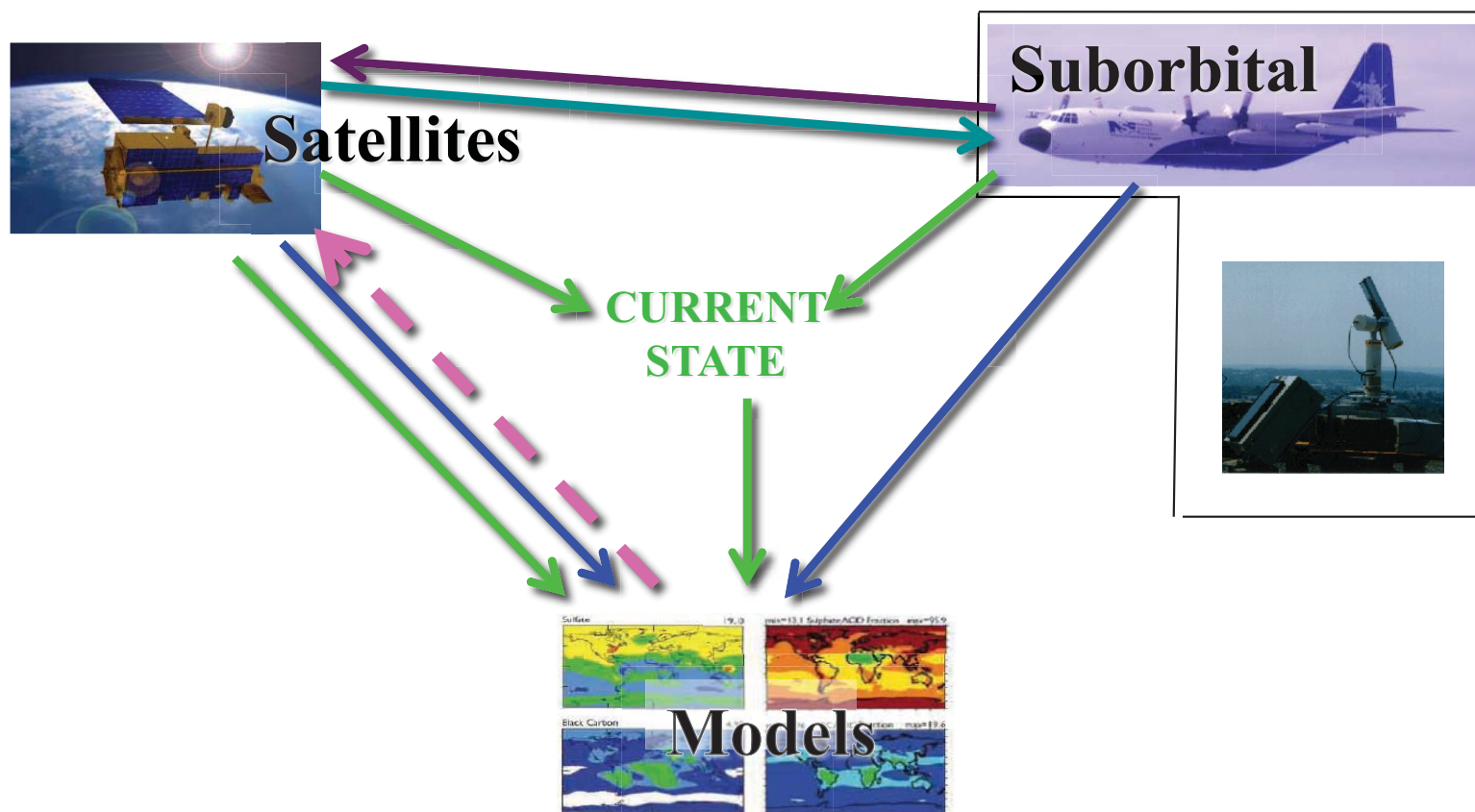


# A Three-way Street:

***MISR*** and ***MODIS*** Provide Context,  
***SEAC4RS*** Provides Detail and Validation,  
***Models*** Complete the Picture

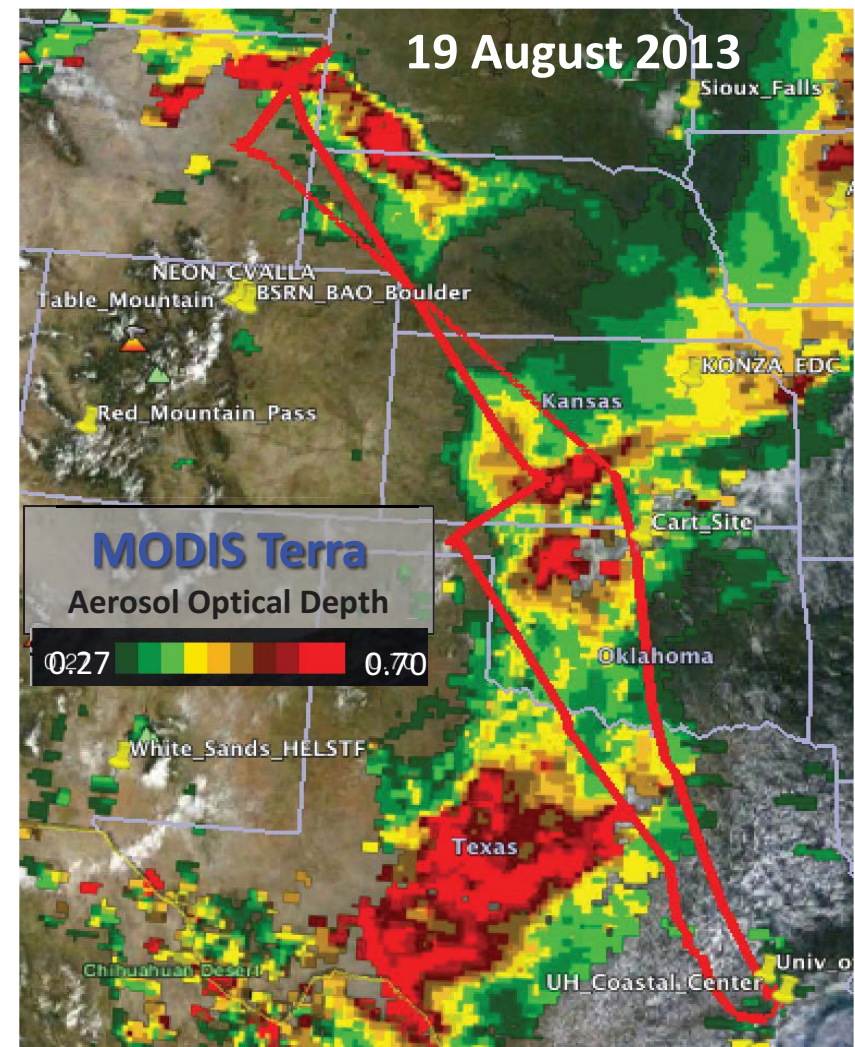
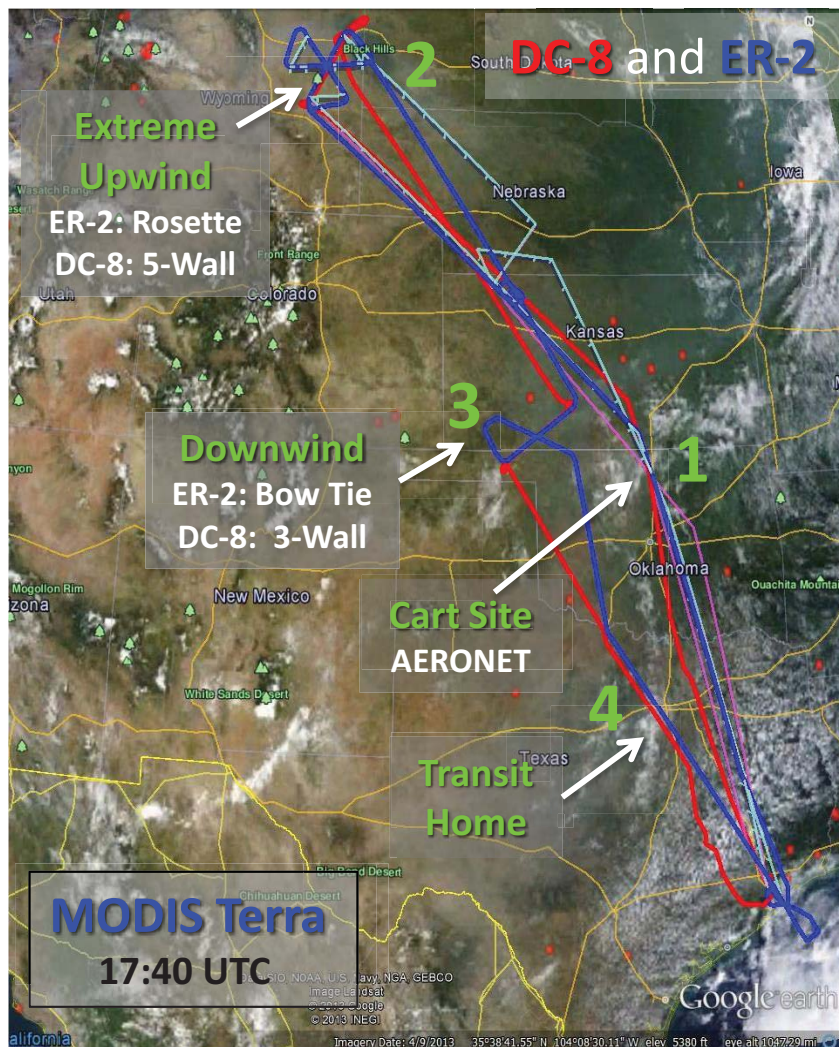
***Ralph Kahn***

NASA Goddard Space Flight Center



# Transported Smoke Survey Objectives

- Evaluate Imager & Polarimeter *Sensitivity to Smoke Properties* [*remote sensing validation*]
- Study Characteristics of *Transported Smoke* [chemistry/*transport*]
- Assess *Radiative Impact of Smoke* Layers [radiation closure]



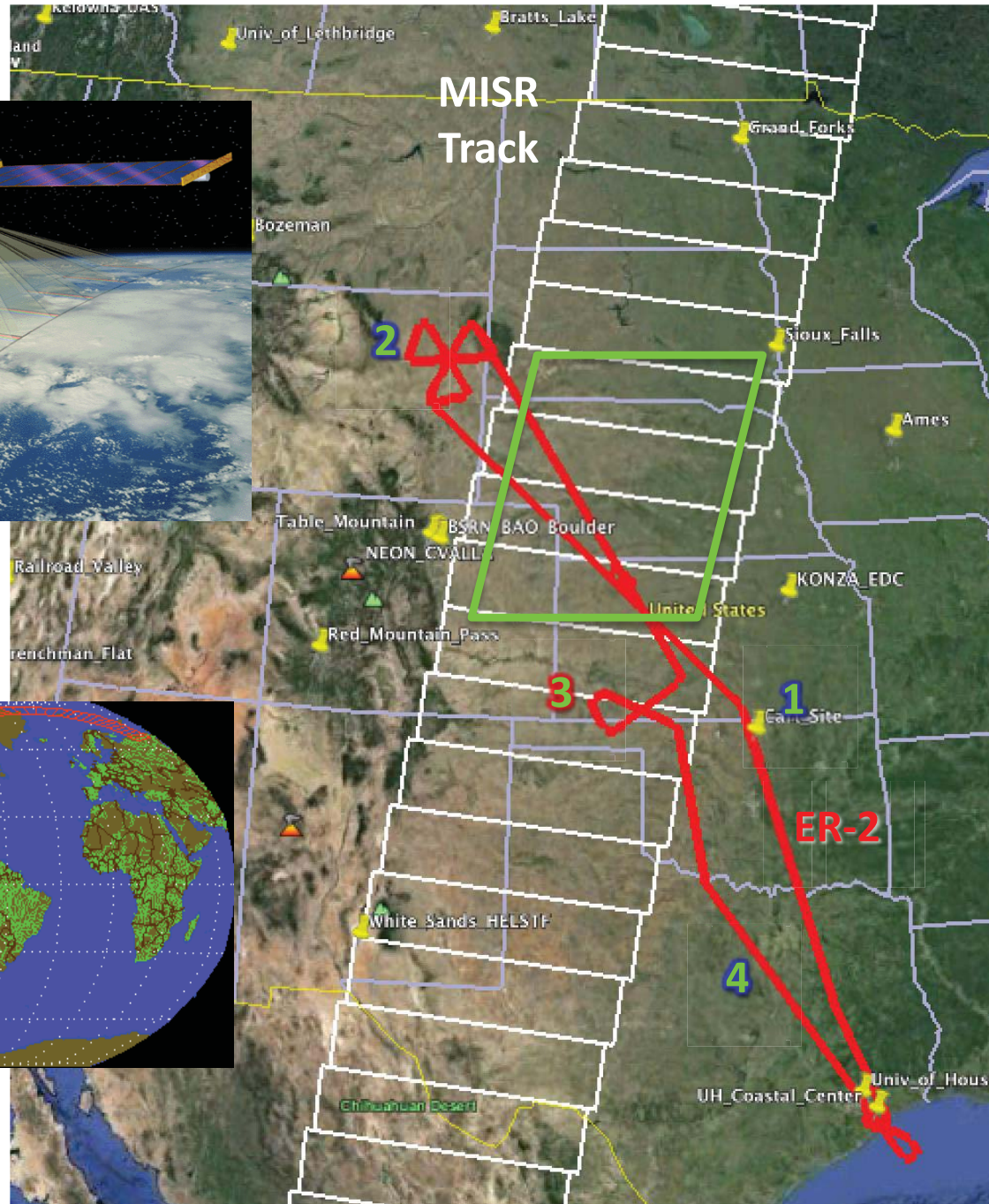
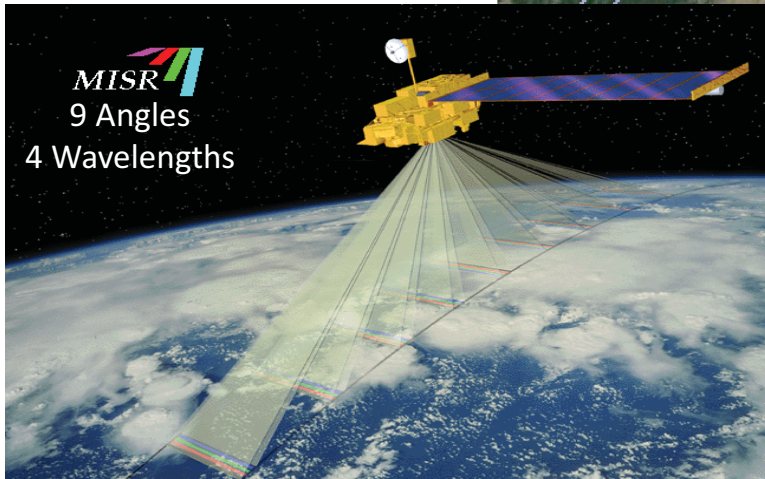
**All Data Shown Are Preliminary**

**Please Contact the Individual Instrument Teams**

**For Further Information**

# MISR (Multi-angle Imaging SpectroRadiometer) Overpass

Monday, 19 August 2013 17:40 UTC

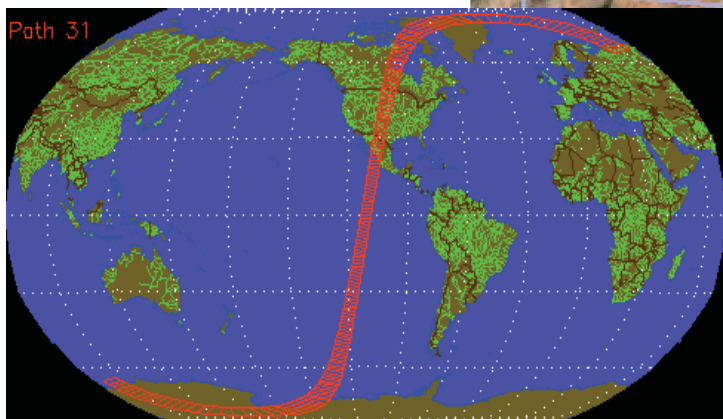


17:40 UTC  
Path 031  
Orbit 72716

South Dakota

Nebraska

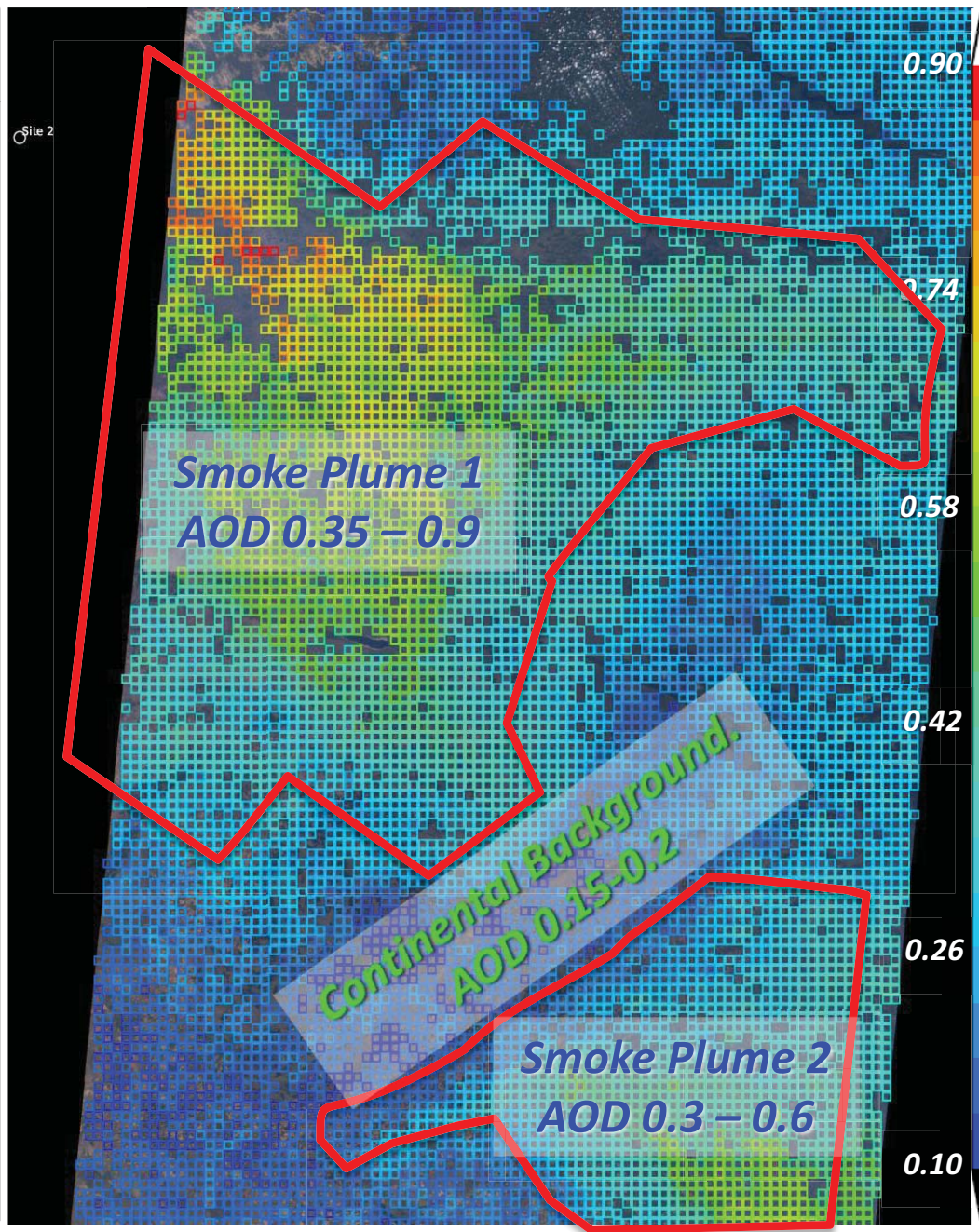
Kansas



# MISR Aerosol Optical Depth (Research Algorithm)

19 August 2013

Site 2



# MISR Aerosol Type (Research Algorithm)

19 August 2013

Site 2



## Angstrom Exponent

2.00

1.80

1.60

1.40

1.20

1.00

Smoke Plume 1  
ANG 1.5-1.9

Continental Background  
ANG 1.0-1.5

Smoke Plume 2  
ANG 1.6-2.0

## Single-Scattering Albedo

1.00

0.98

0.96

0.94

0.92

0.90

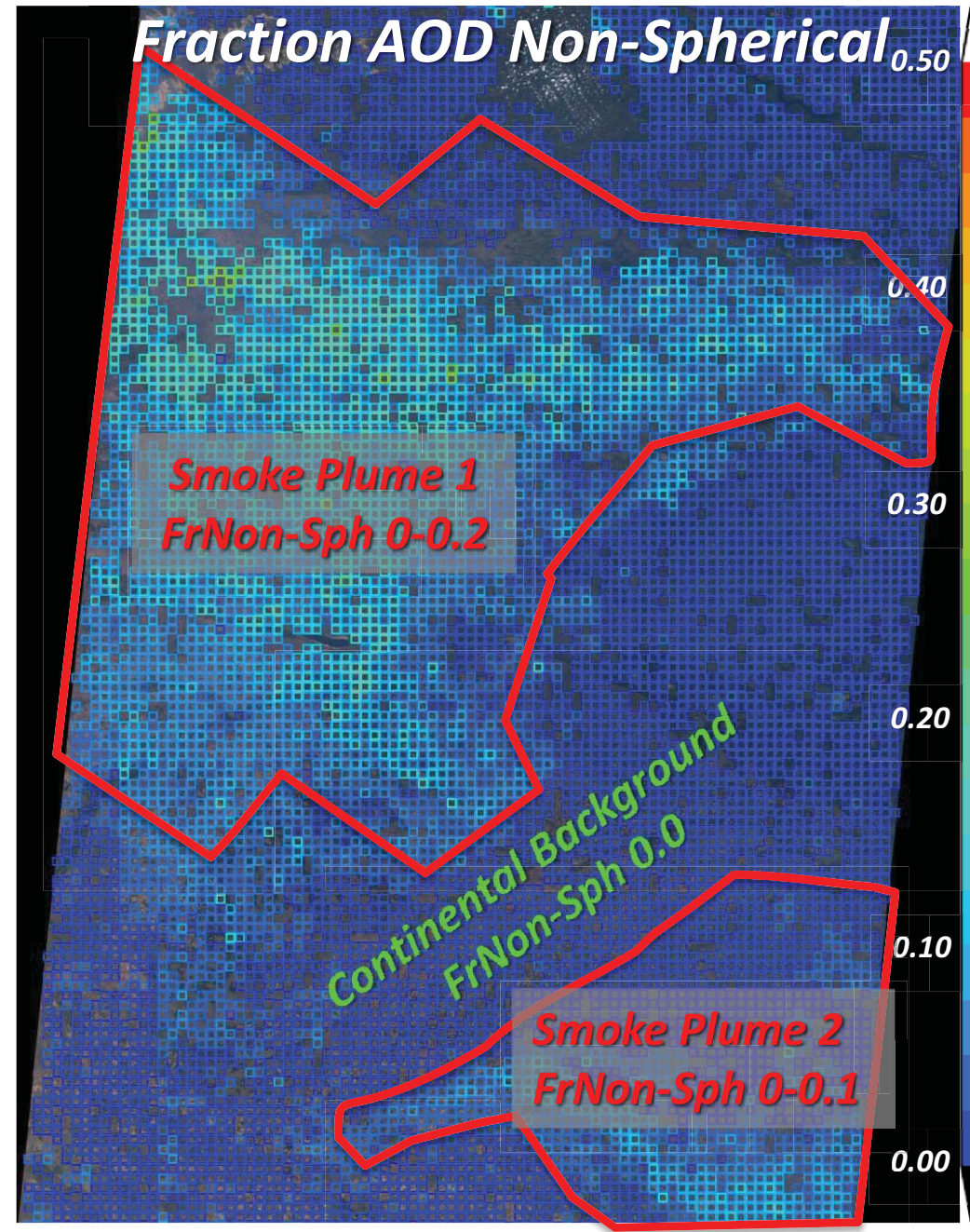
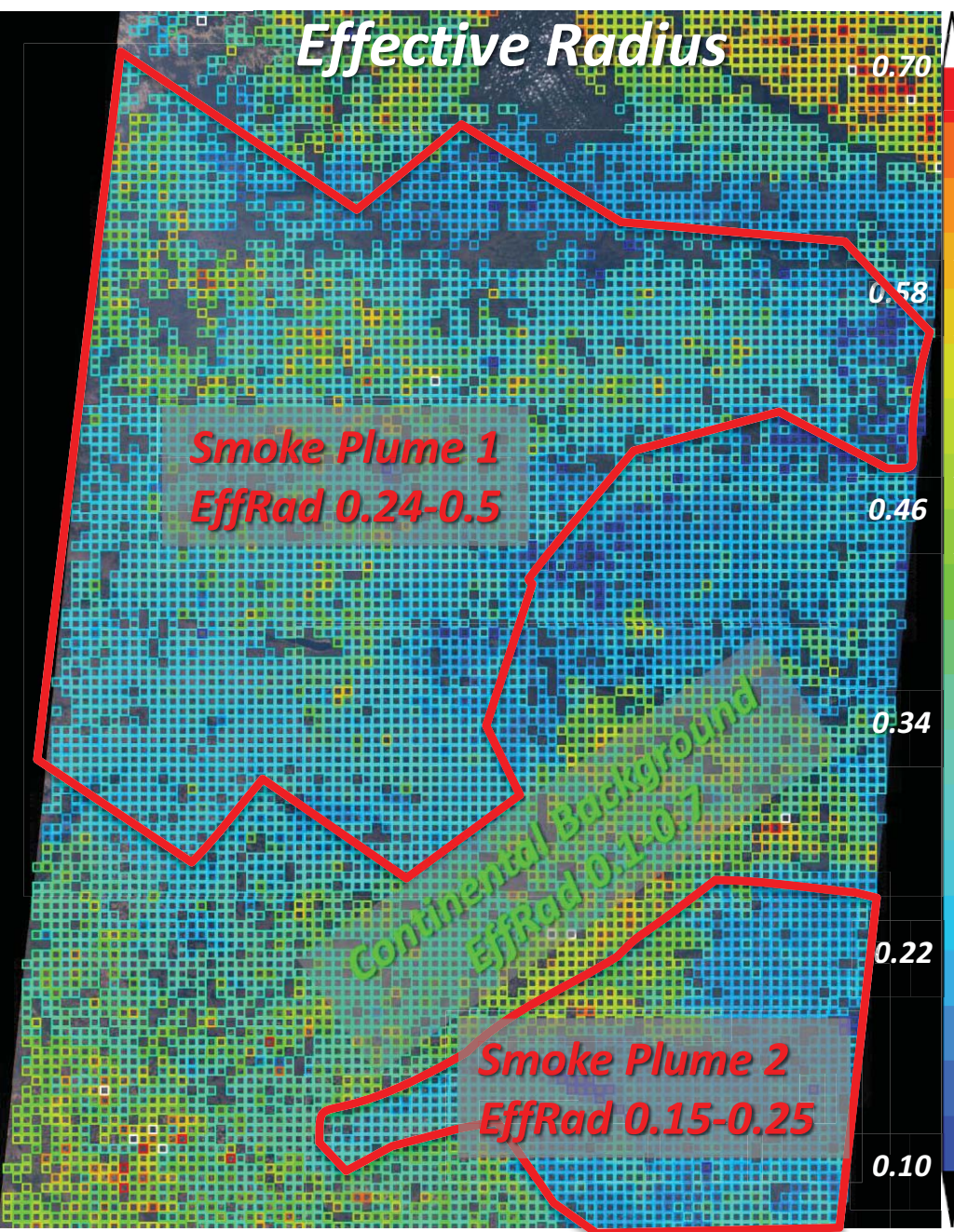
Smoke Plume 1  
SSA 0.94-0.98

Continental Background  
SSA 0.99-1.0

Smoke Plume 2  
SSA 0.96-0.98

# MISR Aerosol Type (Research Algorithm)

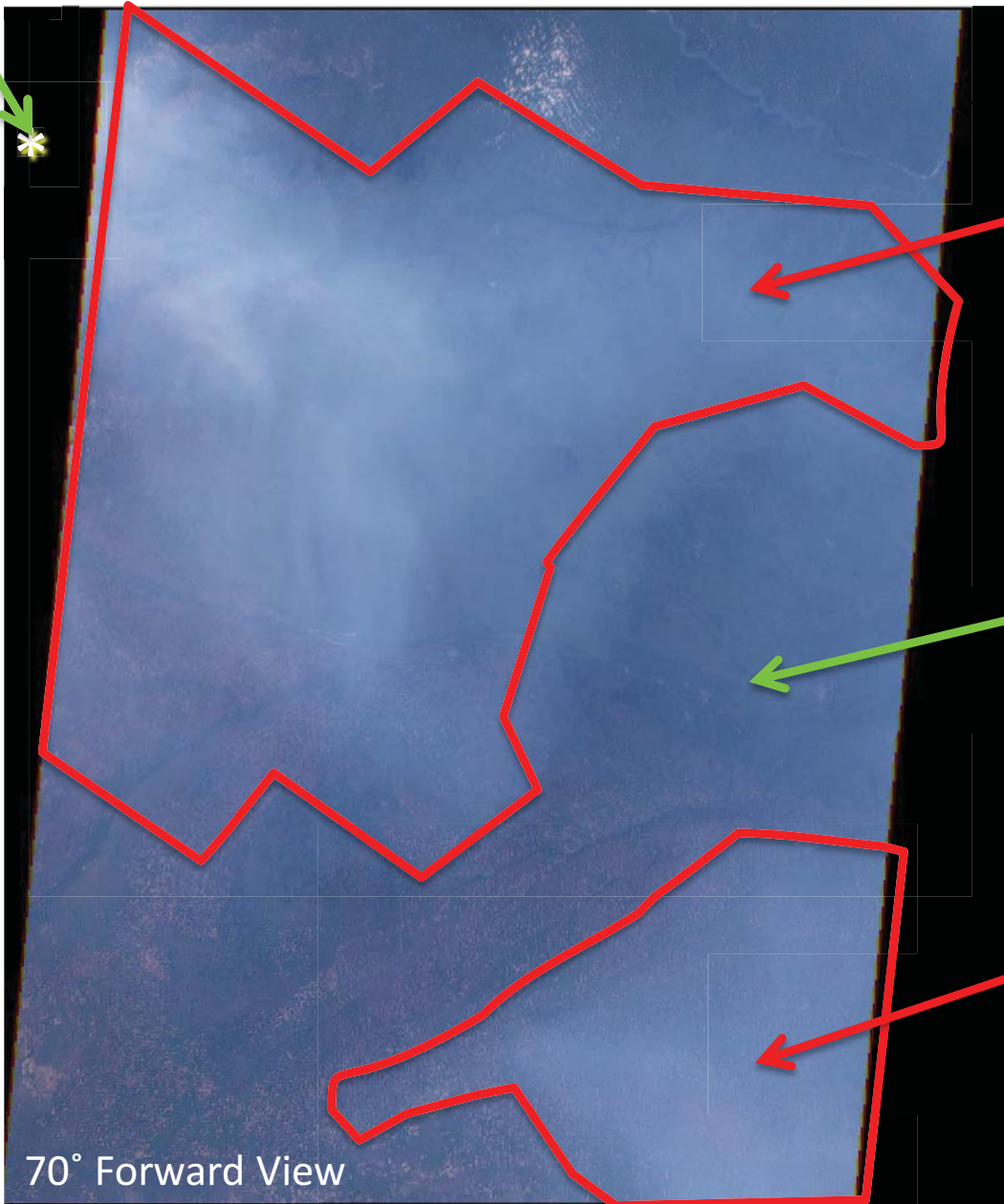
19 August 2013



# MISR Aerosol Type (Research Algorithm)

19 August 2013

Site 2



## Smoke Plume 1

AOD 0.35-0.9

ANG 1.5-1.9 (*small*)

SSA 0.94-0.98 (*absorbing*)

FrNon-Sph 0-0.2 (*mostly spherical*)

## Continental Background

AOD 0.15-0.2

ANG 1.0-1.5 (*medium*)

SSA 0.99-1.0 (*non-absorbing*)

FrNon-Sph 0.0 (*spherical*)

## Smoke Plume 2

AOD 0.35-0.6

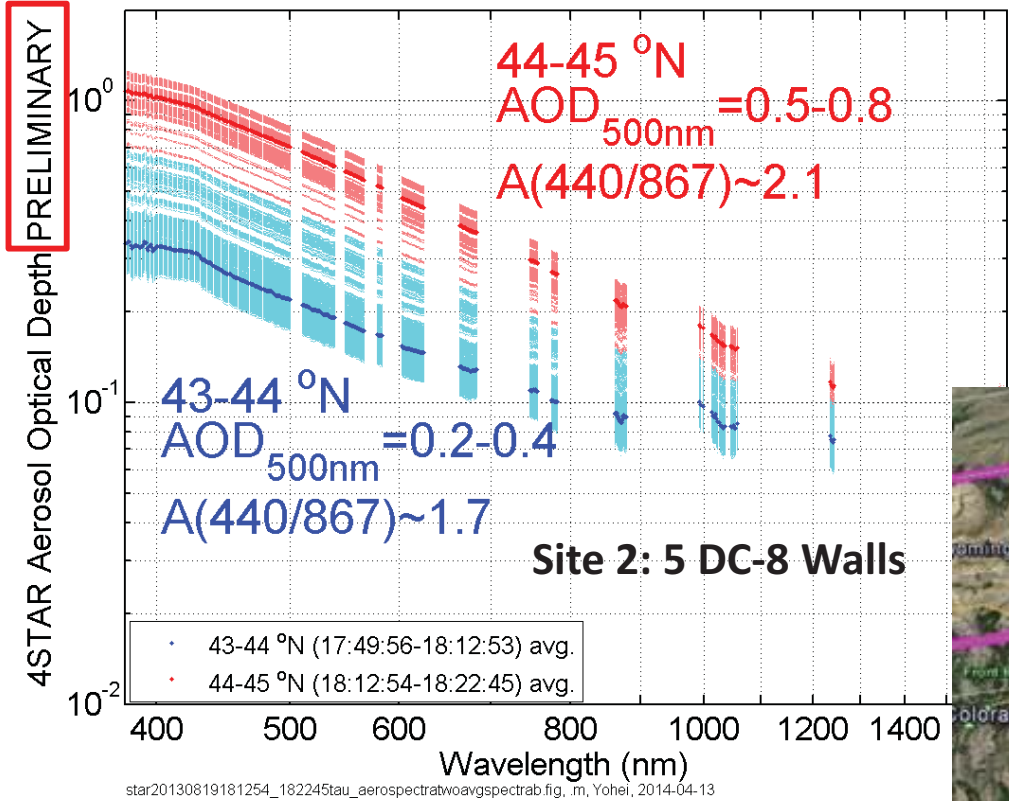
ANG 1.6-2.0 (*smaller*)

SSA 0.96-0.98 (*less absorbing*)

FrNon-Sph 0-0.1 (*more spherical*)

Passive-remote-sensing **Aerosol Type** is a **Total-Column-Effective, Categorical** variable!!



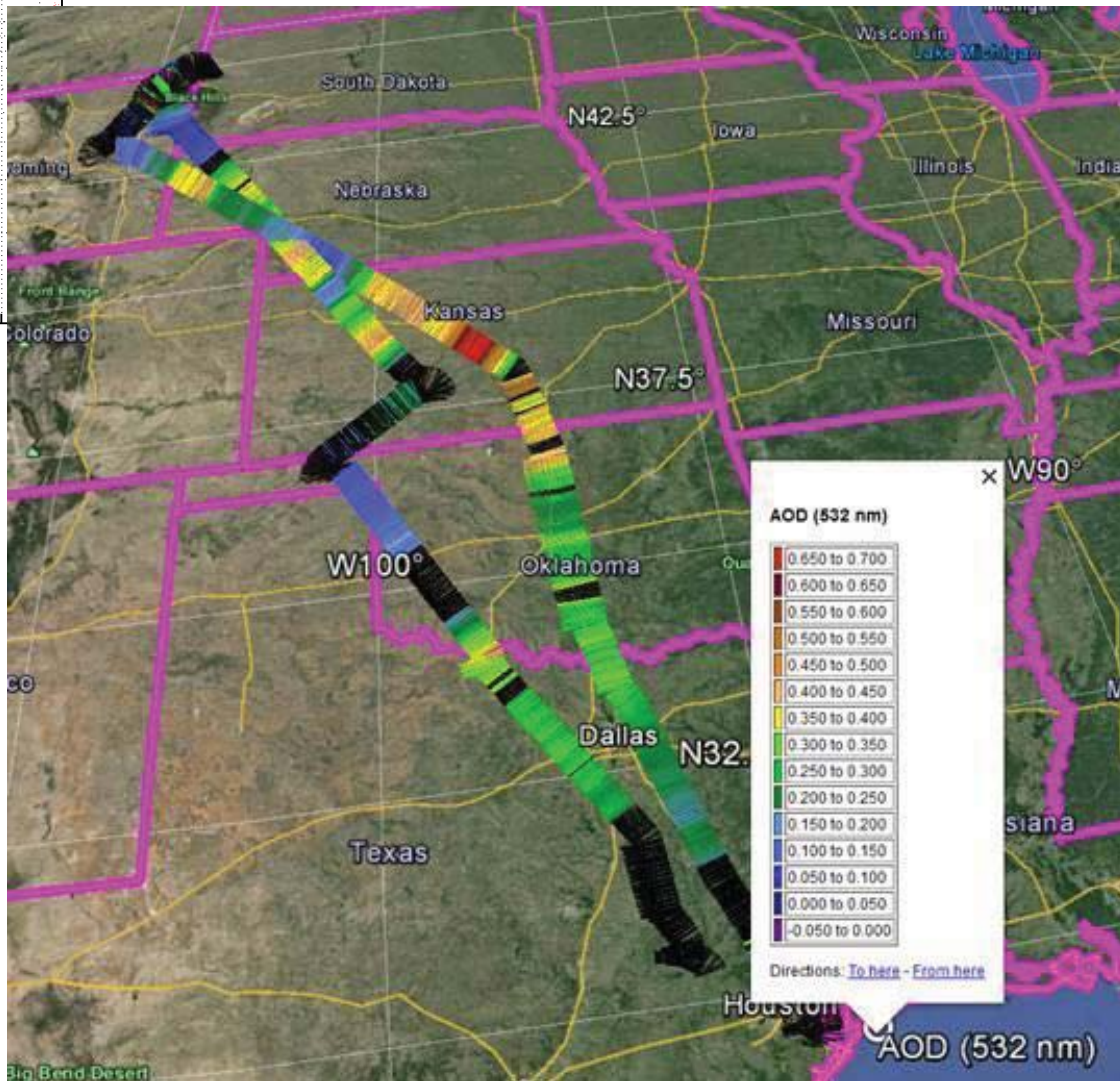


4-STAR Team, Shinozuka et al.

# MISR AOD/ANG

## Validation

19 August 2013



HSRL Team, Ferrare et al.

**MISR Smoke Plume 1**

**AOD 0.35-0.9**

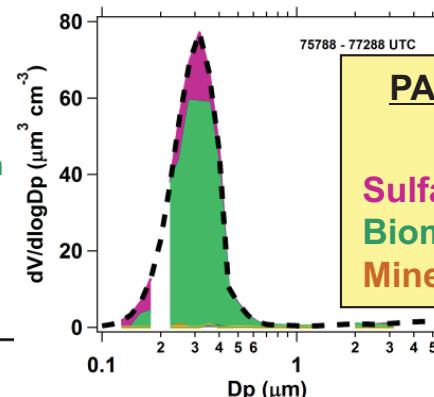
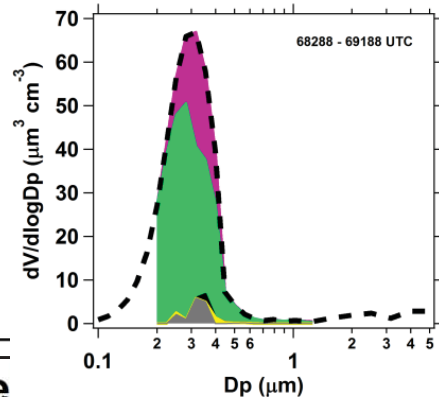
ANG 1.5-1.9 (*small*)

SSA 0.94-0.98 (*absorbing*)

FrNon-Sph 0-0.2 (*mostly spherical*)

# 8/19 PALMS + LARGE *in situ* aerosol

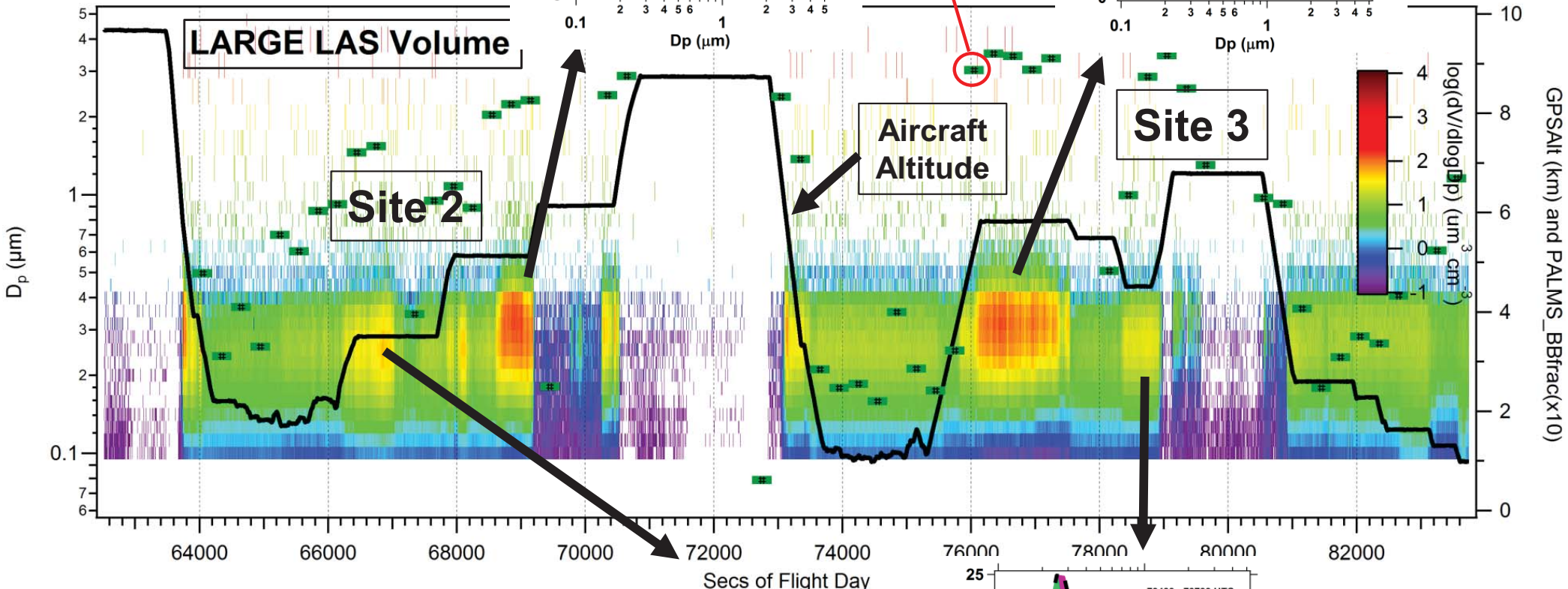
- Mostly **BB particles**
- Some **Sulfate/Organic** mixed into plume
- Very little **Mineral Dust** lofted with smoke



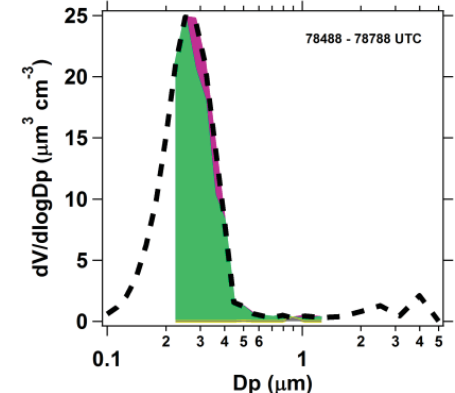
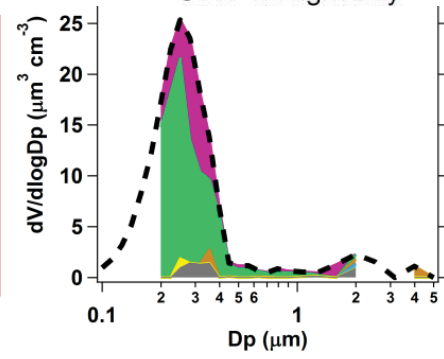
**PALMS particle types**

- Sulfate/Organic
- Biomass Burning
- Mineral Dust

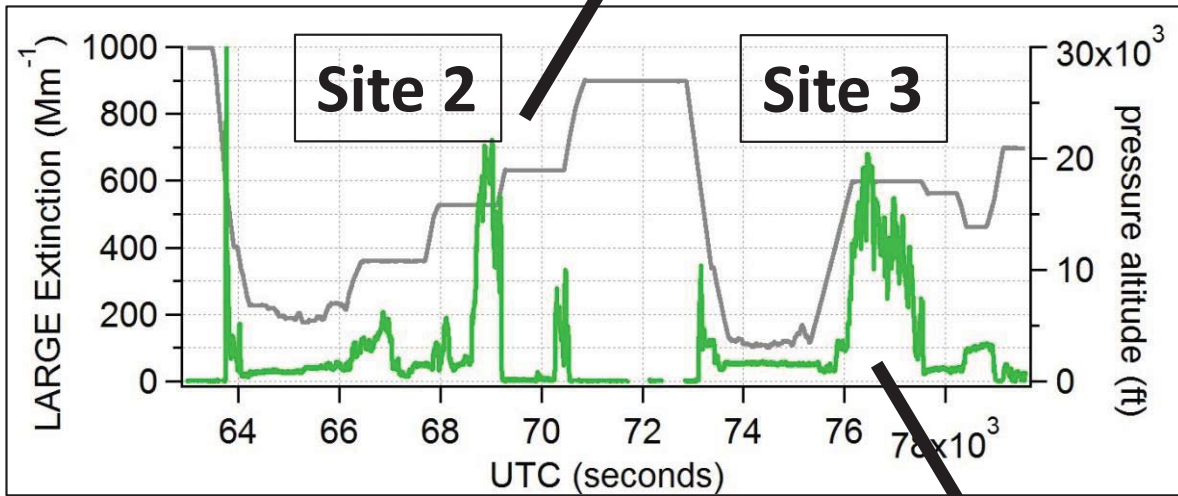
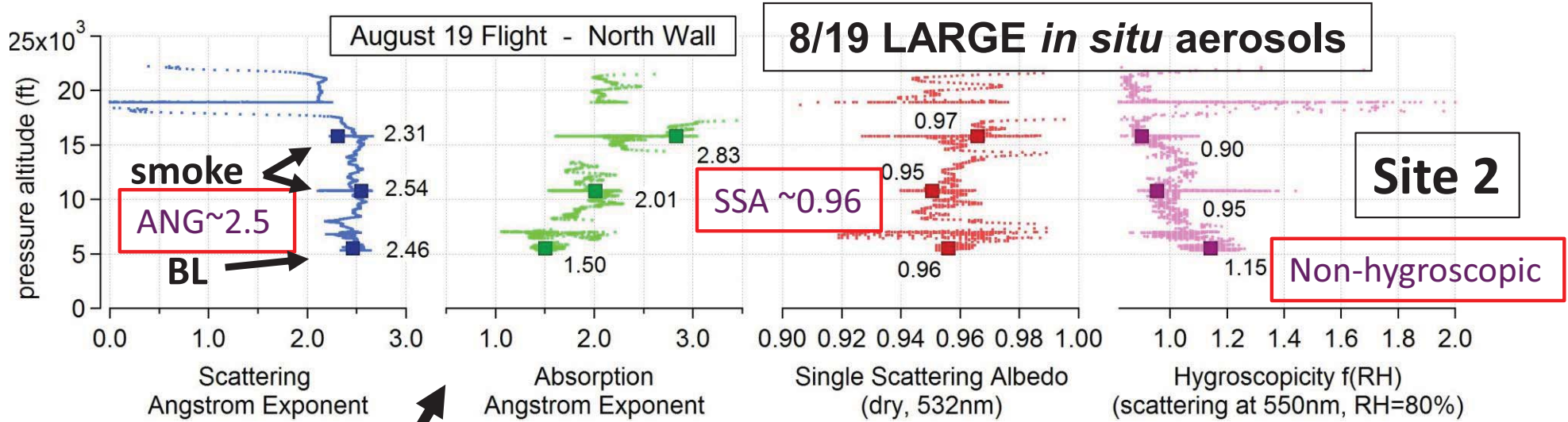
PALMS # fraction of particles that have BB material (0-10 right scale)



- General compositional makeup is similar for 4 plumes
- Older plumes have lower nitrate, higher organic content

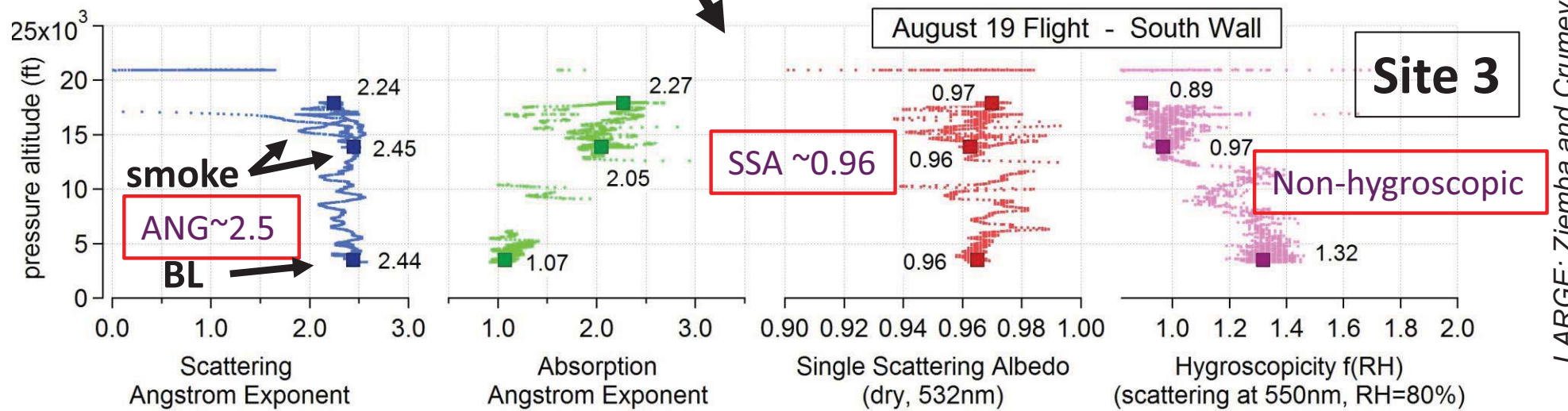


- Plumes from 3-6 km alt, higher plumes are thicker

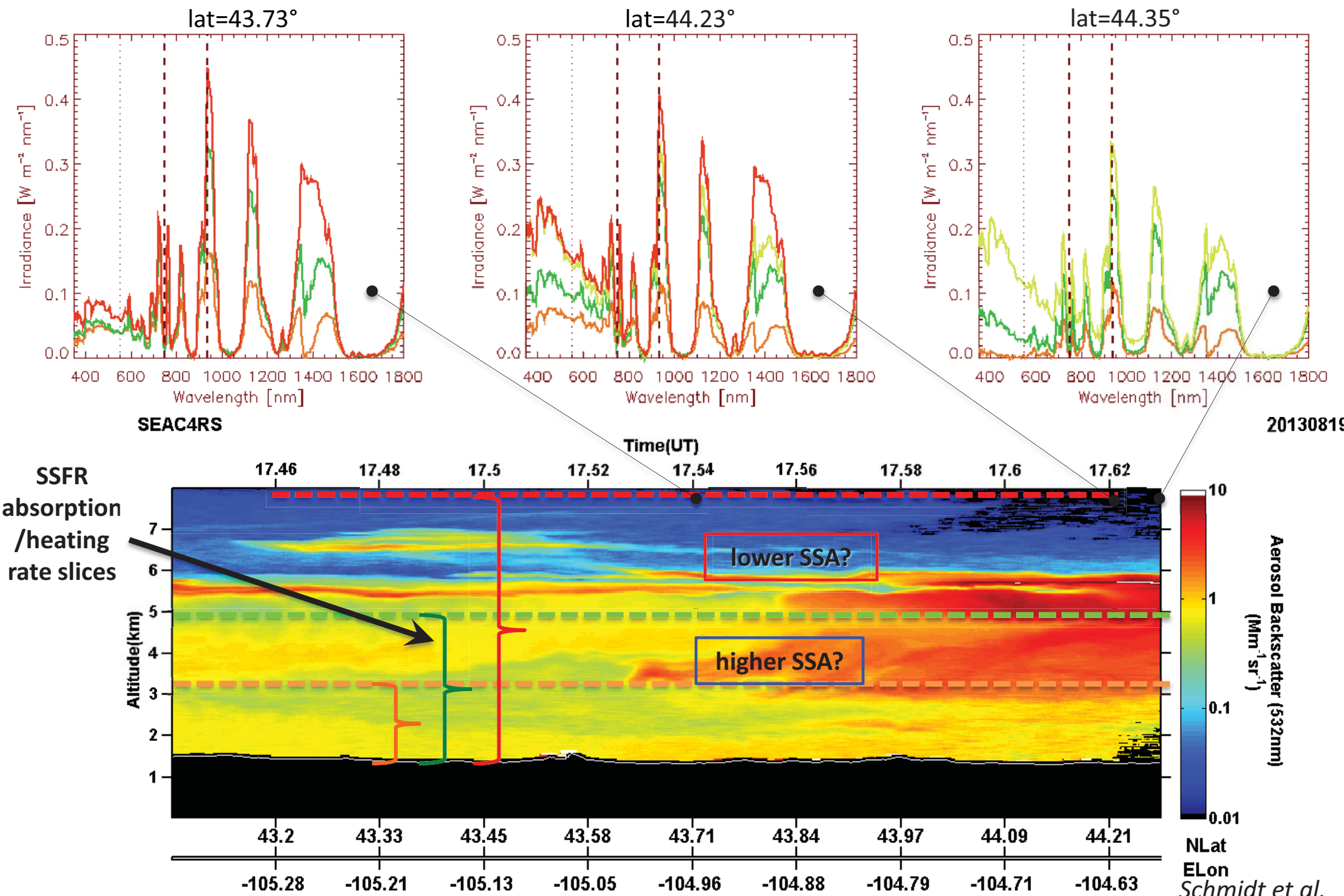


**MISR Smoke Plume 1**  
 SSA 0.94-0.98 (*absorbing*)

- Altitude-dependence of optical properties is relatively unchanged between the plumes
- Smoke plume is *non-hygroscopic*
- SSA and abs-AE indicate *organic coatings are significant*



# Site 2 Upwind Smoke: SSFR Multiple Layer SSA

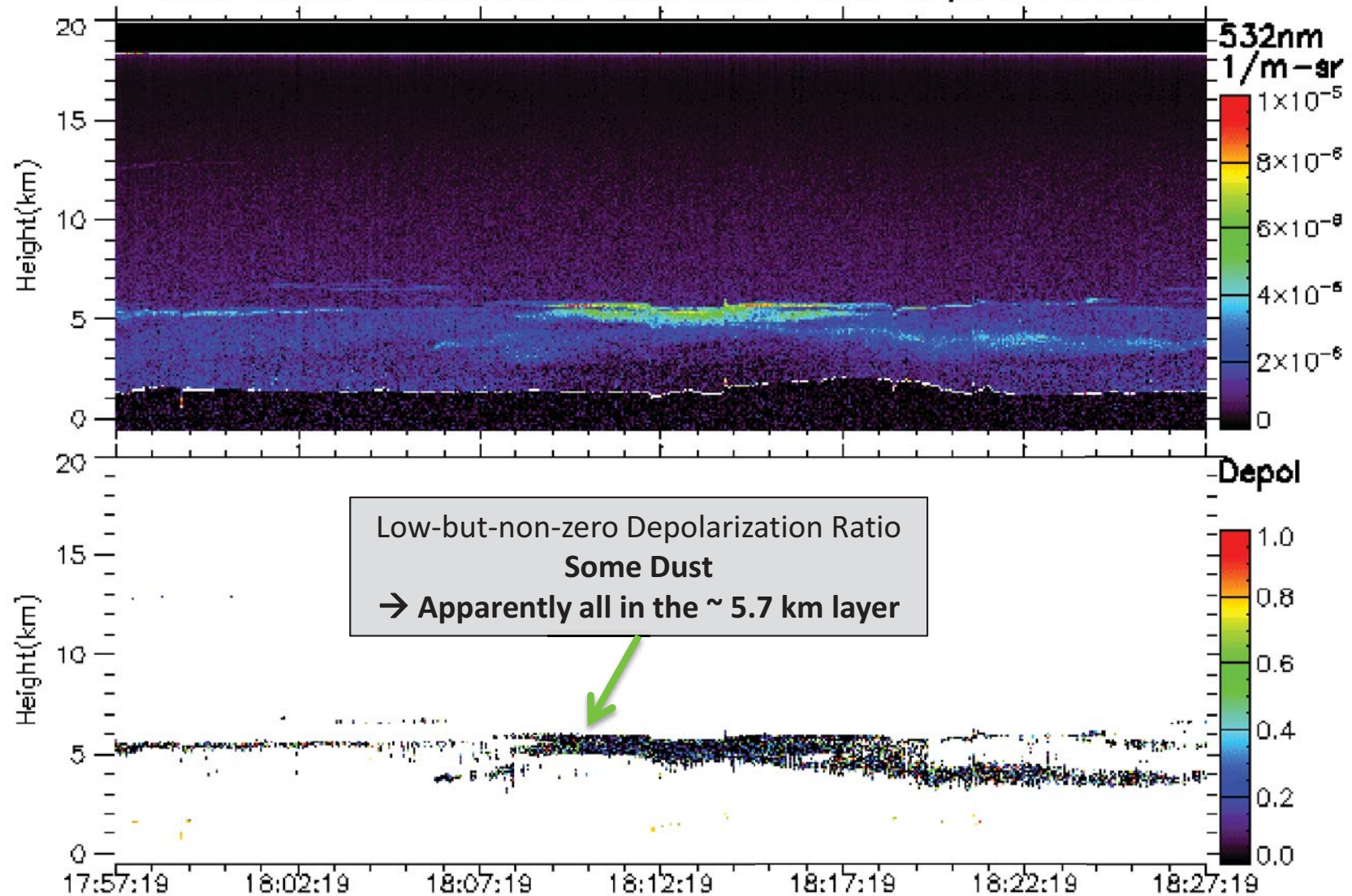


# CPL Backscatter & Depolarization Ratio

19 August 2013 Site 2 Rosette

ER2-CPL SEAC4RS 19Aug13

Attenuated Backscatter Coefficient and Depolarization

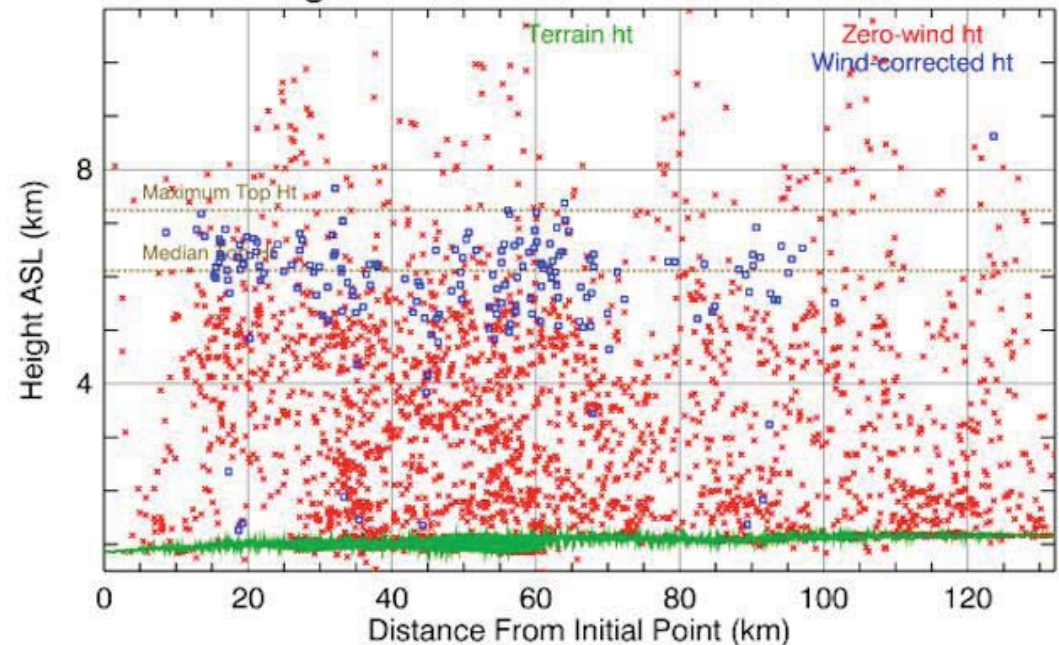
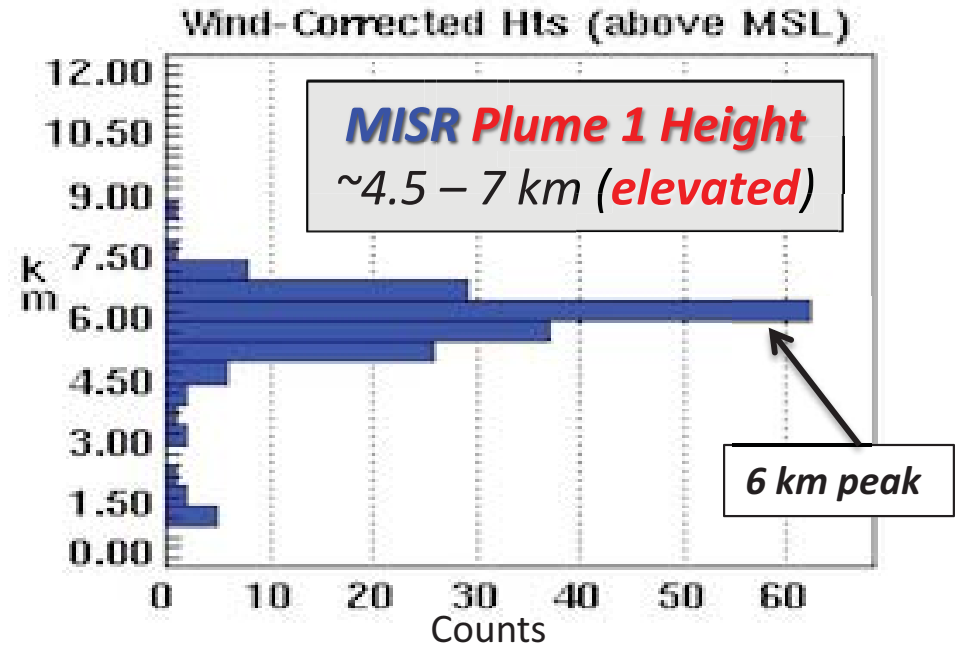
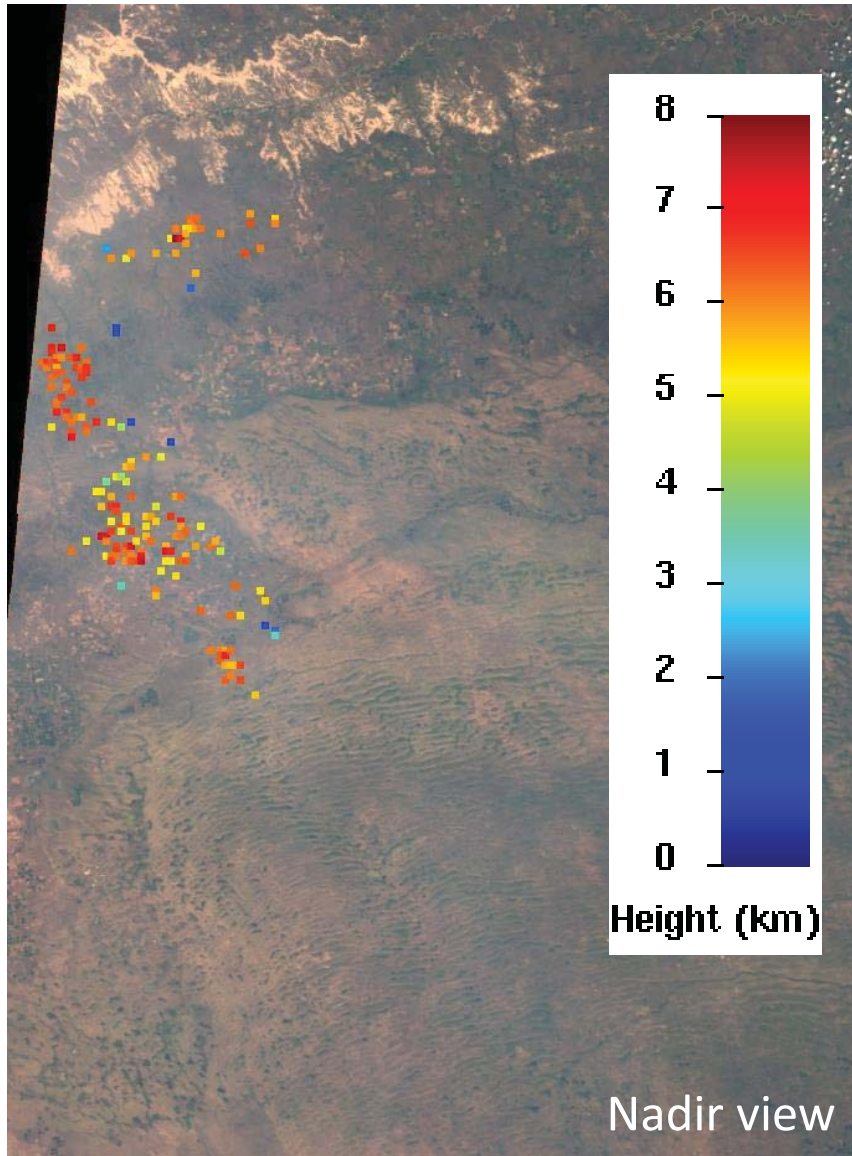


**MISR Smoke Plume 1**

FrNon-Sph 0-0.2 (*mostly spherical*)

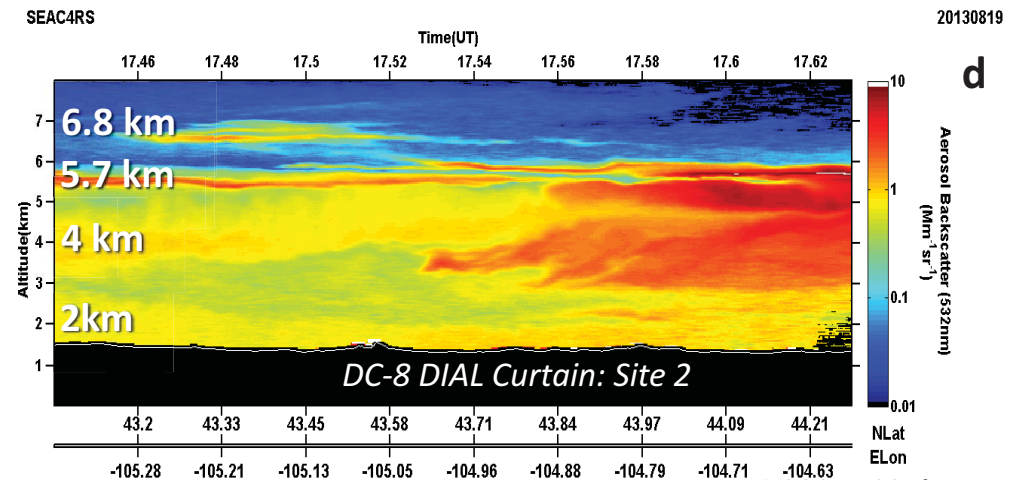
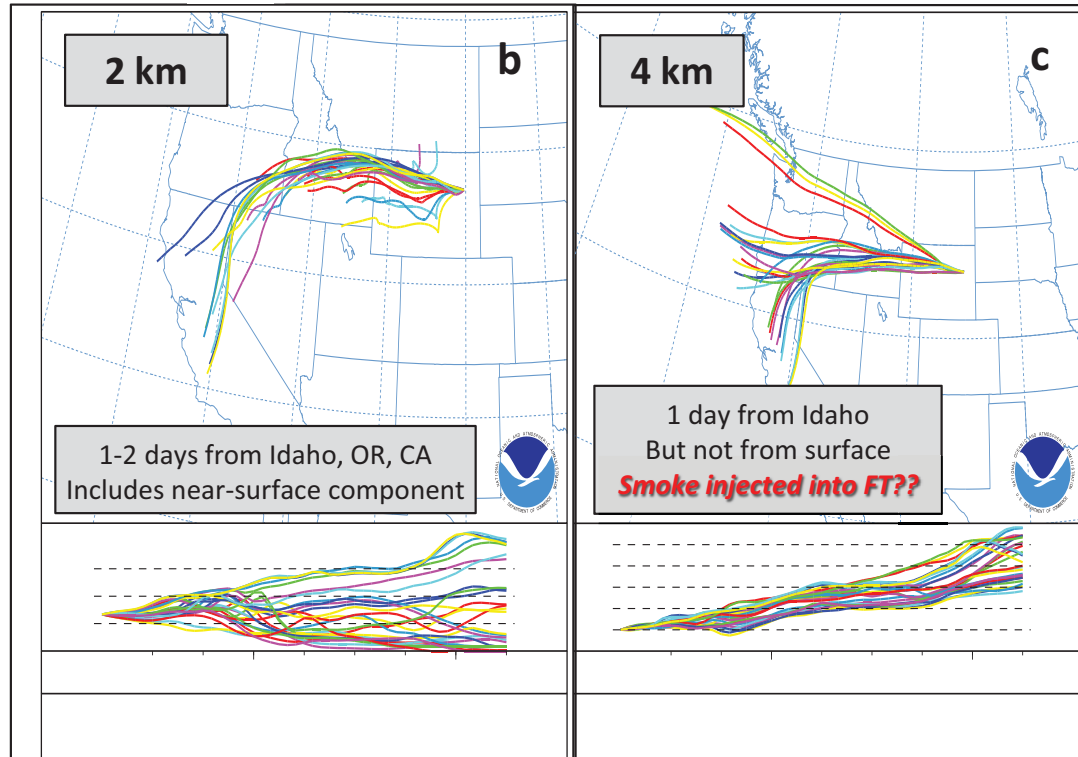
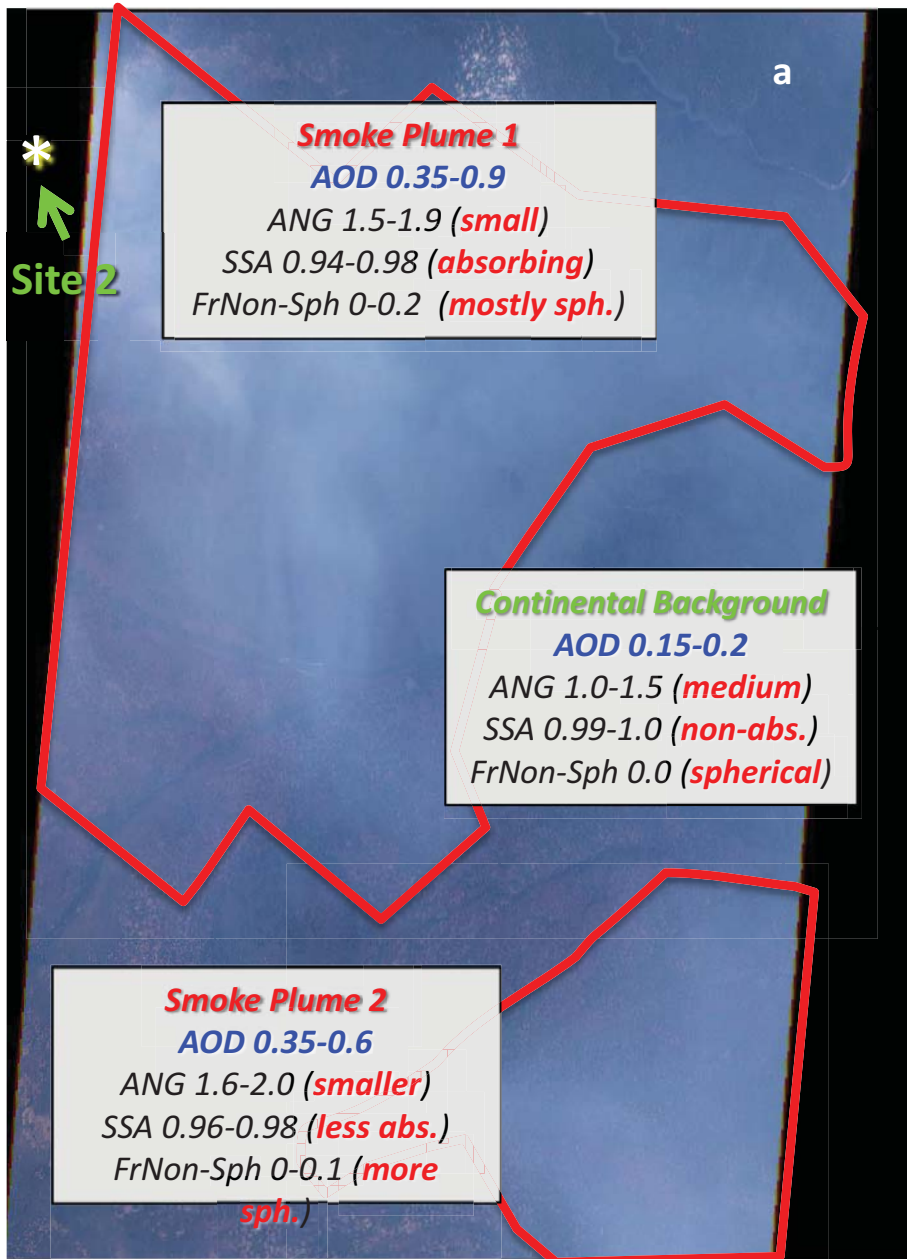
# MISR Plume Height (Level of Max Contrast) Near Site 2

19 August 2013

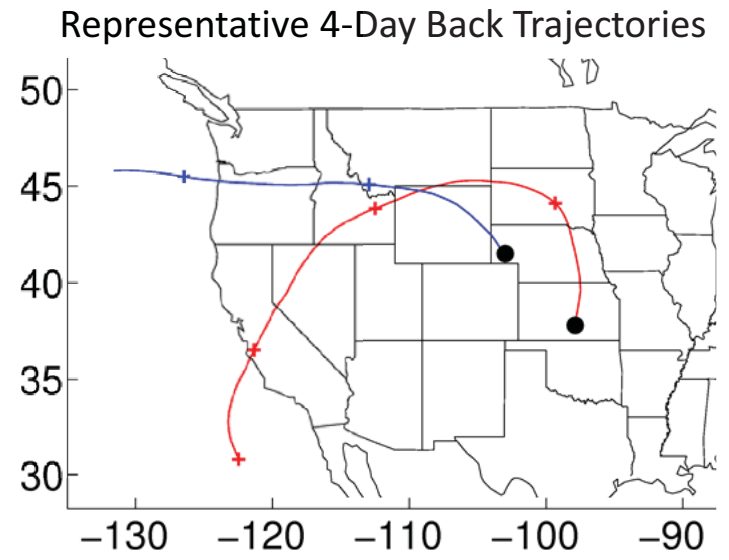
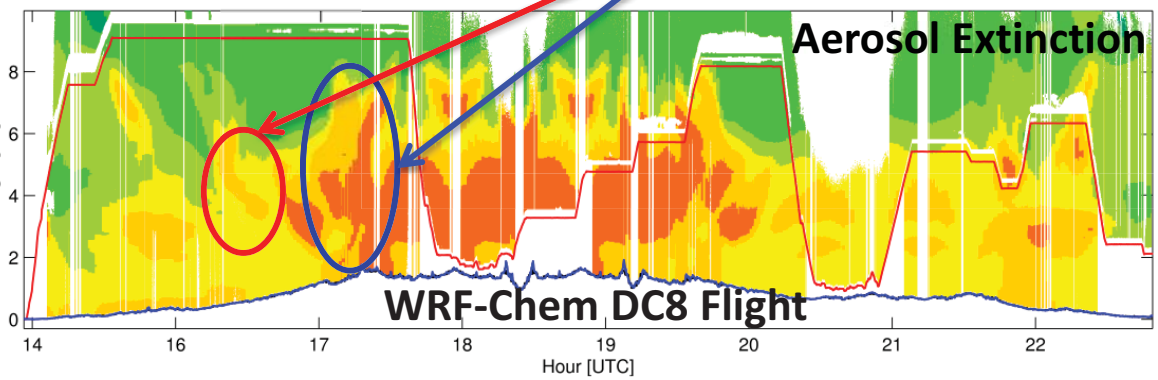
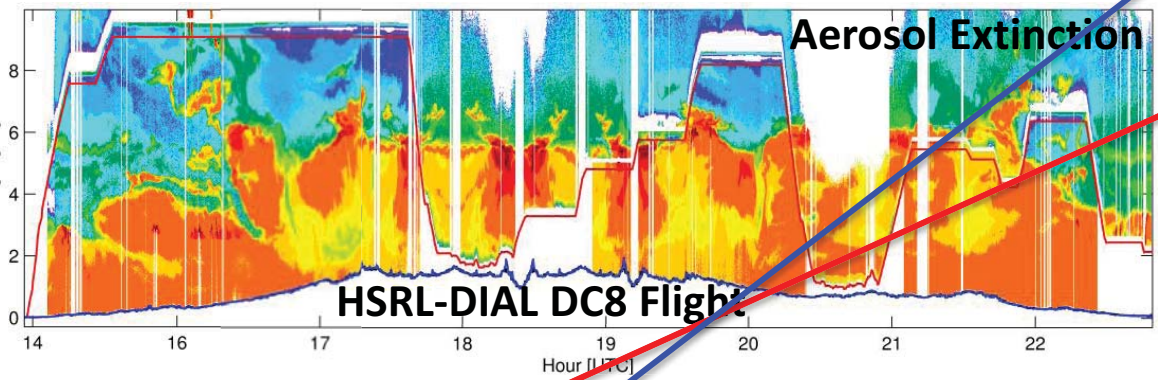
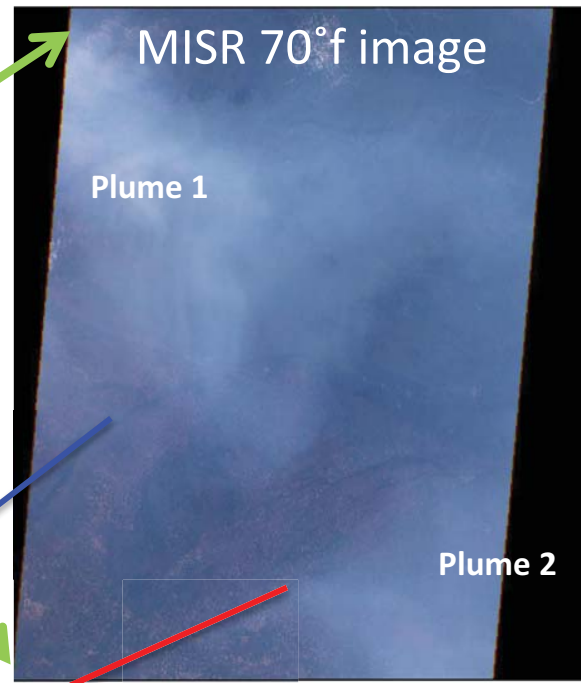
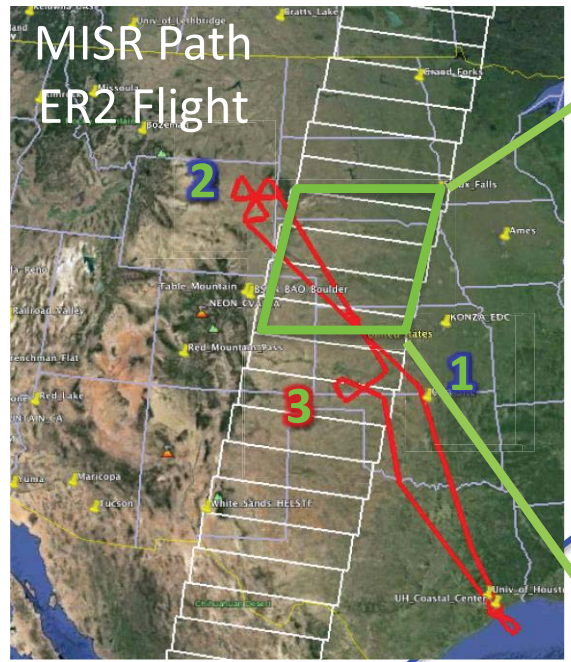
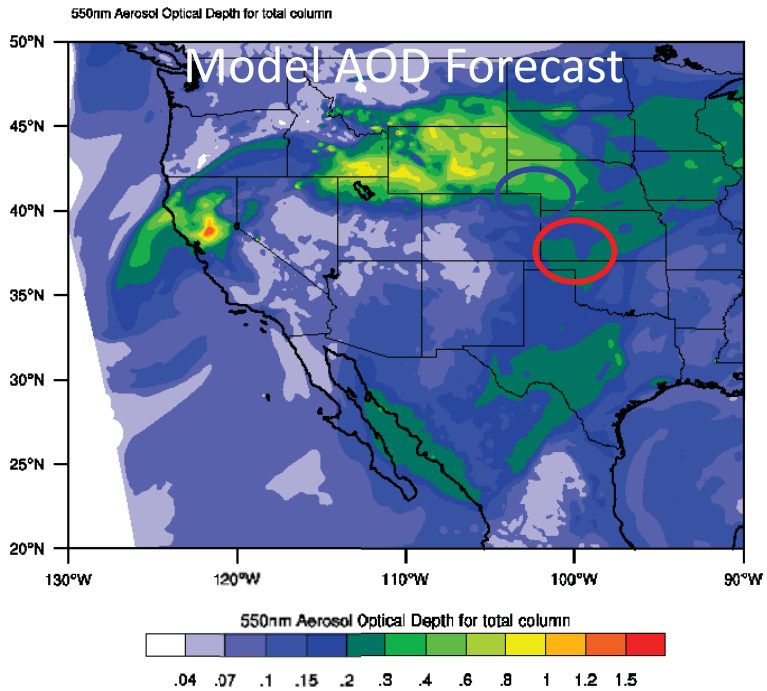


# Site 2 Smoke Transports

19 August 2013



# U. Iowa Modeling SEAC4RS 19 August 2013

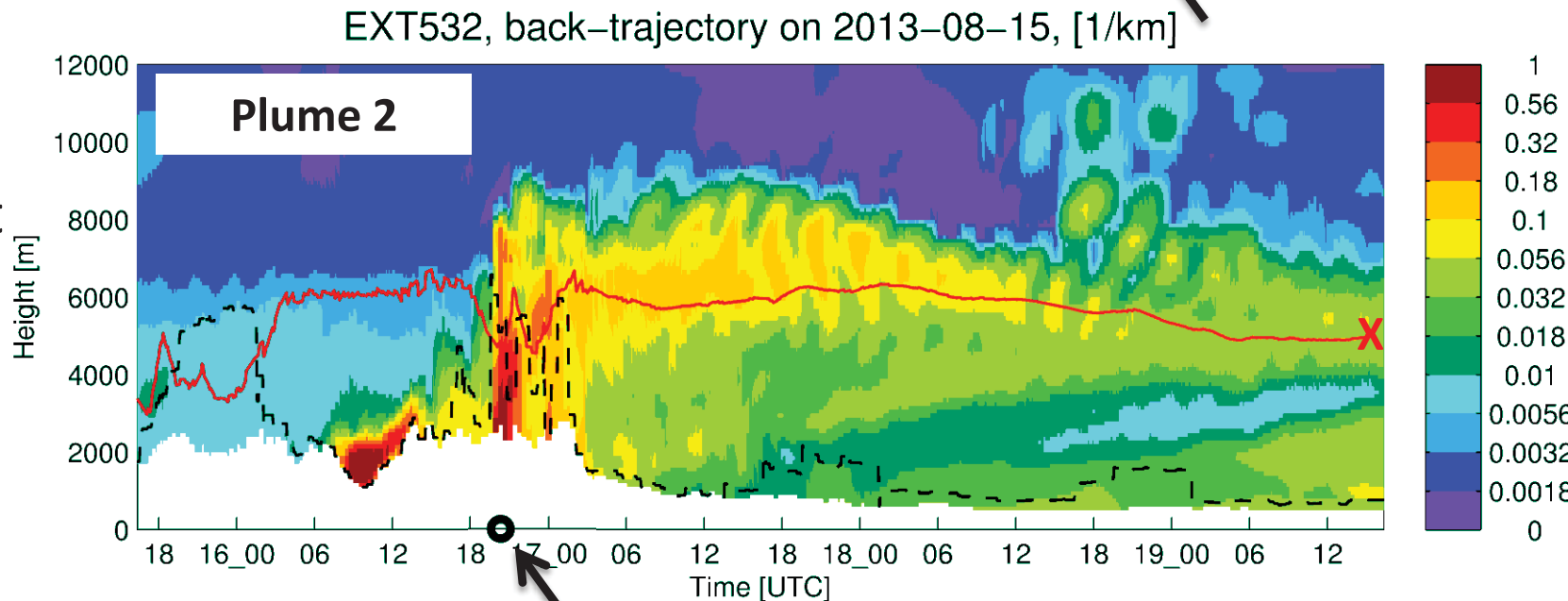
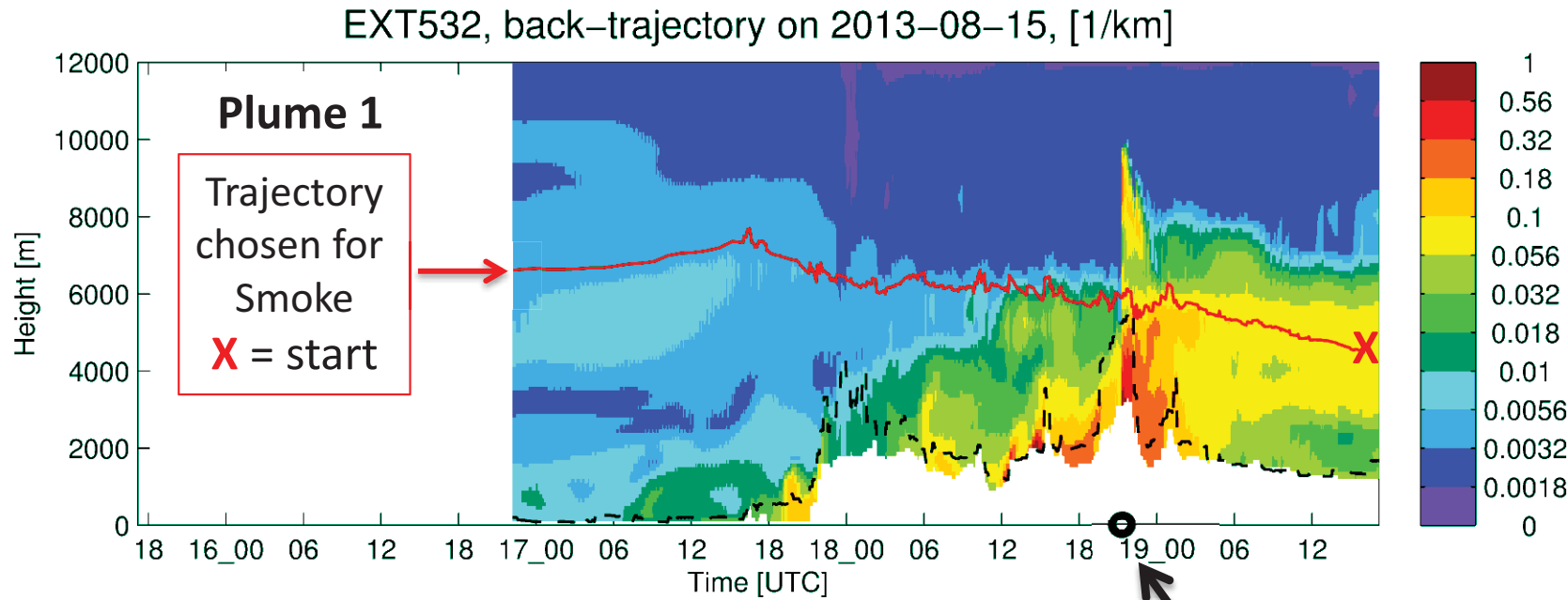


WRF modeling – Saide et al.



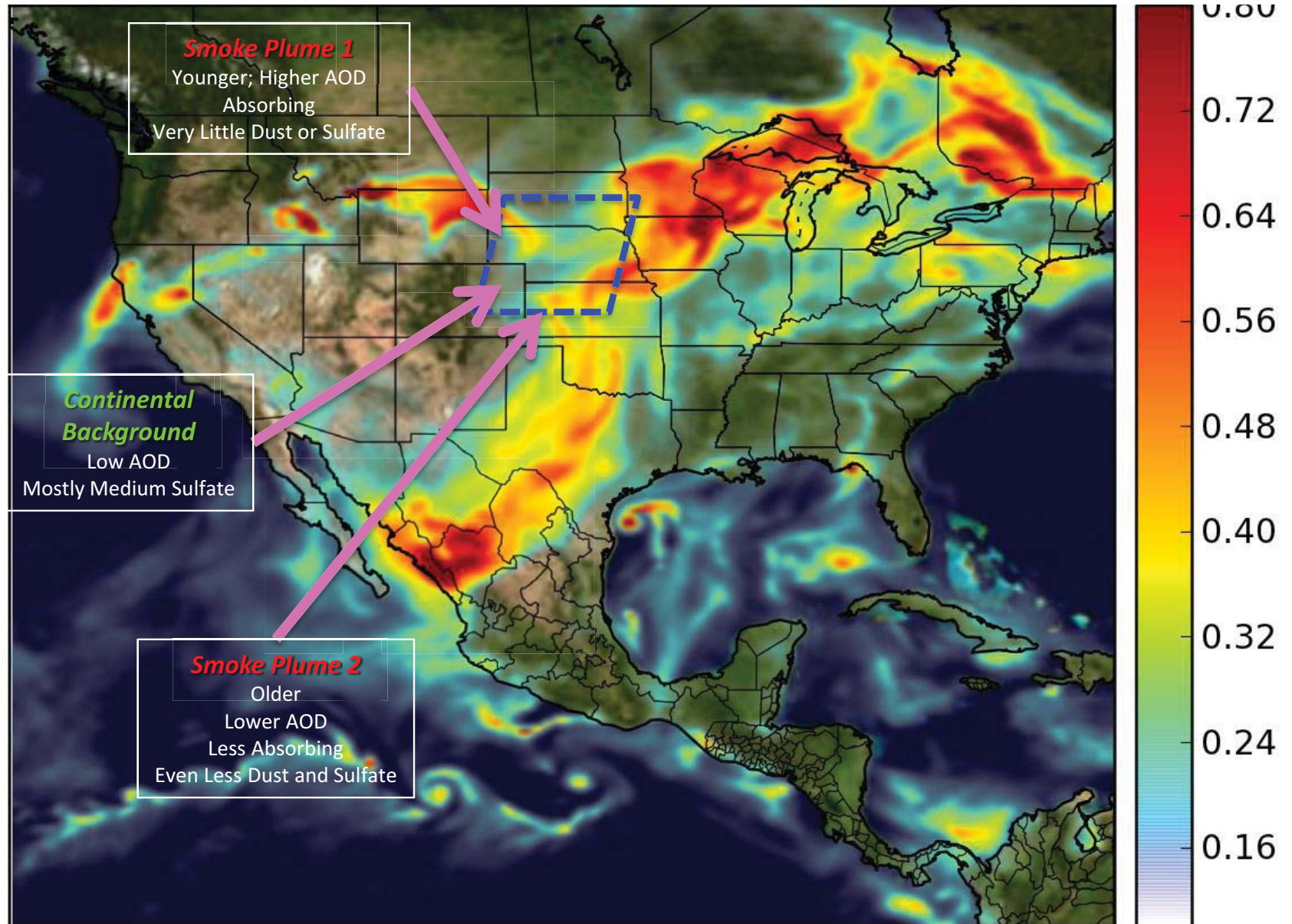
# U. Iowa Modeling – Curtain Along Back Trajectory

- Red solid line: Particle height
- Black segmented line: PBL height
- Black circle: first fire location that the particle intersects



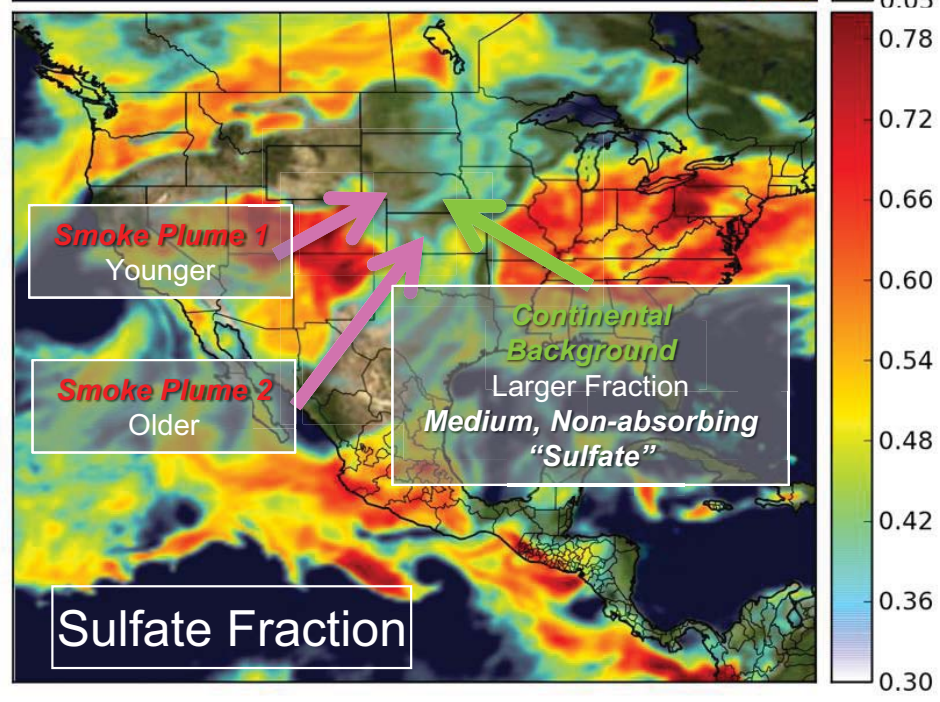
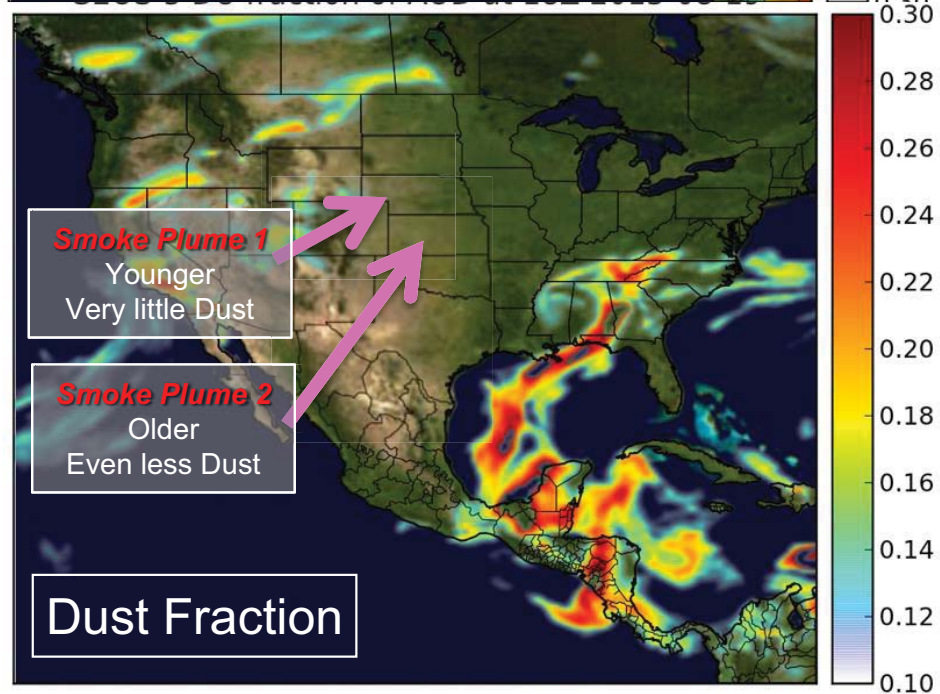
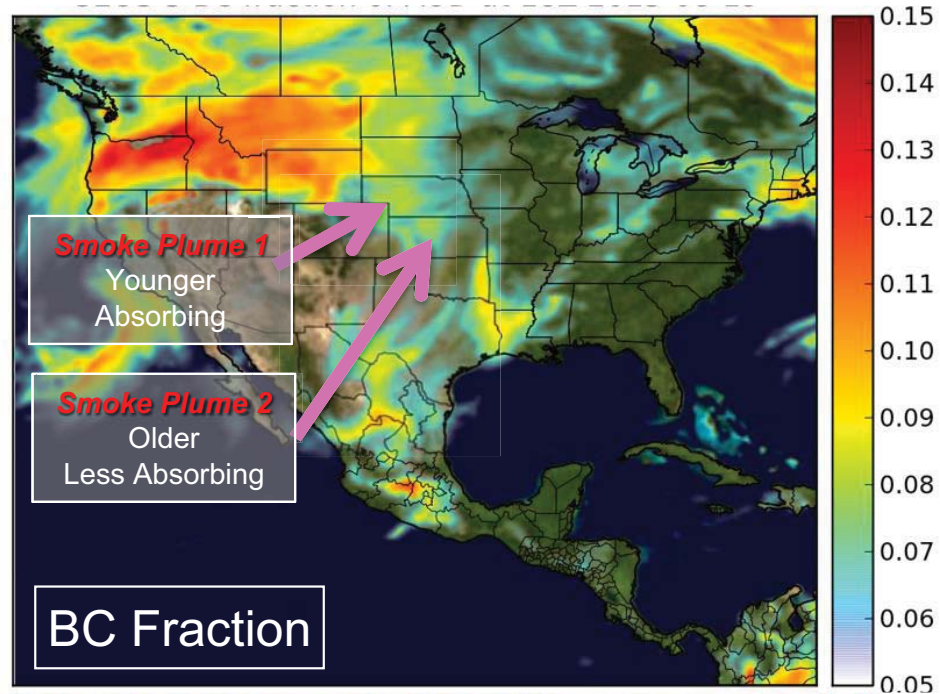
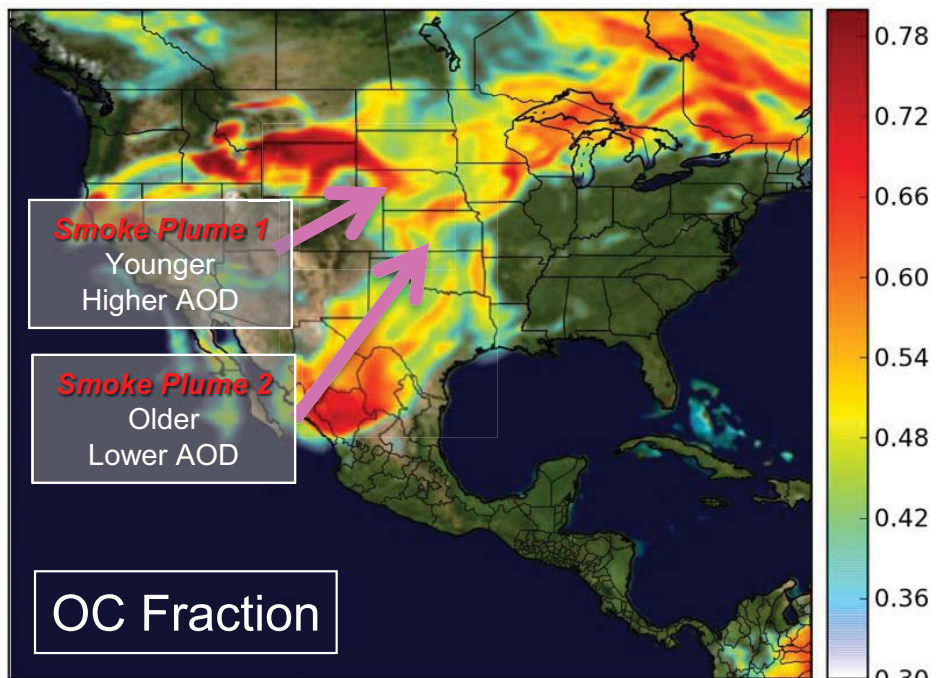
# GEOS-5 MODEL Aerosol Optical Depth

19 August 2013 18 UTC

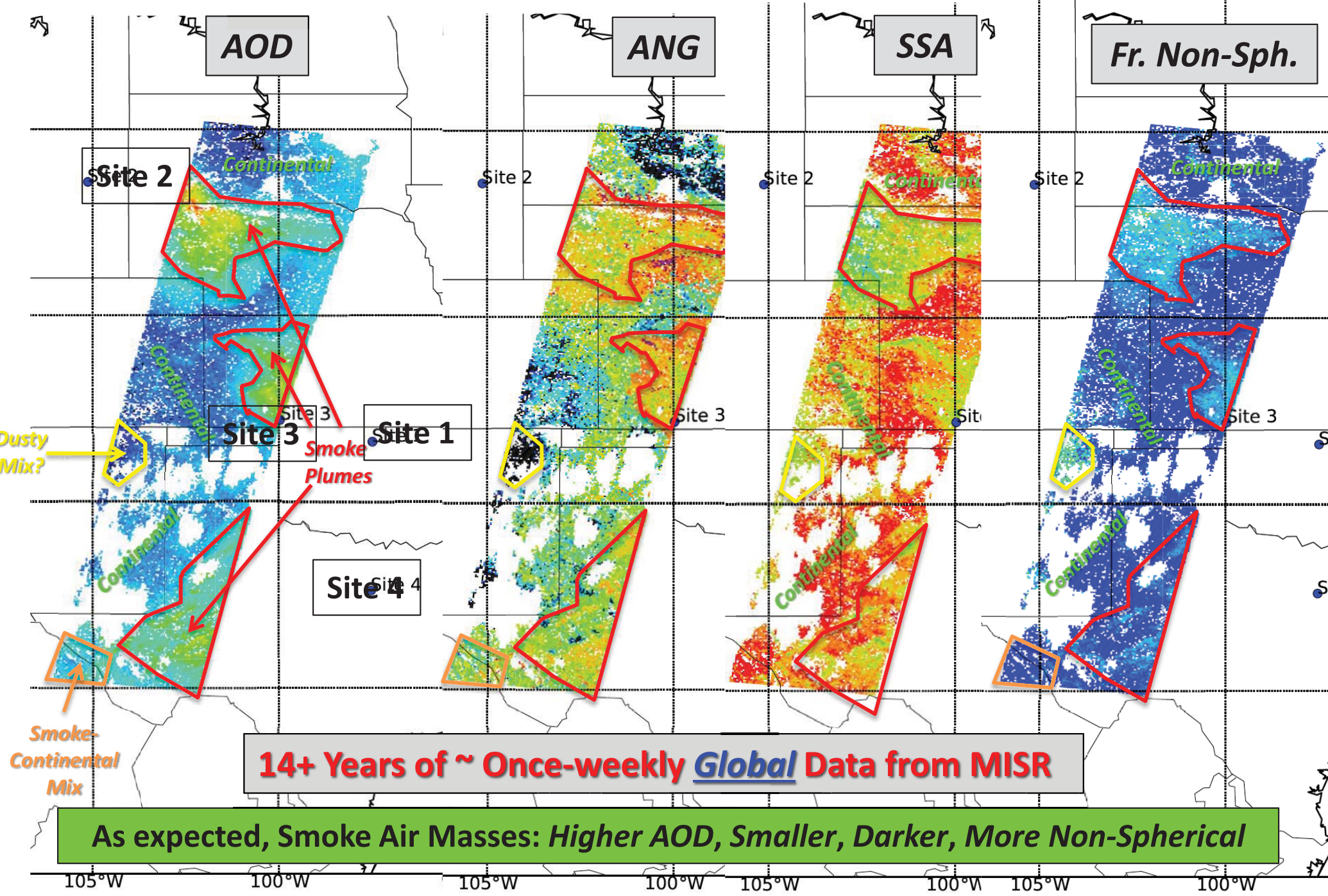


# GEOS-5 MODEL Aerosol Type

19 August 2013 18 UTC



# MISR Summary 19 August 2013



14+ Years of ~ Once-weekly Global Data from MISR

As expected, Smoke Air Masses: Higher AOD, Smaller, Darker, More Non-Spherical