Breakout Session 3: Deployment of the Third ARM Mobile Facility to the Southeastern US

AMF3 SEUS: Chongai Kuang, Shawn Serbin, Scott Giangrande, James Smith, Allison Steiner, Gregory Elsaesser, Thijs Heus, John Peters, Mariko Oue, Pierre Gentine

ARM: Jim Mather, Nicki Hickmon, Joe Hardesty

Breakout Session Outline

- **Goals:**
  - Present AMF3 SEUS background, site science, team, and activities.
  - Present and receive feedback on SEUS science opportunities and challenges targeting aerosol, convective cloud, and land-atmosphere interaction topics.

- **Agenda:**
  - AMF3 SEUS Overview
    - Jim Mather: Relocation of the 3rd ARM Mobile Facility to the Southeast US
    - Joe Hardesty: AMF3 Relocation to Southeast US (SEUS)
    - Chongai Kuang: AMF3 SEUS Site Science Team

  - SEUS Science Drivers: opportunities, challenges, and lessons-learned
    - Gregory Starr: Land-Atmospheric Interactions in the Southeast US
    - Allison Steiner: AMF3: Atmospheric Aerosols in the Southeastern US
    - Kevin Knupp: Boundary layer heterogeneity and deep convection
    - Discussion

AMF3 SEUS Site Science Team: Introduction, Timeline, and Activities

Chongai Kuang, Shawn Serbin, Scott Giangrande, James Smith,
Allison Steiner, Gregory Elsaesser, Thijs Heus, John Peters,
Mariko Oue, Pierre Gentine

70 YEARS OF DISCOVERY
A CENTURY OF SERVICE

U.S. DEPARTMENT OF ENERGY
BROOKHAVEN NATIONAL LABORATORY
ASR Atmospheric System Research
ARM CLIMATE RESEARCH FACILITY

Project Introduction

- 2021: AMF3 will begin relocation to the SEUS
- Motivators for going to the SEUS:
  - Abundant surface-forced shallow to deep convection
  - Large amount of vegetative-driven biogenic emissions
  - Strong local coupling of land-surface with atmosphere
- Joint ARM-ASR funded project (Q1 2020)
- 5 year deployment length expected, with operations beginning March 2023
- Specifics on site location, configuration, instrumentation to be determined in part through a DOE supported Site Science Team (SST)

AMF3 SEUS: New Opportunities

- This is the first time that ARM, ASR, and SST are working together like this to advance Science. This is not a conventional AMF deployment - opportunity for collaborative, interdisciplinary, transformational Science.

- We are Gravitational Attractors/Advocates/Ambassadors, not Gatekeepers.

- Emerging measurement opportunities: advanced/spatially distributed sensing.

- **Our proposal was selected, in part, because of Land-Atmosphere Interaction strengths (including terrestrial focus area).**

- Siting of the AMF3 in the SEUS will be informed by: SST, community feedback, and operational/logistical considerations

Project Membership: Core Team

- Chongai Kuang: BNL, PI (**aerosol**)
- Scott Giangrande: BNL, co-PI (**convection**)
- Shawn Serbin: BNL, co-PI (**land-atmosphere interactions**)
- James Smith: University of California, Irvine
- Allison Steiner: University of Michigan
- Gregory Elsaesser: GISS, Columbia University/NASA
- John Peters: Naval Postgraduate School
- Mariko Oue: Stony Brook University, NY
- Thijs Heus: Cleveland State University
- Pierre Gentine: Columbia University







Project Membership: External

- Advisory Committee:
  - BNL leadership (Allison McComiskey, Mike Jensen, Andy Vogelmann, Art Sedlacek)
  - Pavlos Kollias: SBU
  - Dave Turner: NOAA
  - Hugh Morrison: NCAR
  - Markus Petters: NCSU

- External Partners:
  - ARM/SNL (Jim Mather, Nicki Hickmon, Jennifer Comstock, Adam Theisen, Joe Hardesty, Lori Parrott, Rebecca Jeffers, Dari Dexheimer, Fred Helsel)
  - SEUS experts
  - SEUS networks

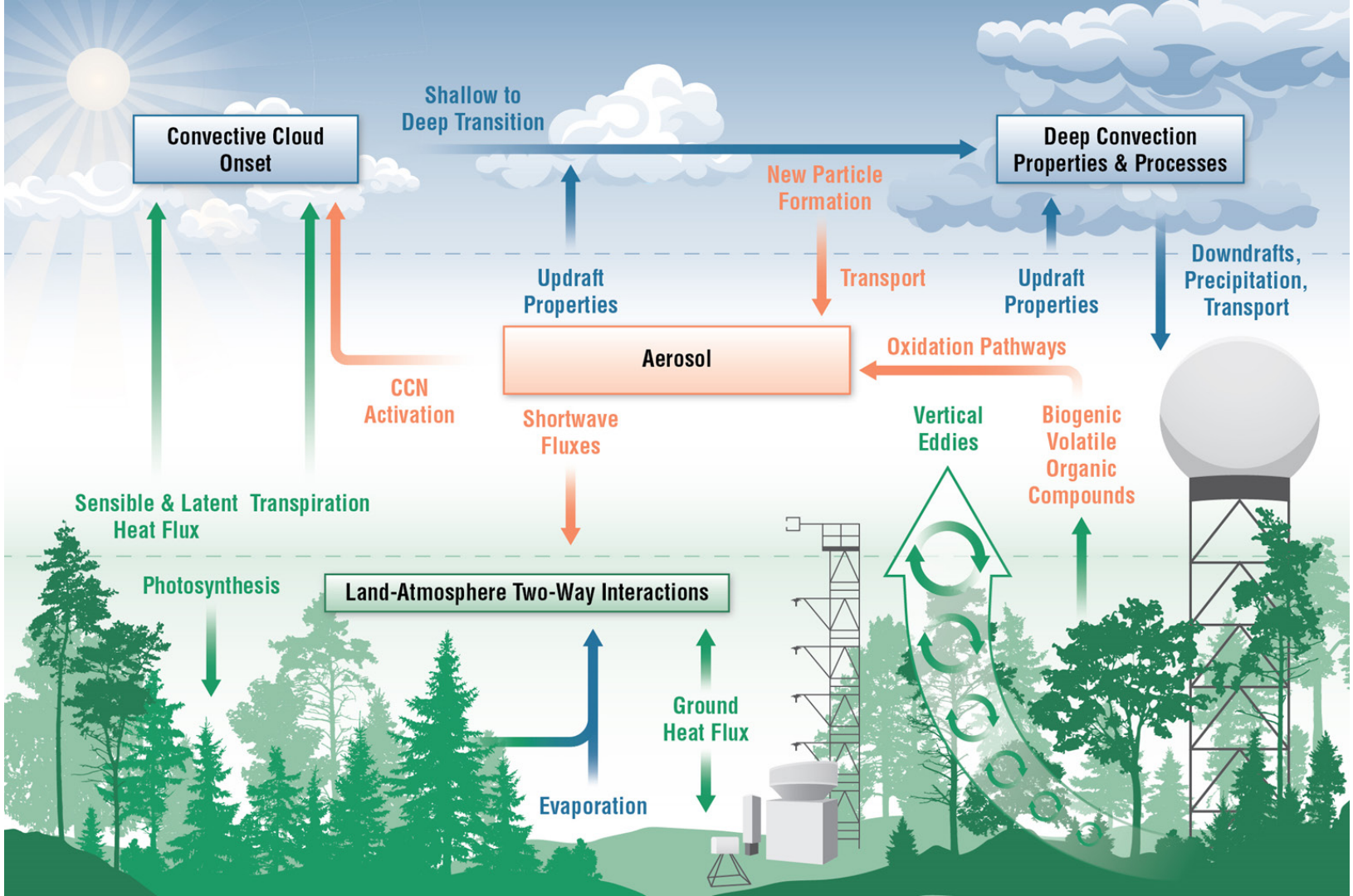
Anticipated Project Timeline

Near Term:

- Jul 2020: Windstorm Extreme Event Research Network Workshop
- Late summer: ESS-targeted AMF3 SEUS workshop (planned)
- Fall 2020: Potential focused ARM/ASR breakouts
- Dec 2020: AGU - town hall
- Jan 2021: AMS - town hall proposal planned

Long Term:

- Mar 2021: Site “shortlist” identified
- Sep 2021: Site identified
- Mar 2023: Site operational
- Mar 2024: Advanced and/or spatially distributed instrumentation installed


Convective Cloud Onset
Shallow to Deep Transition
Deep Convection Properties & Processes
New Particle Formation
Updraft Properties
Transport
Updraft Properties
Downdrafts, Precipitation, Transport
Aerosol
Oxidation Pathways
CCN Activation
Shortwave Fluxes
Vertical Eddies
Biogenic Volatile Organic Compounds
Sensible & Latent Heat Flux
Transpiration
Photosynthesis
Land-Atmosphere Two-Way Interactions
Ground Heat Flux
Evaporation

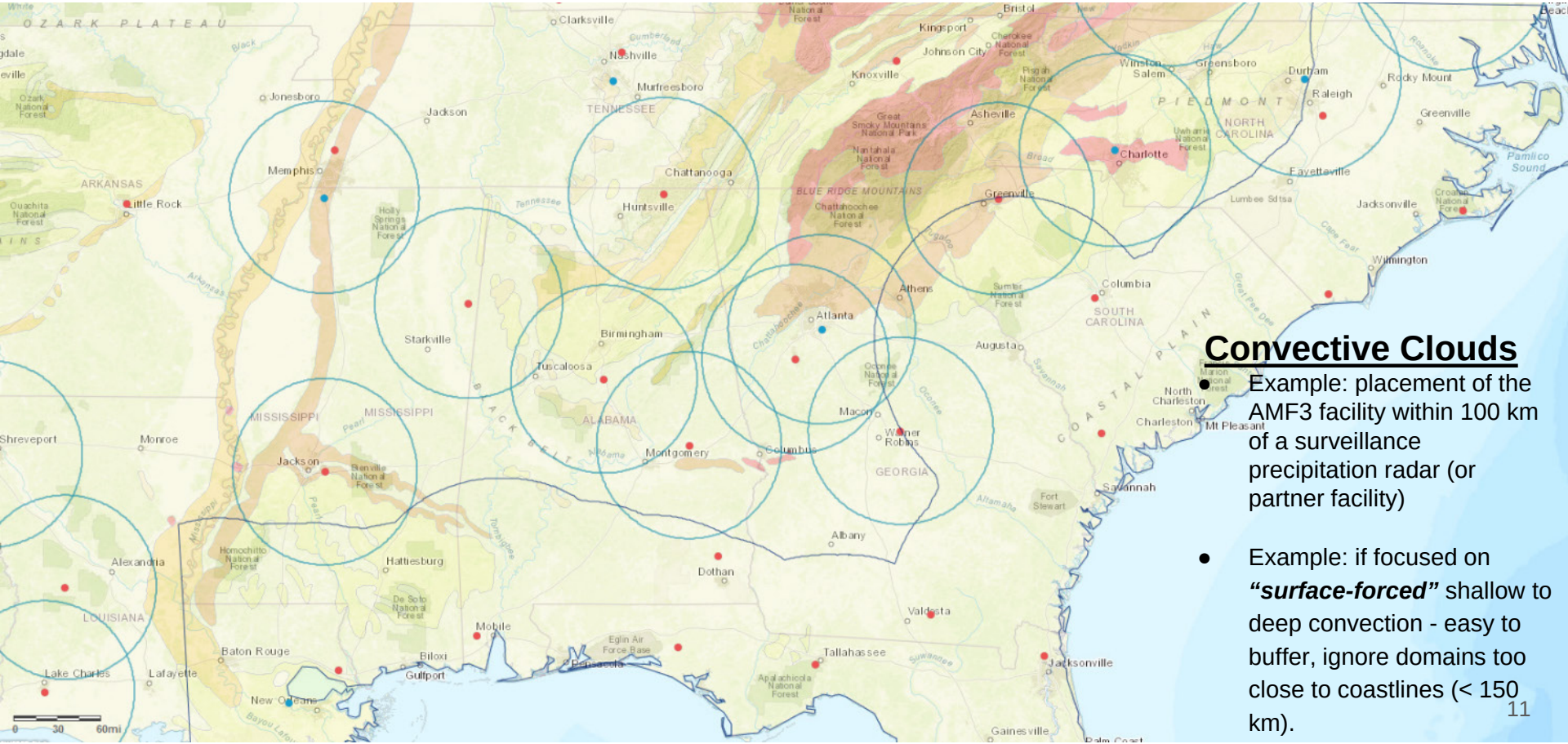
SST Activities: Planning Documents

- Direct guidance from the ASR/ARM (i.e., ARM Workshop outcomes):
  - Spatially distributed measurements
  - Atmospheric state/flux measurements over agricultural and woodlands/forests
  - Characterize variations in aerosols (urban/rural)

- Initial Team Activities: **“Tiered Traceability Matrices”**
  - Science Driver Matrices: Driver ⇒ Prioritized Questions ⇒ Required Measurements
  - Instrument Matrices: Measurements ⇒ Instruments (prioritized) ⇒ Operational Requirements
  - Site Matrices: Potential Sites ranked against Science Drivers
  - GIS Map generation to inform siting
  - Cross-cutting topics: structural co-location/co-prioritization
  - **User feedback on measurement needs and observational scales (spatial and temporal) is critically important!**

- Emphasis on Cross-Cutting Science Drivers:
  - role of plant BVOC emissions on SOA processes/properties
  - aerosol/cloud radiative effect impacts on plant physiological response
  - convective transport impacts on aerosol spatial variability
  - role of surface energy balance on convection

Activities: GIS (Geographic Information System) Maps



Convective Clouds

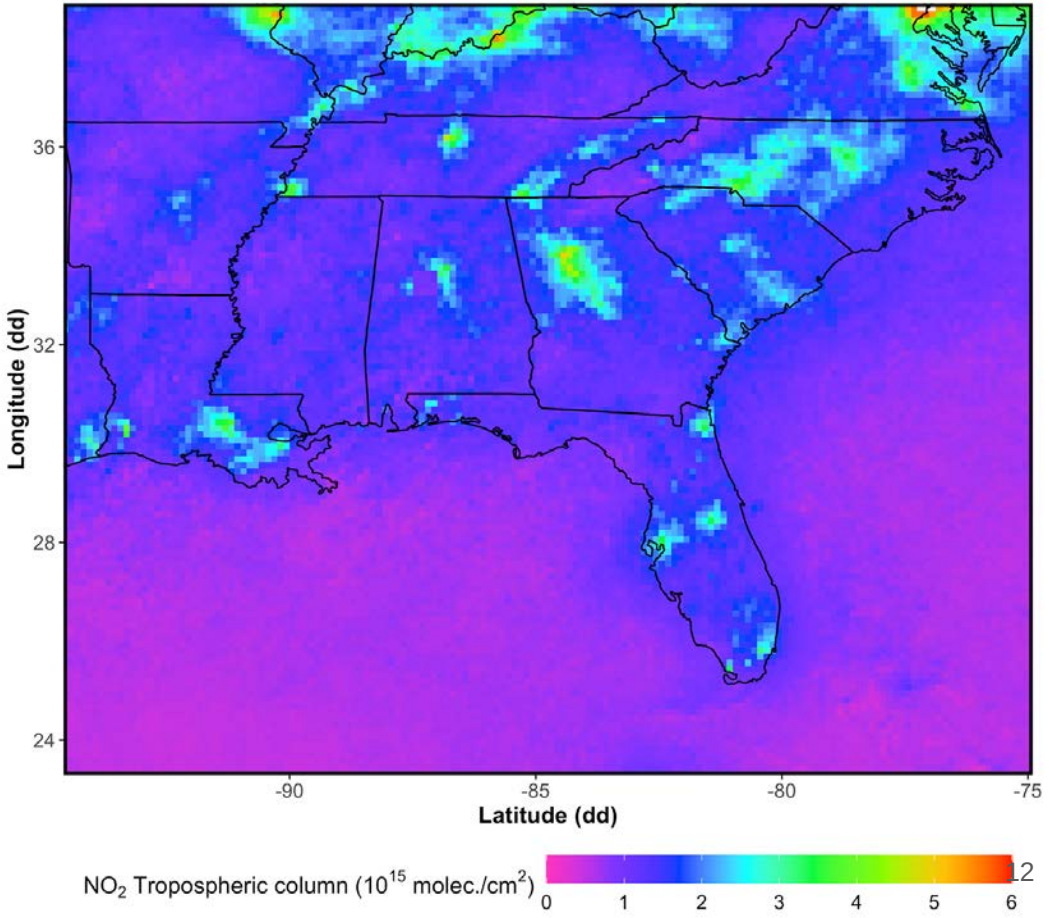
- Example: placement of the AMF3 facility within 100 km of a surveillance precipitation radar (or partner facility)
- Example: if focused on ***"surface-forced"*** shallow to deep convection - easy to buffer, ignore domains too close to coastlines (< 150 km).

Activities: GIS Maps - Aerosol

- **Example**: Column NO2 map from satellite remote sensing (TROPOMI) - indicator of anthropogenic pollution

- **Further map considerations**:
  - Aerosol optical depth
  - Aerosol precursors (SO2, BVOCs)
  - Biomass burning

- **Siting**:
  - Avoid strong industrial/urban emission sources
  - Avoid complex topography



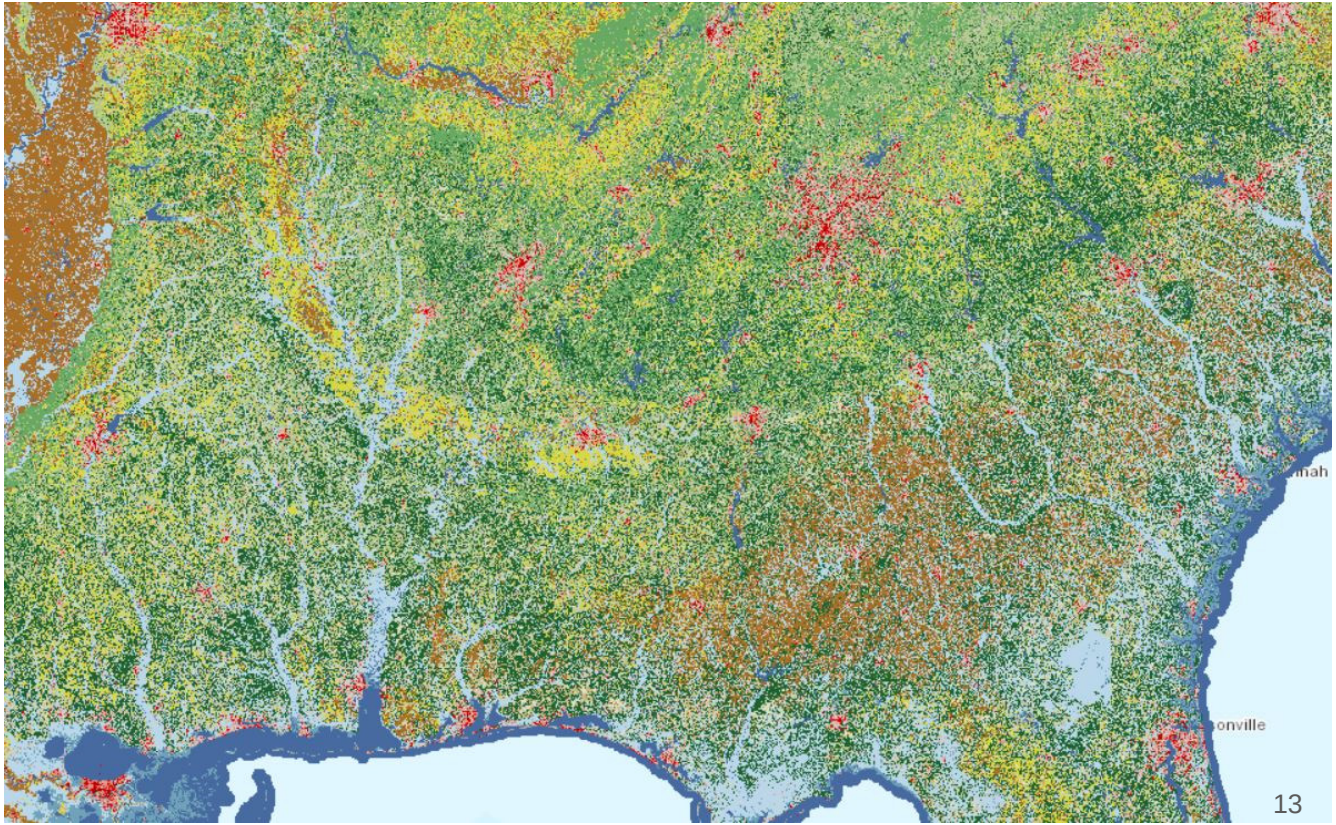
Activities: GIS Maps - Land-Atmosphere Interactions

NLCD Land Cover Classification Legend

- 11 Open Water
- 12 Perennial Ice/ Snow
- 21 Developed, Open Space
- 22 Developed, Low Intensity
- 23 Developed, Medium Intensity
- 24 Developed, High Intensity
- 31 Barren Land (Rock/Sand/Clay)
- 41 Deciduous Forest
- 42 Evergreen Forest
- 43 Mixed Forest
- 51 Dwarf Scrub*
- 52 Shrub/Scrub
- 71 Grassland/Herbaceous
- 72 Sedge/Herbaceous*
- 73 Lichens*
- 74 Moss*
- 81 Pasture/Hay
- 82 Cultivated Crops
- 90 Woody Wetlands
- 95 Emergent Herbaceous Wetlands

* Alaska only

National Land Cover Database - 2016



Activities: Outreach

- ARM has always sought community feedback -- continuous improvement, flexibility to identify high priority science needs -- often gathered through workshops, ASR Working Groups, Field Campaign PIs, and other mechanisms (**this breakout session**).

- We strive for a very active community outreach. This includes outreach to:
  - Environmental System Science
  - ARM constituent groups (UEC, AMSG, CPMSG)
  - science working groups (ACPC)
  - ASR working groups (AP, CP, WBLP)
  - Relevant multi-agency SEUS Field Campaigns
  - SEUS experts, partners, and measurement networks

- Slack channel
- email list: seus@arm.gov, seusteam@arm.gov
- webpage: https://www.arm.gov/capabilities/observatories/amf/locations/seus

Thank You!

https://uah.roundshot.com/swirll/