



# High Altitude Lidar Observatory - (HALO)

## A Combined Water vapor DIAL and High Spectral Resolution Lidar

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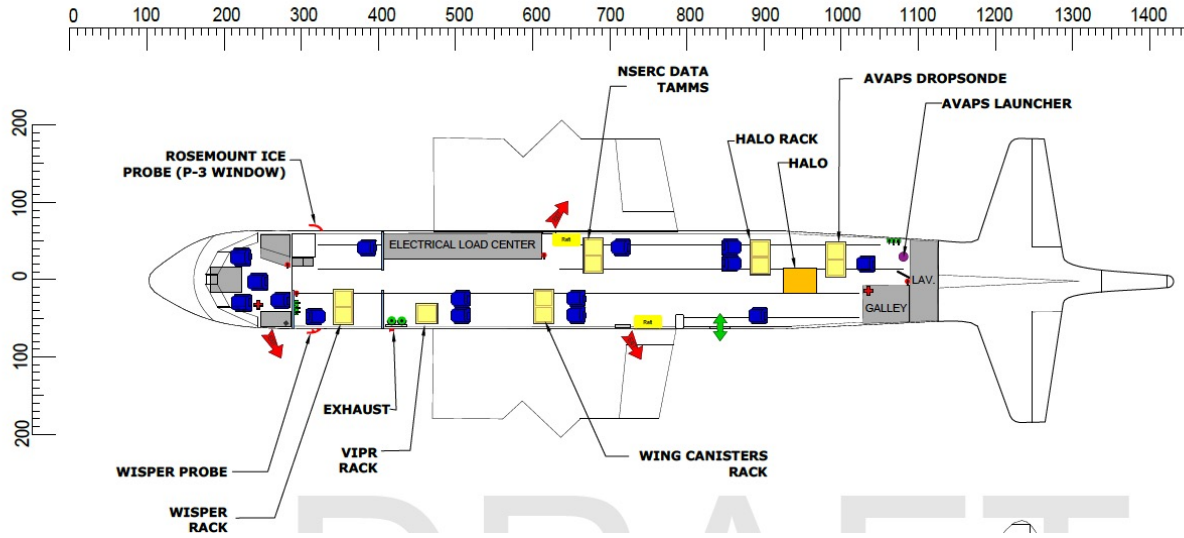
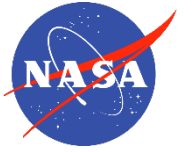
Amin Nehrir

Rory Barton-Grimley, Brian Carroll, James Collins, Susan Kooi,  
Anthony Notari, David Harper, Joe lee

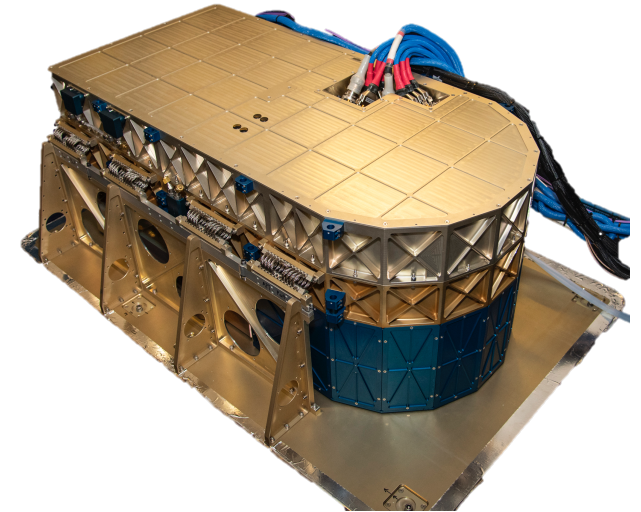


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# HALO Specifications



Instrument head

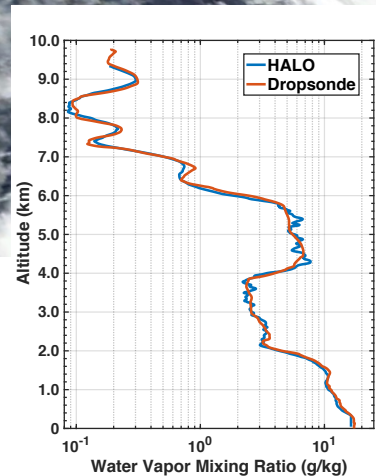
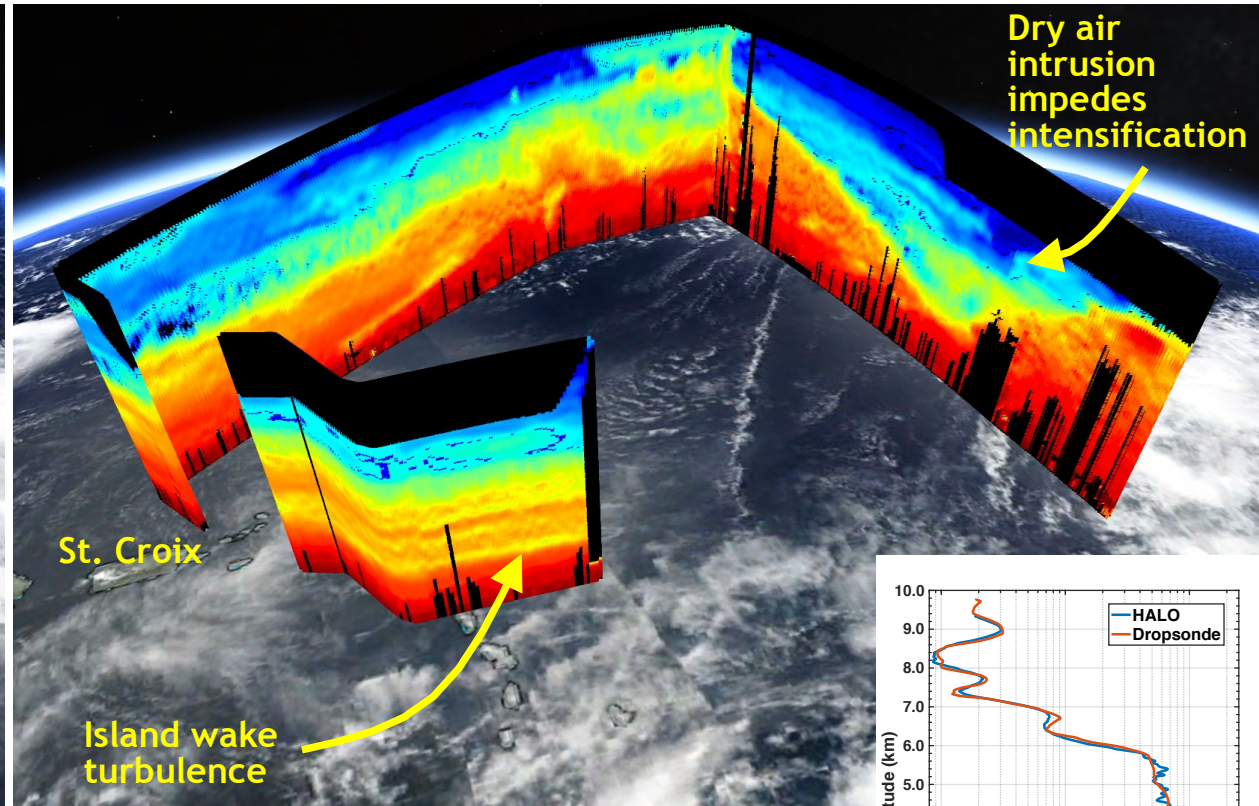
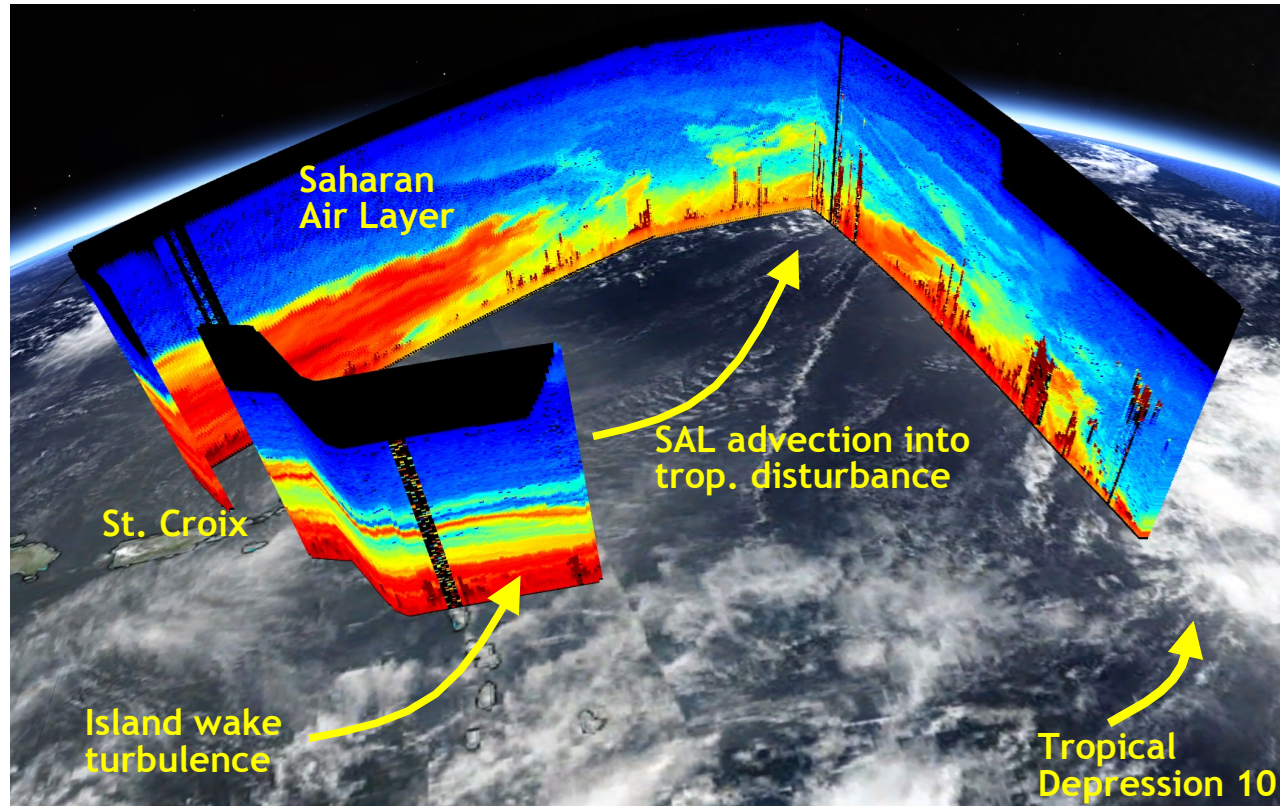
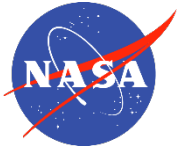


Parameter	Wavelength (nm)	Approximate Precision	Horizontal Resolution	Vertical Resolution
Aerosol Backscatter	532/1064	$0.2 \text{ Mm}^{-1}\text{sr}^{-1}$	1 km	15 m
Aerosol Extinction	532	$0.01 \text{ km}^{-1}$	12 km	300 m
Depolarization	532/1064	0.01	1 km	15 m
Aerosol Optical Depth	532	0.01	1 km	N/A
Boundary Layer Height	532	Varies with conditions	200 m	15 m
Aerosol Type (e.g., marine, dust, smoke)	N/A	Qualitative	12 km	300 m
Water vapor mixing ratio	935	<10%	1-12 km Varies with altitude and conditions	100-600 m Varies with altitude and conditions
Total Perceptible Water Vapor	935	~1%	Same as WVMR	NA
Relative Humidity (derived using HALO+MERRA reanalysis)	935	<20%	Same as WVMR	Same as WVMR



Instrument rack

# Example Data Products – Water Vapor and HSRL

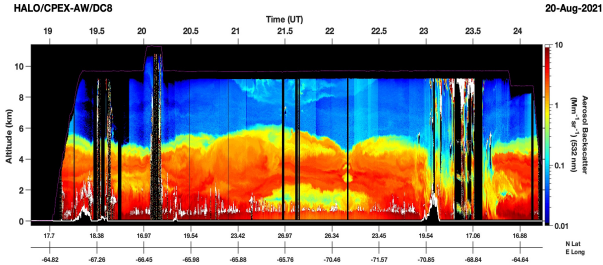


# Example Data Products – Additional Products

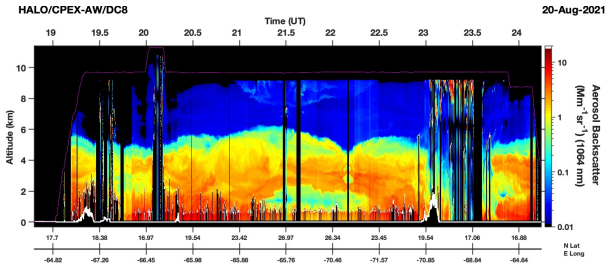


## Aerosol Extensive Parameters

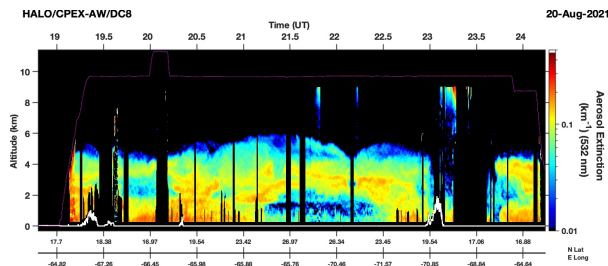
532 nm Backscatter



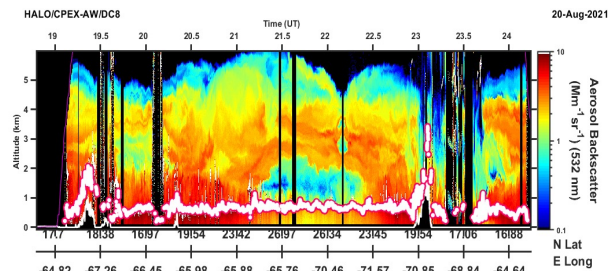
1064 nm Backscatter



532 nm Extinction

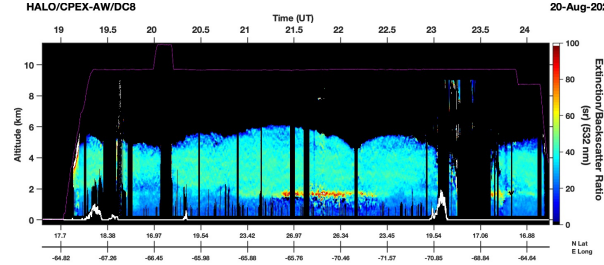


Mixed Layer Heights

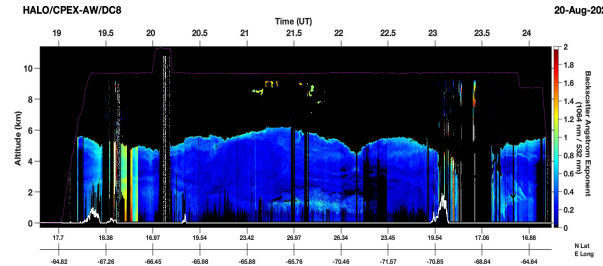


## Aerosol Intensive Parameters

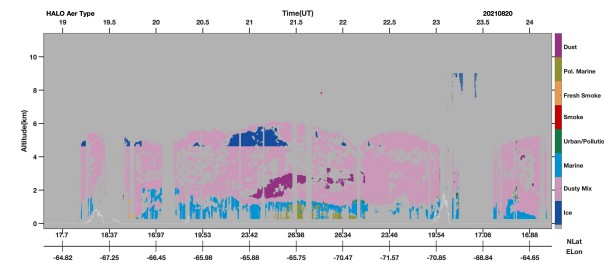
532 nm Lidar Ratio



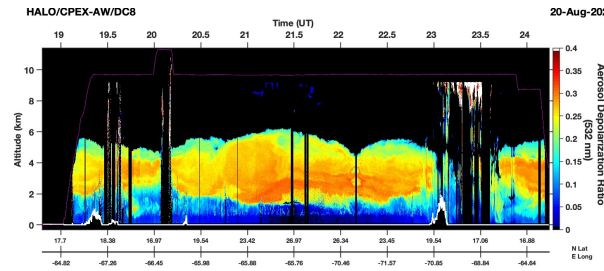
1064/532 nm Backscatter Angstrom Coeff. (particle size)



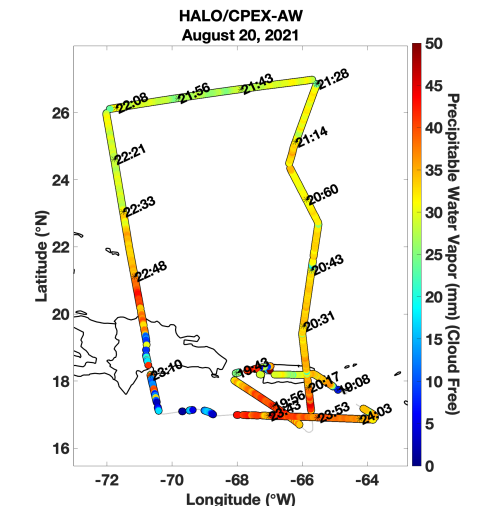
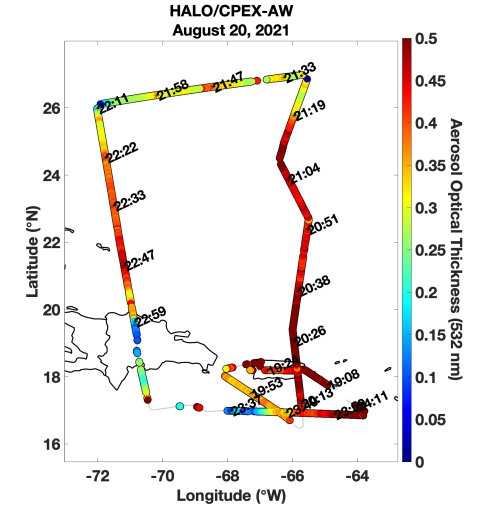
Aerosol Typing



1064/532 nm Depolarization Ratio



## Layer Integrated Products



# Objectives



- Assess synergies of collocated HALO Differential Absorption Lidar (DIAL) and VIPR Differential Absorption Radar (DAR) measurements of water vapor in clear and cloudy conditions, respectively
  - Assess feasibility of joint retrievals to provide full sky retrievals of water vapor profiles
  - Assess spatial variability of moisture field at cloud edges
- Collect DIAL/DAR data over a wide range of atmospheric conditions and aircraft altitudes to inform future modeling efforts to assess synergies of such sensors deployed from space
- Assess performance of HALO water vapor DIAL retrievals in P3 vibration environment
- Joint flights with ACTIVATE EVS-3 to leverage simultaneous in-situ observations of cloud microphysics

