# Airborne Multi-wavelength High Spectral Resolution Lidar Observations and Applications from TCAP

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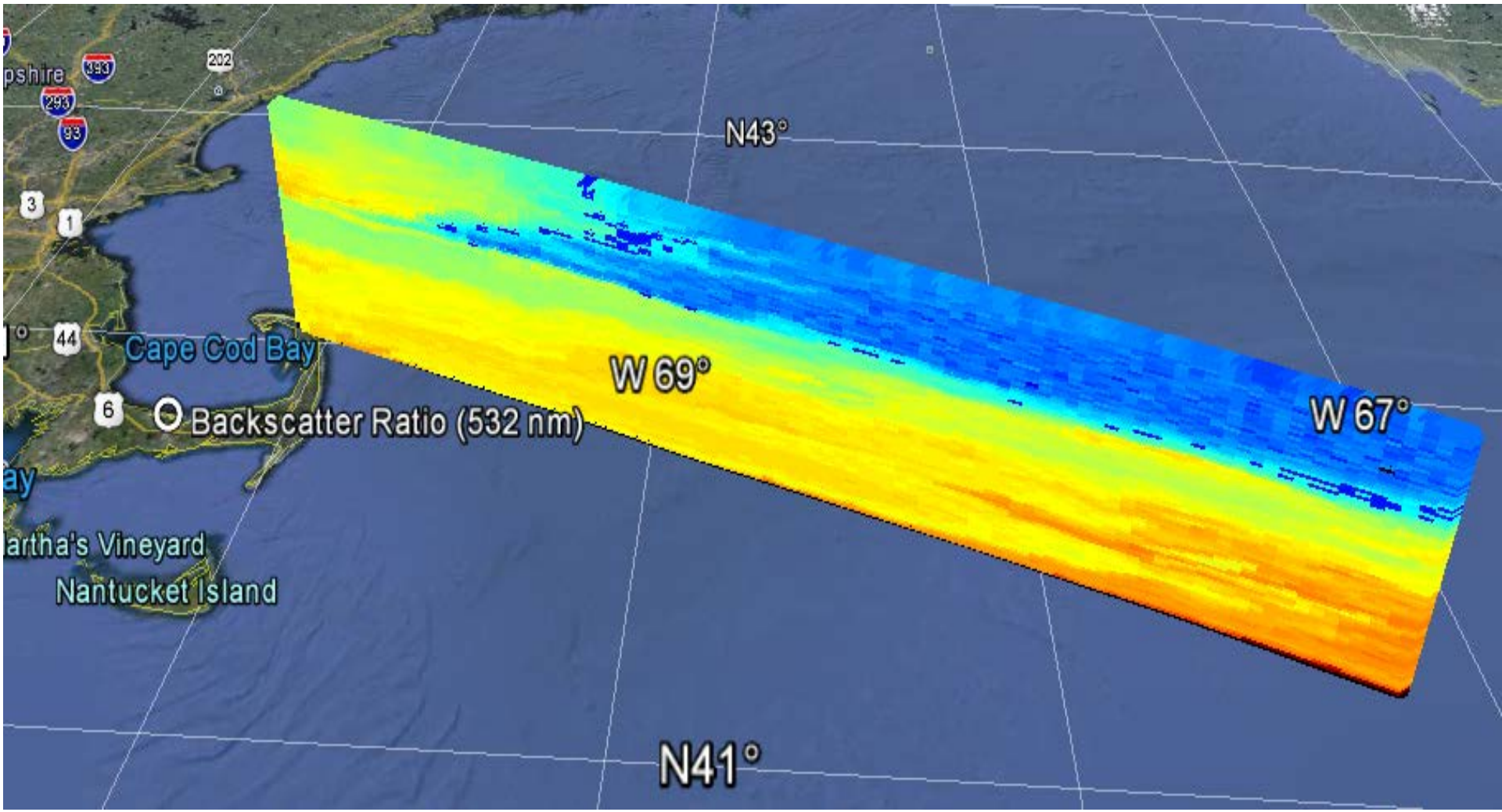
# Summary

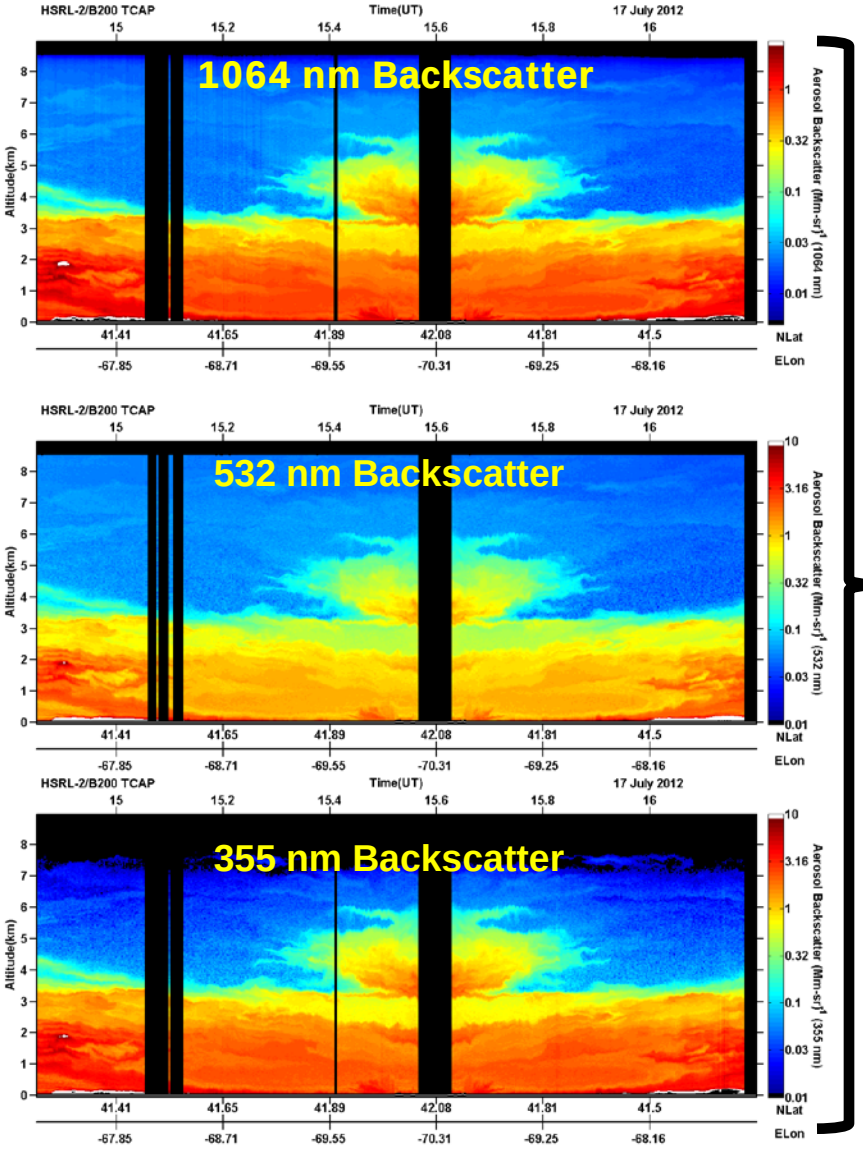
- HSRL-2 products are available from the TCAP ftp archive site
- These products include:
  - Quick look images of many parameters and flight track
  - Google Earth (kmz) files showing aerosol backscatter ratio and flight path color-coded by AOT
  - Data files in hdf5 format
- Data files include:
  - Aerosol backscatter, extinction, depolarization, AOD (532 nm)
  - Aerosol backscatter, depolarization (1064 nm)
  - Flight parameters (lat, lon, time, etc.)
- Have produced preliminary retrievals of aerosol optical and microphysical characteristics
  - Not archived but available from LaRC upon request
  - Currently working with G-1 data to assess retrievals
  - Seek additional results for further assessments
- Currently working on producing ML heights

# 532-nm Aerosol Scattering Ratio from 17 July 2012



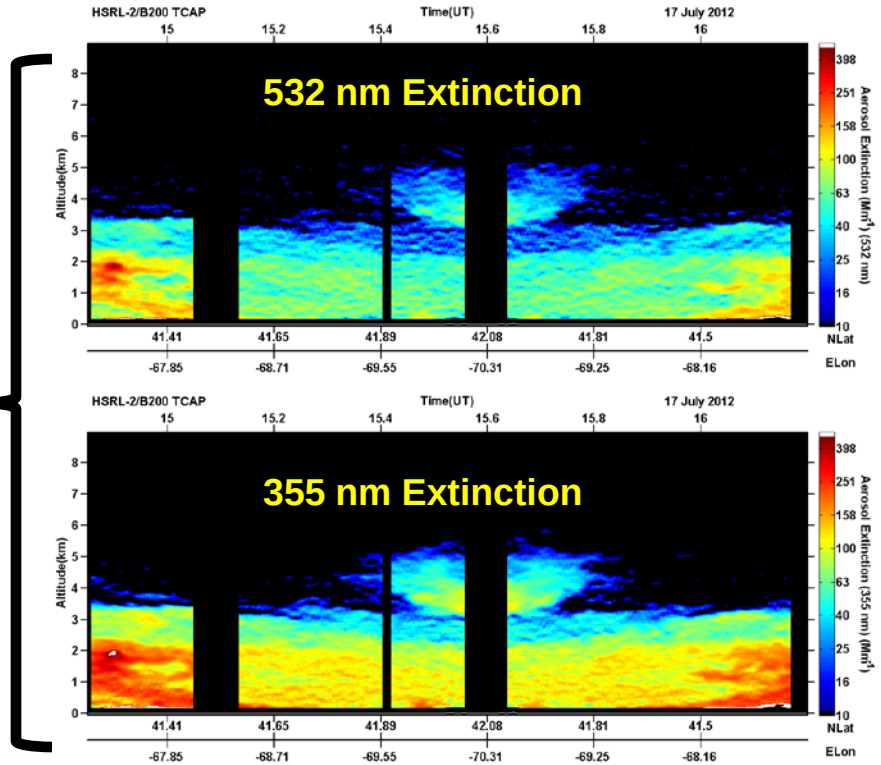
# Airborne multi-wavelength “3β+2α" HSRL measurements from the TCAP field campaign

07/17/2012 TCAP flight on B200 aircraft




3β

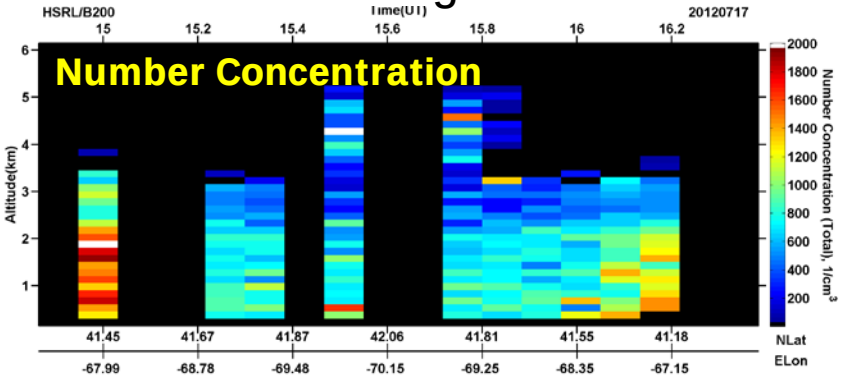
2α

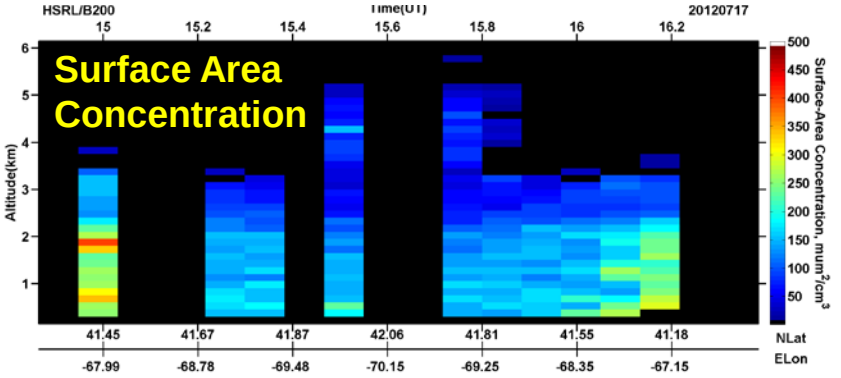


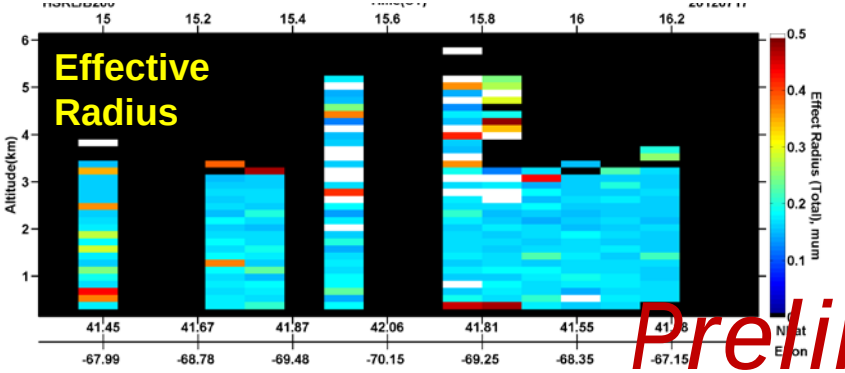

- High Spectral Resolution Lidar (HSRL) provides independent retrievals of aerosol extinction and backscatter
- HSRL-2 Capabilities
  - Backscatter at 355, 532, and 1064 nm
  - Extinction at 355 and 532 nm (HSRL)
  - Depolarization at 355, 532, 1064 nm

# HSRL-2 “3β+2α" Microphysical Retrieval

07/17/2012 TCAP flight on B200 aircraft

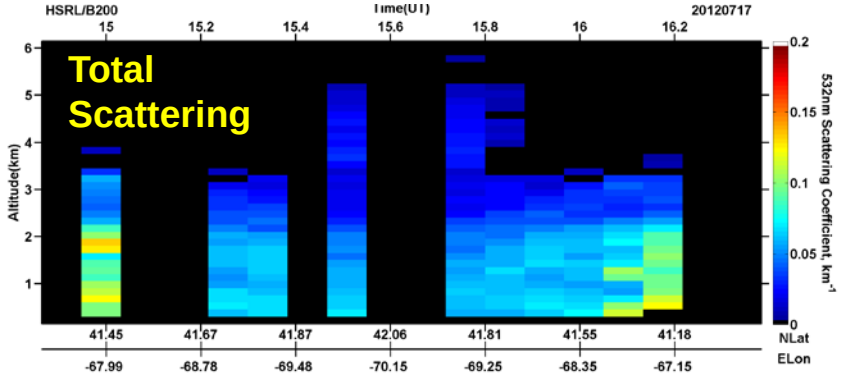


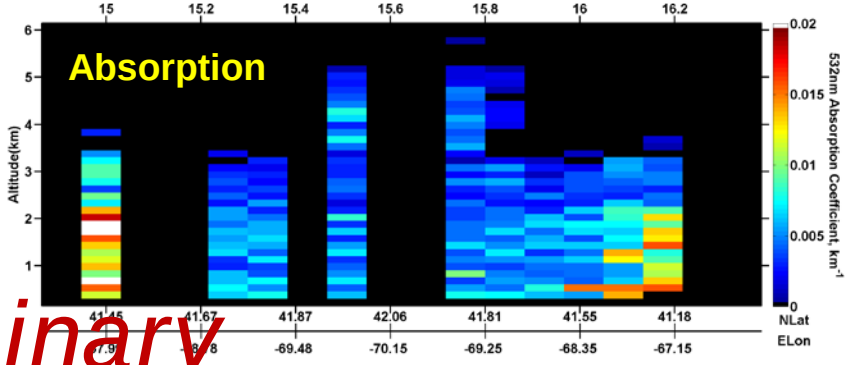




- Inversion with Regularization (Muller et al. 1999, Veselovskii et al 2002)
- Produces horizontally and vertically resolved curtains of microphysics including:

  Effective radius – Complex index of refraction – Scattering coefficient – Absorption coefficient – Single scatter albedo – Number, Surface and Volume Concentration



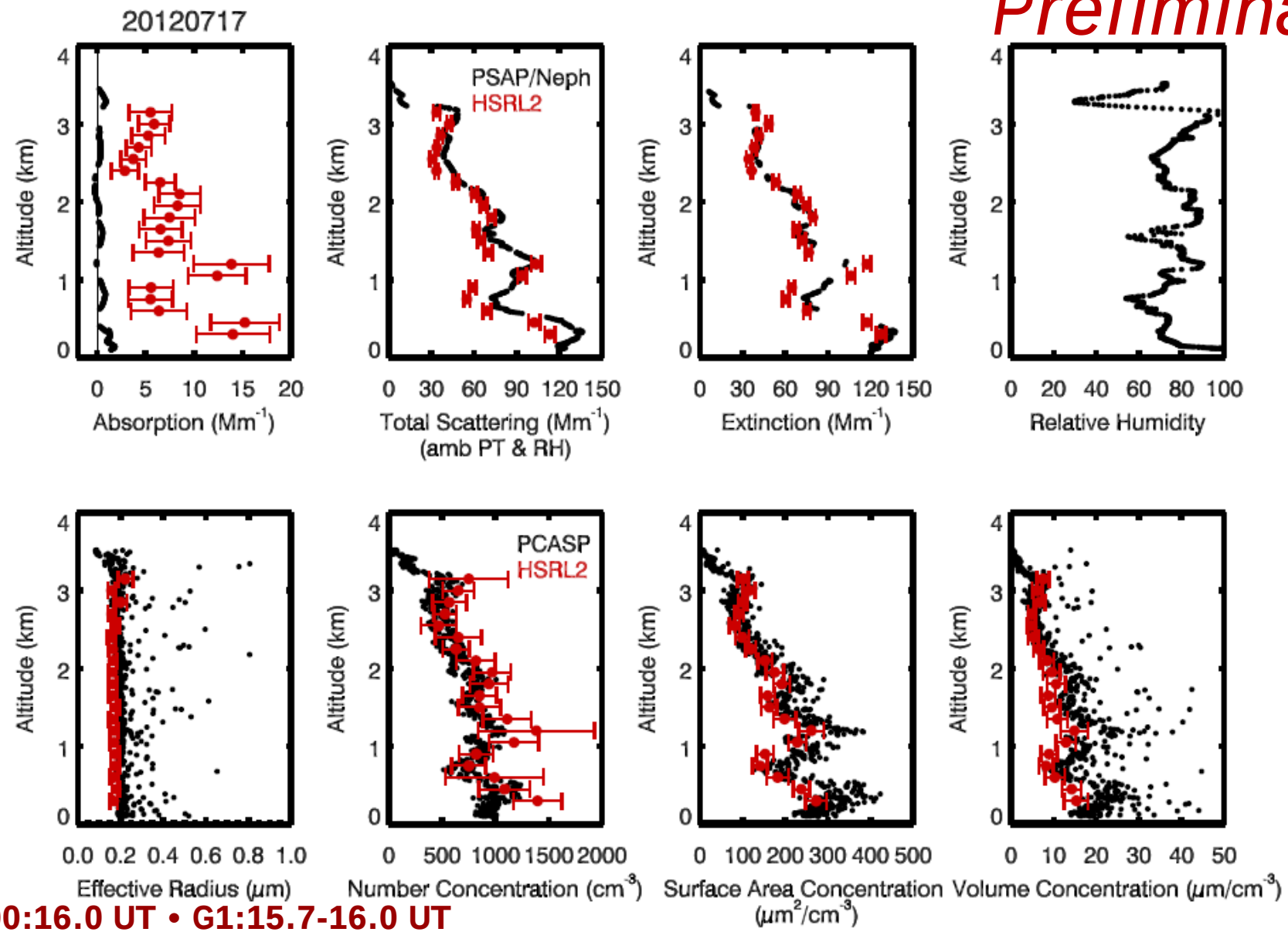




Preliminary

# HSRL-2 Microphysics Comparison with G1 In Situ

## 17 July

*Preliminary*

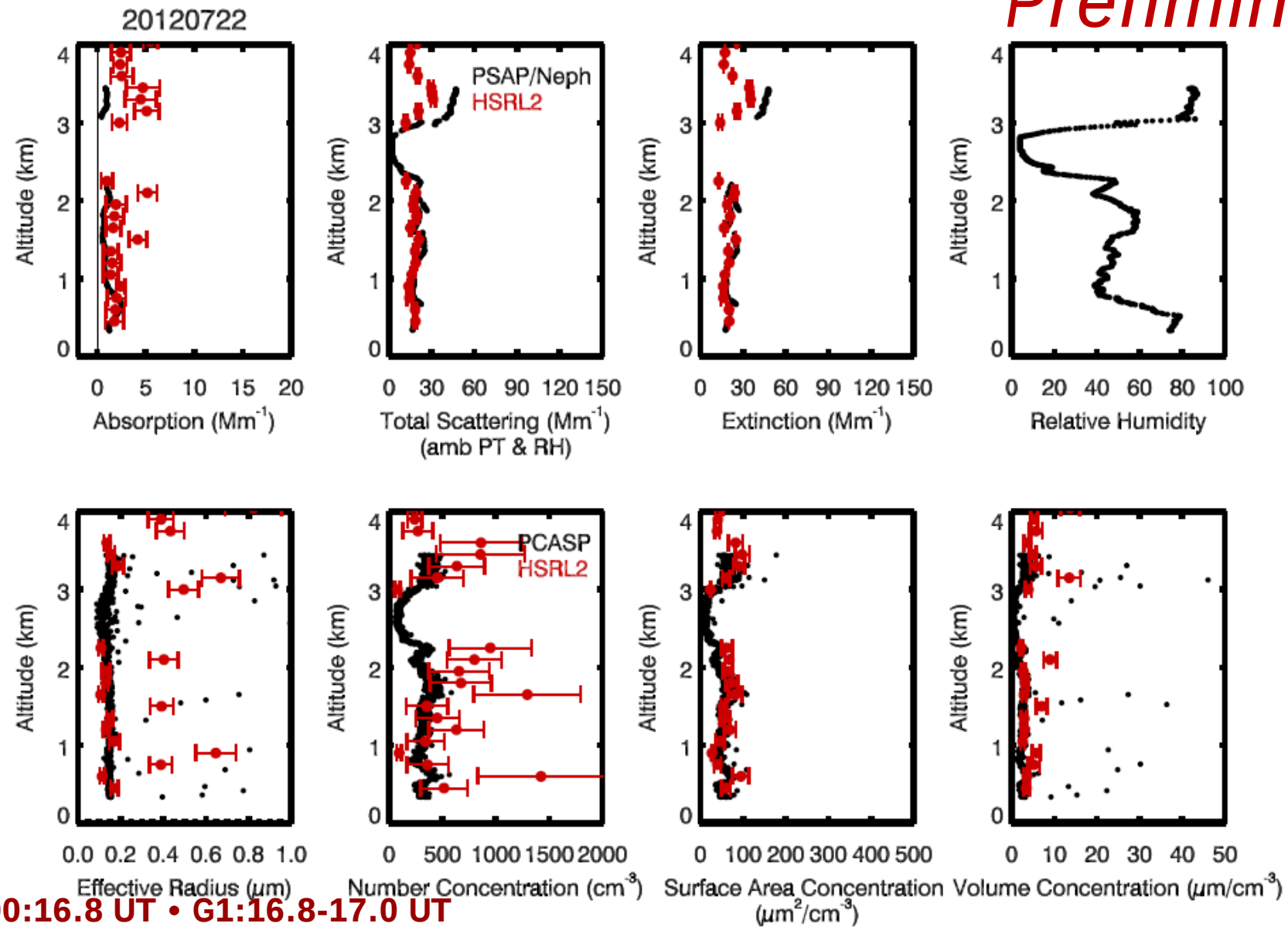



**B200:16.0 UT • G1:15.7-16.0 UT**

# HSRL-2 Microphysics Comparison with G1 In Situ

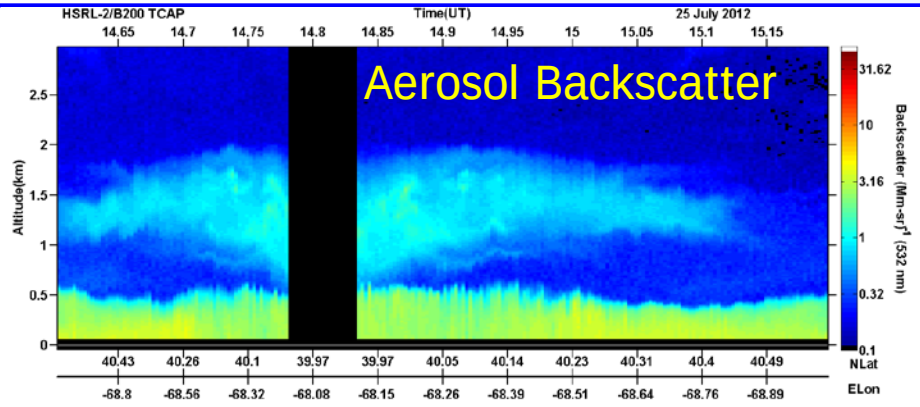
## 22 July

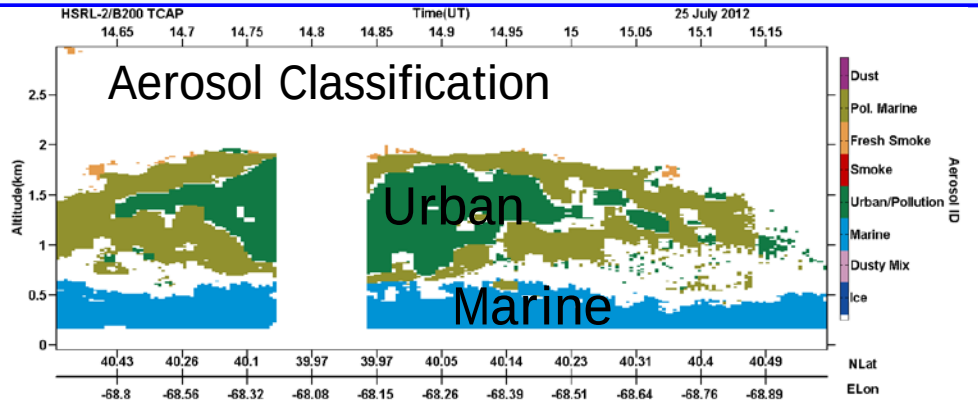
*Preliminary*

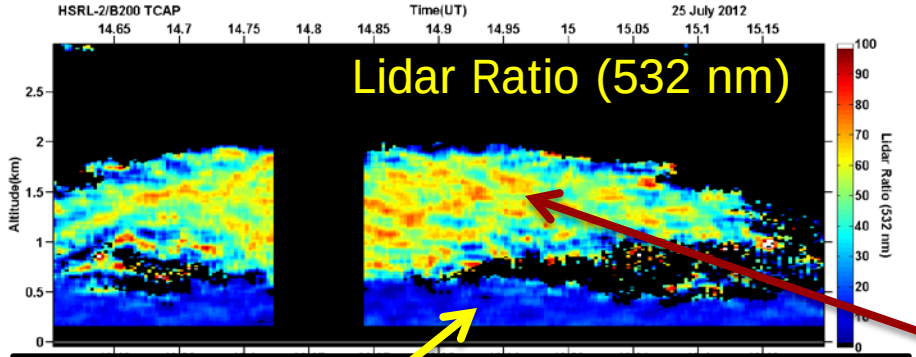


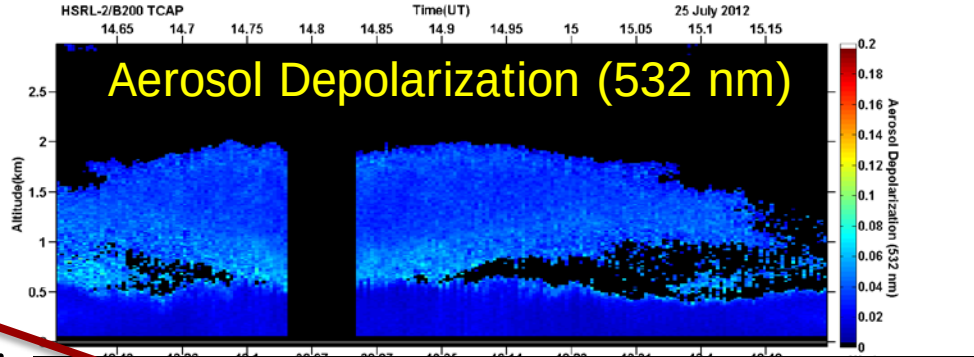

**B200:16.8 UT • G1:16.8-17.0 UT**

# HSRL-2 Aerosol Classification 7/25



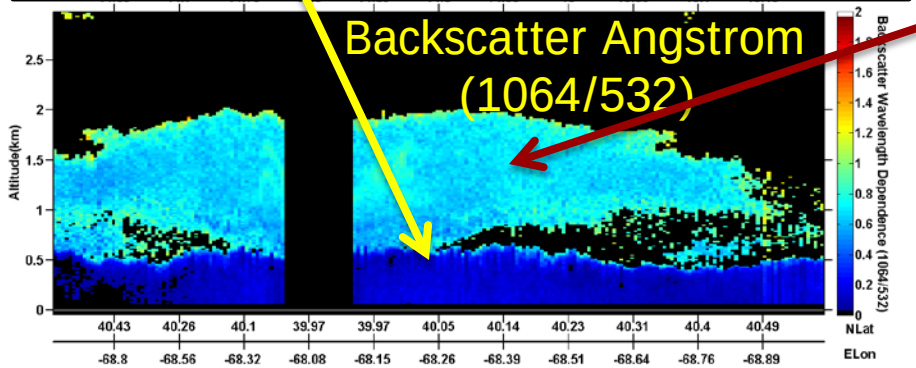



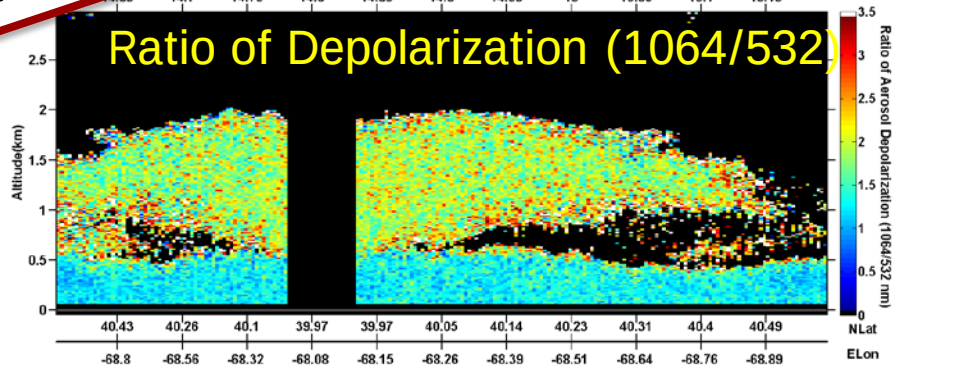



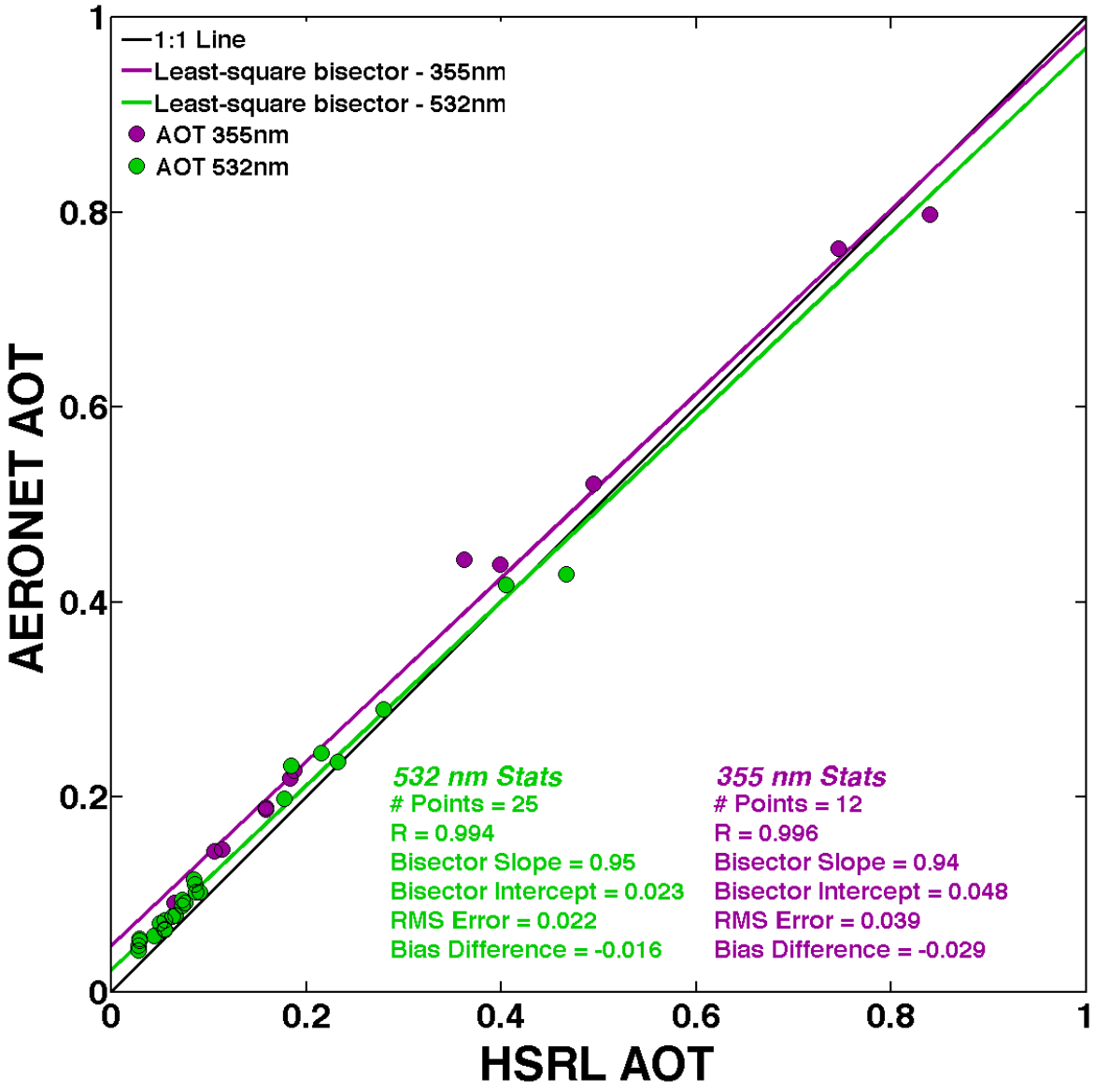

Marine indicated by low lidar ratio and small backscatter angstrom (large particles)

Urban outflow indicated by high lidar ratio and larger backscatter angstrom (smaller particles)



# HSRL and AERONET AOD Comparison



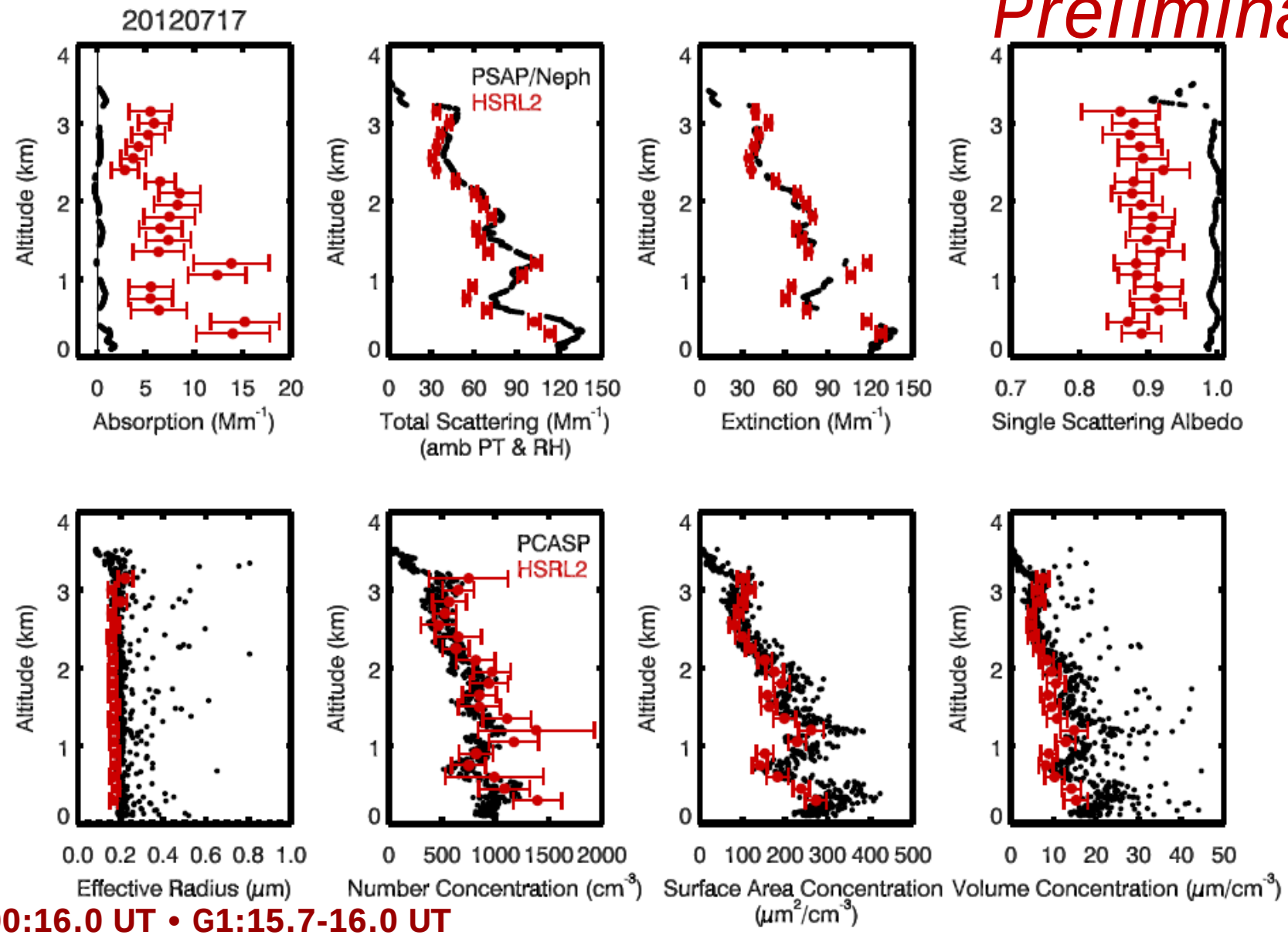

- Data points from when HSRL was within 15 km/30 min of the AERONET sites
- AERONET is Level 1.5 Data
- Bias Diff is HSRL-AERONET

| Distance | 15km / 30min | |
|---|---|---|
| Wavelength | 355 | 532 |
| # Points | 12 | 25 |
| R | 0.996 | 0.994 |
| Intercept | 0.048 | 0.023 |
| Slope | 0.94 | 0.95 |
| RMS Error | 0.039 | 0.022 |
| Bias Diff | -0.029 | -0.016 |

# HSRL-2 Microphysics Comparison with G1 In Situ

## 17 July

*Preliminary*

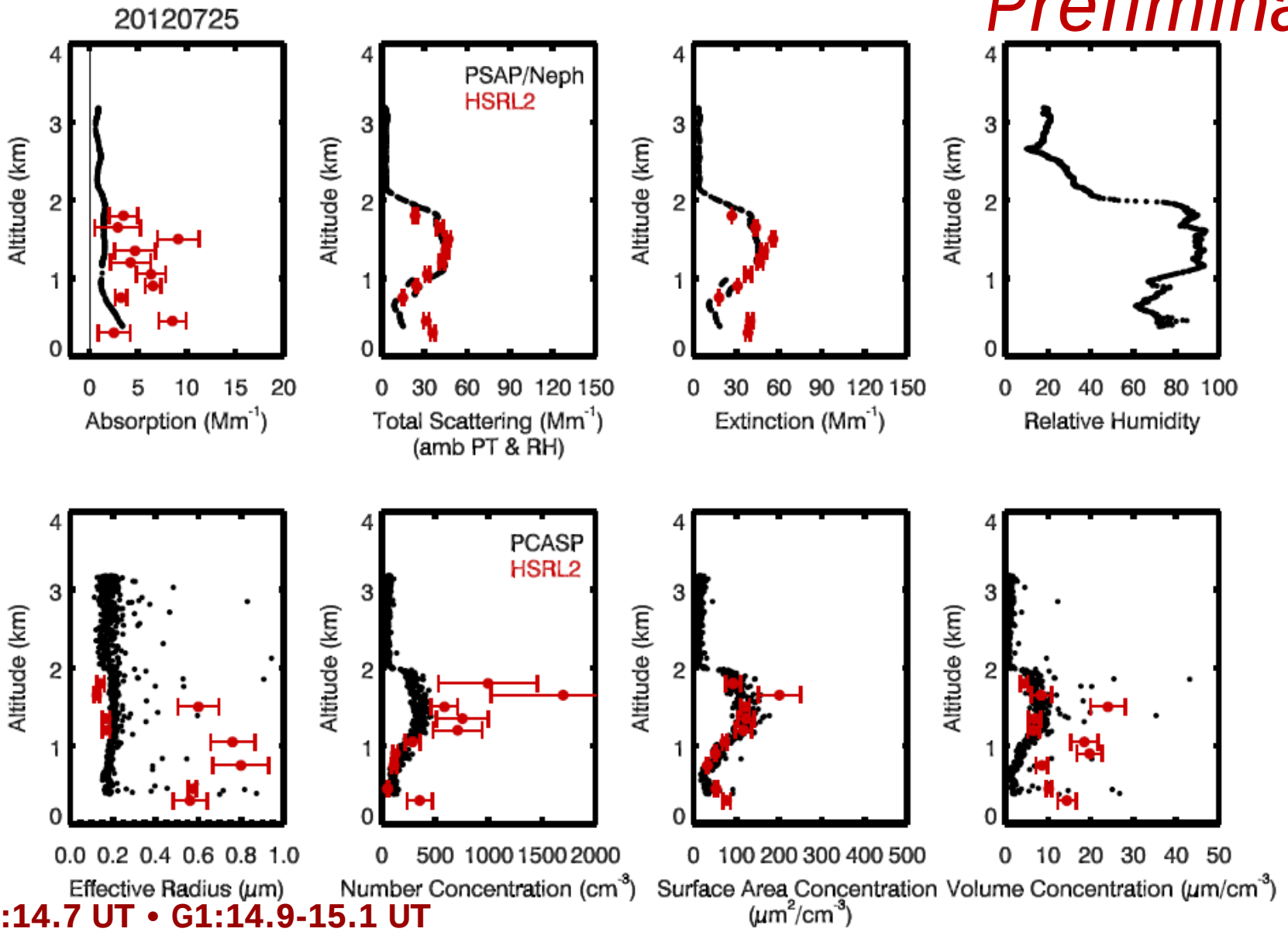



**B200:16.0 UT • G1:15.7-16.0 UT**

# HSRL-2 Microphysics Comparison with G1 In Situ

## 25 July

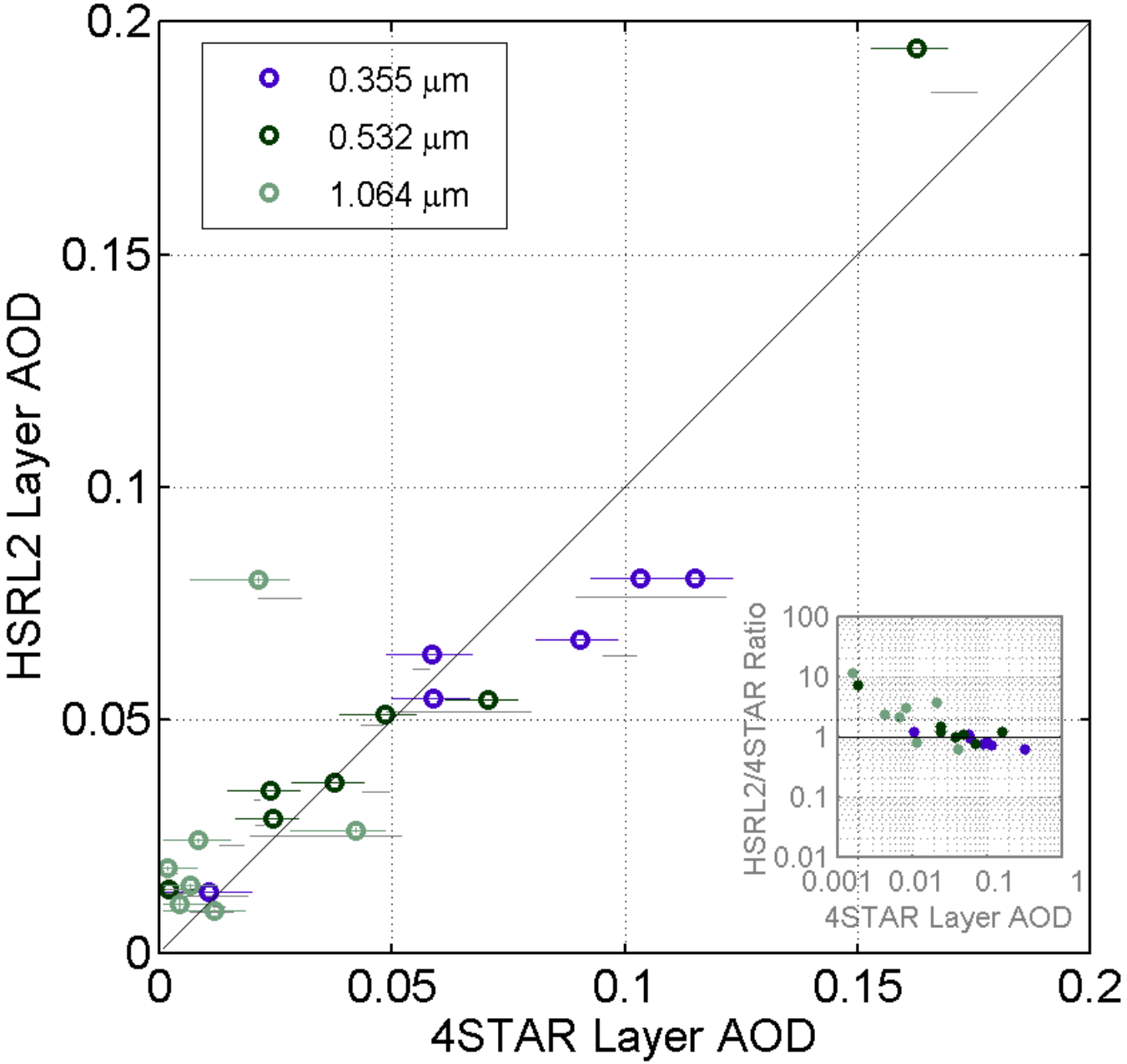
*Preliminary*




**B200:14.7 UT • G1:14.9-15.1 UT**

# TCAP 4STAR Vertical Profiles

The 4STAR Team and Collaborators
Figures generated by Yohei Shinozuka

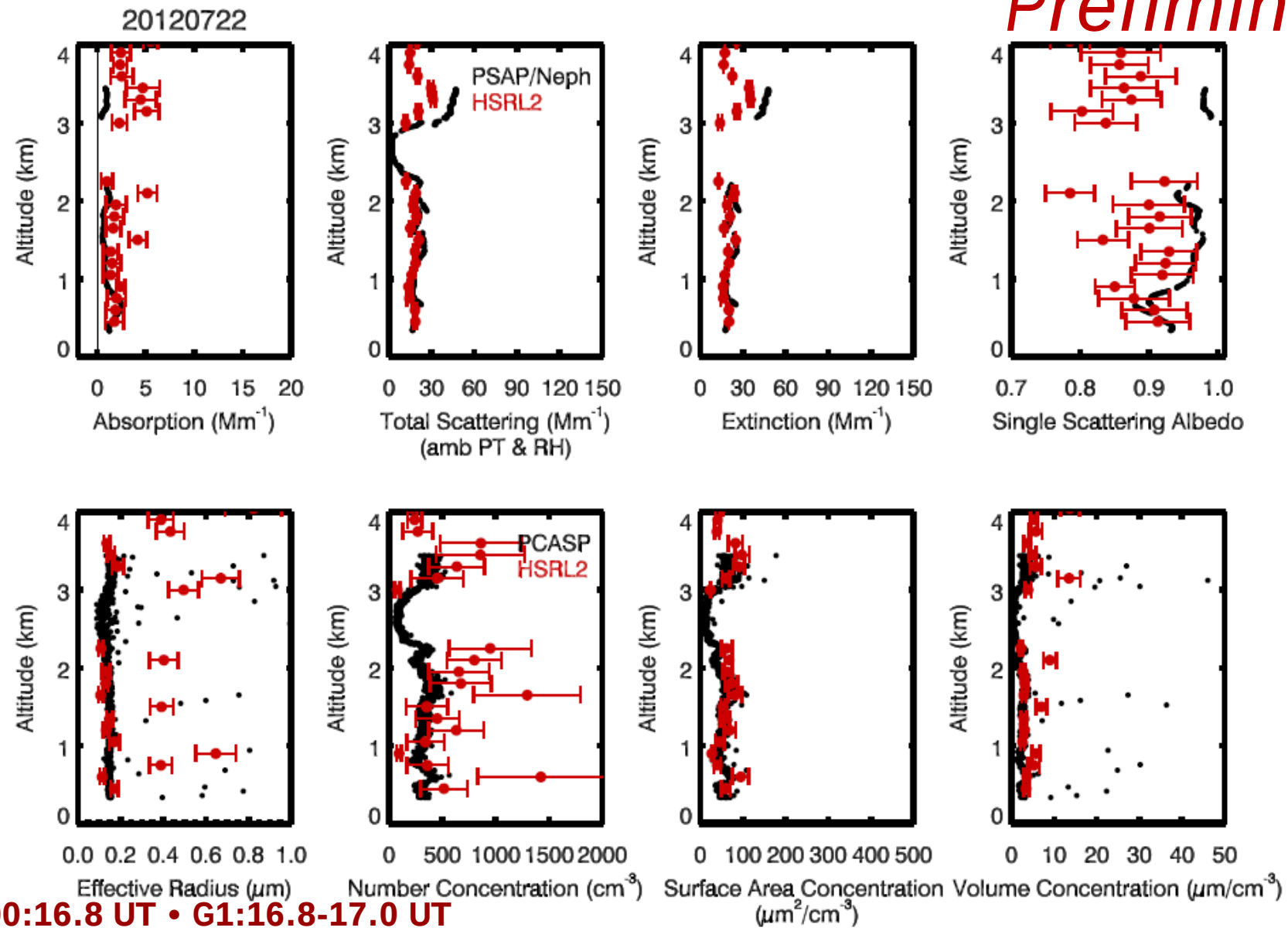



TC4STARHSRL2v13c_noHSRL2unclinear.fig, TC4STARAODclosure.m, Yohei, 2013-03-11

# HSRL-2 Microphysics Comparison with G1 In Situ

## 22 July

*Preliminary*

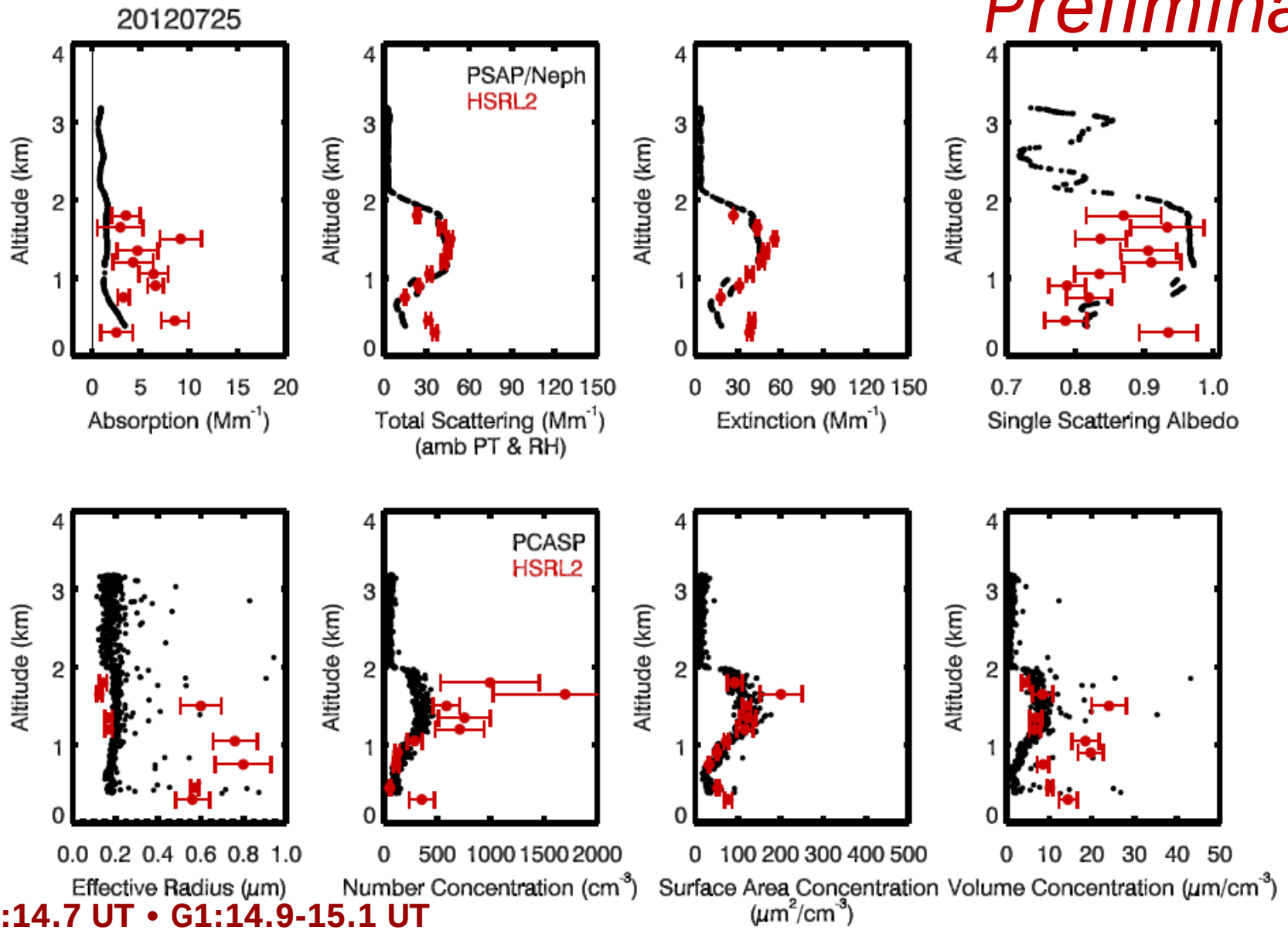



**B200:16.8 UT • G1:16.8-17.0 UT**

# HSRL-2 Microphysics Comparison with G1 In Situ

## 25 July

*Preliminary*

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