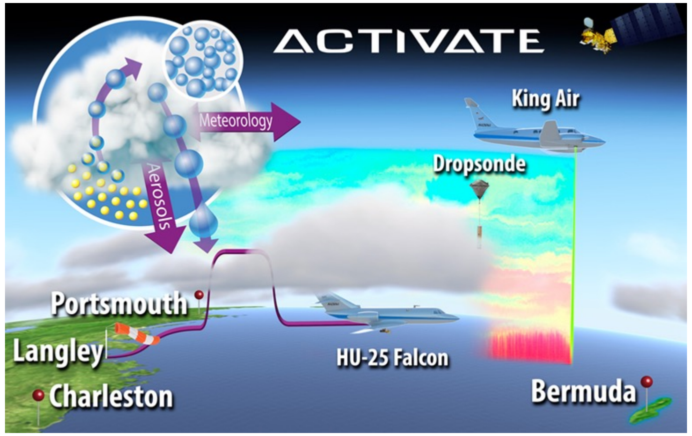
Updates from Zeng's Group



HSRL2 and dropsonde MLH comparison (Xu et al. 2023, submitted)

Relation between HSRL2 cloud fractions versus dropsonde environmental conditions (Cutler et al.)

Triple-correlation analysis of the HSRL2, RSP, and MODIS AOD data (Siu et al., 2023, submitted)

Data gridding (Cutler et al.) - Monday afternoon

Intercomparison of PBLH algorithms (Xu et al.) - Tuesday afternoon

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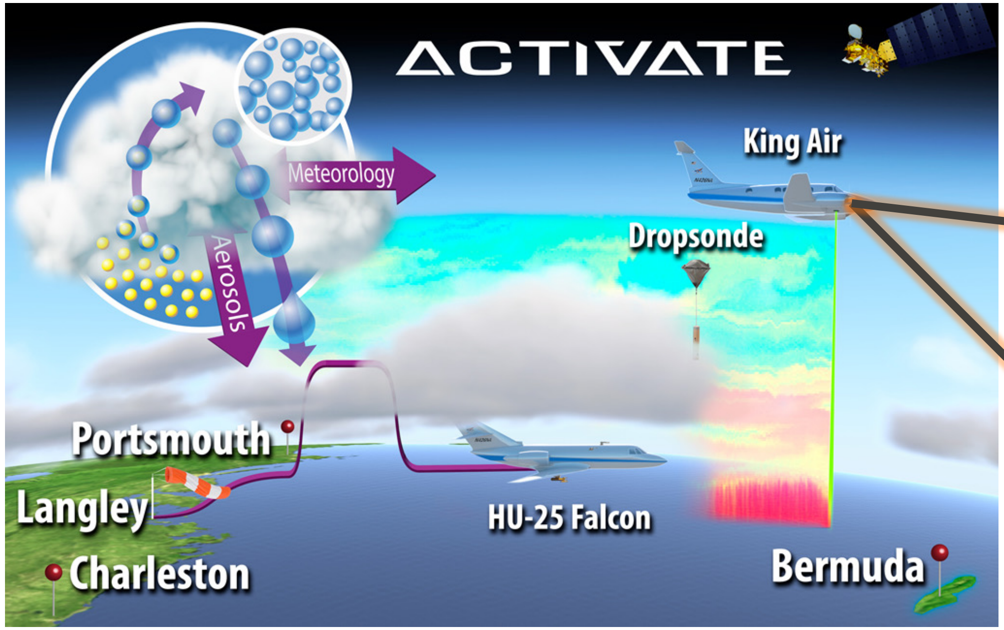
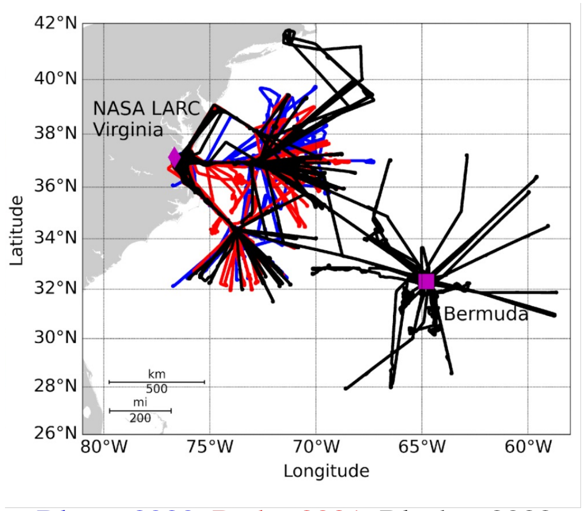
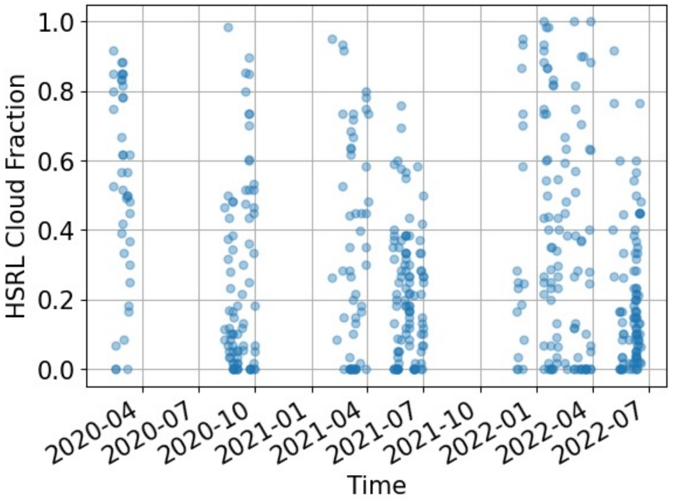
The ACTIVATE field campaign



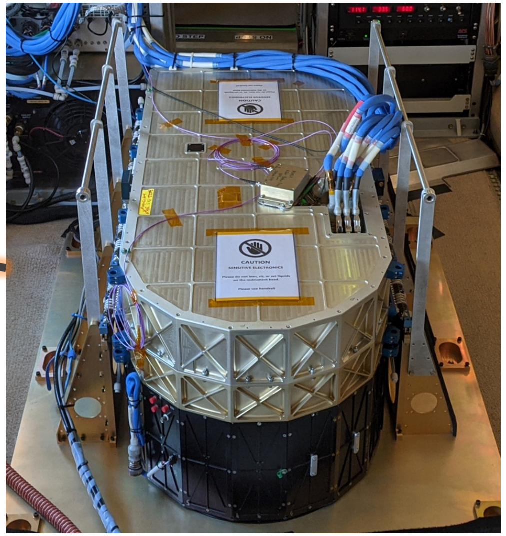




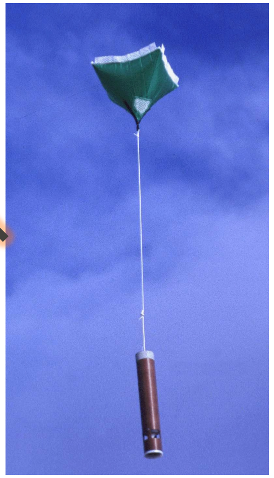
Blue = 2020, Red = 2021, Black = 2022

HSRL

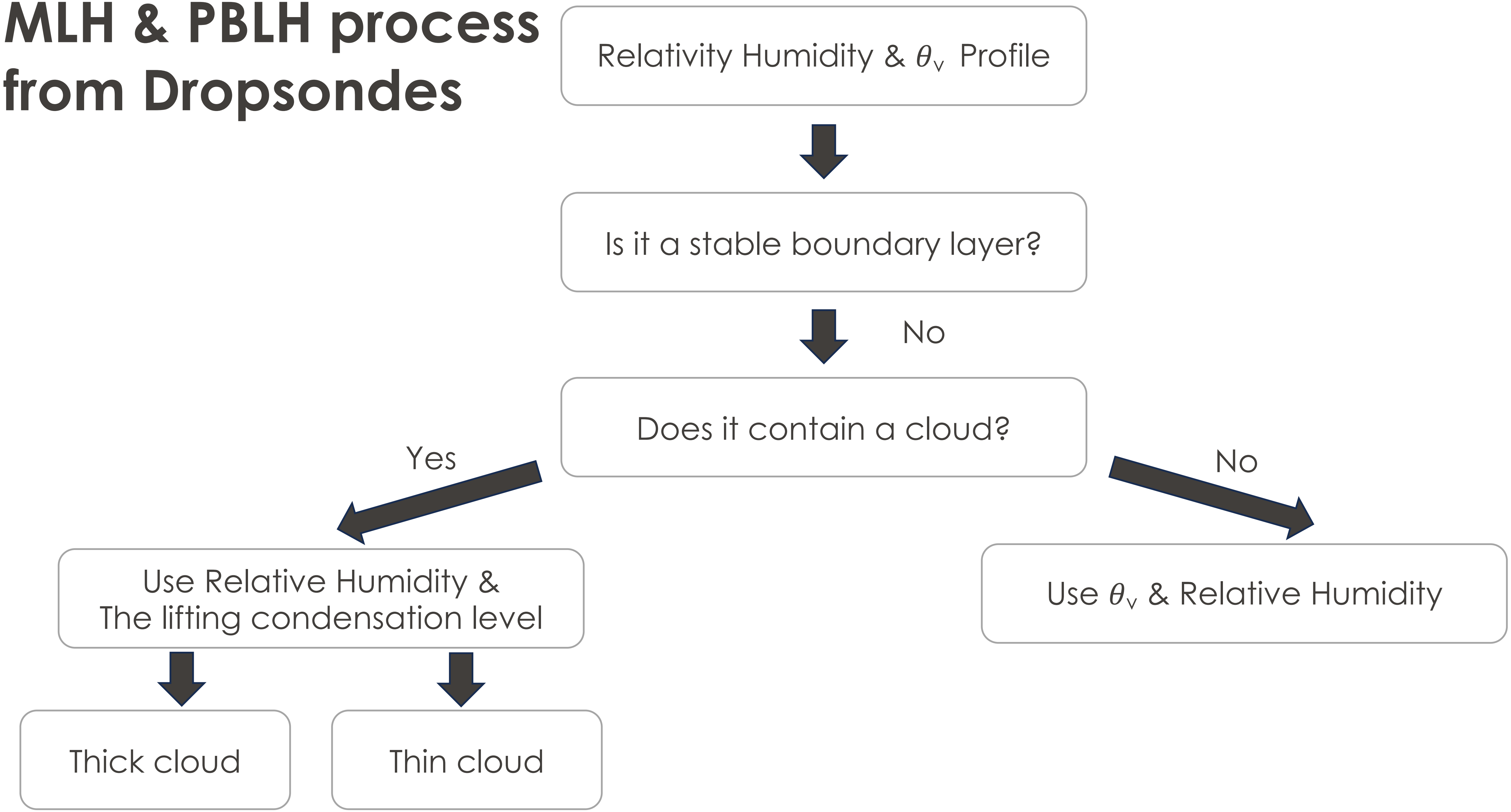
(airborne **H**igh **S**pectral **R**esolution **L**idar)



Dropsondes

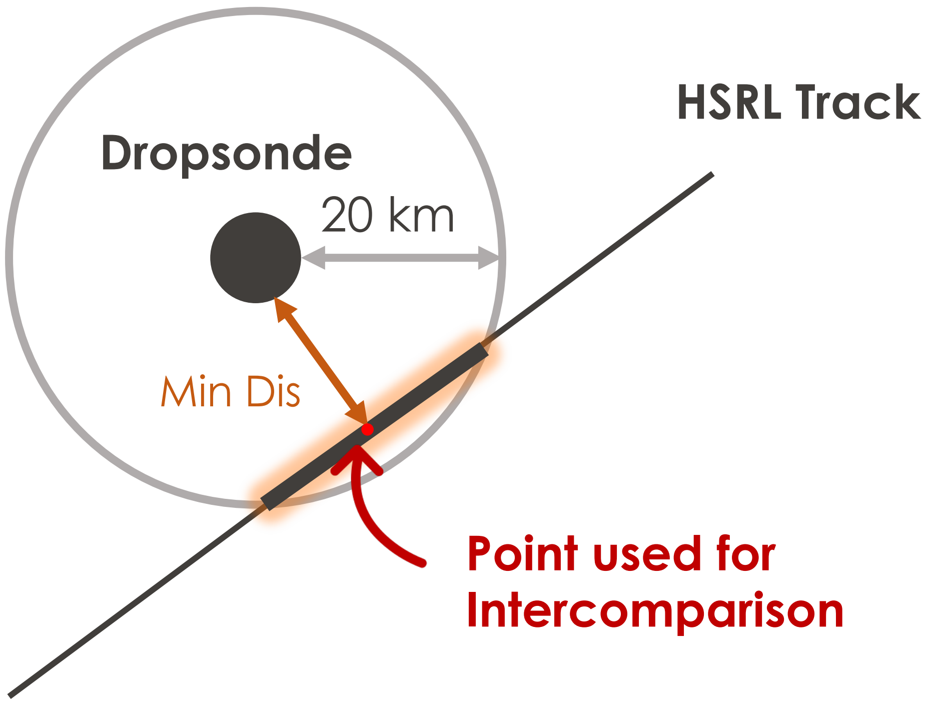


MLH & PBLH process from Dropsondes



(Xu et al.. 2023, *JGR-Atmo*, Under Review)

Data Collocation

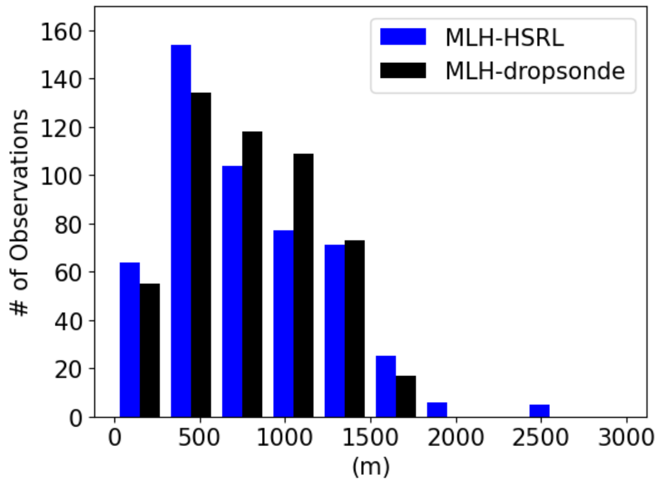


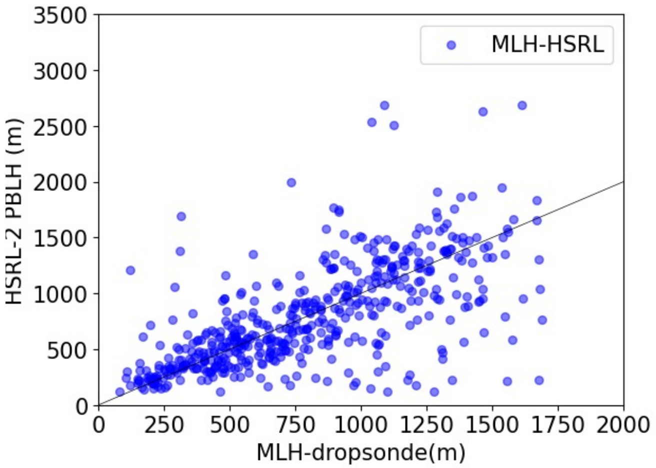
Removed in **statistic analysis** (but included in **the database)**:

- Dropsondes that **too far away**
- Dropsondes with an **ambiguous PBLH/MLH**

506 Dropsondes

How does MLH-HSRL perform on MLH?





2020 - 2022 MLH			
	R^2	Median Difference (m)	IQR Difference (m)
MLH-HSRL	0.44	18	286

➢ **The MLH-HSRL performs well for MLH.**

Evaluating the Relationship Between Low Cloud Fraction and Atmospheric Stability Indices Over the Western North Atlantic

Lauren Cutler (laurencutler@arizona.edu) and **Annalisa Minke**

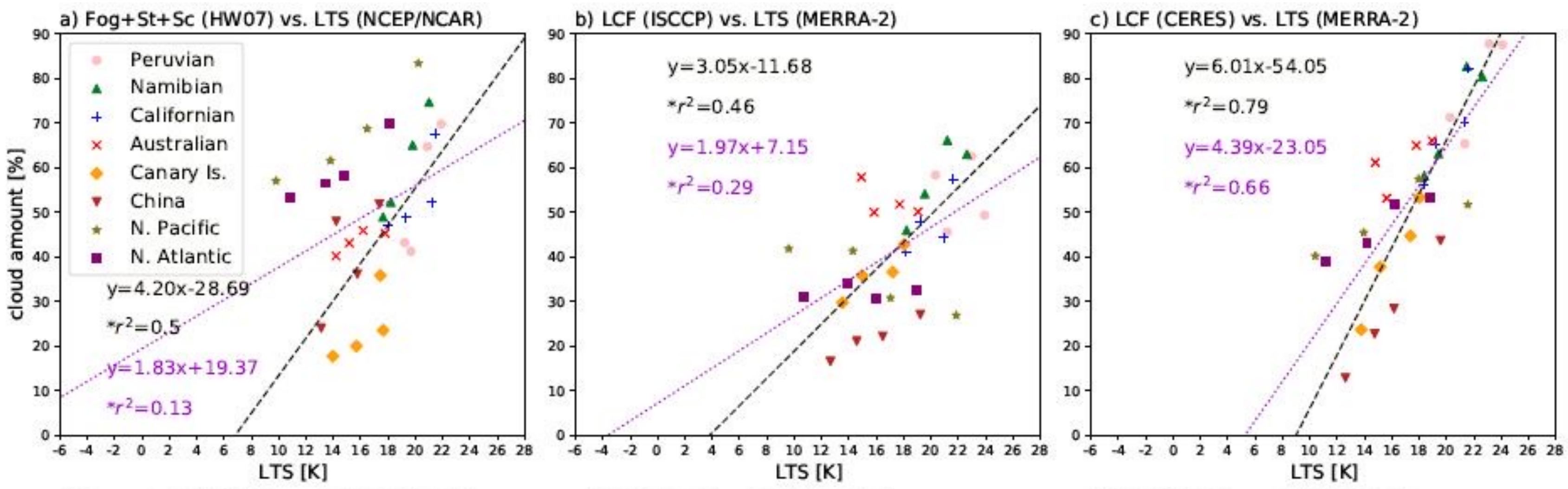


Figure from Cutler et al. (2022, GRL)

Relationship of seasonal low cloud fraction and LTS (pictured) and EIS (not pictured) vary depending on the cloud dataset used

How do the relationships between low cloud fraction and atmospheric stability indices from ACTIVATE observations compare to the same relationships at individual time steps in atmospheric models?

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Variable	Instrument	Info
Low Cloud Fraction (**LCF**)	HSRL-2, cloud_top_height	2min & 5min (calculated)
Lower Tropospheric Stability (**LTS**) (Klein & Hartmann, 1993)	Dropsonde	$LTS = \theta_{700} - \theta_{slp}$
Estimated Inversion Strength (**EIS**) (Wood & Bretherton, 2006)	Dropsonde	$EIS = LTS - \Gamma_m^{850}(z_{700} - LCL)$
Estimated Cloud-Top Entrainment Index (**ECTEI**) (Kawai et al., 2017)	Dropsonde	$ECTEI = EIS - \beta(L/c_p)(q_{sfc} - q_{700})$
Cold-Air Outbreak Index (**CAO**)	Dropsonde	$CAO = \theta_{skt} - \theta_{800}$
Inversion Strength **(IS)**	Dropsonde	Calculated from PBLH

MAM - ACTIVATE

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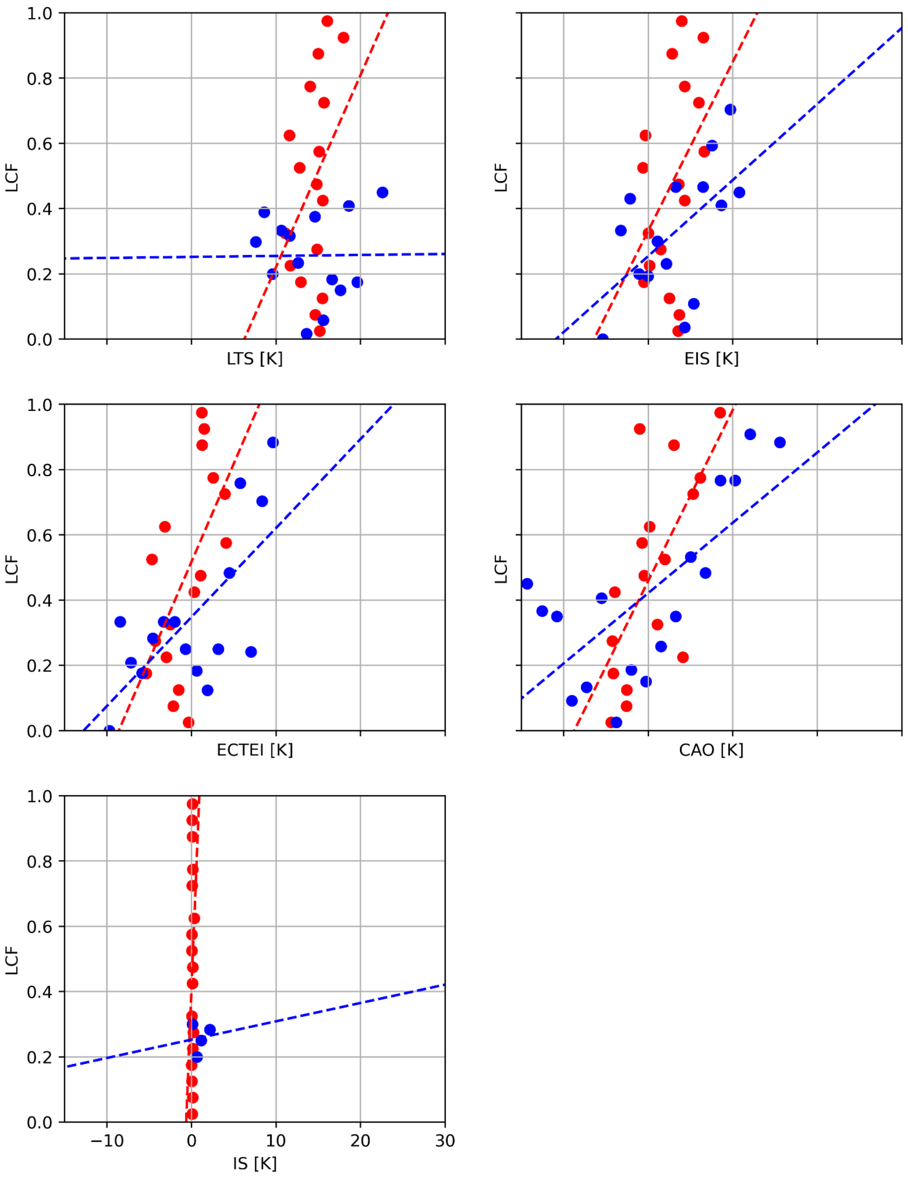


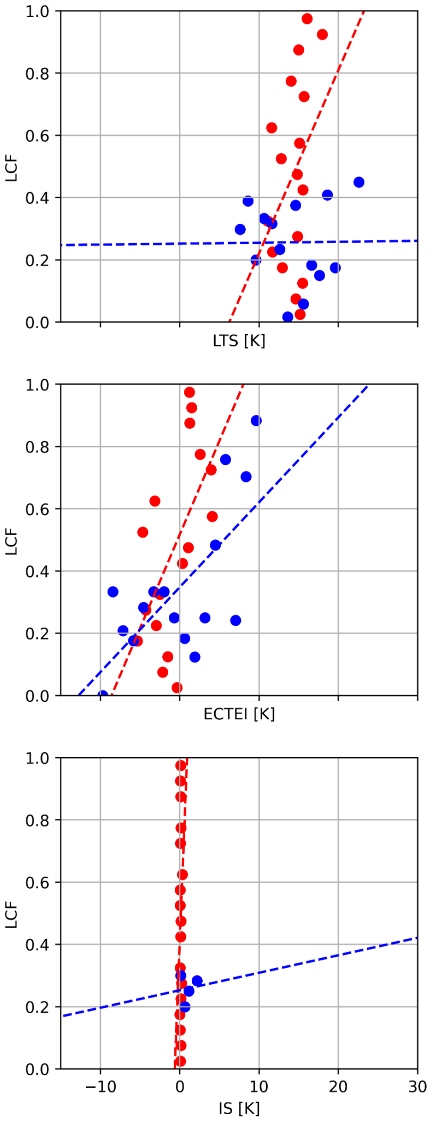
Red = binned by cloud

Blue = binned by index

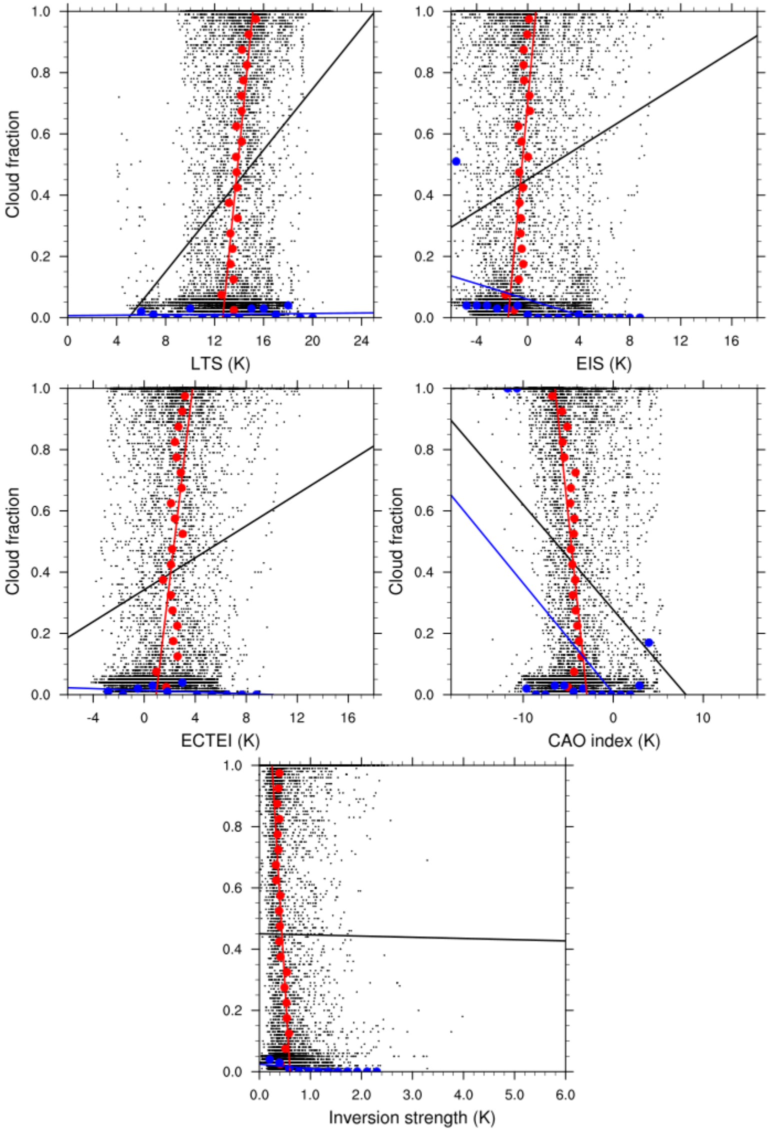
Index	r^2 (Binned by Cloud)	r^2 (Binned by Index)
LTS	0.12	0.00
EIS	0.17	**0.33**
ECTEI	**0.34**	**0.48**
CAO	**0.46**	**0.50**
IS	0.03	0.01

ECTEI and CAO are the best predictors of LCF for both binning scenarios.

MAM - ACTIVATE



May – E3SM2



Red = binned by cloud

Blue = binned by index

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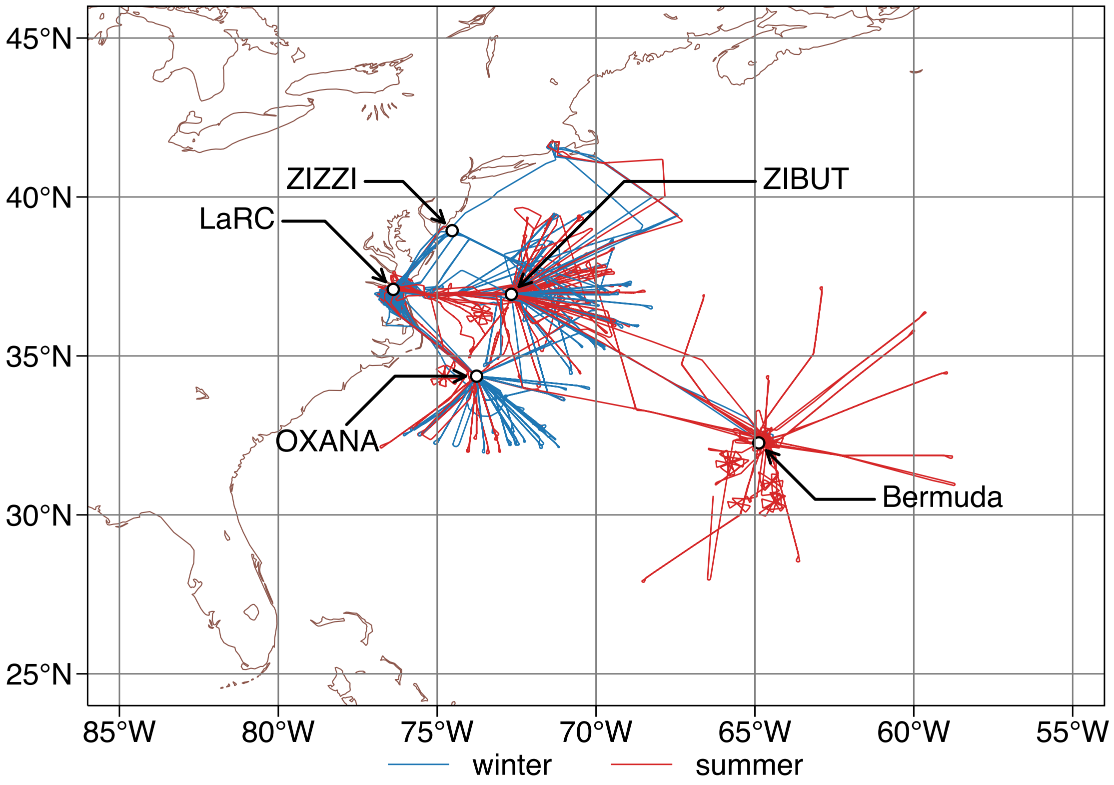
The cloud fraction values for the binned by index case are lower for E3SM2 (CF<0.2) compared to observations from ACTIVATE.

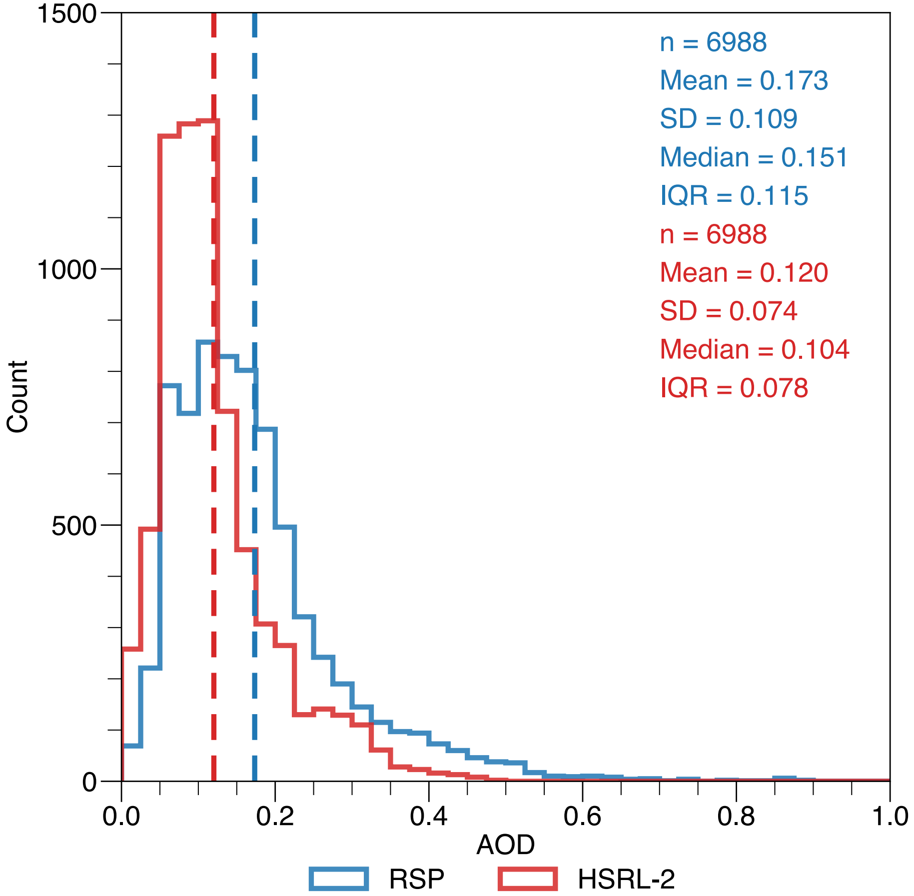
Retrievals of aerosol optical depth over the western North Atlantic during ACTIVATE

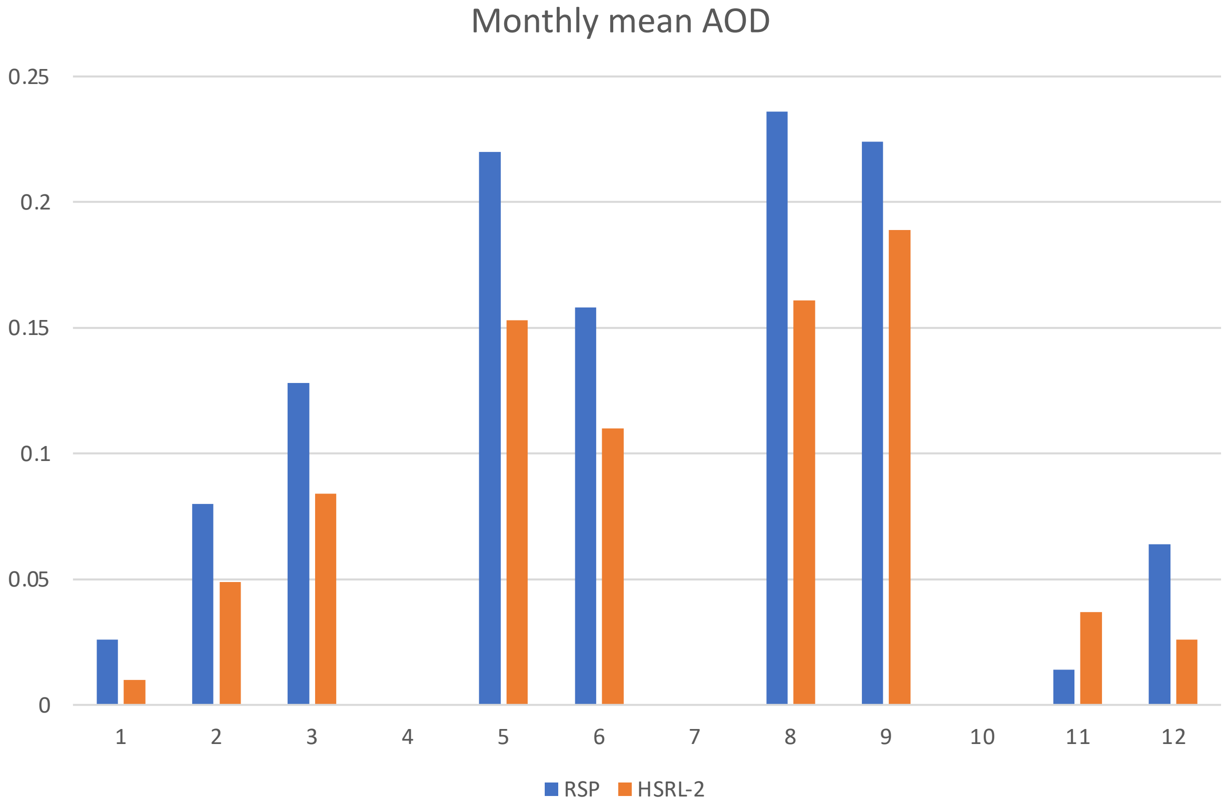
- Two instruments retrieve AOD during ACTIVATE
  - Research Scanning Polarimeter (RSP)
  - Second Generation High Spectral Resolution Lidar (HSRL-2)
- Challenge:
  - How do we objectively assess the two datasets?
- Solution:
  - Technique: Triple collocation
  - Third dataset: Moderate Resolution Imaging Spectroradiometer (MODIS)



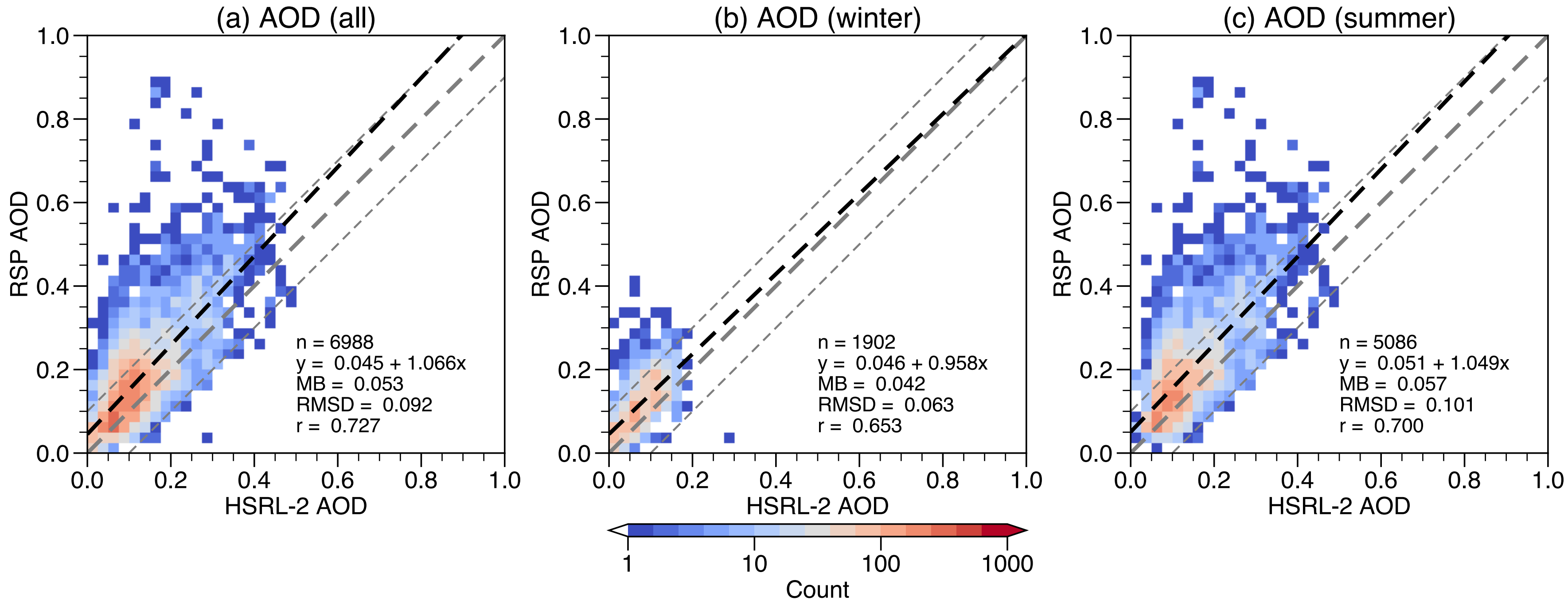
Siu et al. (2023, submitted)

RSP and HSRL-2 AOD have large seasonal variations but also exhibit considerable deviations between the two.





Mean squared deviation budget analysis shows that lack of correlation contributes the most deviation.



Mean squared deviation = squared bias + nonunity slope + lack of correlation

TC analysis shows that HSRL-2 is the most accurate dataset over the ACTIVATE region.

	RSP		HSRL-2		MODIS	
	$\sigma_{\varepsilon_{\mathrm{RSP}}}$	r_{RSP}	$\sigma_{\varepsilon_{\mathrm{HSRL\text{-}2}}}$	$r_{\mathrm{HSRL\text{-}2}}$	$\sigma_{\varepsilon_{\mathrm{MODIS}}}$	r_{MODIS}
N = 2344	0.0637	0.796	0.0273	0.926	0.0511	0.858

- sigma is RMSE of each instrument with respect to ground truth.
- r is correlation coefficient of each instrument with respect to ground truth.

A simple filtering criterion has been developed to improve the RSP data quality.

- Imposing a more stringent cost function in the RSP retrieval algorithm improves agreement between RSP and HSRL-2.