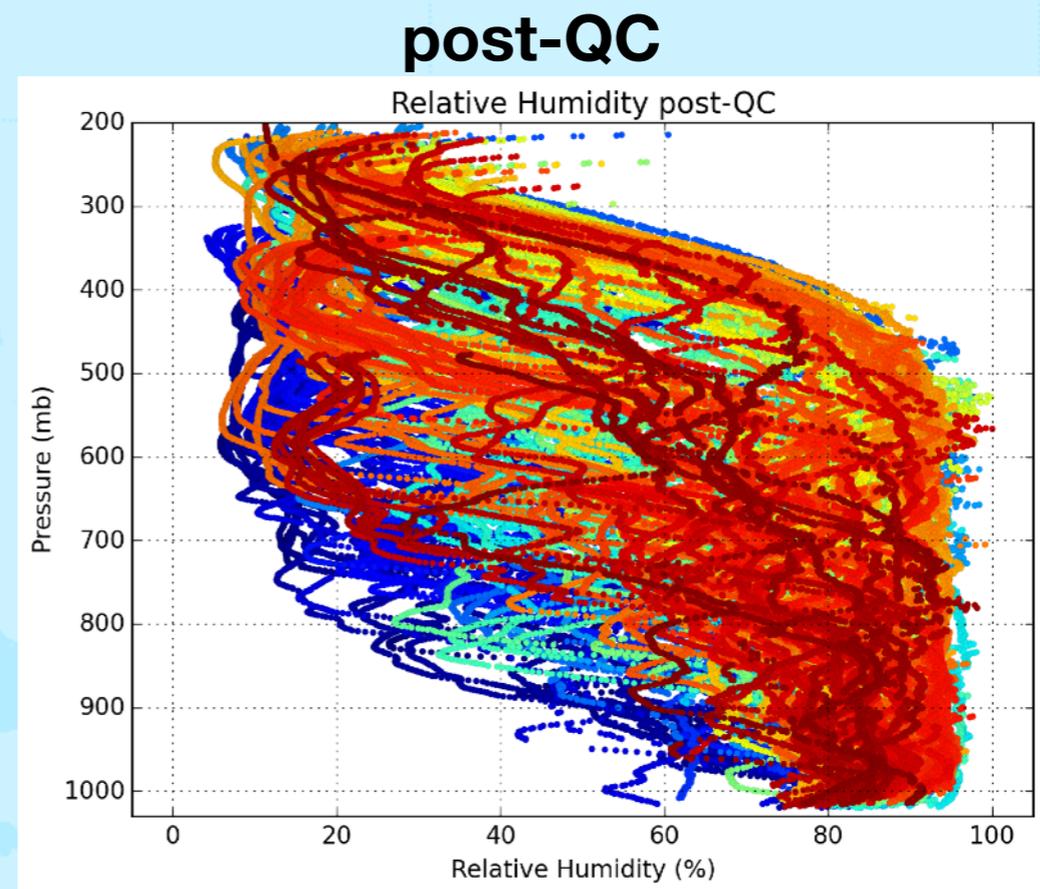
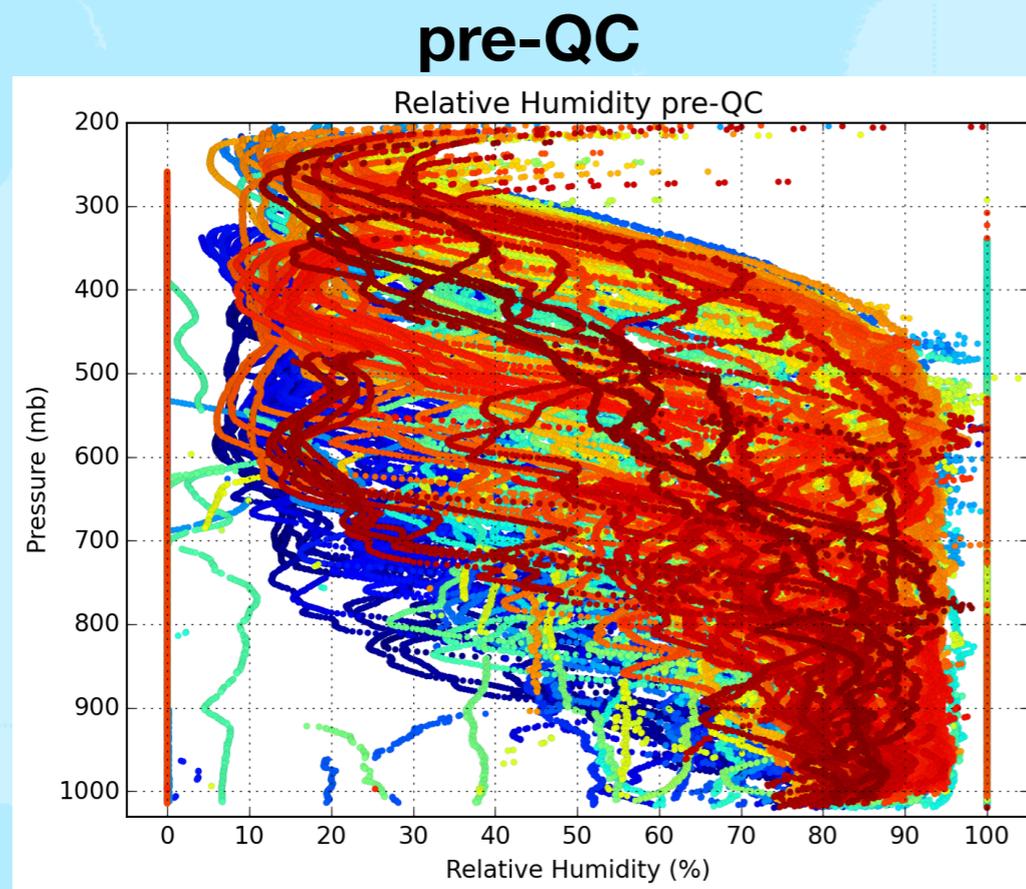


- Remove data points that lie between two NaNs and outliers.
- Remove temperature from profiles in which temperature decreases with height.

Points removed from temperature are also removed from RH and dewpoint temperature.

\* On original data collected during CPEX

# Dropsonde QC\* - temperature

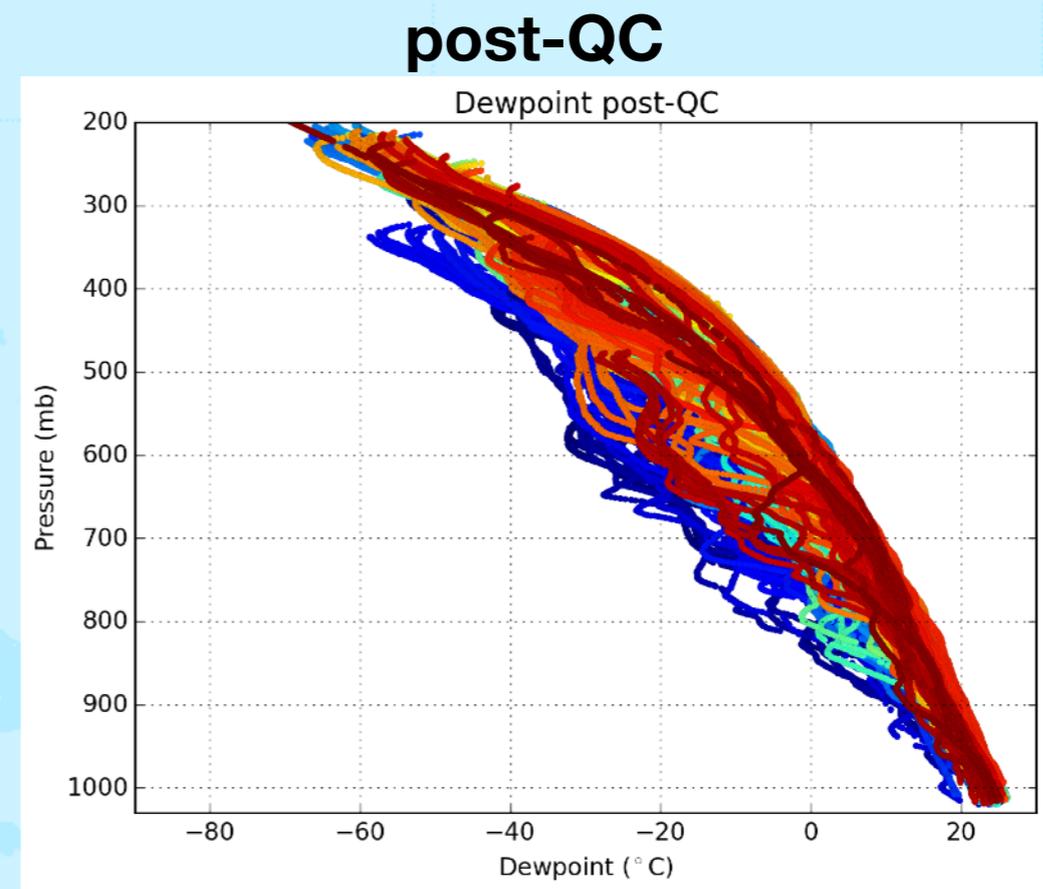
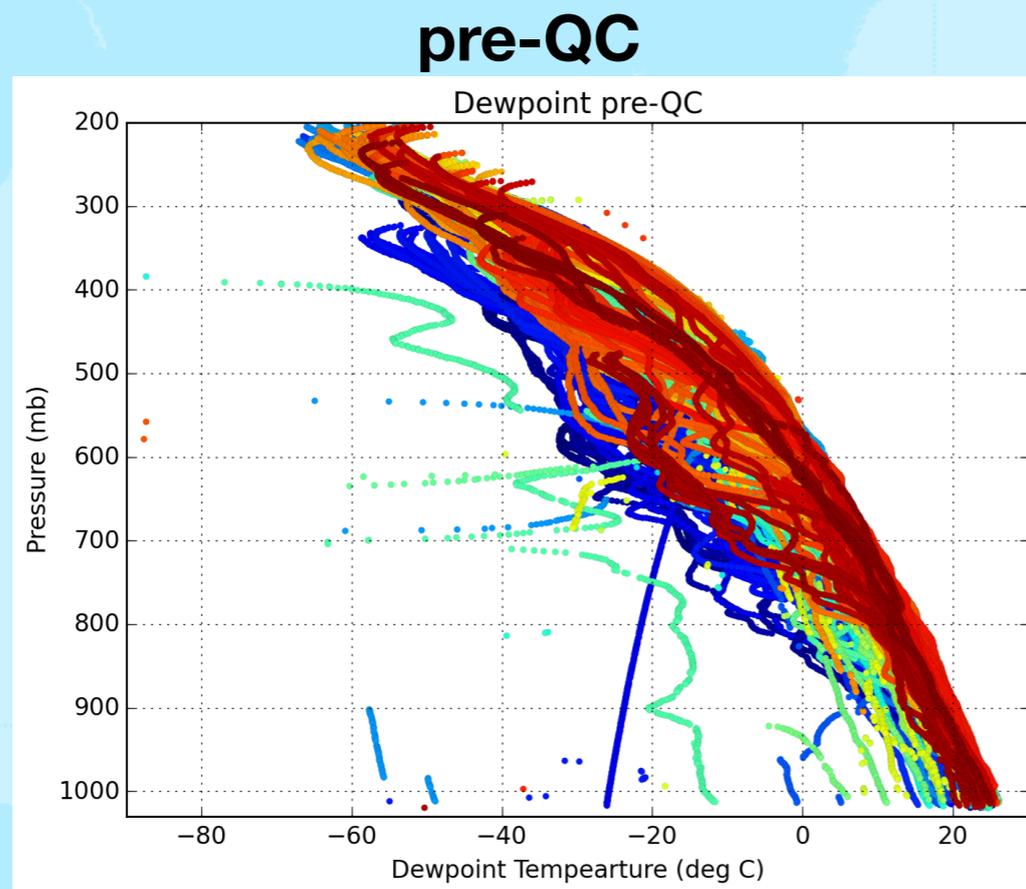


- Remove data points that lie between two NaNs and where RH gradient is more than 15% per 0.5 seconds.
- Remove points with  $RH > 100\%$ , profiles with constant 100% RH and profiles where maximum  $RH < 20\%$ .
- Remove outliers.

Points removed from RH are also removed from dewpoint temperature.

\* On original data collected during CPEX

# Dropsonde QC\* - temperature

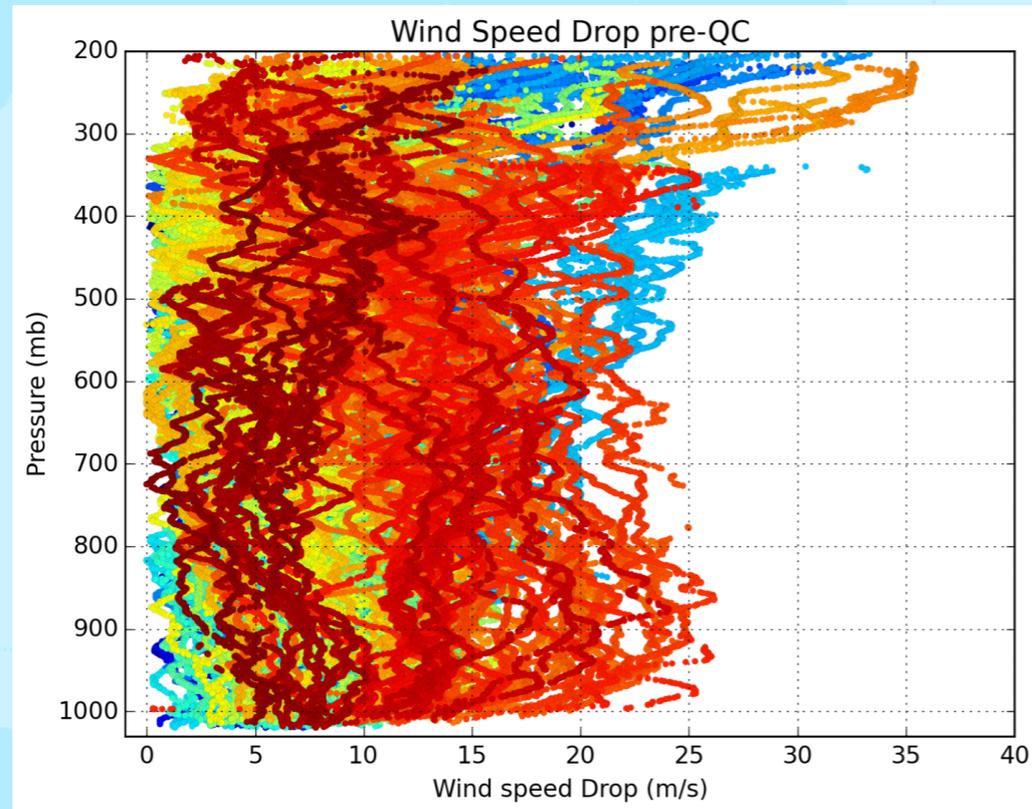


- Remove data points that lie between two NaNs and points that were removed from temperature and RH data.

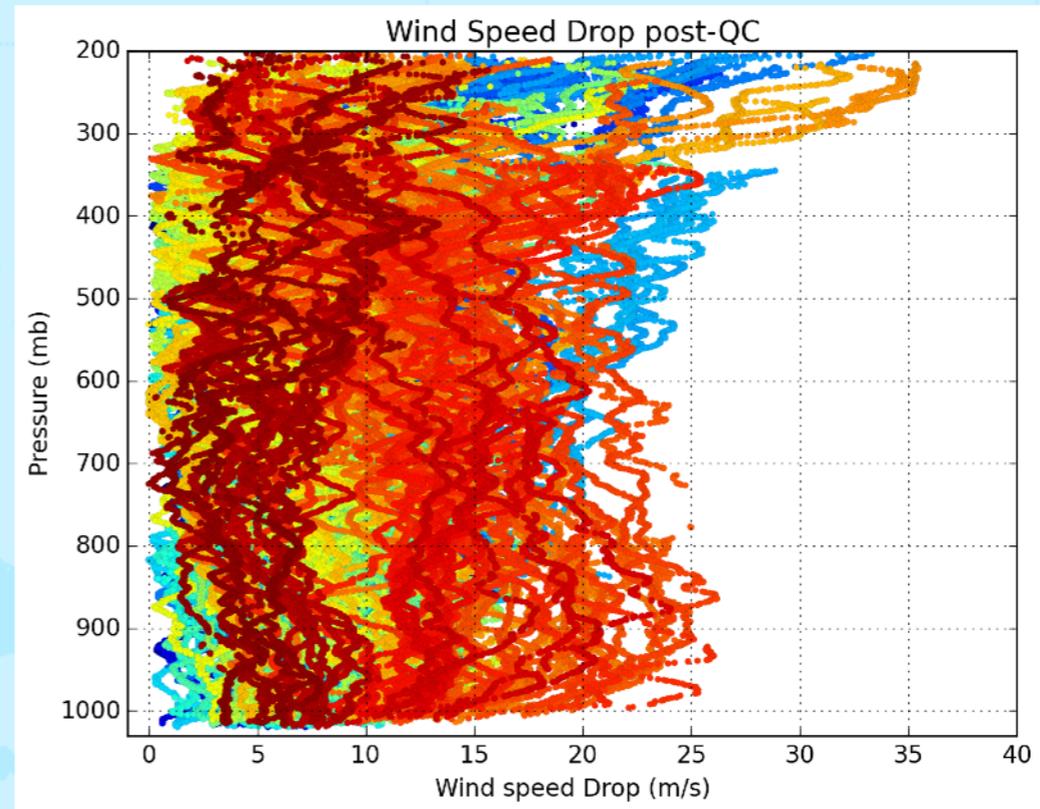
\* On original data collected during CPEX

# Dropsonde QC\* - winds

pre-QC



post-QC

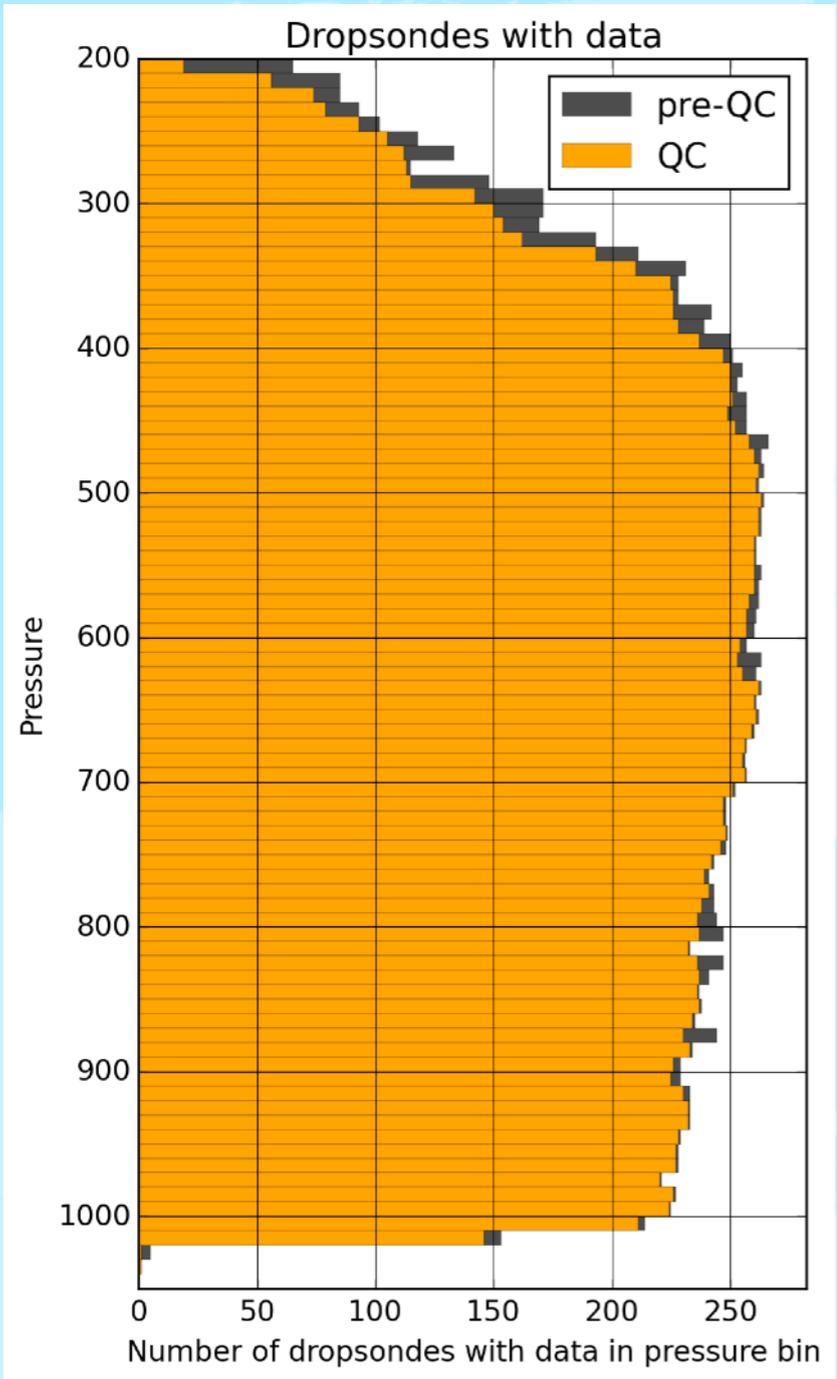


- Remove data points that lie between two NaNs, and outliers.

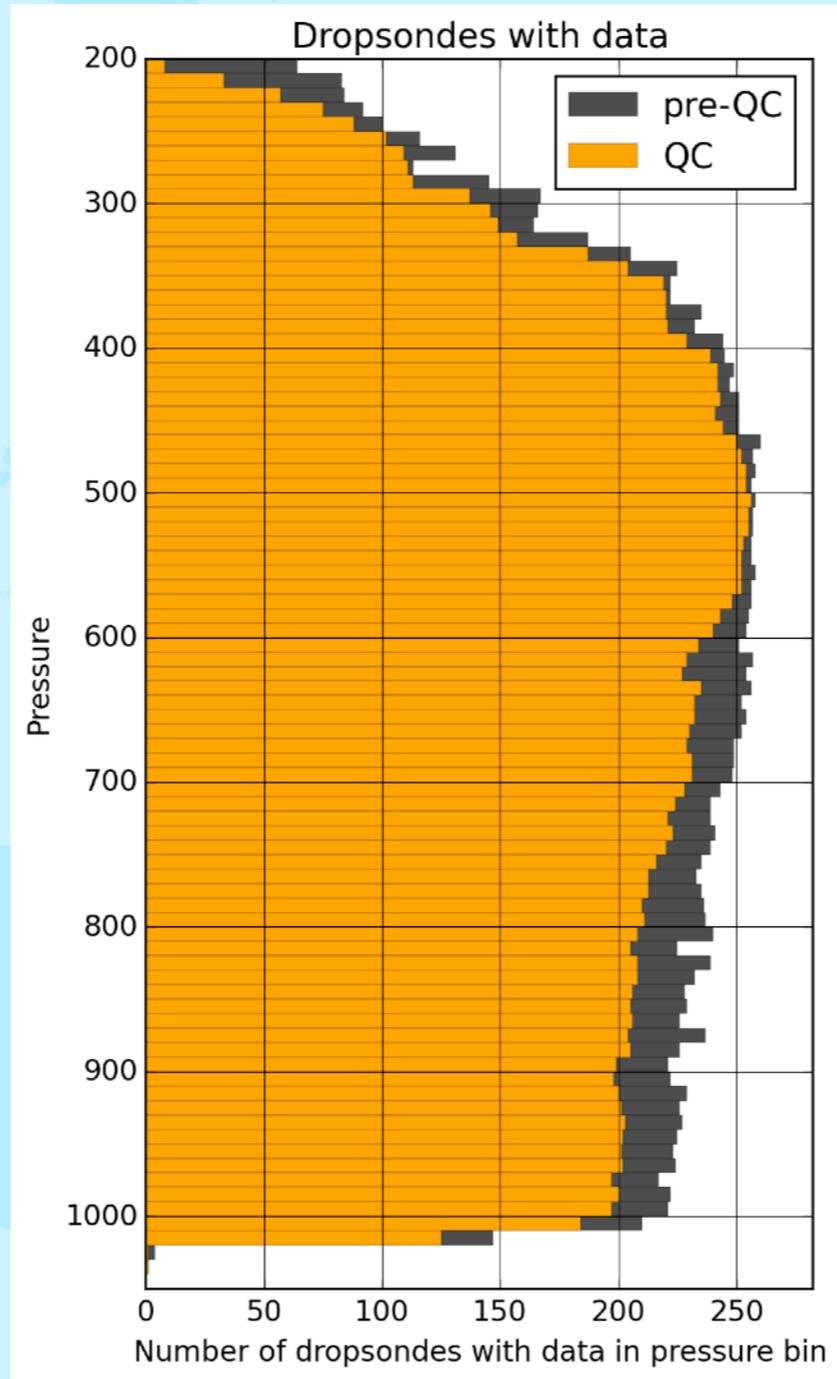
\* On original data collected during CPEX

# Dropsonde QC\* - overall

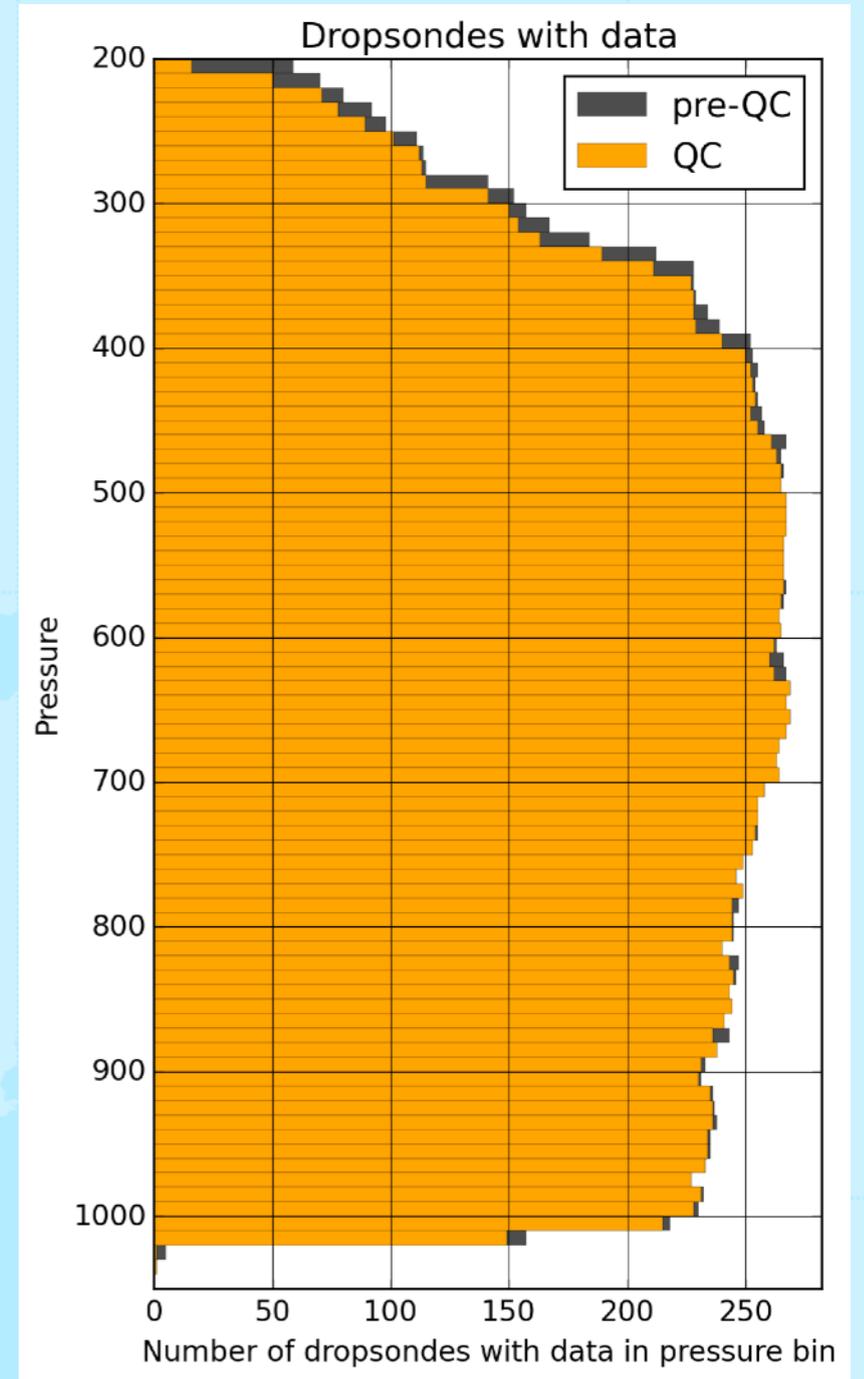
## Temperature



## Dewpoint

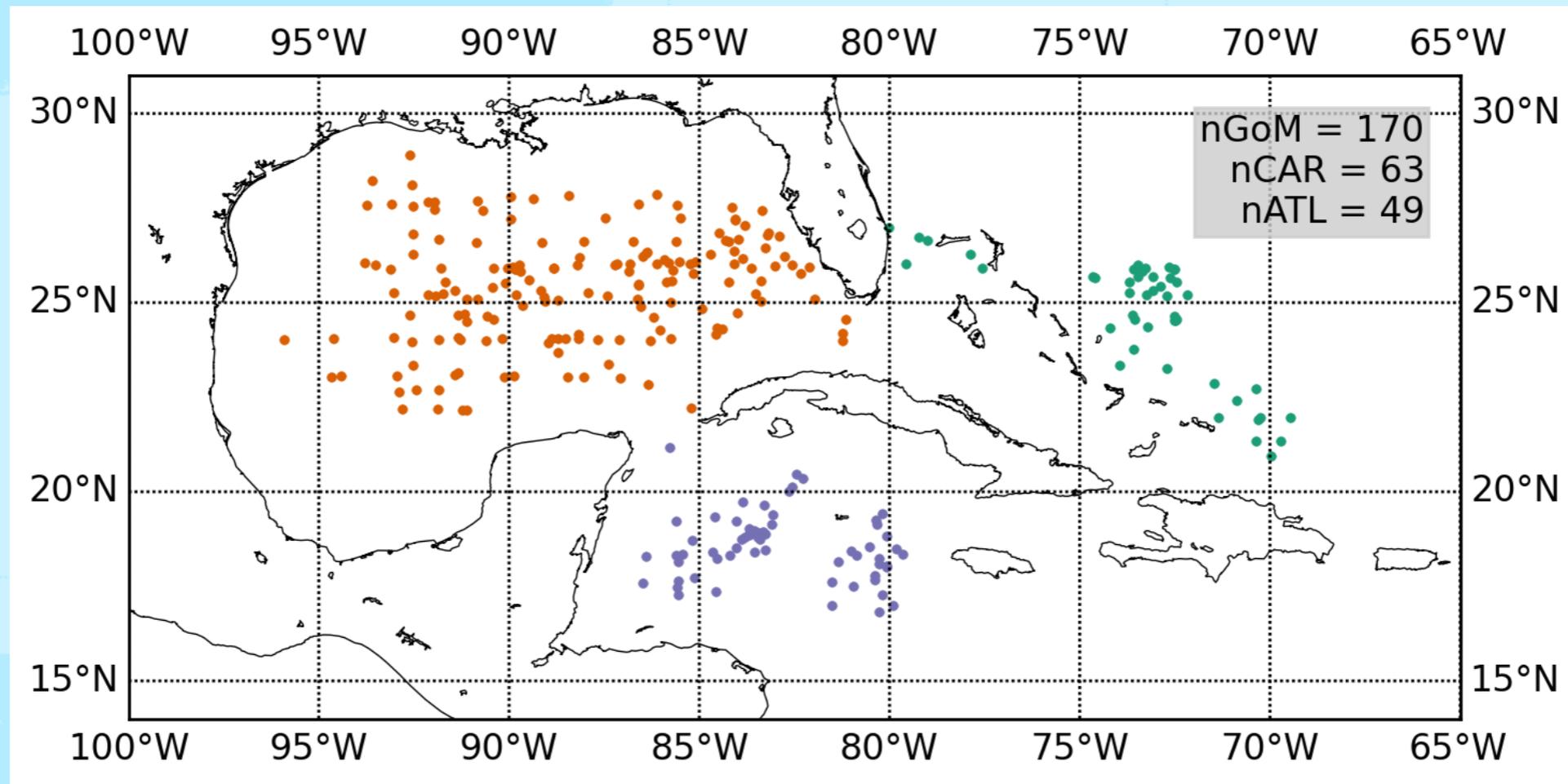


## Winds



\* On original data collected during CPEX

# Dropsonde QC\* - summary

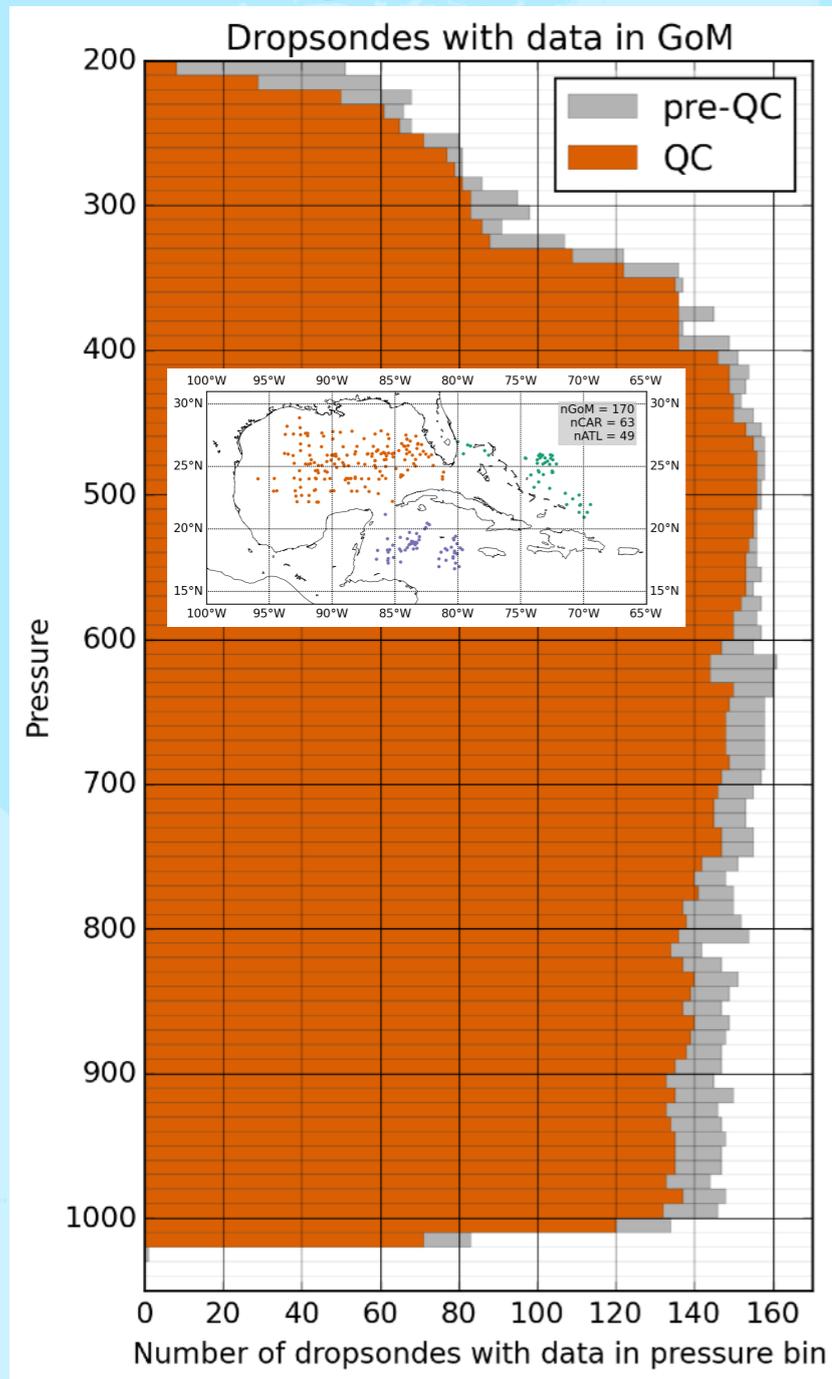


- 282 dropsonde records collected over 16 flights.
- 8 flights in Gulf of Mexico (GoM) → **170** dropsondes
- 4 flights in the Caribbean (CAR) → **63** dropsondes
- 3 flights in the West Atlantic (ATL) → **49** dropsondes

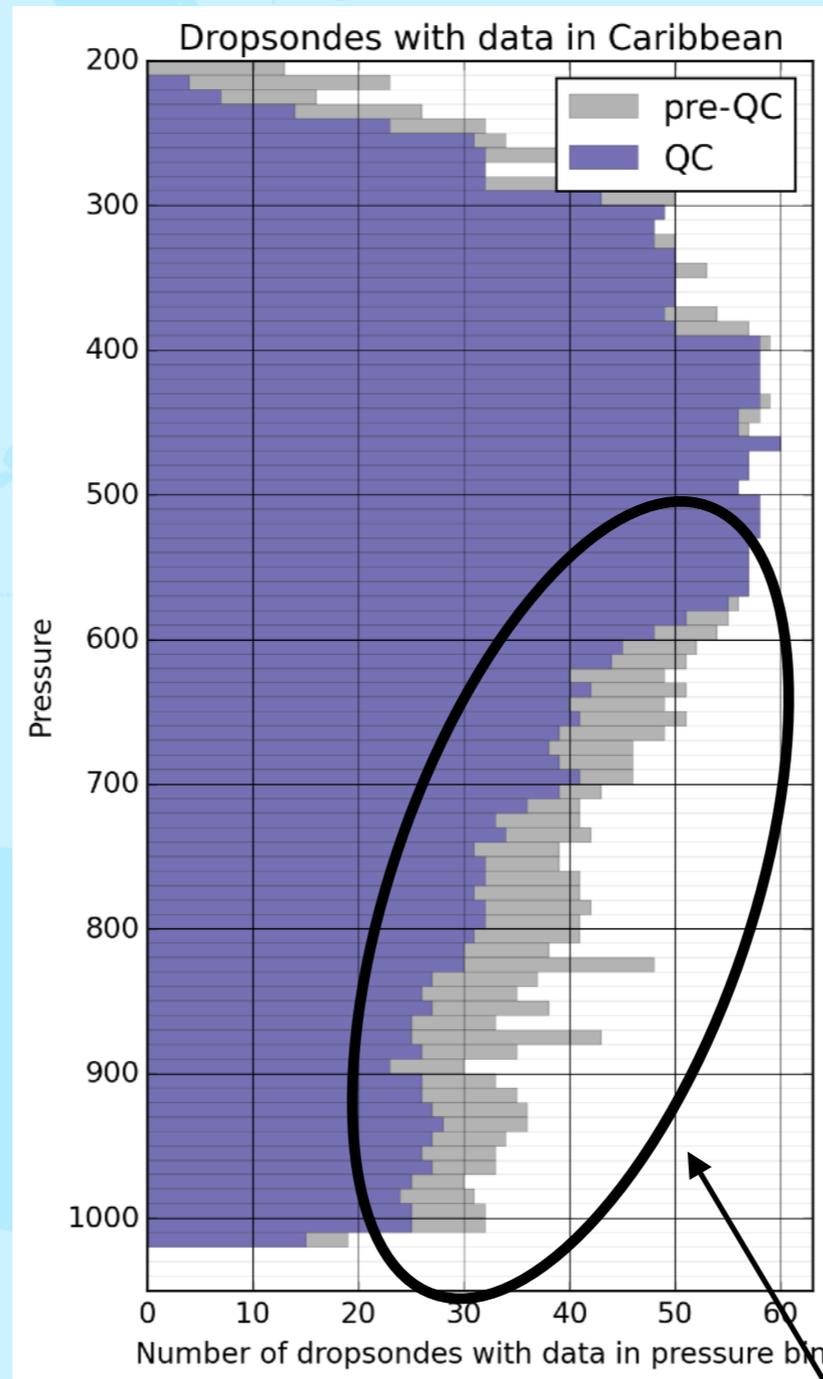
\* On original data collected during CPEX

# Dropsonde QC\* - regional

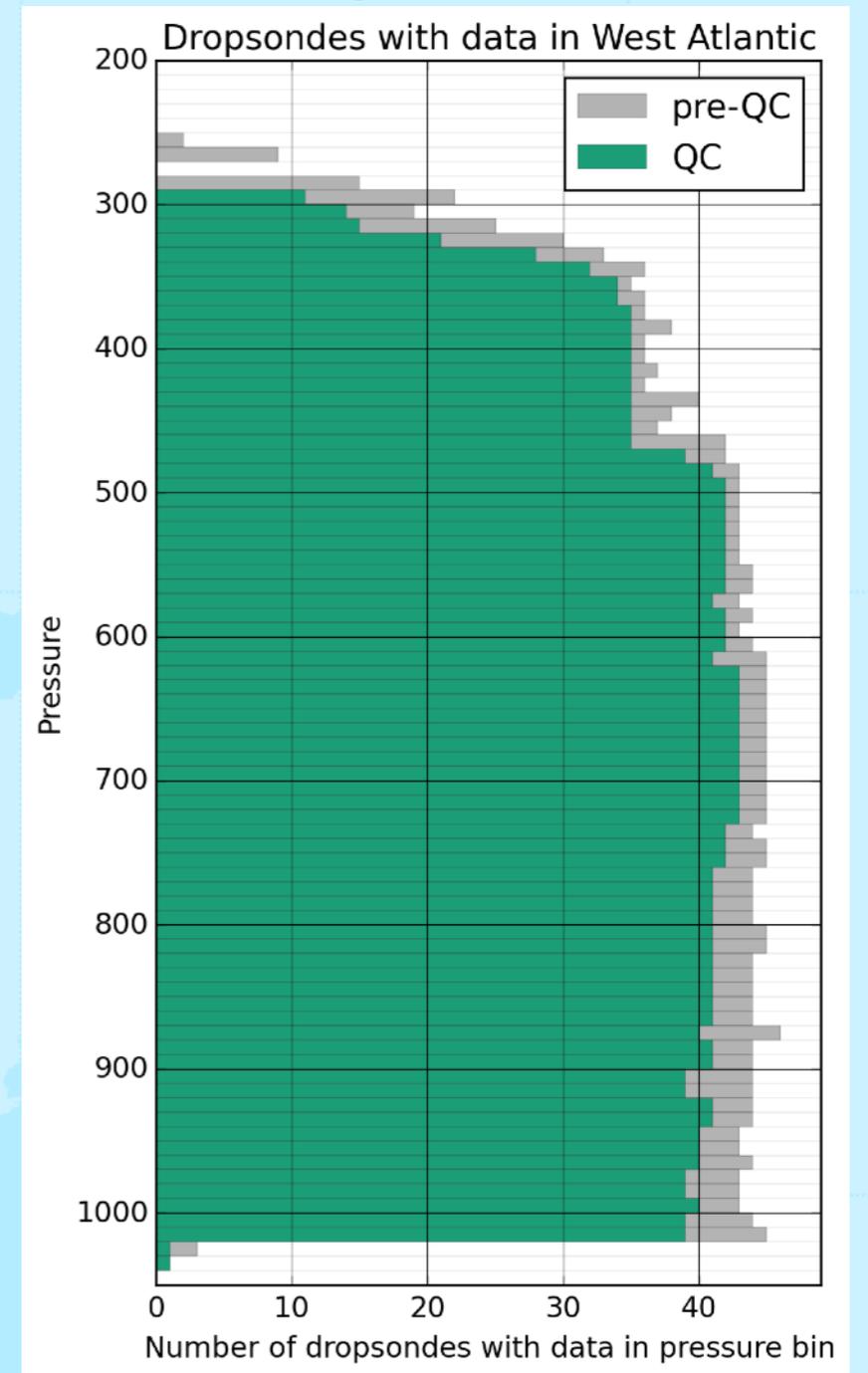
## Dewpoint, GOM



## Dewpoint, CAR



## Dewpoint, ATL



A lot of missing data below 600 mb,  
more removed during QC

\* On original data collected during CPEX

# Dropsonde QC\* - summary

After removing data records that were never dropped, or had fewer than 100 points, we are left with **282 dropsonde data records**.

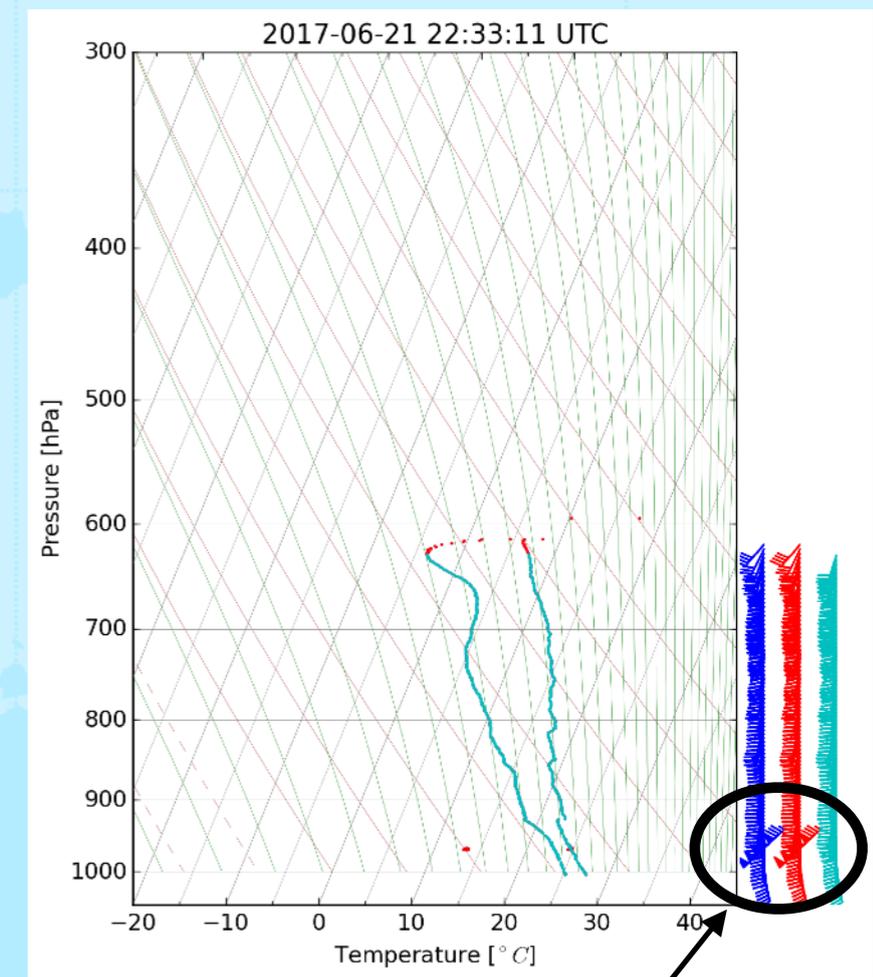
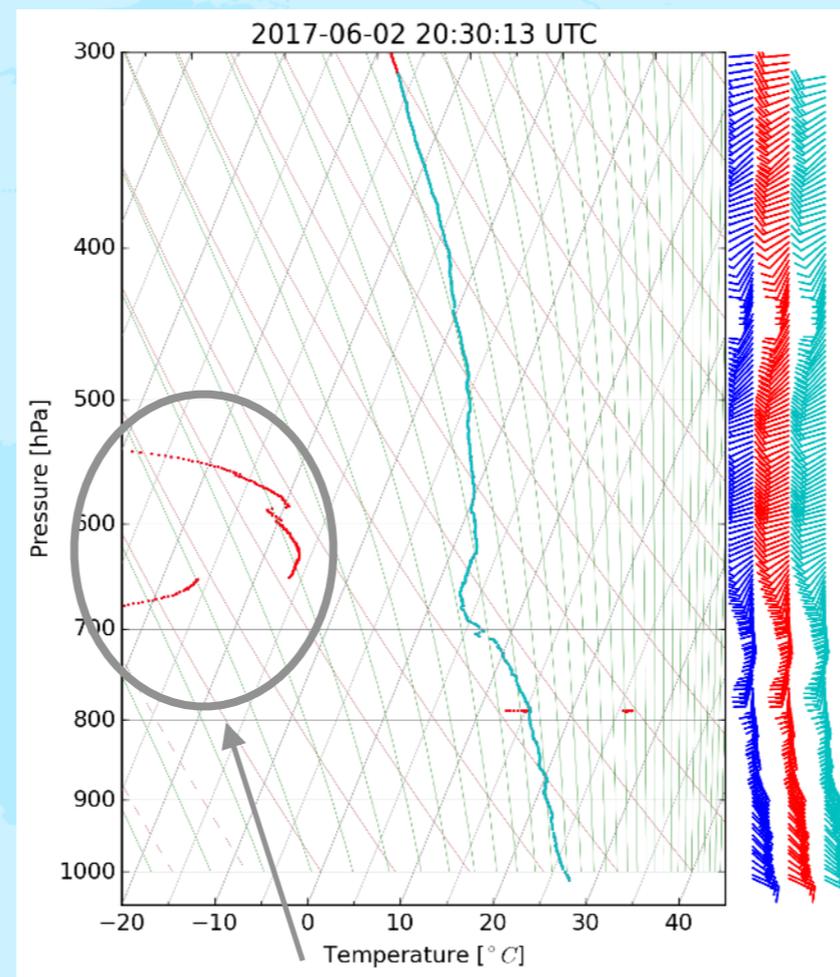
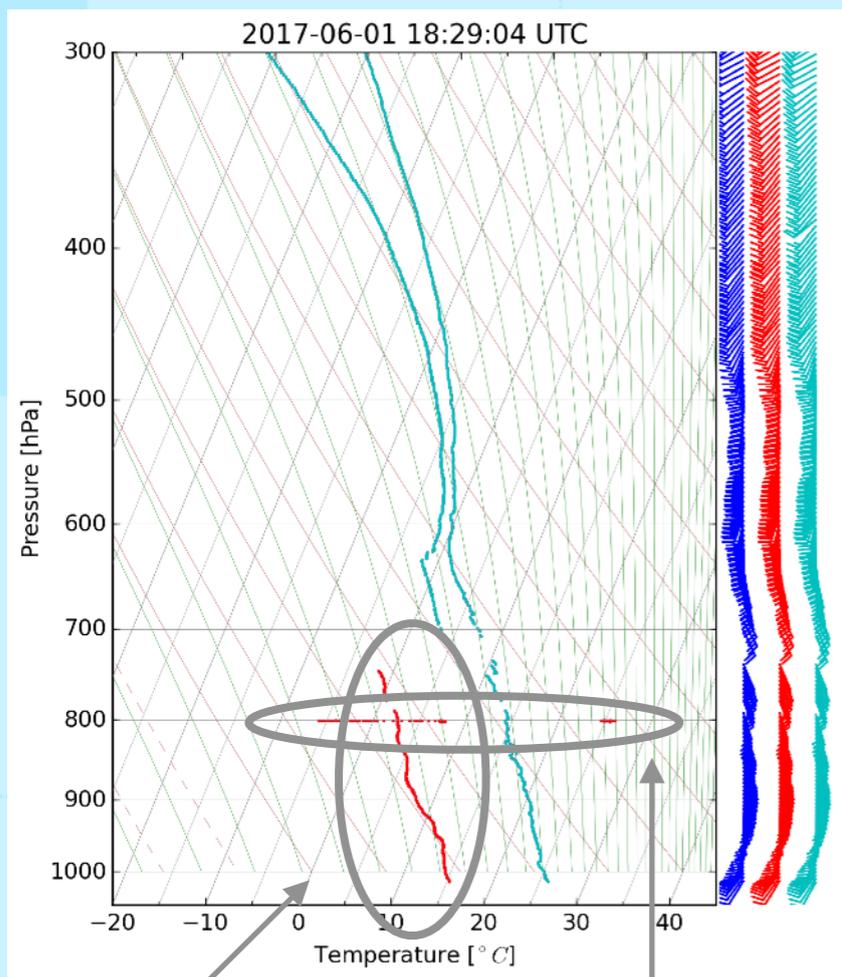
Examples (**blue**: raw data, **red**: V3 data, **cyan**: our QC):

\* On original data collected during CPEX

# Dropsonde QC\* - summary

After removing data records that were never dropped, or had fewer than 100 points, we are left with **282 dropsonde data records**.

Examples (**blue**: raw data, **red**: V3 data, **cyan**: our QC):



Large moisture discontinuities

Data collected on aircraft

Unrealistic humidity values

Airplane velocities



# **Convective Environments in Three Regions Using Dropsondes**

# Dropsonde Classification

Separate dropsondes based on their environment:

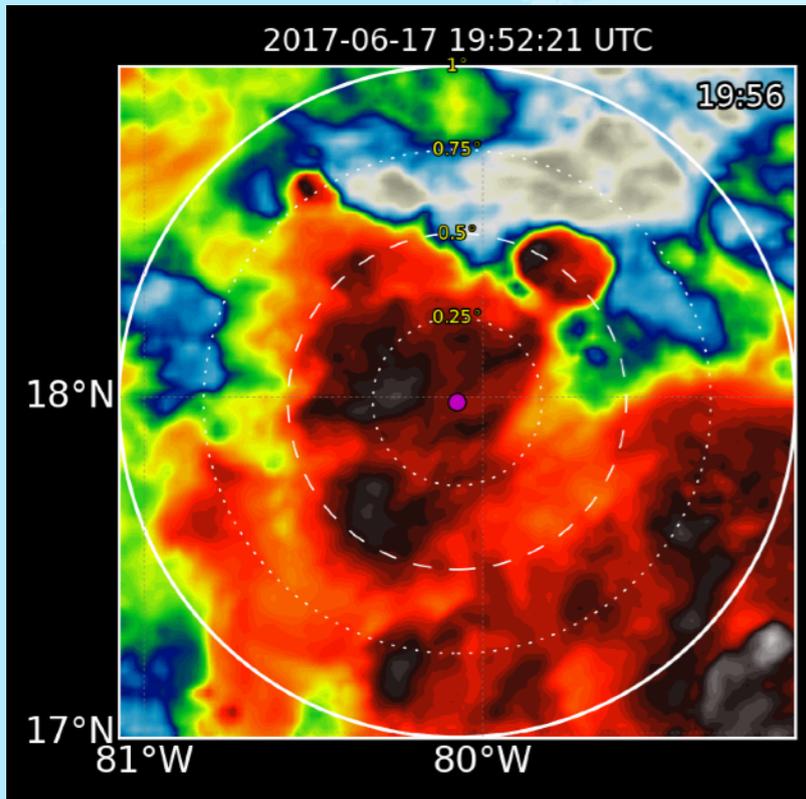
- **Convective,**
- **Disturbed** (near convection),
- **Undisturbed** (far from convection).

The classification is primarily done based on GOES-16 IR brightness temperature.

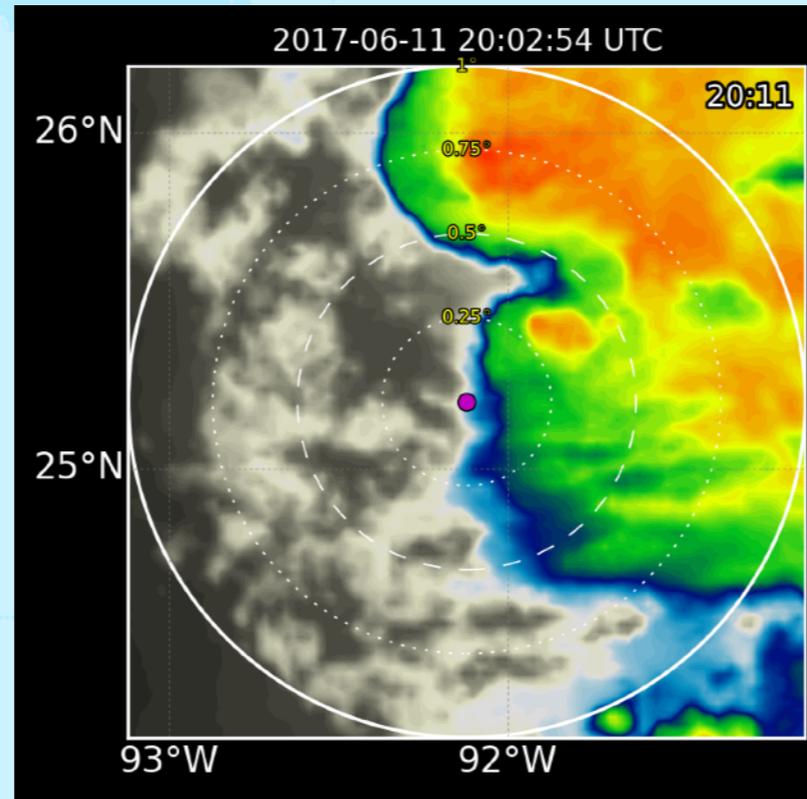
- We double-check the convective v. disturbed classification using APR-2.

# Dropsonde Classification

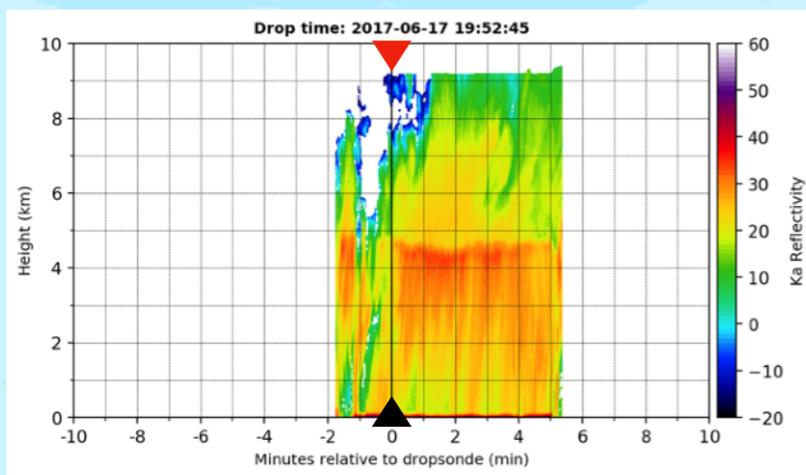
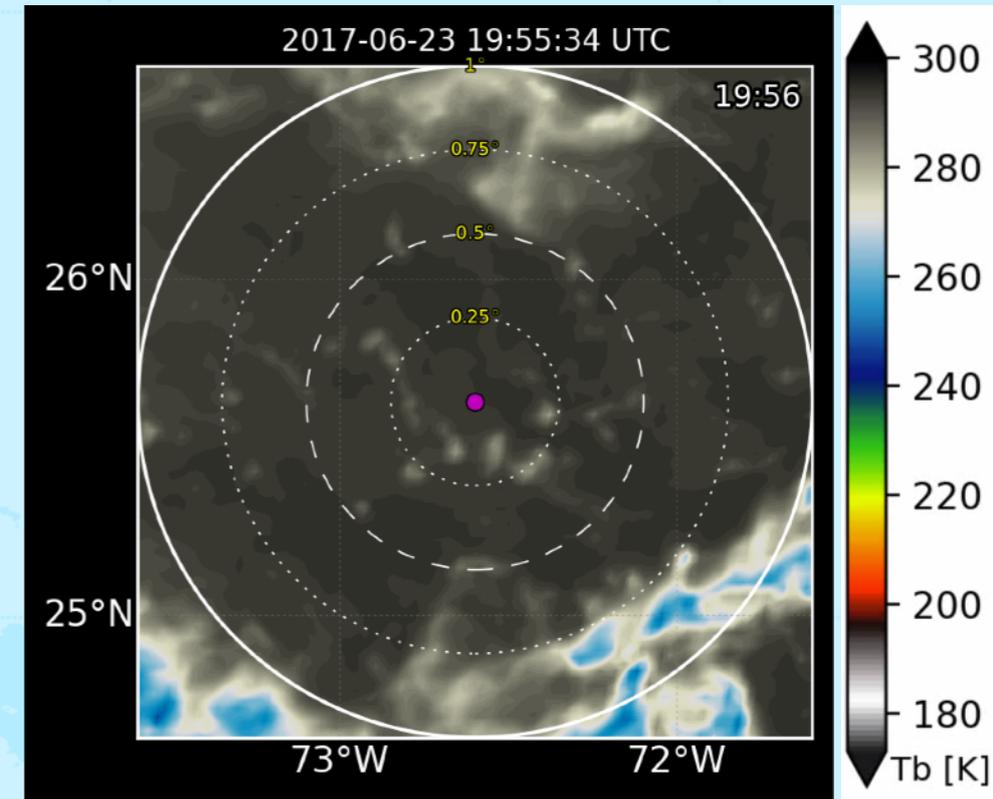
## Convective



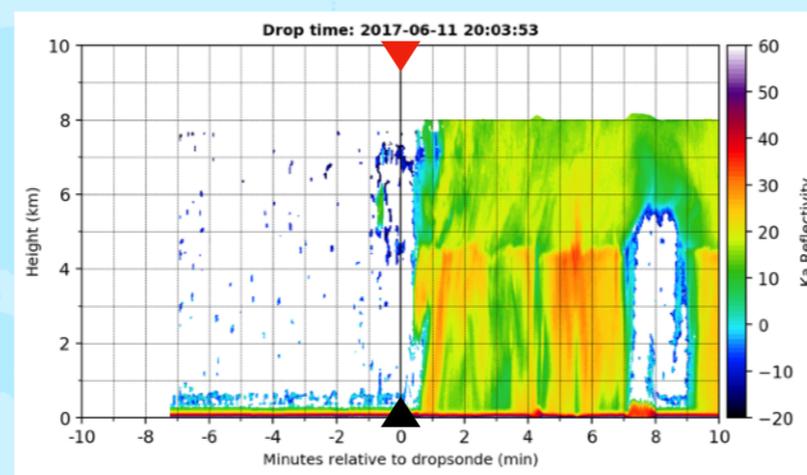
## Disturbed



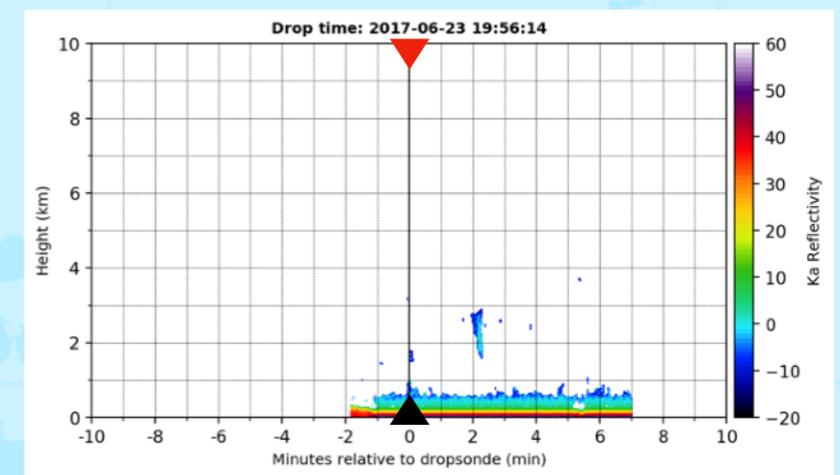
## Undisturbed



(106)



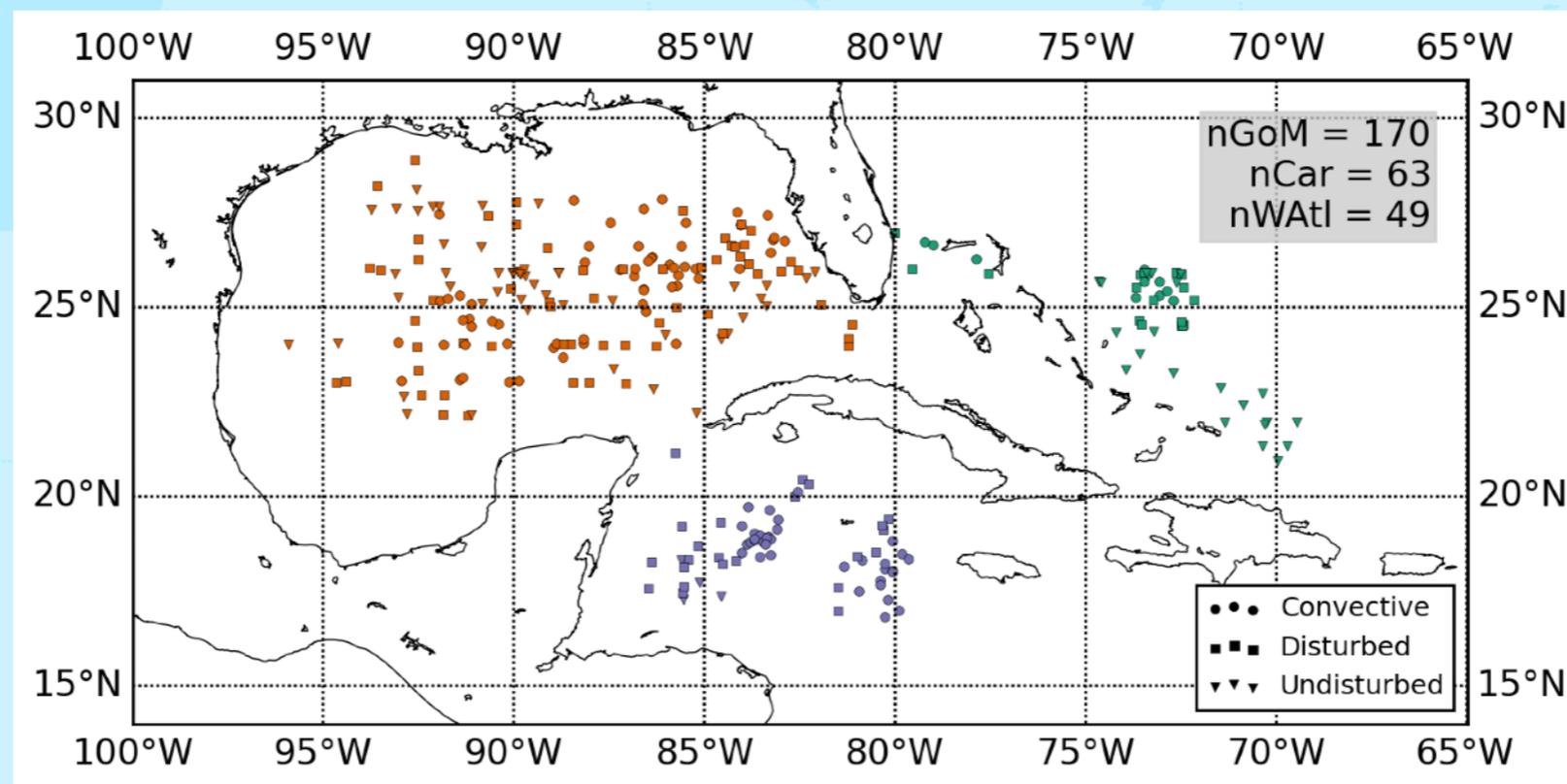
(100)



(76)

# Dropsonde Classification

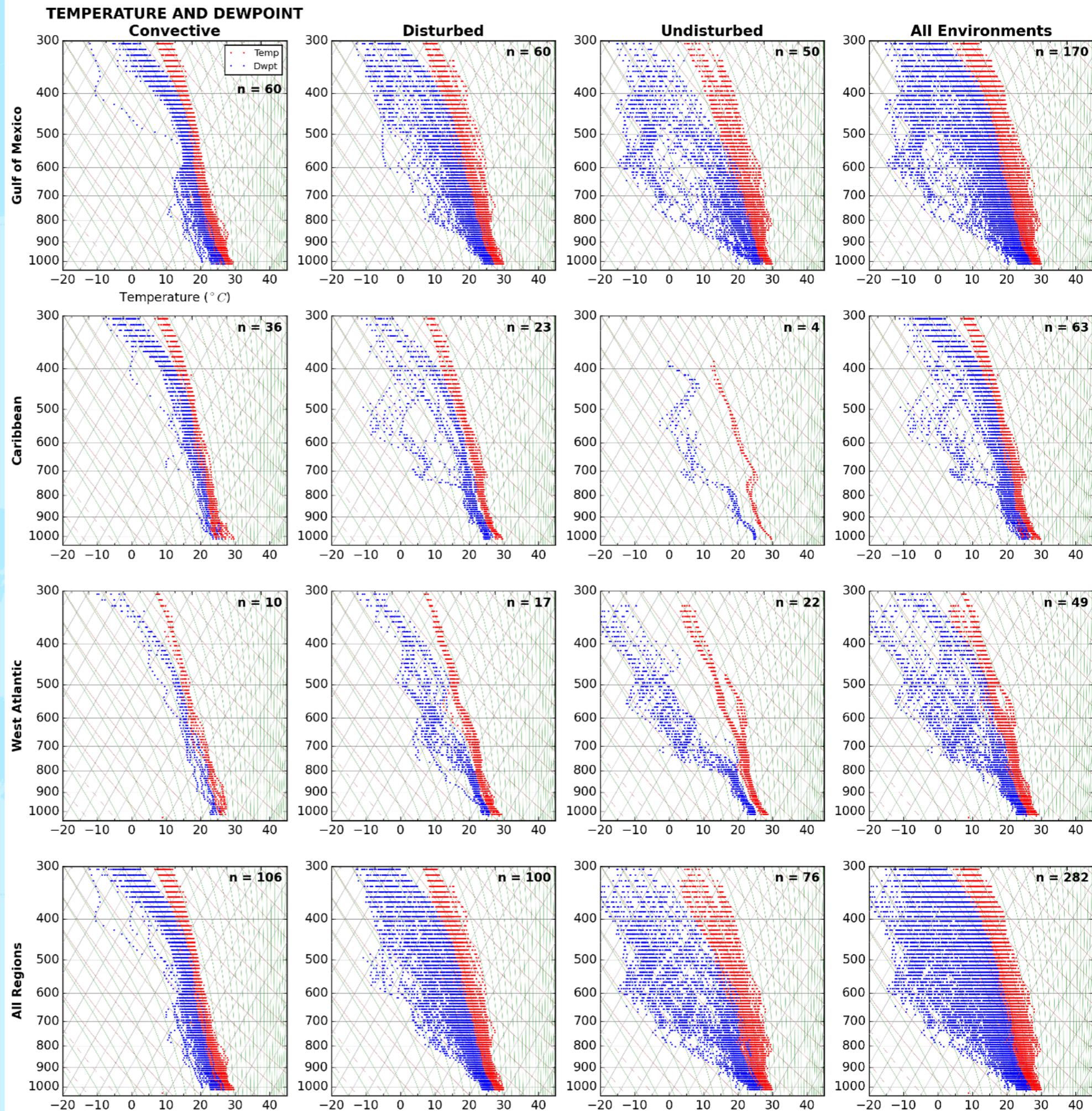
	Convective	Disturbed	Undisturbed	$\Sigma$
GOM	60	60	50	170
CAR	36	23	4	63
ATL	10	17	22	49
$\Sigma$	106	100	76	282



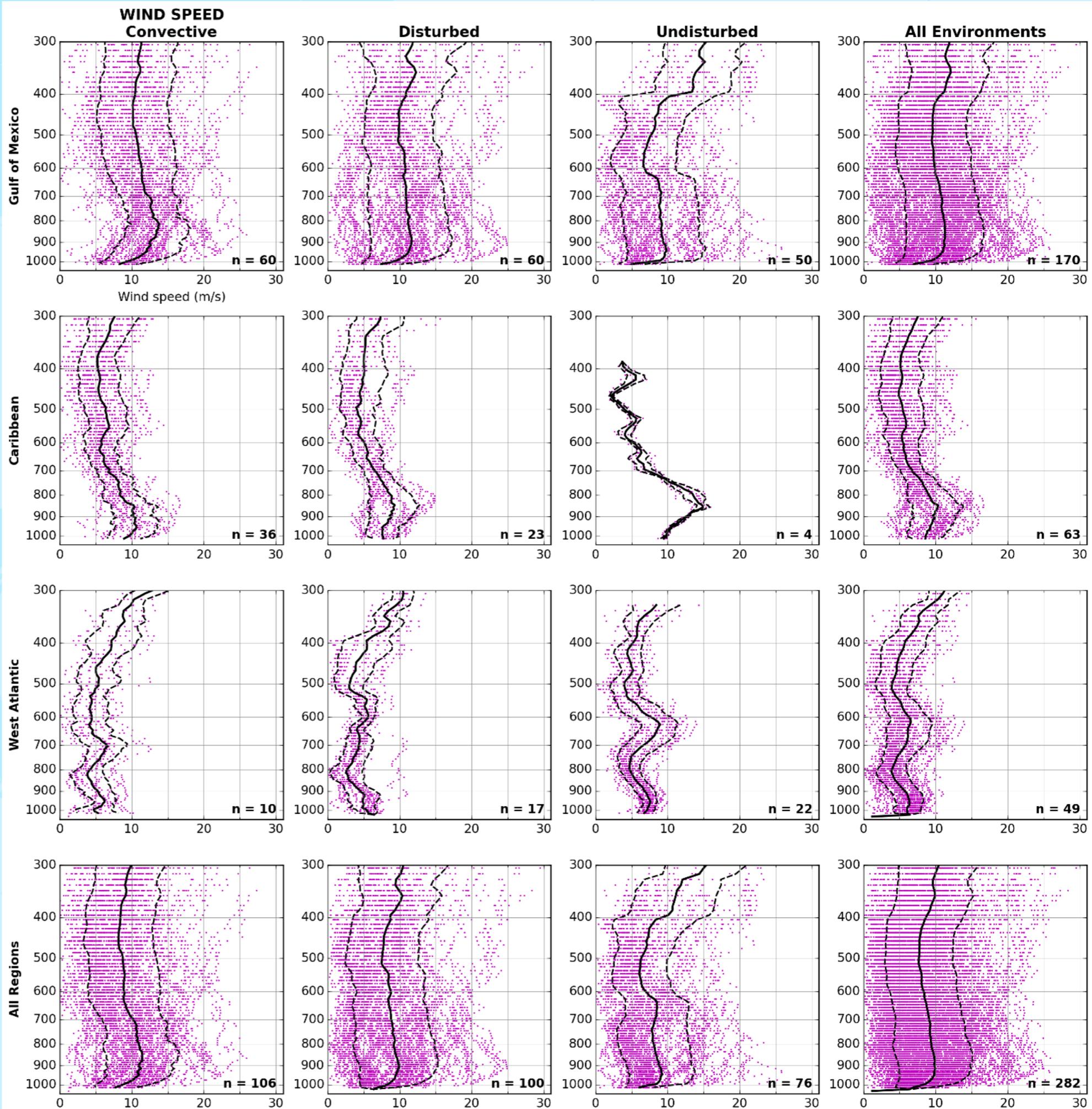
# Separation Summary

**Convective:**  
similar in all  
regions

**Undisturbed:**  
CAR and ATL  
moist a lower  
levels, dry above  
800 mb; GOM has  
a bimodal  
signature in the  
mid-levels (pre-  
and post-frontal).



# Separation Summary



# Data Availability after Separation

We had issues with dropsondes reporting in convective environments, mostly below 600 mb.

The values that were reported were also not always accurate, and were further flagged by QC.

GOM

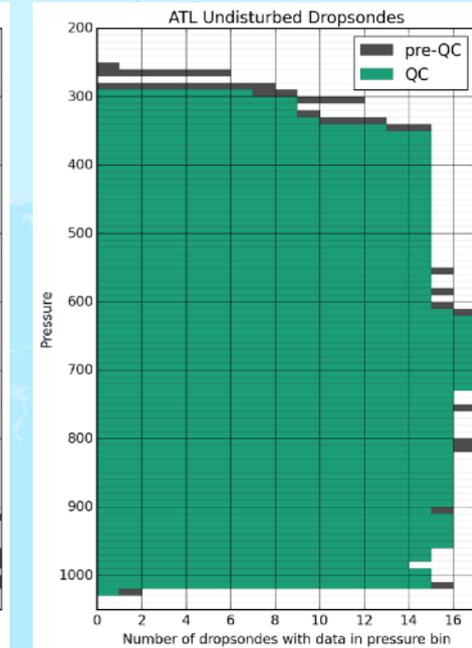
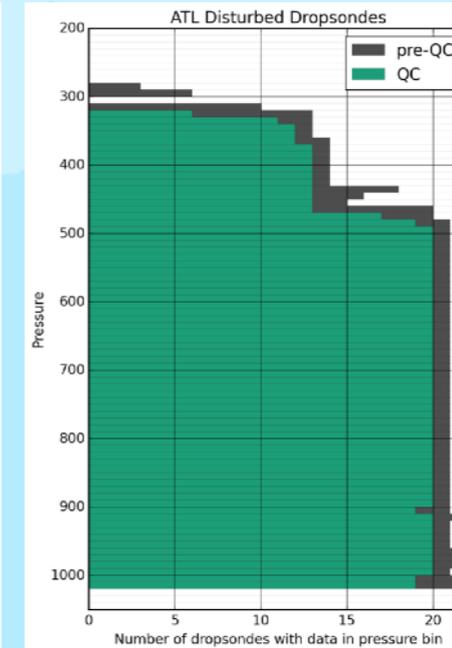
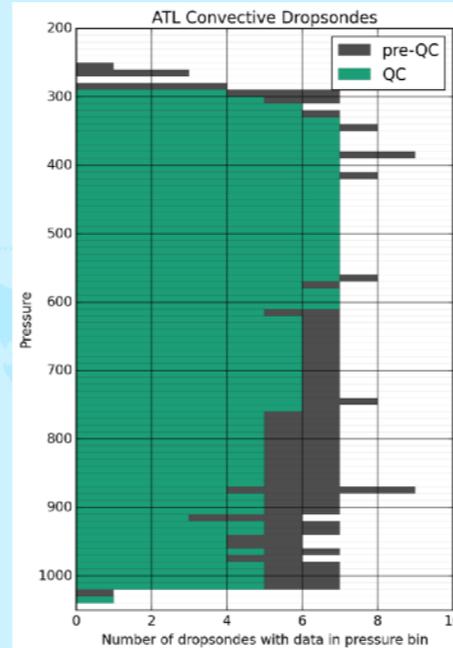
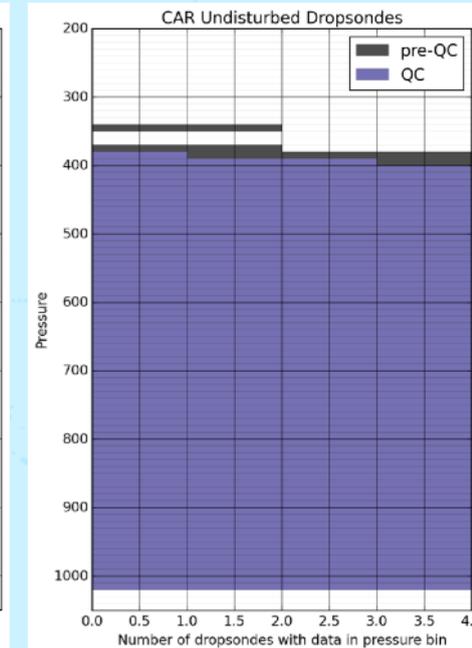
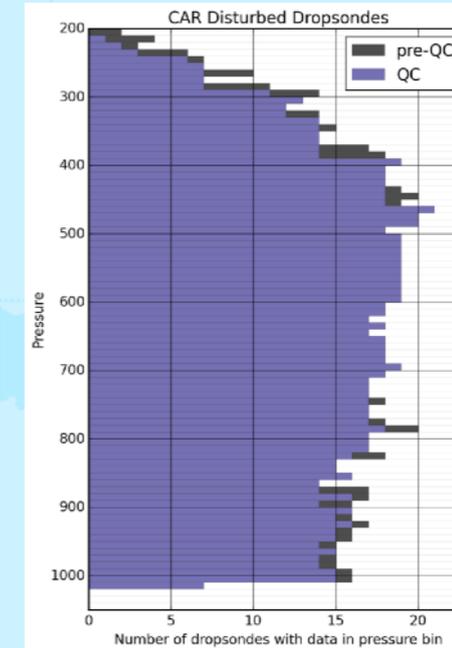
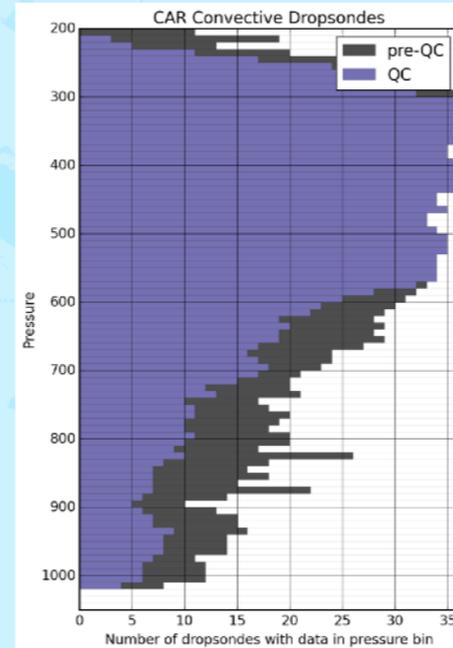
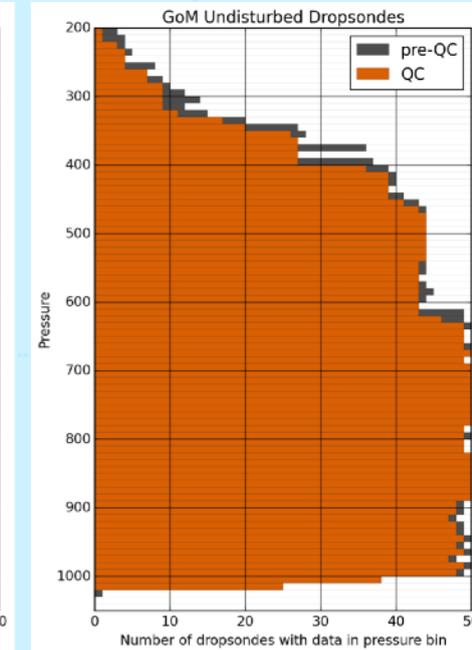
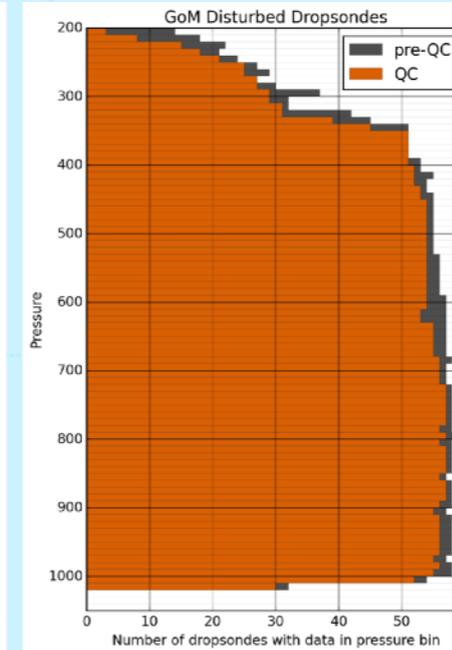
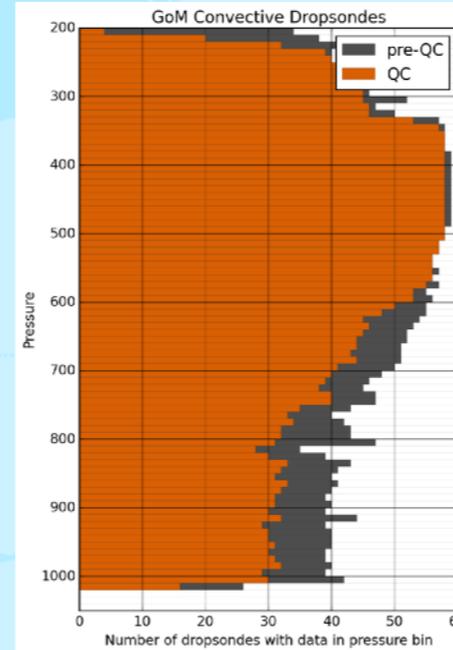
CAR

ATL

Convective

Disturbed

Undisturbed



# Summary

Having quality unified QC data is important for any kind of statistical comparison.

Convective environments (convective, disturbed, and undisturbed) are distinct, and there are differences among the three regions.

Future work: How does this relate to the life-cycle of convection?