



*Division of Atmospheric Sciences*

*Science*

*Environment*

*Solutions*



**Dr. A. Gannet Hallar**  
**Director, Storm Peak Laboratory**  
**Desert Research Institute**  
**[gannet.hallar@dri.edu](mailto:gannet.hallar@dri.edu)**



**Storm Peak  
Laboratory**

*Unique, high elevation, mountain-top atmospheric research facility readily accessible under all weather conditions!!!*



# Storm Peak Laboratory

Located on Steamboat Springs Ski Resort

Elevation: 3.2 km (10,530 ft)  
~ 690 mb

In cloud ~25% of time

Mixed Phase Clouds

Free Tropospheric Air

Year-Round Access

9 Person Bunkhouse

Full Kitchen

Facility Instruments



***Unique, high elevation, mountain-top atmospheric research facility readily accessible under all weather conditions!!!***

# STORM PEAK LABORATORY

## MISSION STATEMENT:

*To ensure that Storm Peak Laboratory will continue to integrate climate research and education by advancing discovery and understanding within the field of aerosol, pollution, and cloud interactions.*



# Storm Peak Lab **Cloud Property** **Validation** Experiment

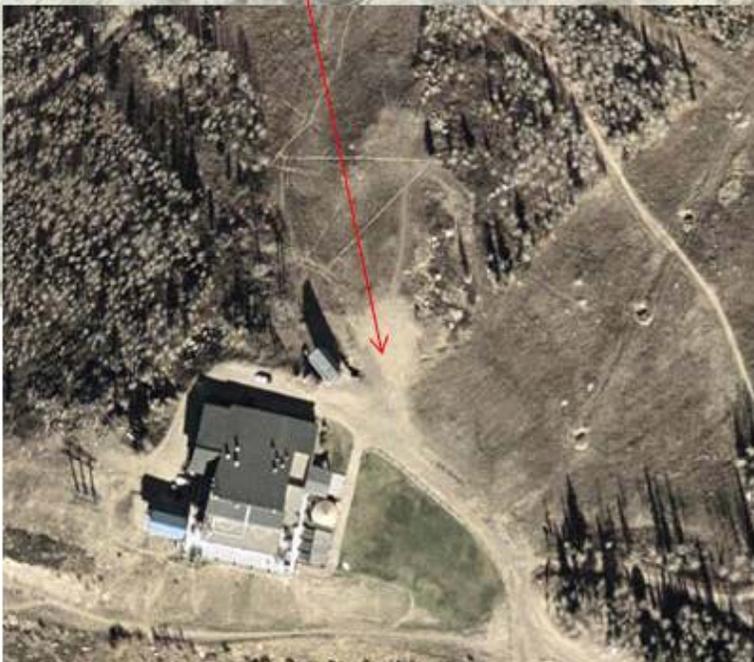
AMF2 Deployment October 2010 - April 2011



**Proposed  
AMF Location**

**2.4 km Horizontal  
500 m Vertical**

**Storm  
Peak Lab**



**SPEC Microphysics  
Lab at SPL**



**Cloud Drop  
Spectrometer**

**Extinctionmeter**



**Aspirated CPI's at**



**the South Pole**

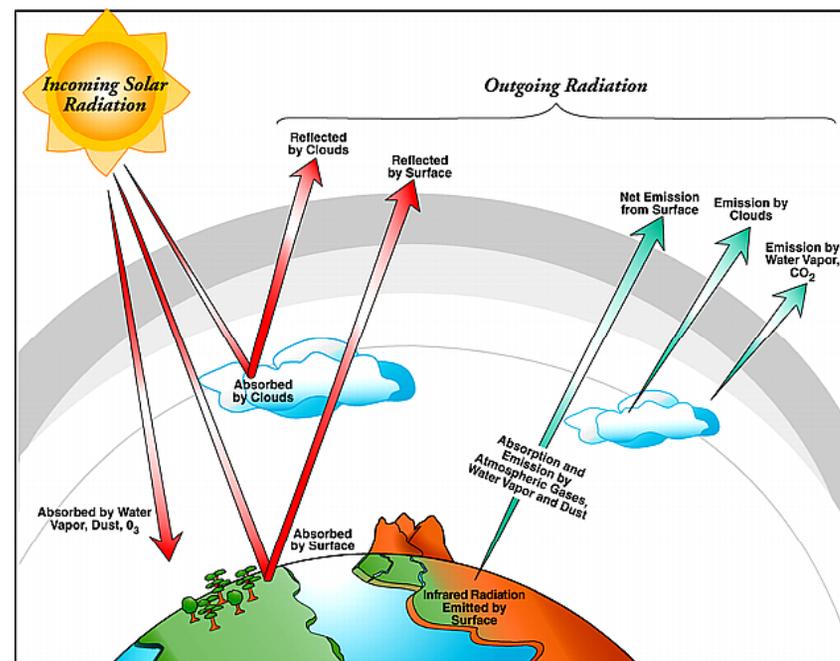
# Current Equipment



- **Aerosol Concentration**
  - Including Ultra-Fine
- **Aerosol size distributions**
  - TSI SMPS and APS
- **DMT Cloud Condensation Nuclei (CCN)**
- **Multi-Filter Shadow-band Radiometer**
- **Cloud droplet size distributions**
  - DMT SPP-100 forward scattering spectrometer
  - modified PMS-2DP precipitation probe
- **CO<sub>2</sub> Measurement - Britt Stevens, NCAR**
- **O<sub>3</sub> Measurement**
- **Pyranometer**
- **Cold Room- Cloud Sieves**
- **Meteorological Station – 7 on Mountain**

# Motivation for Studying Aerosols at SPL

- impact climate through direct and indirect forcing
- degrade air quality and visibility
- have detrimental effects on human health.



*With SPL, questions regarding aerosol mechanisms can be studied and understood.*

***-Why all the OOA?***

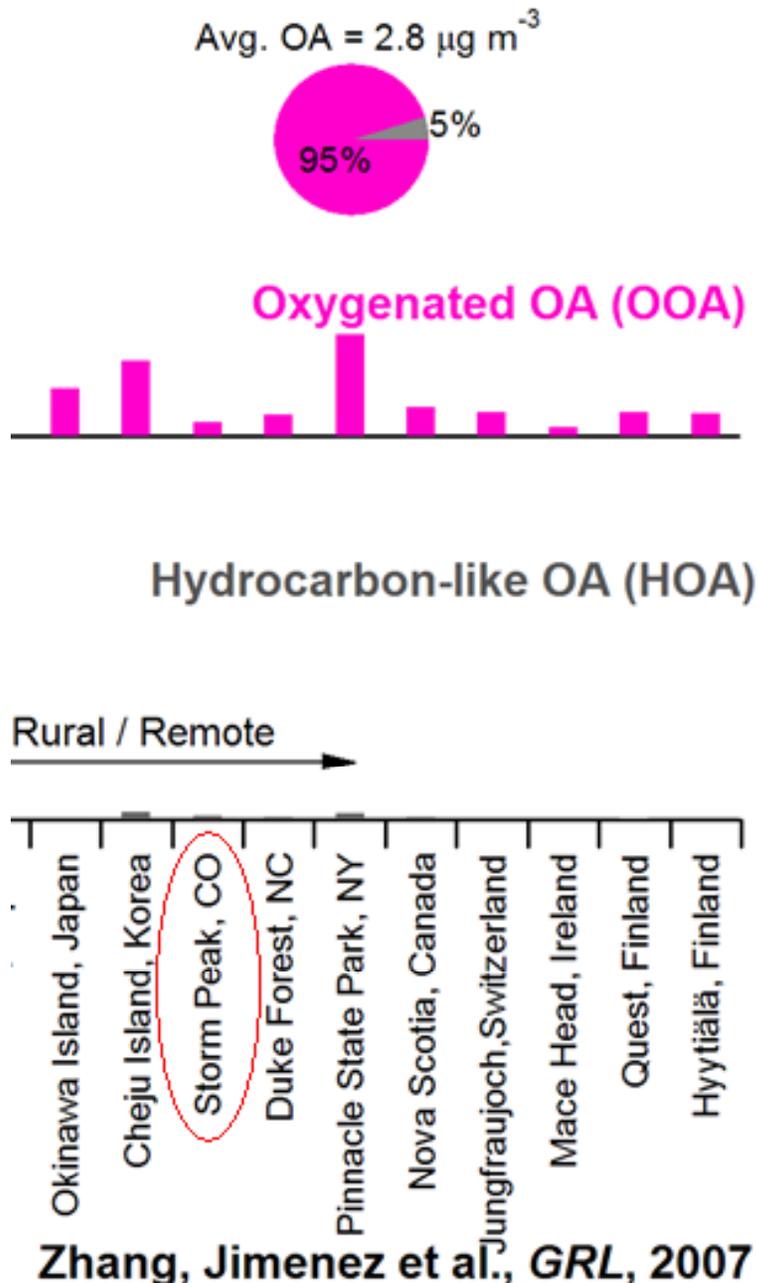
***-What triggers nucleation events?***

***-Why are nucleation events so frequent at SPL?***

***-Understanding the hygroscopicity of OA***

***-Alter cloud microphysics and reduce snowfall through riming inhibition***

# Previous Result OC at SPL



Water extracts of PM<sub>2.5</sub>  
Polar Organic Compounds  
January 9<sup>th</sup> -14<sup>th</sup> 2007

Most abundant compounds:

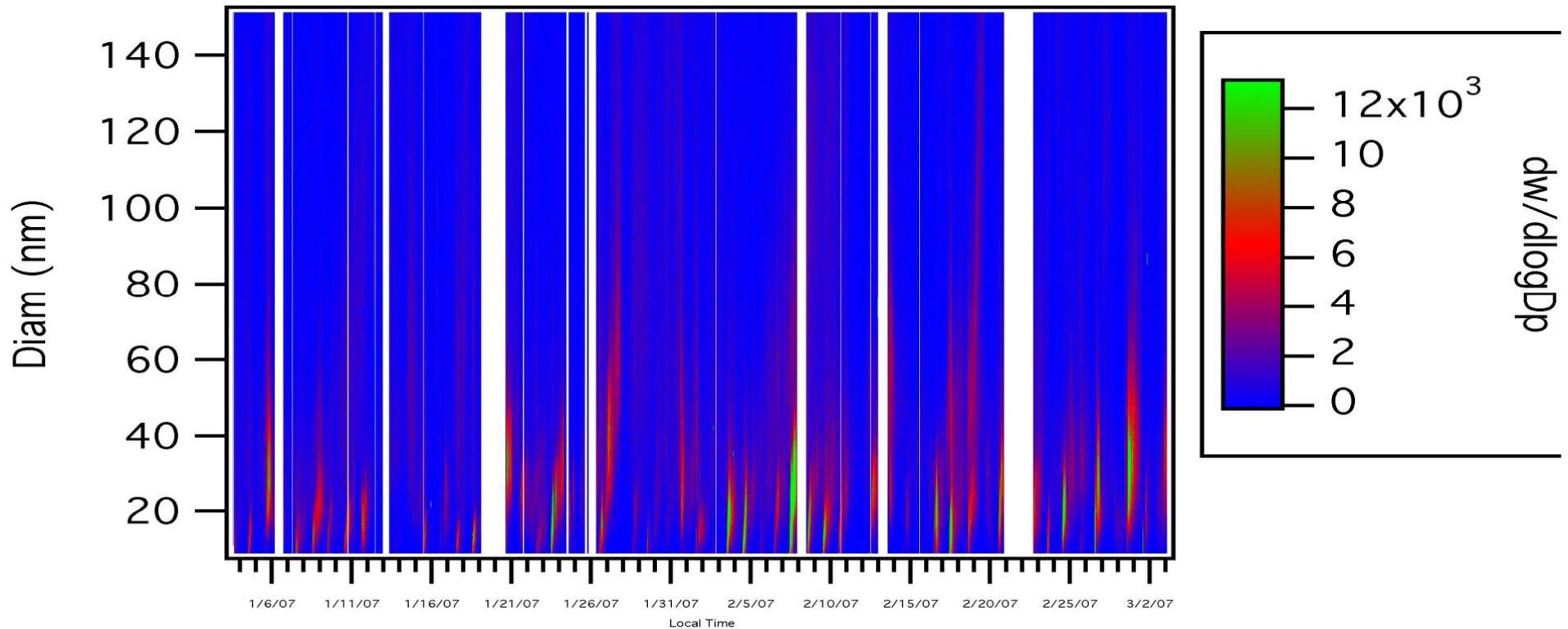
- Levoglucosan ( $9\text{-}72 \text{ ngm}^{-3}$ )
- Palmitic acid ( $10\text{-}40 \text{ ngm}^{-3}$ )
- Succinic acid ( $18\text{-}27 \text{ ngm}^{-3}$ ).

Cloud water from 2002 revealed a similar compound abundance trend.

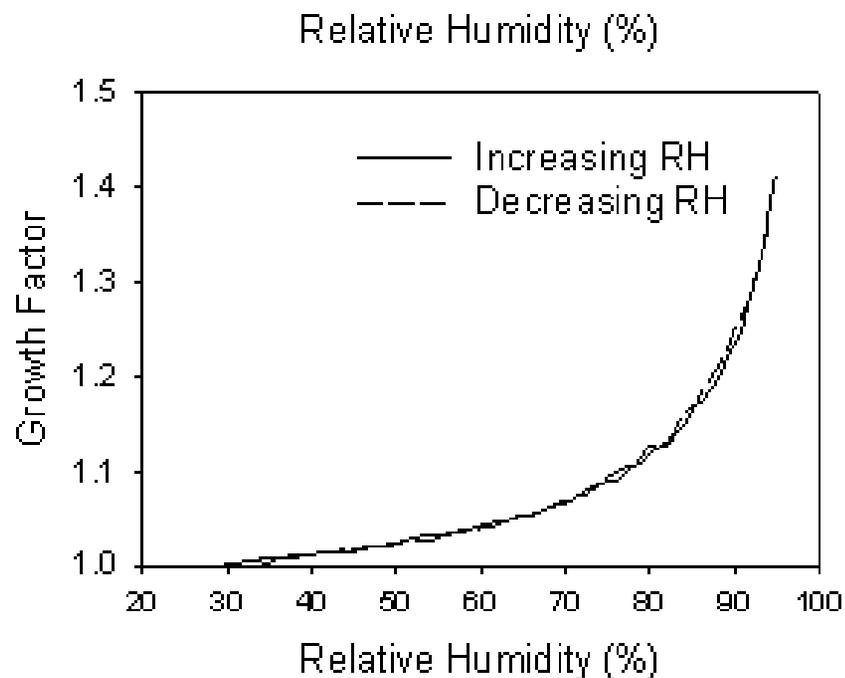
*Samy et al., submitted Atmospheric Environ. 2009*



Aerosol Formation at SPL observed 77% of total days including “in cloud” scenarios

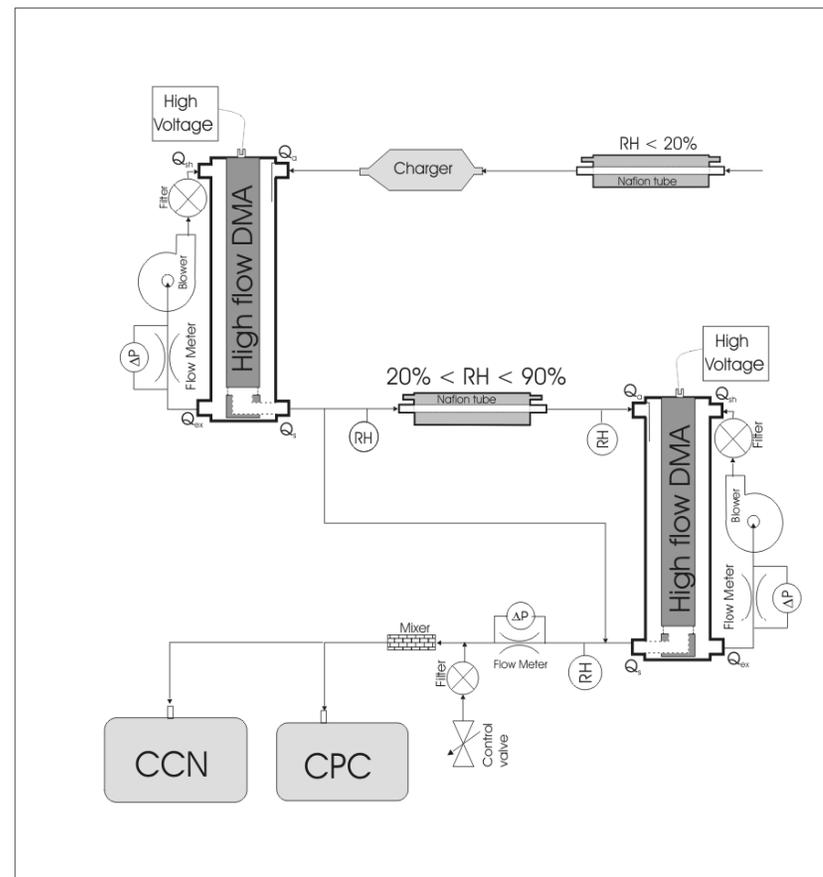


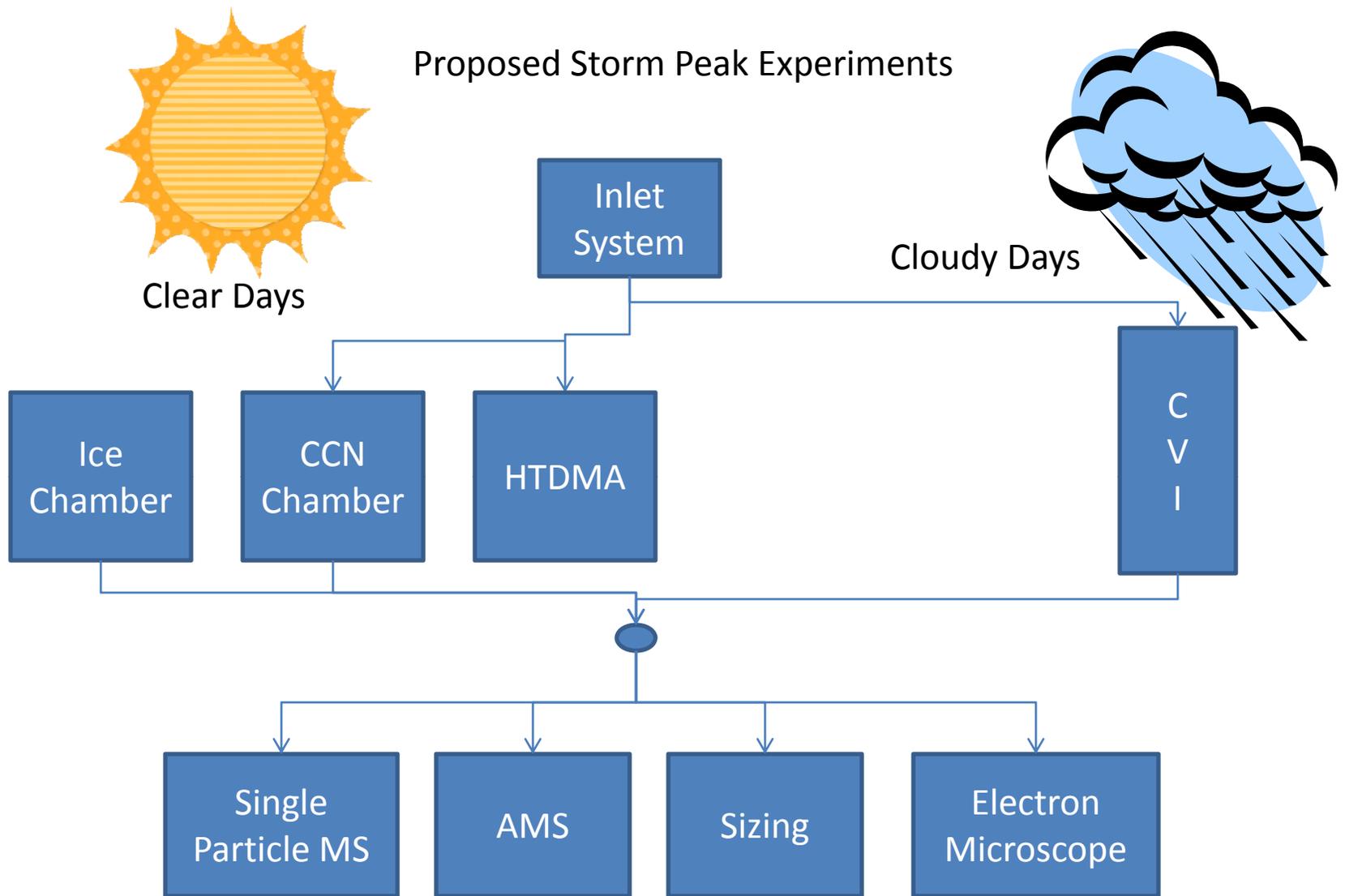
# WHAT IS THE CONTRIBUTION OF OA TO HYDROSCOPIC GROWTH ?



Hygroscopic growth curves for isolated WSOC from Great Smoky Mountains NP, summer, 2006.

(JGR, in press: <http://www.agu.org/journals/pip/jd/2008JD01274-pip.pdf>; courtesy of D. Lowenthal )





- What are the ice nuclei? Ice residue?
- What are the CCN? Drop residue?
- How are these inter-related? Anthropogenic influence?

# StormVEx Aerosol Needs

- High Volume Filter Samples and Analysis
- Aerosol Size Distribution
- Hygroscopic Growth - HTDMA and CCN
- Real Time Chemistry – AMS, Single Particle
- Aerosol Optical Properties
  - Bsp: Nephelometer
  - Bap:PASS, PSAP, SP2
  - Bex: Cavity Ringdown