Team Overview

ACTIVATE

- Labwork 2020-2022: PILS and cloud water samples
- Leg Index Files
- Outreach: Virtual and In-person events
- Science


Lin Ma


Hossein Dadashazar


Rachel Braun

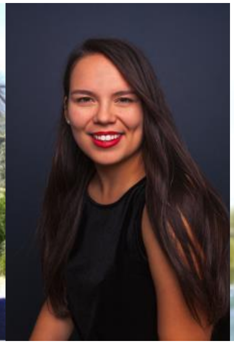

Alex MacDonald

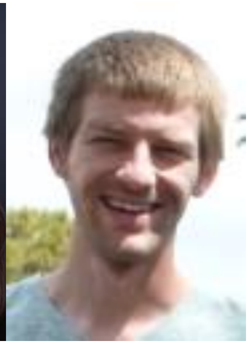

Monem Aldhaif


Ali Hossein Mardi


Connor Stahl


Andrea Corral


Marisa Gonzalez


Joseph Schlosser


Eva-Lou Edwards


Genie Lorenzo


Miguel Hilario


Kira Zeider


Kayla McCauley


Sanja Dmitrovic


Cassidy Soloff

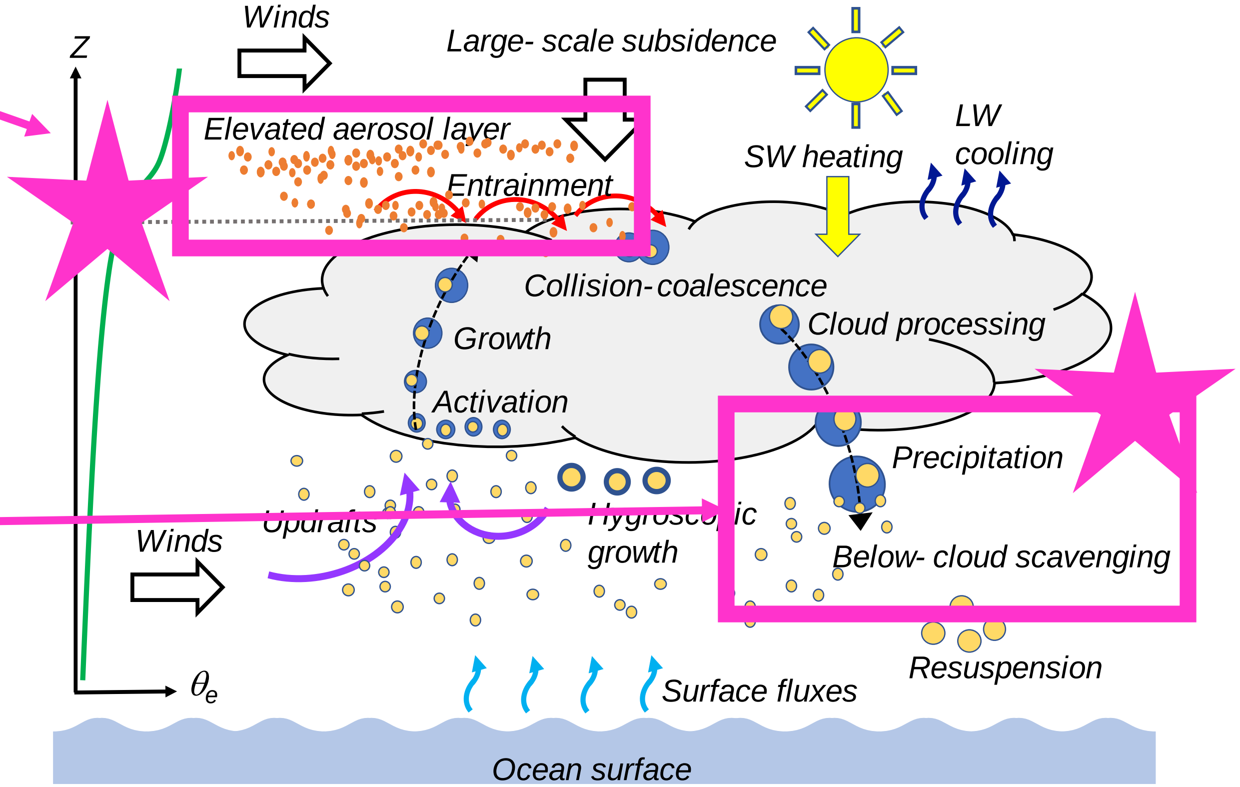

Grace Betito


Chris Siu

Recent Publications

ACTIVATE

Corral et al.: Cold Air Outbreaks Promote New Particle Formation Off the U.S. East Coast, Geophys. Res. Lett., 10.1029/2021GL096073, 2022.



Dadashazar et al.: Aerosol responses to precipitation along North American air trajectories arriving at Bermuda, Atmos. Chem. Phys., 21, 16121-16141, 10.5194/acp-21-16121-2021, 2021.

Recent Publications

ACTIVATE

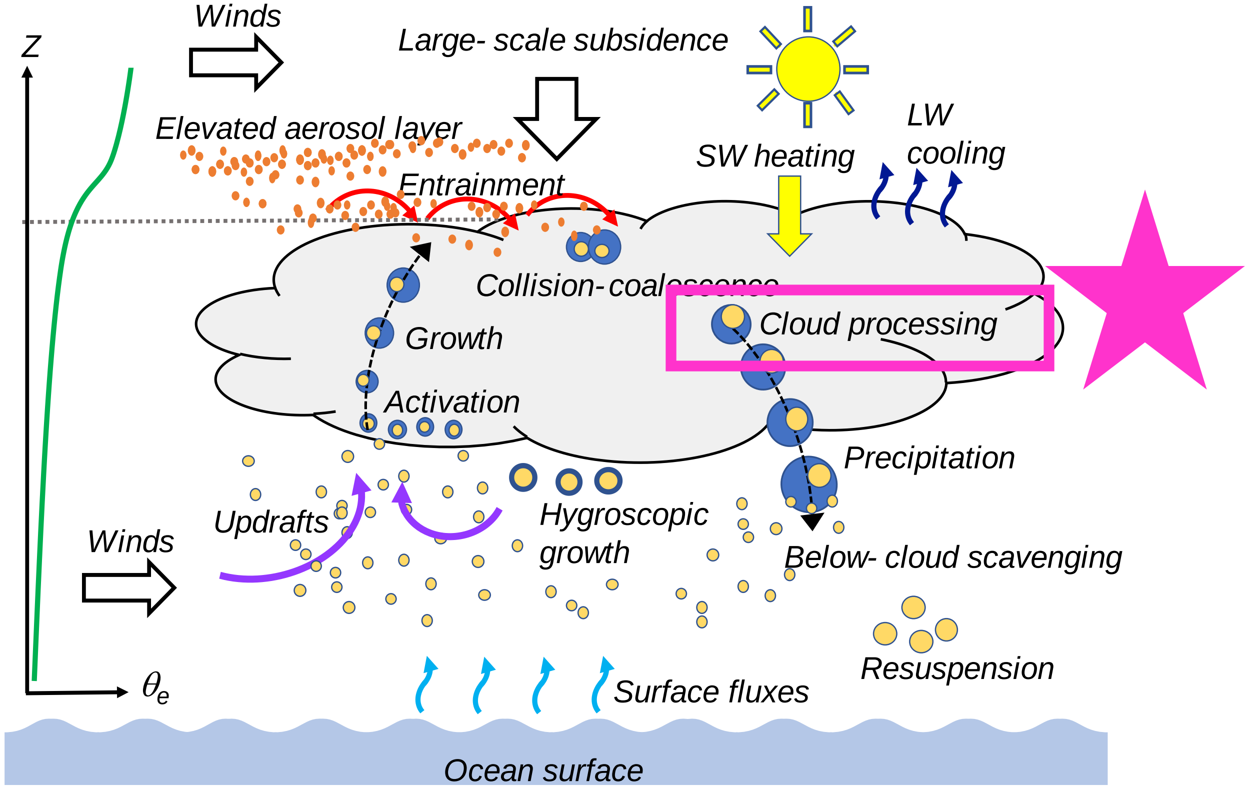
Corral et al.: Dimethylamine in cloud water: A case study over the northwest Atlantic Ocean, Environ. Sci.: Atmos., 10.1039/D2EA00117A, 2022.

Dadashazar et al.: Organic enrichment in droplet residual particles relative to out of cloud over the Northwest Atlantic: Analysis of airborne ACTIVATE data, Atmos. Chem. Phys., 10.5194/acp-2022-387, 2022.

Gonzalez et al.: Relationships between supermicrometer particle concentrations and cloud water sea salt and dust concentrations: analysis of MONARC and ACTIVATE data, Environ. Sci.: Atmos., 10.1039/D2EA00049K, 2022.

Hilario et al.: Particulate oxalate-to-sulfate ratio as an aqueous processing marker: similarity across field campaigns and limitations, Geophys. Res. Lett., 10.1029/2021GL096520, 2021.

Ma et al.: Contrasting wet deposition composition between three diverse islands and coastal North American sites, Atmos. Environ., 10.1016/j.atmosenv.2020.117919, 2021.



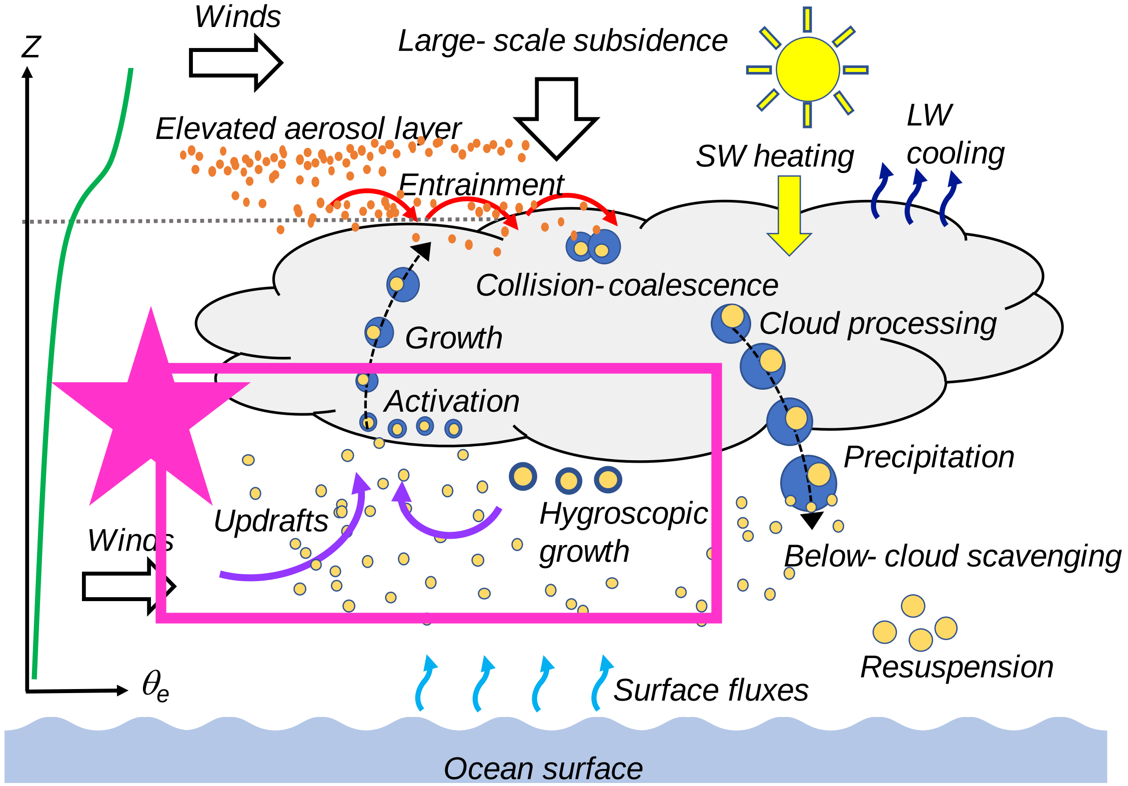
Corral et al.: Source apportionment of aerosol at a coastal site and relationships with precipitation chemistry: A case study over the Southeast United States, Atmosphere, 10.3390/atmos11111212, 2020.

Edwards et al.: Impact of various air mass types on cloud condensation nuclei concentrations along coastal southeast Florida, Atmos. Environ., 10.1016/j.atmosenv.2021.118371, 2021.

Dadashazar et al.: Cloud drop number concentrations over the western North Atlantic Ocean: seasonal cycle, aerosol interrelationships, and other influential factors, Atmos. Chem. Phys., 10.5194/acp-21-10499-2021, 2021.

Mardi et al.: Biomass burning over the United States East Coast and Western North Atlantic Ocean: Implications for clouds and air quality, J. Geophys. Res. –Atmos., 10.1029/2021JD034916, 2021.

Aldhaif et al.: An aerosol climatology and implications for clouds at a remote marine site: Case study over Bermuda, , J. Geophys. Res. –Atmos., 10.1029/2020JD034038, 2021.



Recent Publications

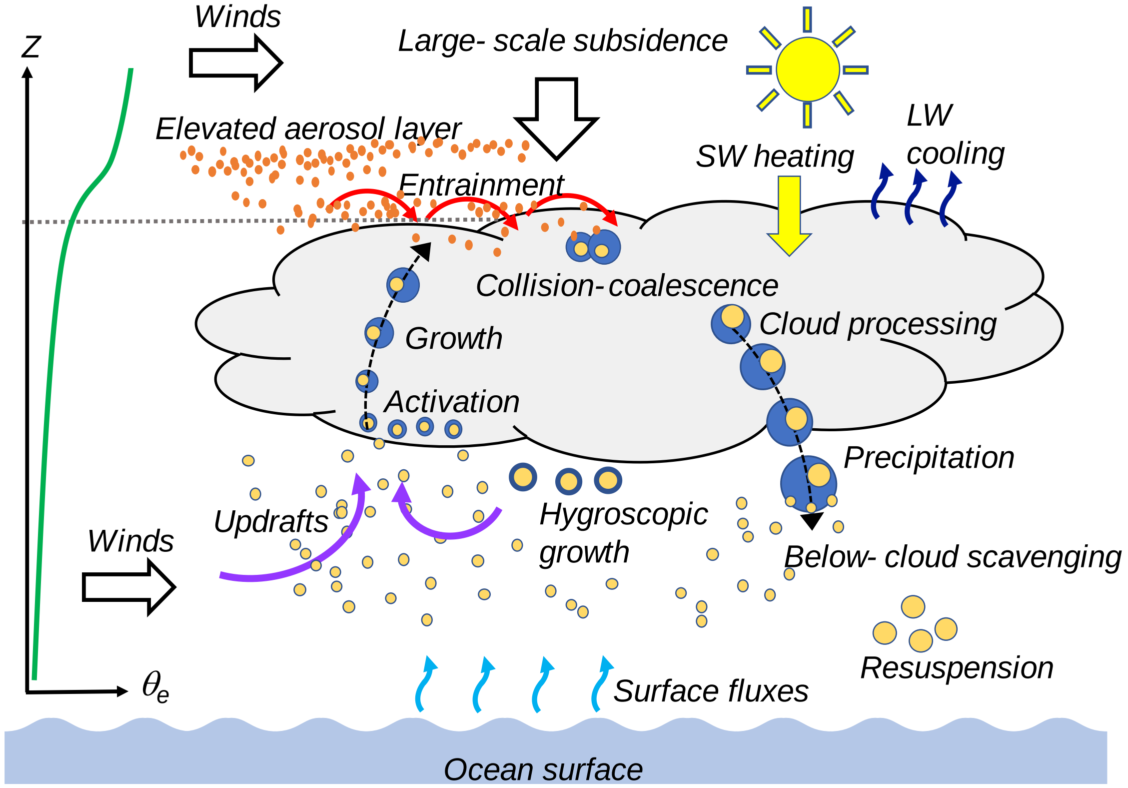
ACTIVATE

Dadashazar et al.: Analysis of MONARC and ACTIVATE airborne aerosol data for aerosol-cloud interaction investigations: Efficacy of stairstepping flight legs for airborne in situ sampling, Atmosphere, 10.3390/atmos13081242, 2022.

Schlosser et al.: Polarimeter + Lidar–Derived Aerosol Particle Number Concentration, Frontiers in Remote Sensing, 10.3389/frsen.2022.885332, 2022.

Corral et al.: An overview of atmospheric features over the western North Atlantic Ocean and North American East Coast – Part 1: Analysis of aerosols, gases, and wet deposition chemistry, J. Geophys. Res. –Atmos., 10.1029/2020JD032592, 2021.

Braun et al.: Cloud, aerosol, and radiative properties over the Western North Atlantic Ocean, J. Geophys. Res. – Atmos., 10.1029/2020JD034113, 2021.

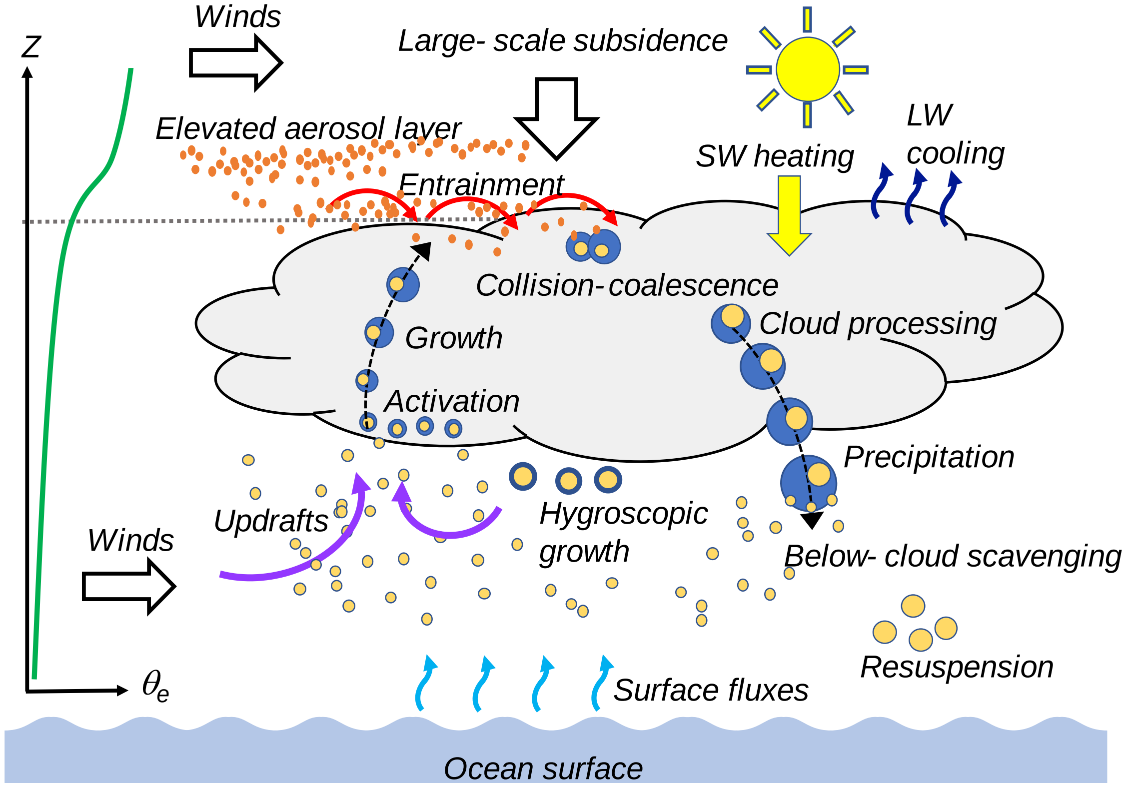


Aldhaif, A. M., Lopez, D. H., Dadashazar, H., and Sorooshian, A.: Sources, frequency, and chemical nature of dust events impacting the United States East Coast, Atmos. Environ., 10.1016/j.atmosenv.2020.117456, 2020.

Ongoing Projects

ACTIVATE

- Edwards: Sea salt reactivity (PILS)
- Edwards: Polyfluoroalkyl substances (PFAS) in cloud water (AC3)
- McCauley: Coupling of marine boundary layer clouds to the surface over the Northwest Atlantic and relationships with gas and aerosol properties
- Dmitrovic: The validation of airborne High Spectral Resolution Lidar 2 (HSRL-2) retrievals for the estimation of ocean surface wind speeds
- Soloff: CCN closure analysis (?)
- Siu: Triple collocation method
- Sorooshian: ACTIVATE overview paper? (will go over strategy on Wednesday)
- Starting collaboration with Anne Monod (Aix-Marseille Université, France) to test for surfactants in cloud water; there is other outside interest too in any remaining cloud water volume for additional tests



Kayla McCauley – Coupling Regimes of Marine Boundary Layer Clouds to the Surface and Relationship with Aerosol Properties from ACTIVATE

Question: Can HU-25 Falcon leg data accurately capture if the MBL clouds are coupled to the surface through replication of previous coupling studies that relied on vertical profiles and thermodynamic statistics of the Lifting Condensation Level (LCL) and cloud base?

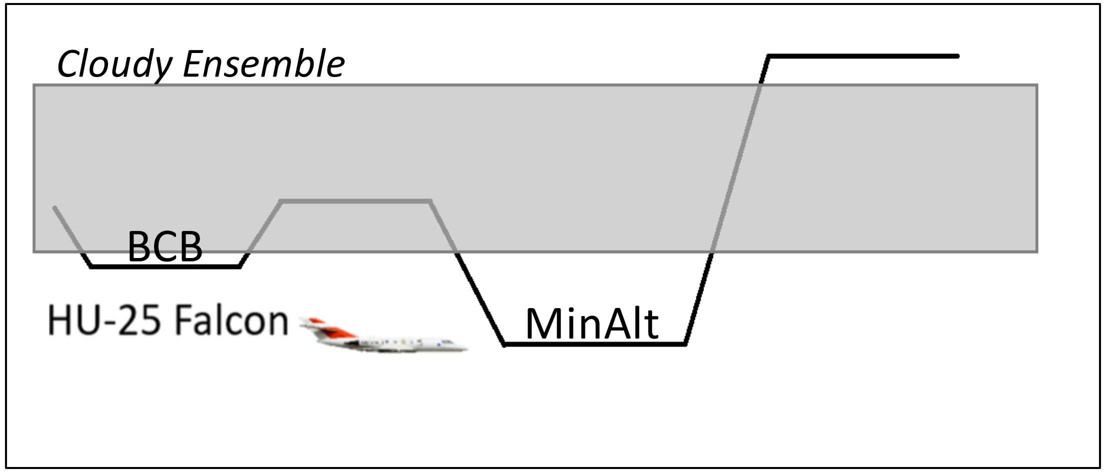
- What thermodynamic statistics best characterize coupled or decoupled MBL clouds in the Northwest Atlantic?

Objectives:

- Assess the ability to use Minimum Altitude (MinAlt) and Below Cloud Base (BCB) legs from Falcon flights to determine if MBL clouds are coupled with the surface through thermodynamic statistics
- Investigating if aerosol scattering (from TSI-3563 Nephelometer instrument at 550 nm) values can be used as a parameter for determining coupling behavior

Methods:

- Pairing MinAlt and BCB legs in 2020 and 2021 ACTIVATE flights in cloudy ensembles. Liquid potential temperature (θ_L) and total water mixing ratio (q_t) were taken at each leg to determine thermodynamic vertical variation
- Vertical profiles of θ_L , q_t, and aerosol scattering were plotted for each MinAlt and BCB pair to characterize coupling regimes



Preliminary Results

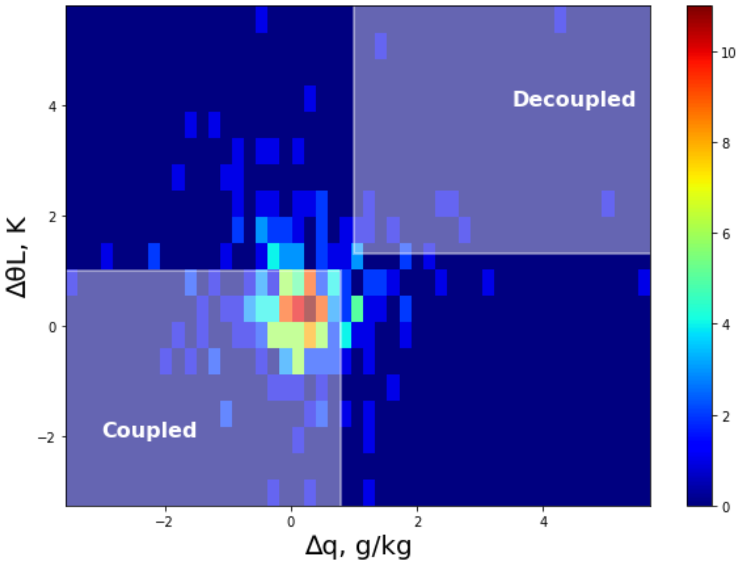


Figure. 2D histogram of frequency of coupling, decoupling, and 'other' from 2020-2021 ACTIVATE flights based on $\Delta\theta_L$ and Δq_t where the regions not shaded in white represent 'other'

- A criteria of the MinAlt to BCB differences in the thermodynamic properties emerged that delineated whether the MBL could best be categorized as coupled, other, or decoupled as was done in previous studies (Table 1)
  - The 'other' categorization emanated from vertical profiles that could not clearly fit as either coupled or decoupled
- Aerosol scattering differences and vertical profiles did not have a clear pattern as it relates to the degree of coupling
  - Further methods are being investigated as alternative methods for determining if green scattering can accurately represent coupling

Table 1. Summary of past papers that determined coupling with thermodynamic properties and criteria from 2020-2021 ACTIVATE flights

	Jones et al. 2011	Dong et al. 2015	Wang et al. 2016	Su et al. 2022	**ACTIVATE**
Criteria	Coupled: $\Delta q < .5$ gkg^{-1} and $\Delta\theta_L < .5$K. All other profiles are considered decoupled		Decoupled: $\Delta q > .6$ gkg^{-1} and $\Delta\theta L > 1.0$ K. All other clouds are considered coupled.	Coupled: $\Delta\theta_V < 1.0$K and Decoupled $\Delta\theta_V > 1.0$K	Coupled: $\Delta q < .8$ gkg-1 and $\Delta\theta L < 1.0$ K Decoupled: $\Delta q > 1$ gkg-1 and $\Delta\theta L > 1.3$ K Other: All remaining pairs
Second Critera	Coupled: distance between LCL and cloud base is <150m, otherwise decoupled		N/A	Different Thermodynamic Stability (DTDS) Method	Investigating possibility of green scattering
Calculation Layers	Calculations of bottom minus top taken from the surface to just below the inversion (LCL to cloud base height)		Bottom minus top of the sub-cloud layer	Cloud Base Height minus Plantary Boundary Layer Height	BCB leg minus MinAlt leg
Cloud Type	Marine Stratocumulus			Low Clouds over Land	Multiple Marine Regimes including Stratiform, Stratocumulus, and Cumulus
Study Region	Southeast Pacific	Azores	Southeast Pacific	Southern Great Plains	Northwest Atlantic