Infrastructure lessons learned during ABoVE:

What have we learned about running coordinated field campaigns?

Planning Airborne Campaigns

- Multi-aircraft campaigns can be challenging
    - Differing flight planning tools
    - Differing map projections
    - Facility instrument planning tools are not coordinated, and PI-lead instruments are also not coordinated
- Aircraft operations interrupted early on - navigation issues in the Arctic
- Risk management decisions - airport choice (if repairs are needed)
- Engagement around airborne flight paths. Consultations with other agencies (drawing on maps to find sites) were appreciated by collaborators.
- Be cautious in proposals specific to a single airborne instrument or technique - when simultaneous L- and P- band didn't happen, this was an issue for some teams
- Developing asset maps (locations of flux towers, on the ground research) - where was the current infrastructure that would be needed? The Arctic Observing Network has a new working group on asset mapping.
    - ABoVE has a static set of assets at the time of the 2017 airborne campaign. Action - send Sandy sites document

Communication Across Institutions

- Success of Airborne daily listserve
- ABoVE slack workspace - not heavily used. Other campaigns have used this. NGEE used slack for a long time, but once the pay system started then interest died off.
- All of the research in ABoVE can be overwhelming - a lot of research, a lot of history, amount of remote sensing. Could a primer on ABoVE be provided on the website for folks just joining.
    - ABoVE Newsletter is useful.

    - Documents to clearly link on website: Experiment Plan. Phase 2 report whitepaper. Logistics page for ASTM.
- Other resources for ABoVE investigators: CLM - email list uniting land modelers, updates sent out. Consider offering this to ABoVE as well - let ABoVE team know about it.

Supersites vs Disparate Sites

- Supersites - difficult to develop, but trade-offs in maximizing science. Is this desirable for future campaigns?
- Some science would not work - i.e. pan-Arctic biomass or traits
    - Nature article - bias in field sites
- Science team discussed this during the Concise Experiment Plan phase and felt that we needed to cross the gradient
- Co-location of sites - NGEE-Arctic operated this way.
- Coordination with collaborators from Canada became an important way to maximize science across disparate areas
- ABoVE - selections did not map directly to ACEP or each other. Science leads did not have a say in the selection of individual projects in Phase 2 and 3, but did provide some input for phase 1 (other field campaigns had a science PI who could help select other projects)

Developing Protocols

- Early phases worked to develop field protocols which could be shared across teams (soil moisture and active layer thickness)
- This was not done with all methodologies
- Ensure protocols are archived

Data management

- Cyberinfrastructure—did we have enough to handle the data for the models? Converting the data in a way that is useful for modelers, but also useful to field ecologists.
    - Modeling team survey - sent to 40 modelers. They have an updated list of land modeler PIs. Could send list of ABoVE data to these modelers and see how it could be used to calibrate/validate models.

    - Harmonizing datasets can be a challenge. Planning/vision needs to happen early on. These are the types of data and here is how they can be used.
    - For future campaigns, during scoping study process - they are sending out surveys to develop science data products. In the modeling working group of scoping studies, think about how to format data.
- Challenge - NASA ISS instruments do not reach boreal regions. NISAR was also delayed. SMAP active portion failed. Model for next campaign - use airborne to train models to then ingest global datasets from satellite products.
- NGEE - data sharing agreement at the beginning of campaign. Expectation of use. Took time to develop culture. Each team would work amongst itself to develop products.
- Science cloud - barrier to entry, difficult to spin up, but did have products available for team use that could not be accessed elsewhere (high res commercial imagery)
    - PRISM Juypter hub was useful.
    - MAAP also very useful - Jupyter Hub provides a model to share with others. Could future campaigns have a MAAP portal?
    - DAAC tutorials to facilitate the adoption of different visualization platforms like Jupyter Hub or MAAP
    - Have 2 sets of data delivered by projects (for modelers vs science). AVIRiS is creating 2 versions (one for modelers and RGB for others).
- DAAC comment - from Delta-X/Bioscape - NASA-funded centralized data manager would prepare all datasets and then send to DAAC for archive
- Data chasing - Ensure all datasets are archived
- Data management plans required by investigators
- Future ideas:
    - Satellite data processing - each team worked up their own scripts to analyze data (spectral reflectance mosaics for example). Could this have been done jointly? Hackathon idea?
    - Github repository for the team overall with fundamental functions for working on satellite data
    - Infrastructure for the future - field protocols, field safety, make a common repository and archive it

Safety

- NGEE - safety wide project manual and videos, then each lab has it's own. ORNL - pre-trip meeting for every trip (Tellgate) - for every team member (physical/psychological safety - 20 minutes).
- Tabletop safety exercises (NGEE does this with their entire team, ABoVE does this within the Northern Environments Course)
- During ABoVE and NGEE - these teams have influenced each other, and have also helped to influence and be influenced by the broader scientific community:
    - AGU code of conduct.
    - Institution feedbacks
    - AGU DEI committee webinars: Safe and Equitable Access to field work
    - Medical conditions in a red envelope including blood type. Ready for if a team member needs to go into the field.
    - USPA safety training
- NGEE goes to only a few places, while ABoVE goes to multiple locations. Difficult to coordinate safety together.
    - For ABoVE, Dan meets with every PI before the field season, but not before each trip.
- Psychological and emotional safety - also part of ABoVE. Training people in how to talk and communicate.
- ABoVE - relies on PI for hazard information.
    - Provides a safety database. ASTM good place to meet with PIs.
    - Northern Environments Field Safety course - tabletop exercises are provided.
- SnowEx had coordinated meetings with the entire team,
- Have larger field groups - 4, minimum 3 people in field at a time
- Prepare for protecting equipment from disturbance (wildlife, fire, etc.)

Meeting Location

- ASTM rotations. Meeting in Canada would have been nice (issue for non-US citizens - getting visas). Variety has been good.

Other Comments:

- Intern program as a good way to help working groups and move synthesis products forward
- Working groups worked very well. Brought people together. Doing synthesis activities.
- Inclusive atmosphere/culture - calm, welcoming to women and other groups
- International efforts such as the international polar year - how to engage.
- Tracing what where when with data and field work
- Airborne campaign to stitch campaign together - helped synthesis effort

Unaltered Notes:

Charge:
Infrastructure lessons learned during ABoVE (South Auditorium):
What have we learned about running coordinated field campaigns,
Planning Airborne Campaigns

- Airborne teams - map projections. Multi-aircraft flight planning tools would be advantageous. Facility instruments don't have coordination (AVIRIS vs LVIS vs SAR)
- Communication about where the planes were and what they were doing - Airborne daily listserve
- Aircraft operations - institutions which operated aircraft - issues with navigation. CAS might be monitored out of one center. Commercial might change also.
- Airborne - risk management in terms of airport. Aircraft stuck in remote aircraft.

- Supersites - difficulty in developing these sites, but trade-offs in maximizing science. Is this desirable for future campaigns? If we are all at different sites, how coordinated are we really? Some science would not work - pan-Arctic biomass or traits
    - Nature article - bias in field sites
    - Science team discussed this too and felt that we needed to cross the gradient
- Co-location of sites - did that work in ABoVE? Was there more we could have done? Did work with NGEE-Arctic. Also had some coordination with collaborators from Canada.
- ABoVE - selections did not map directly to ACEP or each other. Science leads did not have a say in the selection of individual projects (other field campaigns had a science PI who could help select other projects)
- Engagement around airborne flight paths. Consultations with other agencies (drawing on maps to find sites)
- Early phase - sharing methodologies - collecting soils data the same way. Teams not always collecting same things. Soil moisture came together across the team. ALT similar across teams.
- Cautious to have a specific request with the airborne campaign. L- and P-band simultaneous - didn't happen.
- Satellite data processing - each team worked up their own scripts to analyze data (spectral reflectance mosaics for example). Could this have been done jointly? Hackathon idea?
- Github repository for the team overall with fundamental functions for working on satellite data
- Infrastructure for the future - field protocols, field safety, make a common repository and archive it
- ABoVE slack workspace - not heavily used. Other campaigns have used this. Communication team to team vs open to everyone. NGEE used slack for a long time, but once pay system started then interest died off
- CMS model - taking data and working with stakeholders, Carbon Cycle Science also. Modeling Analysis and Prediction, NSF
- Intern program as a good way to help working groups and move synthesis products forward
- Working groups worked very well. Brought people together. Doing synthesis activities.

- Inclusive atmosphere/culture - calm, welcoming to women and other groups
- All of the research in ABoVE can be overwhelming - a lot of research, a lot of history, amount of remote sensing - primer on ABoVE. Newsletter helps. ACEP could help also. Phase 2 report whitepaper also on website. Maybe for logistics page for ASTM, link to some of the primer documents.
- Asset maps - where was the current infrastructure that would be needed? AON has a new working roup on asset mapping. ABoVE has a static set of assets at the time of the 2017 airborne campaign. Action - send Sandy sites document., SAR paper, LVIS paper.
- International efforts such as the international polar year - how to engage.
- Prepare for protecting equipment from disturbance (wildlife, fire, etc.)

data management,

- Cyberinfrastructure—did we have enough to handle the data for the models. Converting the data in a way that is useful for modelers, but also useful to field ecologists.
- Modeling team survey - sent to 40 modelers. They have an updated list of land modeler PIs. Could send list of ABoVE data to these modelers and see how it could be used to calibrate/validate models.
- Challenge - NASA ISS instruments do not reach boreal regions. NISAR was also delayed. SMAP active portion failed. Model for next campaign - use airborne to train models to then ingest global datasets from satellite products.
- NGEE - datasharing agreement at the beginning of campaign. Expectation of use. Took time to develop culture. Each team would work amongst itself to develop products.
- Science cloud - barrier to entry, difficult to spin up, but did have products available for team use
- Consider how things worked with Bioscapes
- What happens to data after ABoVE?
- DAAC - from Delta-X/Bioscape - centralized data manager then DAAC work becomes much easier. NASA-funded project person to only manage the datasets for the campaign.
- Harmonizing datasets can be a challenge. Planning/vision needs to happen early on. These are the types of data and here is how they can be used.

- During scoping study process - they are sending out surveys to develop science data products. In modeling working group of scoping studies, think about how to format data.
- PRISM Juypter hub was useful. MAAP also very useful - Jupyter Hub that provides a model to share with others. ABoVE having a MAAP portal.
- DAAC tutorials to facilitate the adoption of different visualization platforms like Jupyter Hub or MAAP
- Have 2 sets of data delivered by projects (for modelers vs science). AVIRiS is creating 2 versions (one for modelers and RGB for others).

logistics across institutions, and

- Slack
- CLM - email list uniting land modelers, updates sent out. Consider offering this to ABoVE as well - let ABoVE team know about it.

keeping investigators safe?

- NGEE - safety wide project manual and videos, then each lab has it's own. ORNL - pre-trip meeting for every trip (Tellgate) - for every team member (physical/psychological safety - 20 minutes).
- Have learned and collaborated with NGEE and ABoVE. AGU code of conduct. Collaborated on webinars through AGU DEI committee. Safe and Equitable Access to field work (through AGU).
- Medical conditions in an envelope including blood type. Ready for if a team member needs to go into the field.
- NGEE goes to only a few places, while ABoVE goes to multiple locations. Difficult to coordinate safety together. Dan meets with every PI before the field season, but not before each trip.
- ABoVE - relies on PI for hazard information. Also have a safety database and Office meets with each PI before the summer. ASTM good place to meet with PIs.
- SnowEx had coordinated meetings with the entire team, but that was different from ABoVE. Provide lists for packing.
- Same place vs multiple locations
- Safety culture moving into AGU. Institutions are taking the culture of these campaigns. NGEE - tabletop round robins to go over safety scenarios. Bond with modelers that way too. In Northern Environments Field Safety course - tabletop exercises are provided.
- Psychological and emotional safety - also part of ABoVE. Training people in how to talk and communicate.

- Have larger groups - 4, minimum 3 people in field at a time
- Safety training portal,
- USPA safety training. Red envelope of medical information.
- Onboarding to training

Meeting Location

- ASTM rotations. Meet in Canada would have been nice (issue for non-US citizens - getting visas). Variety has been good.

What is the relevance to current scoping studies and future campaigns?