Deployment of the 3rd ARM Mobile Facility to the Southeastern United States:

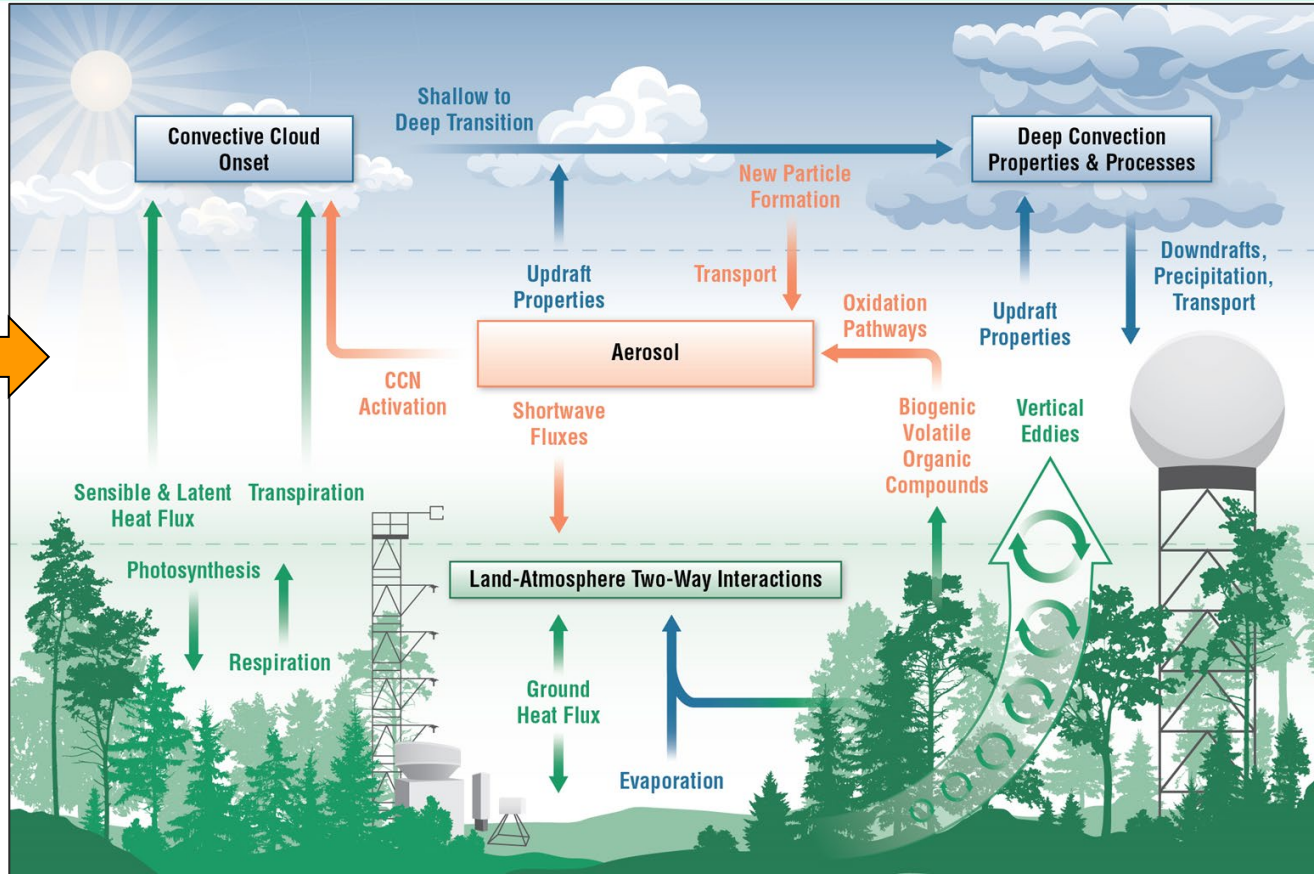
"Aerosol Processes" Sub-Breakout

Some initial questions to ponder…

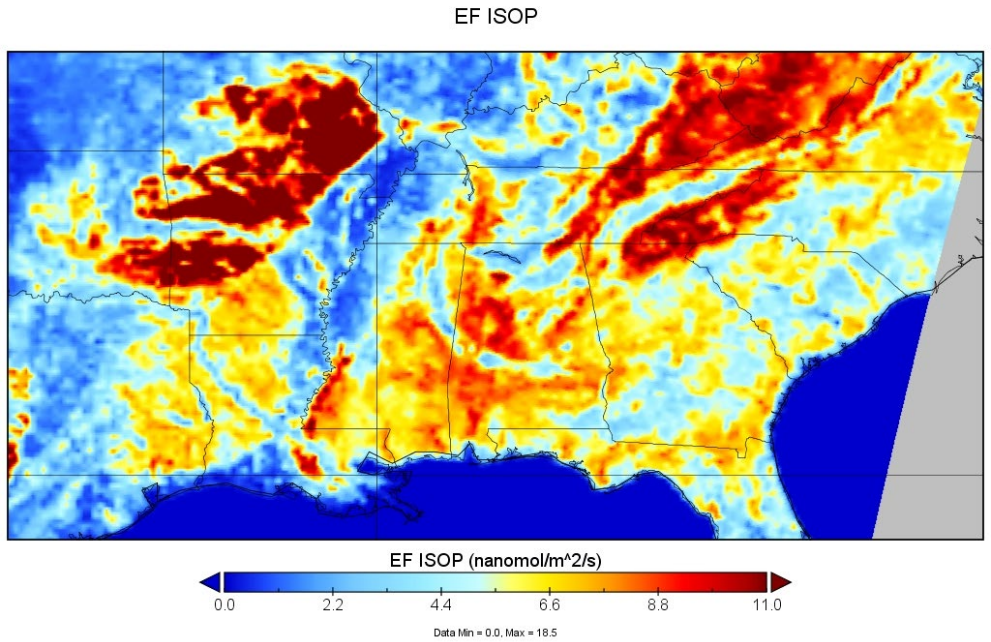
- What are the critical (missing) aerosol / gas-phase measurements? – NOx, Biological, INP
- What is the larger deployment “eco-system? – IMPROVE/CSN, ASCENT, other AMFs!
- How are we thinking about modeling? – process-focused, regional-focused, LES, canopy-scale
- How are we addressing spatial / temporal variability? – supplemental sites, aerosol sensor node network, partners!
- How should we think about aerosol flux-tower based science/measurements? – above/below canopy, biological flux, vertical transport
- What are the emerging measurement technologies / platforms? – UAS, TBS, aerosol nodes, aerosol precursors
- How can we better observing coupled aerosol-convection-LAI processes?

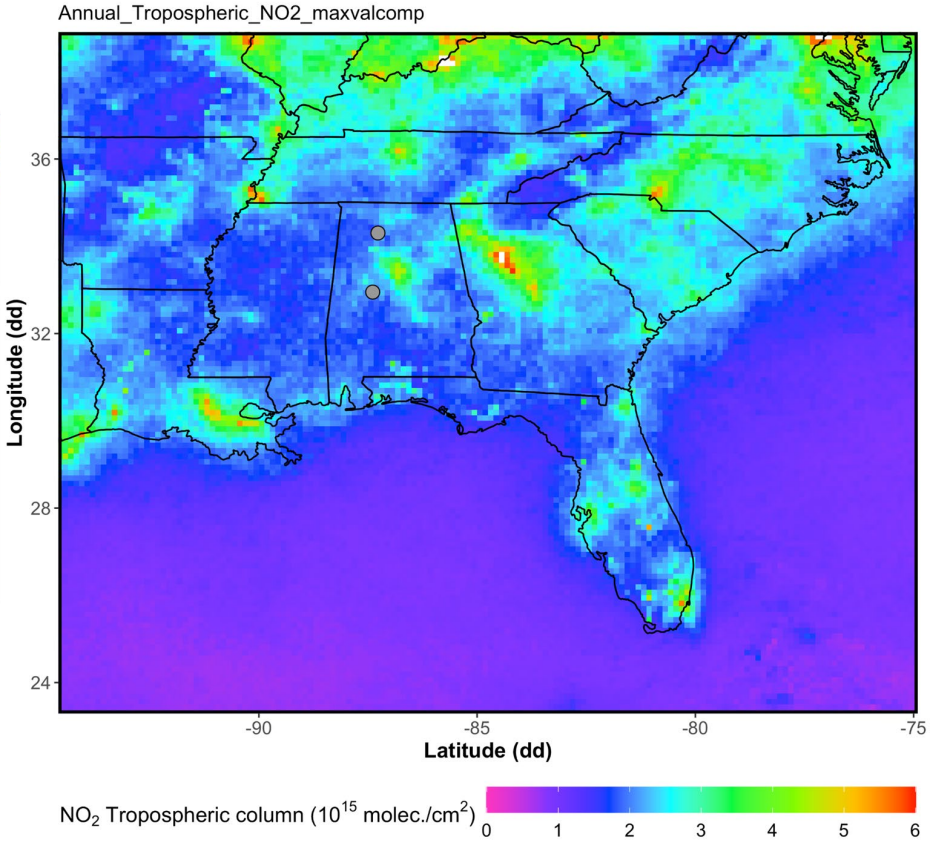
AMF3 Southeast US: Aerosol Science Drivers

- **Properties/processes that control the cloud condensation nuclei budget:**
  - New particle formation and transport
  - Secondary organic aerosol
  - Spatio-temporal variability in aerosol hygroscopicity
- **Aerosol optical properties:**
  - Particle water uptake
  - Biomass burning
  - Brown carbon

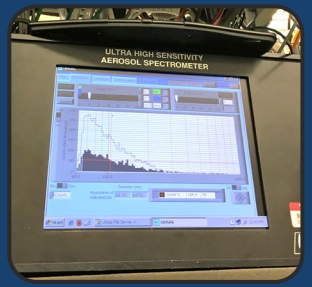


Science-Driven Siting





AOS Measurements and Instrumentation

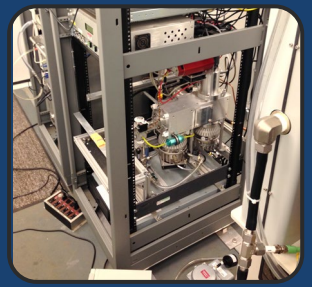


Number concentration and size (3 nm – 20 µm)

- CPC
- SMPS
- UHSAS
- Coarse mode

Hygroscopicity

- CCN
- HT-DMA

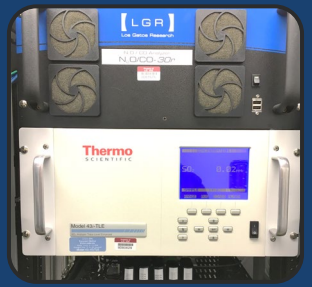


Chemical composition

- ACSM
- SP2-XR*
- SP2*

Optical properties

- CAPS
- Nephelometer
- PSAP



Trace gases

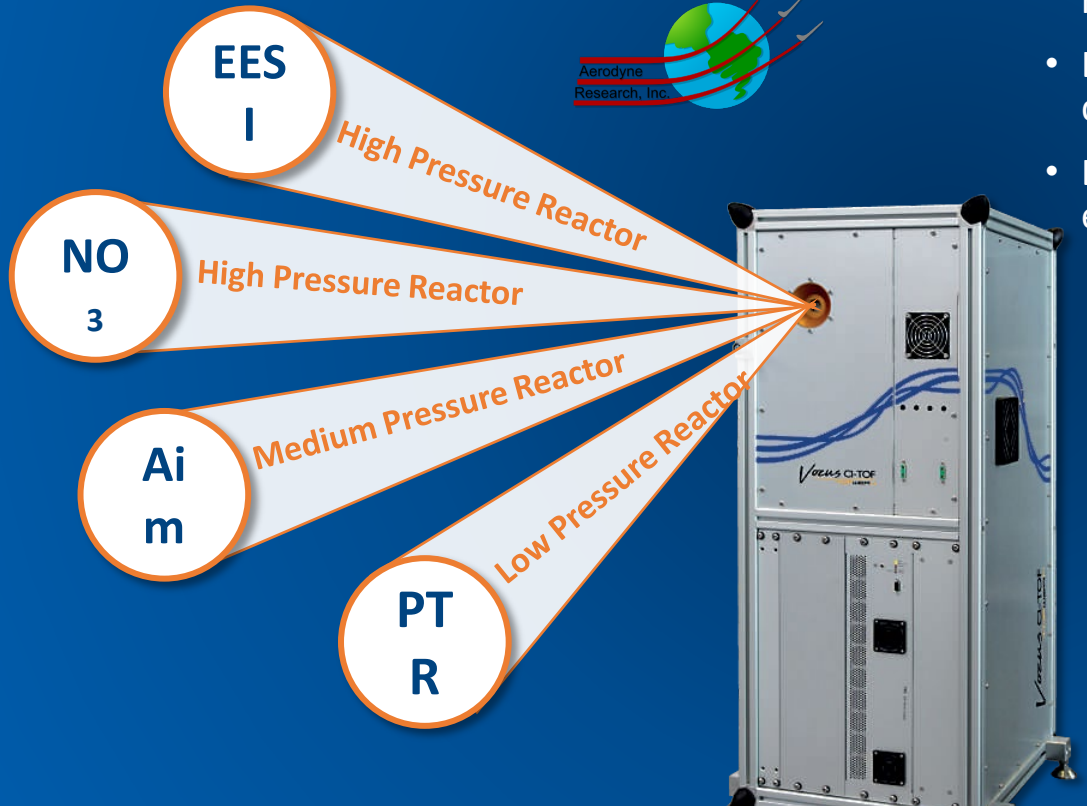
- CO
- O_3
- SO_2

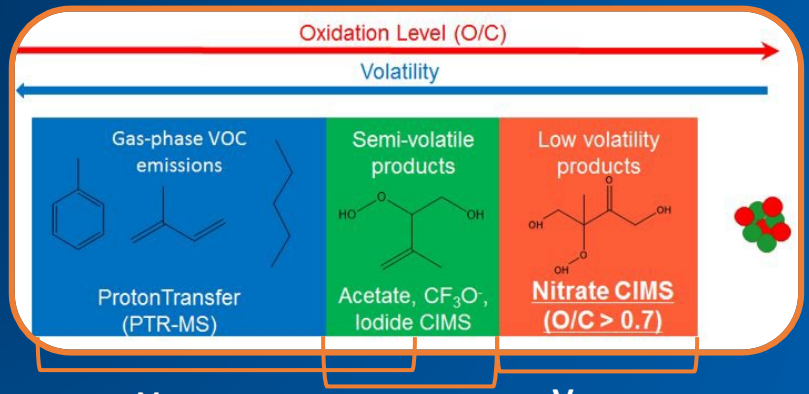
Vocus Reactors

CI-TOF

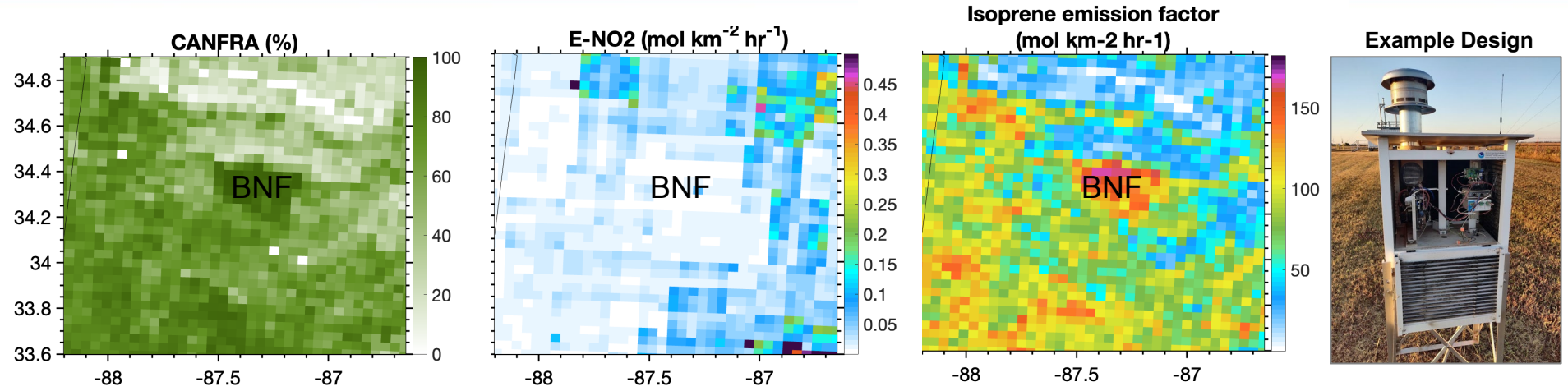
TOFWERK

- Ultimate flexibility for targeting specific compound classes.
- Fast, automatic (<10s) reagent ion switching, robust and reliable
- Low relative humidity dependence due to use of dopants
- Live data output of select, calibrated compounds, e.g. isoprene, monoterpenes, toluene





Aerosol Sensor Node Network - ENG0004533



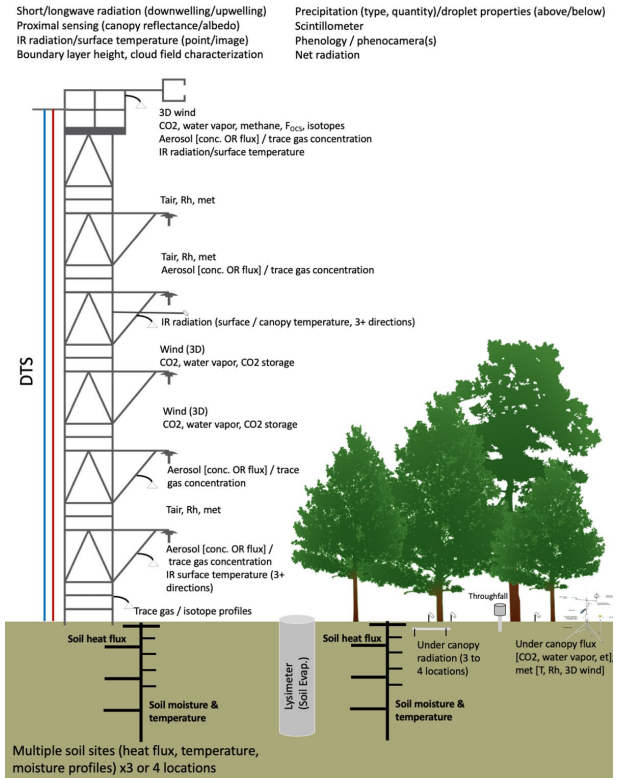
- "Typical" global climate grid cell over Northern Alabama domain exhibits high aerosol variability due to heterogeneous surface controls on: aerosol sources (e.g., BVOCs, anthropogenic emissions), aerosol sinks (e.g., wet / dry deposition), and aerosol transformations (e.g., water up-take).
- Initially develop 2+ aerosol sensor nodes that meet measurement requirements (e.g., aerosol number, size, composition) and operational requirements (e.g., lower cost / complexity), targeting aerosol variability in AMF3 domain.

analysis courtesy of Tamanna Subba

Phase 1, Main Tower Site: Planned Design & Configuration

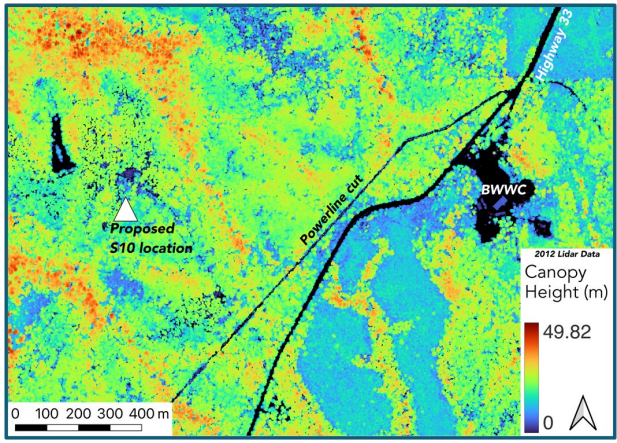
- **Measurement Heights:**
  - Top of tower
  - Above/Below Canopy
  - 10 meter/4 meter
  - Surface
- **Planned Measurements:**
  - 3D winds, T/RH, precipitation
  - Greenhouse Gases
  - Radiation: full-range, direct/diffuse, incident/reflected, profiles
  - Fluxes: C, H2O, energy (vertical/ecosystem)
- **Under Review / IOP Measurements:**
  - Aerosol flux - ENG0004574
  - Biological aerosol (WIBS/EMSL)
  - Biogenic VOC concentration + flux
  - AmeriFlux CO2 Flux & Storage System
  - Distributed Temperature Sensing

Concept



Siting

- mixed pine-oak forest, west of the BWWC
- determined via consideration of dominant winds, fetch, forest cover, and terrain



Some Q/A Starters…

- What are the critical (missing) aerosol / gas-phase measurements? – NOx, Biological, INP
- What is the larger deployment “eco-system? – IMPROVE/CSN, ASCENT, other AMFs!
- How are we thinking about modeling? – process-focused vs. regional-focused
- How are we addressing spatial heterogeneity? – supplemental sites, aerosol sensor node network, partners!
- How should we think about aerosol flux-tower based science/measurements? – above/below canopy, biological flux, vertical transport
- What are the emerging measurement technologies / platforms? – UAS, TBS, aerosol nodes, aerosol precursors
- What are the exciting IOPs that we should propose?