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NATIONAL LABORATORY

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# TCAP Breakout Session



POC: Larry Berg ([larry.berg@pnnl.gov](mailto:larry.berg@pnnl.gov))

December 3, 2013



## ► Overview of TCAP analysis

- |   |           |         |
|---|-----------|---------|
| ■ Review of TCAP science goals  | Berg      | 15 min. |
| ■ Aerosol optical properties measured using HSRL  | Ferrare   | 10 min. |
| ■ Aerosol optical properties measured using min.4STAR—Conditions in the summer and winter | Redemann  | 10      |
| ■ Measurement of particle mixing state  | Zelenyuk  | 10 min. |
| ■ Particle size distributions   | Tomlinson | 10 min. |
| ■ WRF-Chem results  | Fast      | 5 min.  |

## ► Discussion of research status and future efforts

- Status of data, known issues
- Additional data products needed by the community
- Ongoing/planned research using TCAP data
- Status of papers (1 published, 2 nearing end of review process, 1 near submission)

## Designed to address a number of science questions:

- ▶ How do primary and secondary aerosol become internally mixed? ✓
- ▶ What are the aerosol optical properties in the two columns and how do they vary with wavelength? ✓
- ▶ How critical is the particle chemical composition and mixing state in determining the CCN activity? ✓
- ▶ What is the relative importance of aerosol indirect effects in maritime boundary-layer clouds?
- ▶ How do the aerosol chemical composition, mixing state, and optical properties vary seasonally? ✓
- ▶ Can regional and global scale models accurately represent these aerosol properties? ✓

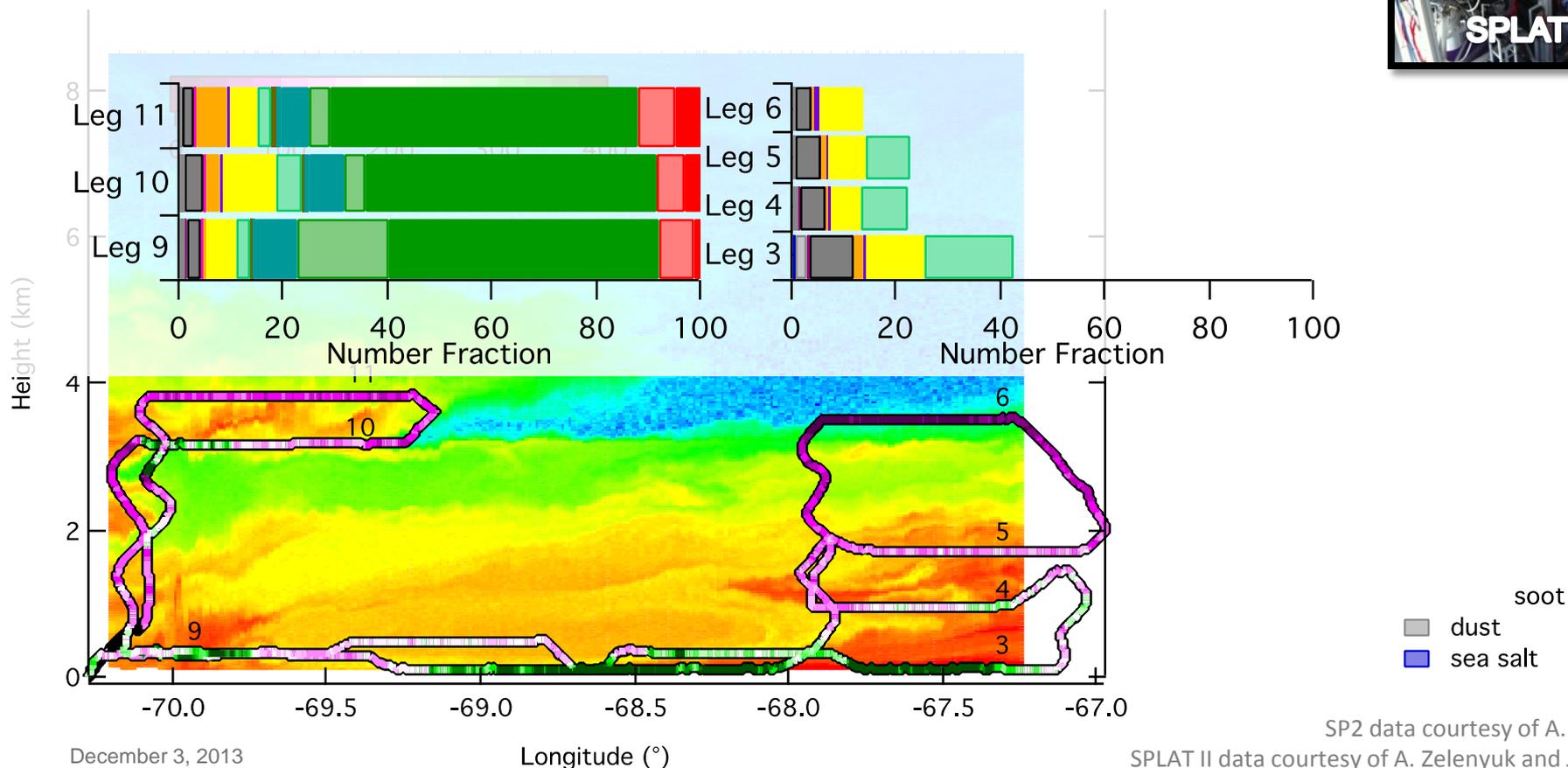
# TCAP: Design

- ▶ Sample in two columns near the eastern edge of North America
  - First column fixed over Cape Cod—12 month deployment of DOE Atmospheric Radiation Measurement (ARM) Mobile Facility (AMF)
  - Second column moveable over the Atlantic—2 DOE ARM Aerial Facility deployments, 1 NASA deployment



# Aerosol Mixing State

**Relevant measurements:** Chemical composition [SPLAT II, SP2, MIT CCN-PCVI-AMS (Phase 2 only)]

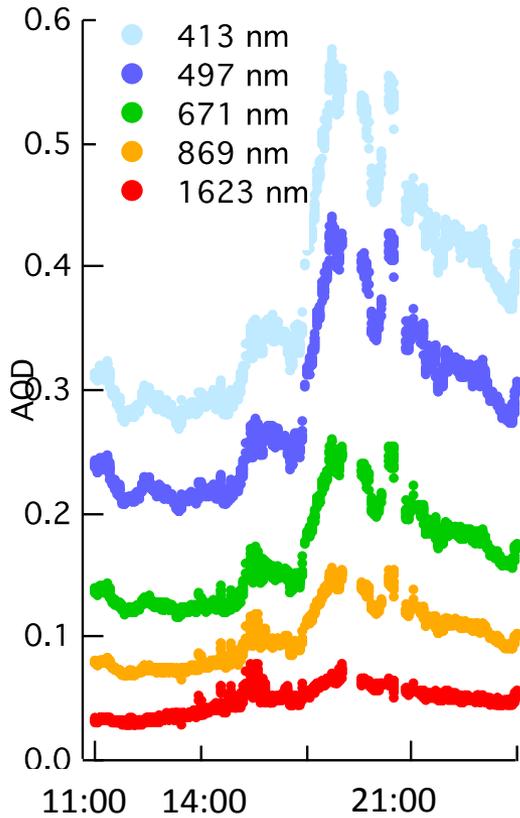


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SP2 data courtesy of A. Sedlacek  
SPLAT II data courtesy of A. Zelenyuk and J. Wilson  
HSRL-2 data courtesy of R. Ferrare, C. Hostetler et al.

# What are the Aerosol O

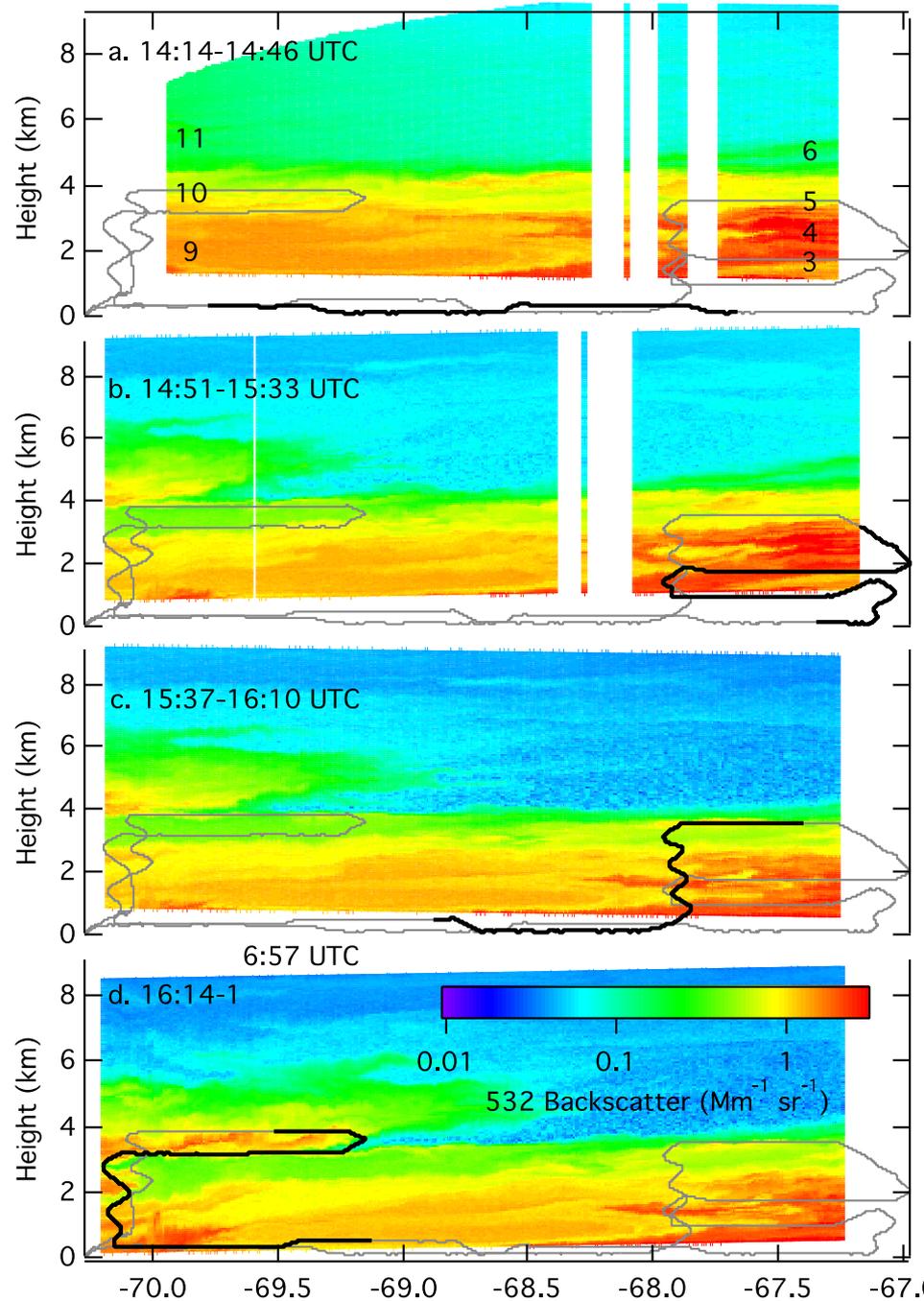
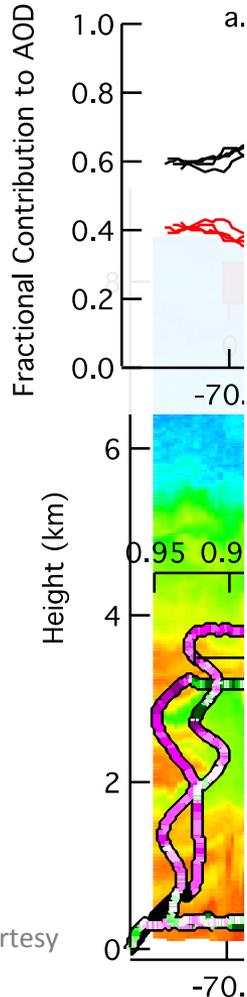
Relevant measurements: Colu  
HSRL-2, MFRSR, CU 2D-BMAX  
absorption



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Time (UTC)

MFRSR data courtesy of J. Michalsky



1965

57.0

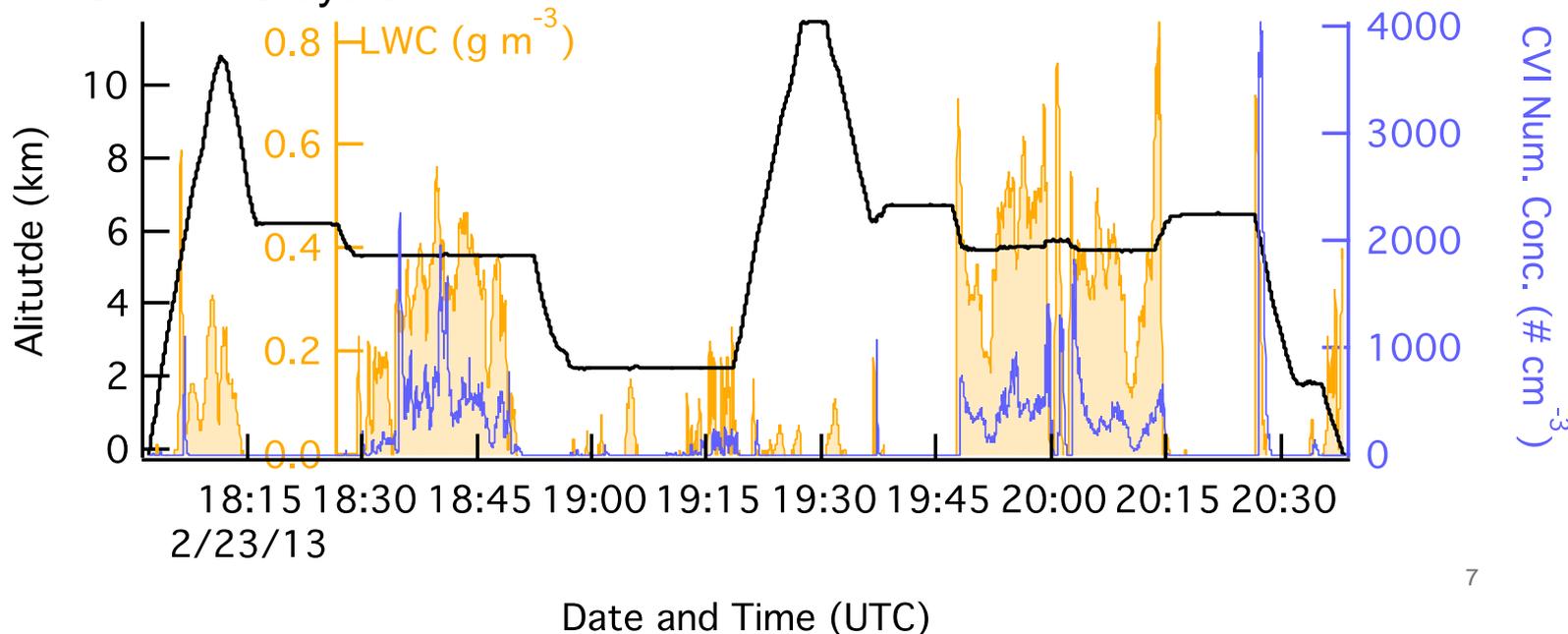
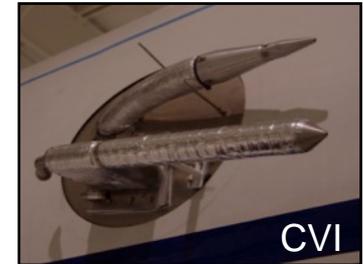
7.0

and

# Role of Size, Chemical Composition and Cloud Dynamics on Aerosol Activation

**Relevant measurements:** CCN, chemical composition (AMS, SPLAT II), size distributions, cloud radars

- ▶ Two inlets used during Phase 2
  - Counter Flow Virtual Impactor (CVI)—cloud drops
  - Isokinetic inlet—interstitial particles
  - AMS and SPLAT II sampled behind both inlets
- ▶ MIT ground site (Phase 2)
  - CCN-PCVI-AMS system



# Seasonal Variation of Aerosol Properties

**Relevant measurements:** CCN counter, chemical composition (AMS, SPLAT II, ACSM), size distributions, trace gas chemistry,

▶ Long-term observations from AOS

■ Changes in absorption Ångström exponent as a function of time of year

▶ Phase 1 and Phase 2 observations from G-1 and MAOS

■ Optical properties

■ CCN

■ Size distributions

■ Chemical composition from AMS, SPLAT II and ACSM

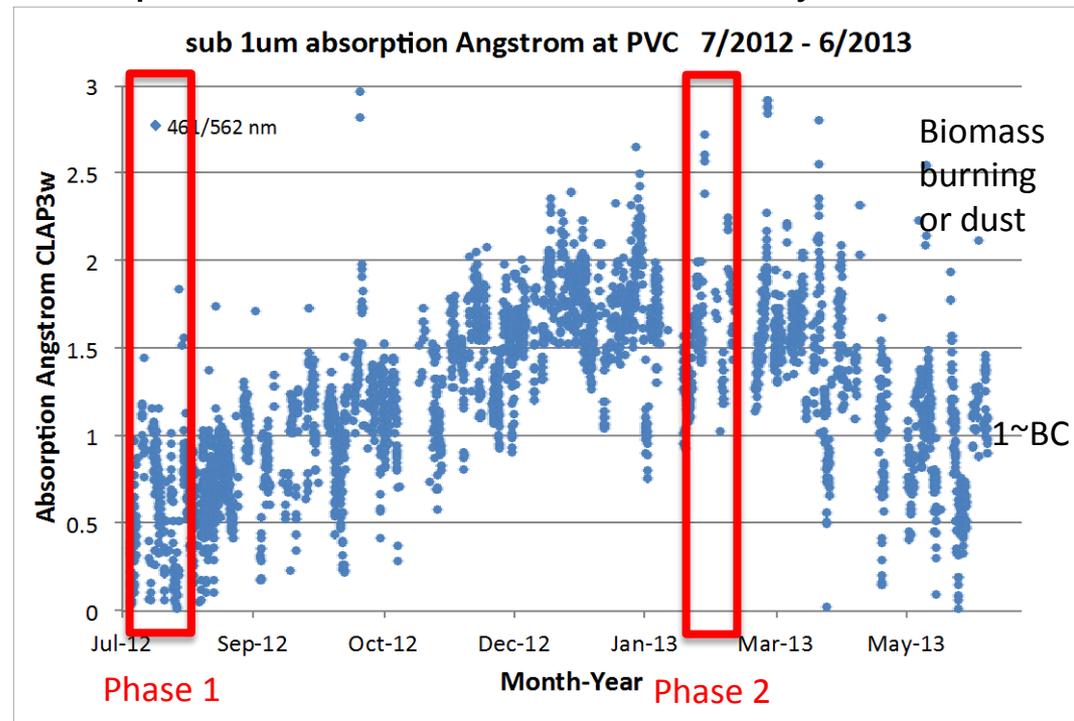


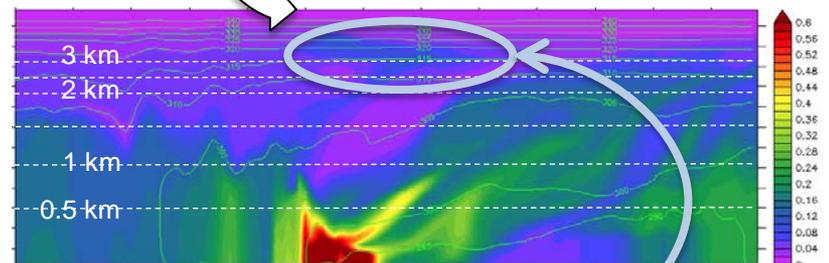
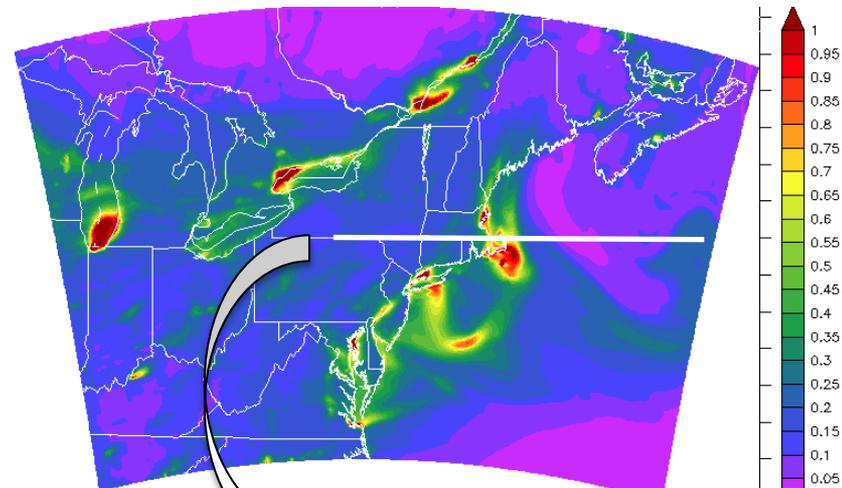
Image courtesy of A. Jefferson

# Representation of Aerosol in Regional and Global Models

**Relevant measurements:** Measurements from surface site and aircraft

- ▶ Can models accurately predict ...
  - Aerosol layers?
  - Aerosol chemical composition?
  - Aerosol size distribution?
  - Optical properties?
- ▶ What are the sources of the layers?

**Simulated Surface BC, 17 UTC July 17**



Layer visible in HSRL-2 data

