NASA Community Snow Meeting, Full Group Meeting Notes

This is a designated space for notes generated during full group discussion periods across sessions. Please scroll to your designated session to infill discussion points.

Day 1 (August 14, 2024)

Morning: Summary and State of the Science/Community Discussion

Session 1 Moderator: Kate Hale, Jack Tarricone (Virtual), **Randall Bonnell** (Notes)

08:15 AM-09:30 AM

- Opening remarks and acknowledgements - Thank you to NASA Terrestrial Hydrology Program, organizing team, and CU-Boulder Institute of Arctic and Alpine Research.
- Welcome, expectations, and state of the science
    - Upcoming breakout sessions and poster sessions today
    - Each session throughout the day will be followed by a period of questions and answers
    - Code of conduct - Located in the google drive. Anonymous reporting form link on the code of conduct form.
    - Please include breakout session number on your name tag (given during registration)
- Meeting Objectives:
    - Recognize the conclusion of the NASA SnowEx field experiment and the recent Earth Systems Explorers satellite proposal missions - A unique opportunity to discuss where we were, where we are, and where we are going as a snow community.
    - Objective 1: Head towards consensus across snow community.
        - Connect across institutions and career levels to build inclusive community - everyone gets a voice
        - Discuss snow mission requirements, science questions, etc.
    - Objective 2: Summarize the current state of snow remote sensing, modeling, and technologies
    - Objective 3: Develop a white paper to inform the upcoming decadal survey
- Ferguson and Entin - NASA Water and Energy Cycle Focus Area Support for Snow Remote Sensing Science
    - Earth Sciences division organization chart
    - Earth sciences division is looking for applications for the water and energy cycle fleet (e.g., NISAR, SWOT, ISS instruments) and the NASA airborne science program
    - ESD looking to improve our understanding of earth's energy system, water/carbon cycles, predictions between ocean-atmosphere-land-ice feedback
    - ESD is directed/responds to the Decadal Survey. 2017 survey designated snow albedo and SWE as "explorer" observables.
    - ESD divided into 6 divisions and supports satellite missions and field campaigns.
    - Focus area questions: track water throughout the earth system, weather forecast improvement, consequences of land cover and land use change, etc.
    - April 2024, ESD began implementing Earth Science to Action Strategy

        - Hopeful Outcomes of the Community Snow Workshop - Learn from the SnowEx campaigns and recent satellite proposals → Continue community development and show value of SnowEx investment → Develop white paper themes and teams
            - Develop a roadmap for snow depth/SWE mission, how is it NASA unique?
            - Think through potential future field campaign themes and instruments to focus on.
        - Future opportunities for the US snow remote sensing community:
            - NASA EOS - NISAR, SBG TIR, and VSWIR
            - NASA Earth System Explorers - 2030-2032. EDGE (Earth dynamics geodetic explorer), would provide continued lidar (?) measurements
            - ESA Earth Explorer program 2033-2034 - CryoRad (low frequency passive microwave)
        - Upcoming 2027 Decadal survey - How will snow depth and SWE be prioritized in the survey?
            - Have any earth observational priorities or technologies changed?
            - How will commercial satellites and international coordination be considered?
        - Future NASA Funding Opportunities -
            - THP
            - Early Career Investigator program
            - Earth Science US participating investigator program
            - SMD-wide - FINESST, TWSC, NPP
        - Craig Ferguson welcomes opportunities to connect with folks here - Craig.R.Ferguson@nasa.gov
        - Please note the wide variety of audience expertise and adjust how we discuss our research accordingly. Remember that snow is often a link into other research communities.
- Vuoyovich - The NASA SnowEx Mission (2017-2023)
    - The importance of seasonal snow - snow supports 2 billion people for water supply. Satellites are an optimal solution, but the implementation of these techniques is challenging.
    - SnowEx is a multi-year coordinated campaign dedicated to bringing together the community to develop and test different remote sensing techniques
    - SnowEx timeline
        - First community meeting in Boulder in 2013
        - 2016 meeting - what are science priorities, questions, etc.
        - 2017 meeting - developed a science plan
        - 2019 meeting - hackweek discussions, presented SnowEx 2020 plan
        - 2020 meeting - THP snow roadmap presented, future mission proposal opportunities
        - Community has been critical to the development of SnowEx
    - SnowEx science plan
        - Lays out SnowEx priorities and current state of technologies
        - Gaps included forests, prairie snow, etc.
        - Identified measurement capabilities and gaps for different snow sensing techniques

- 2017 Campaign
    - Focused on snow distribution between different canopy types, canopy densities, and terrains
    - Grand Mesa and Senator Beck, CO
- 2020 Campaign
    - Time Series for L-band InSAR for SWE change detection among different snow climates/landscapes
    - Period of observation at Grand Mesa for SWESARR
- 2021 Campaign
    - Continued time series for L-band InSAR for SWE change detection
    - Albedo at Senator Beck Basin
- 2023 Campaign
    - Evaluated remote sensing approaches in tundra and boreal forest environments
    - How do snow microstructure and canopy affect high-frequency SAR backscatter?
    - Albedo in the boreal forest
- Community trainings
    - Hackweeks, CUAHSI Field Measurement schools every January, and Winter Wildlands Alliance snow school for K-12 students.
- Outreach activities
    - SnowEx-ED - developed educational snow kits and disbursed them throughout the country
    - SnowEx-MAIANSE internships - promotes undergrad internships for Native American and Alaska Native students
- SnowEx Accomplishments to date
    - 4 campaigns, total of 20 different locations and >250 participants
    - 8 aircraft flown, 14 airborne instruments
    - 184 datasets, >40 publications, 2 satellite mission proposals, 26 PhD dissertations, 6 MS theses.
- Data inventory update
    - All 2017 data has been published and available on NSIDC!!
    - About half of 2020 and 2021 datasets are published
    - About 20% of 2023 datasets are published.
    - Megan Mason - SnowEx Data lead
    - SnowEx users have increased substantially through time
- SnowEx publications
    - Nice distribution of papers per recognized snow science gap
    - Strong focus on forests
    - Have yet to address maritime and tundra
    - Large diversity of different techniques have been published on - majority have focused on measurement science (i.e., how are we doing with the techniques?)
    - About half of the papers have used lidar → proven to be key datasets
- Acknowledgement of a LARGE number of collaborators
- Question and Answer Period

- What will be the NASA snow approach for the next decadal survey?
    - Entin/Ferguson: Support consensus building across different sciences. Encouraged a small team to put together a water cycle workshop to revisit 2017 survey recommendations and whether any changes are warranted. Upcoming AGU session to discuss new earth observation strategies. Many program managers are trying to get feedback from the community regarding recommendations. Whatever question is asked by the decadal survey, they need a set of information that is proliferated throughout the community that has everyone on the same page. A shift in the mindset from hypothesis and publication driven science to "how can we use our science to help people".
- Can you talk a bit about budget forecasts? Is there a potential for doing more with less? Continued community building?
    - NASA budgets have kind of flatlined. Any cuts/changes trickle down between divisions
    - Water and energy focus area has a huge coverage - using the limited budget, we can influence the path forward to future campaigns etc.
    - Seizing windows of opportunity for funding - need to recognize and support these opportunities
    - Identifying and using money outside of NASA (e.g., internationally) may be helpful for building leverage for more funding from NASA.

Session 2 Moderators: Jack Tarricone, HP Marshall (Virtual), **Mimi Abel** (Notes)
09:50 AM-12:00 PM

- This is a breakout session, thus we ask that you take synthesizing notes of the summary slide presentations/discussion here.

Afternoon: Mission Concepts and Ongoing Scientific Projects

Session 3 Moderators: HP Marshall, Joe Meyer (Virtual), **Aditya Khuller** (Notes)
01:00 PM-03:00 PM

- TSMM:
    - ○ First and only EO mission dedicated for snow mass
    - ○ SWE maps at 500 m/pixel (weekly) with high-res 50 m/pixel mode
    - ○ Canada and trans-boundary watershed
    - ○ SAR
        - § Operational data
        - § Derived data
- ○ 25% Cycle
- ○ 3 winter seasons baseline lifespan
- ○ SWE-retrieval algorithm (Markov Chain Monte Carlo)
    - § MET data
    - § CROCUS model
- · Can handle alpine and arctic snow
    - § Data assimilation tool

- ○ Working on number of layers for SWE-retrieval
- ○ Improving radiative transfer model efficiency (takes 30 min. for 2-layer model)
- ○ Mission status:
  - § Doubled human resources
  - § Obtained data simulator
  - § Data management plan in progress
- · SBG:
  - ○ Snow and ice – role in the water cycle
  - ○ Spectroscopy: 0.38 to 2.5 microns
  - ○ 30 m/pix every 6-10 days
  - ○ Snowmelt, freshwater supply, flood prediction, droughts
  - ○ Snow and ice fraction (using spectral unmixing)
  - ○ Ice grain size estimates (3.7 microns)
  - ○ Issues:
    - § Roughness
    - § Atmosphere
  - ○ Next steps:
    - § Calibration data
    - § Public algorithms
  - IN-SAR and NISAR
  - ○ L-band tests give 6 mm SWE accuracy
  - ○ SnowEX used to meet virtually every month (just published a paper)
  - ○ UAVSAR data matched Lidar data and GPR data very well
  - ○ SWE loss may be detectable (from melt)
  - ○ Sentinel-1 works well
  - ○ Vegetation doesn't cause too many issues
  - ○ Limitations:
    - § dry or refrozen snow
    - § shallow snow
- ○ NISAR
  - § Aquifers, biomass, hydrology
  - § Delayed to 2/25
  - § 90 days for science data release
  - § L-band: Global (every 12 days)
  - § S-band: limited
  - § 3 years
  - § Products:
  - · 80 m/pixel from interferogram (for SWE changes)
  - · Single images
  - § Better than Sentinel C-band in terms of vegetation, but less sensitive for SWE
- ○ SnoWatch:
  - § Very large uncertainties in SWE
  - § From P-band amplitude and phase:
- · SWE

- · Soil moisture
  - § Goals:
  - · Greater forest transmissivity
  - · Greater snow depth
  - § Constellation of receivers (at least 3) since the military has many transmitters in orbit (since the 70s)
  - § Uses phase wrapping
  - § For wet snow (surface melt):
  - · Reflection from surface
  - § Lacks validation
  - · Used tower-based
  - § Uses SAR processing from 3 receivers
  - § What method of validation is required?
- SnowGlobe
  - § Global SWE and melt onset
  - § Constellation of X and Ku band SAR sensors
  - § 250 m/pixel
  - § 5-day revisit
  - § 5 satellites needed for 95%, but 2 give 90%
  - § Bayesian retrieval SnowSAR algorithm validated
  - § Limitations:
  - · Forests
  - · Cost
  - ○ Field measurements needed for calibration
  - § Microstructure for volume scattering (spatial)
  - § Lidar + in-situ measurements
  - § Liquid water content
  - § Simultaneous measurements
  - § Spectral albedo/measurements coordinated with spacecraft measurements
  - § Optical properties of snow layers and impurities

Day 2 (August 15, 2024)

Morning: Future of Snow Science

Session 1 Moderators: Joe Meyer, Noah Molotch (Virtual), **Otto Lang** (Notes)
08:15 AM-10:30 AM

- This is a breakout session, thus we ask that you take synthesizing notes of the summary slide presentations/discussion here.

Session 2 Moderators: Noah Molotch, Keith Musselman (Virtual), **Hamish Prichard** (Notes)
10:50 AM-01:00 PM

- This is a breakout session, thus we ask that you take synthesizing notes of the summary slide presentations/discussion here.

Afternoon: Community Engagement and Operations + Wrap Up

Session 3 Moderators: Keith Musselman, Carrie Vuyovich (Virtual), **Millie Spencer** (Notes)
02:00 PM-04:00 PM
Overarching Theme: Ways to increase engagement with the broader snow science community through data distribution centers, open science workshops, and operational environments

Sub themes:

- **NASA distributed active archiving centers and cloud computing (Joseph Kennedy, ASF)**
  - Tools and services for working with "big" NASA data like Sentinel-1 and NISAR
  - NASA DAACs: distributed active archive centers
  - Generally organized around disciplines (e.g. NSIDC, ASF…)
  - Ensure mission data is easily and reliably accessible to users
  - NASA Alaska Satellite Facility (ASF) DAAC: specific to SAR data
  - Host 22 PB of data (projected 180 PB of data in 2028), maintained and distributed by ASF
  - Help users find and access data, also provide training and support (resources in slides!) for SAR data processing
  - Host Vertex Data Search/Access Portal and Python Package (asf_search)
    - Of course can also use earthdata search portal and earthaccess python library
  - Need for "on-demand" products to help fill spatial, temporal, and dataset gaps
  - Can download data or access data through AWS cloud
    - Though moving toward the cloud
    - Hosts OpenScienceLab, fires up a machine in AWS that enables you to run work in the Cloud - really helpful for classes and hackweeks, and for broader international snow community to circumvent need for individual AWS payment
    - Similar to CryoCloud (not ASF)

- "Help me help you" message! jhkennedy@alaska.edu how can we help meet your needs?

- **NASA NSIDC DAAC: Open science and community engagement (Stephanie Wong)**
  - Goal to provide open source, publicly available, well documented data
    - FAIR data principles: findable, accessible, interoperable, reusable
  - Archives, distributes, and supports NASA earth science data products
  - Free and accessible to all
  - Aim to get more involved in community (e.g. community developed tools, open sharing, collaboration)
  - Github: https://github.com/nsidc
  - NSIDC and SnowEx: want to move to publish more raw and unprocessed data (18 to date from SnowEx)
    - Produce metadata for you!
    - Encourage publishing data prior to peer review and article publication
      - PIs should submit data with their estimated timeline for article publication (need *minimum* of 6 weeks notice for data publication)
      - NSIDC will pull DOIs immediately, helpful for article review
      - Can update your data and clearly document what changed if something changes during the peer review process
      - Encourage us to submit code alongside data sets
      - NSIDC can advertise PI's code repository too
  - Also publish tutorials, datasets, and user guides (e.g. from Hackweeks, SnowEx SQL database)
  - Generates cross-DAAC buzz for SnowEx-airborne data
  - Moving to the cloud in the next year-18 months, will still be free to access and download

- **How can the hackweek model support future snow community collaborations? (Anthony Arendt)**
  - Provides hands-on opportunities for people to learn the tools of open-source science in a collaborative and welcoming environment
  - Curriculum documented in JupyterHub/Notebooks
    - Teaching fundamentals of collaboration, Python, data access, modeling and machine learning
  - Rely on open-source framework, cloud-computing environment with public infrastructure as code for replicability
  - Hackweeks simplify access, increase inclusivity and a sense of belonging
  - What comes next: community growth and collaboration, community software, research infrastructure, applied snow science, cross-mission collaborations
  - Open source software: E.g. SnowExSQL Database (centralized API level access to SnowEx field campaign datasets) and data harmonization (reduce barriers to connecting model output with field and other observations; common data formats, projections, etc)

- Community snow observations: https://communitysnowobs.org/
    - open source citizen science campaign, specifically geared towards recreationalists
    - Helpful for everyone from backcountry skiers navigating avalanche risks to water managers and forecasters

- **US Snow Measurement Field School (Kate Kale)**
    - NASA funded project, in collaboration with CUAHSI
    - Motivation: accurate snowpack property measurements needed to ground truth remotely sensed data, teaches researchers how to take standardized measurements, how to interpret existing data
    - Aimed at anyone using snowpack data in their career - priority for grad students and early career researchers
    - No prerequisites
    - Typically held in early January, 4 days on-site instruction, associated registration cost
    - SINTER an steering committee help provide curriculum, location, instructors
    - NASA provides support for equipment and a limited number of travel grants
    - Application: through CUAHSI in late summer/early fall
    - Upcoming school (2025) will be on west coast
    - Teach field measurement skills and basic data analysis (snow pits and Federal Samplers, get to explore advanced measurement techniques like drones and thermal cameras, microstructure)

- **Research and Flight operations of airborne platforms (Jeff Deems, ASO)**
    - Airborne Snow Observatories (ASO): Serving water management and watershed research
        - https://www.airbornesnowobservatories.com/
        - https://nsidc.org/data/aso
    - Goal of accurate and time-relevant data: high accuracy and latency are key
    - Runoff forecast integration and capacity building
    - SNOTEL sites can only occur in specific geographic settings, makes interpolation difficult and undersampling a given, requires many assumptions
    - Historical data is increasingly unreliable for forecasting (calibrations no longer apply to current conditions)
    - Snow depth from LiDAR
    - SWE from coupling with observations and modeled density
    - Snow Albedo from HySpex and VSWIR spectrometers
    - Albedo and surface properties
    - Physical modeling with coupled lidar and spectrometer, iSnobal snowpack, WRF-Hydro runoff modeling
    - Post flight processing:
        - LiDAR point cloud extract, line-to-line correct, terrain filter, gridding
        - Spectrometer: radiance extract, surface classify
    - Then co-registration, HS Subtraction, HS + ρ Validation, then SWE Calculation
        - Accuracy within <5cm of snow depth (often a lot better!)
    - 3 day data turnaround post flight

    - operational partnerships with Colorado Water Conservation Board (Department of Natural Resources) and California Department of Water Resources
    - Runoff forecast integration and capacity building
        - CBRFC and CNRFC (lumped models) experimental forecasts
        - WRF-Hydro modeling system
            - Fully integrated chain from snow to runoff
    - Helps with reservoir operations timing, mitigating both drought and flood impacts, wildfire risks, ecologic and in-stream flows
    - Opportunities for multisensor snow density retrieval, capturing snowfall events and forecasting mountain precipitation, constraining ET through better knowledge of snowpack, variability scales and patterns
    - Soon launching snow albedo and spectrometer mission

- **Colorado Airborne Snow Measurement Program (CASM) (Taylor Winchell, Denver Water)**
    - https://coloradosnow.org/
    - Denver Water: enough pipes to cross the entire US!
    - Serves ~4,000 m^2, 1.5 million people
    - Snowpack dominated system
    - Important information: reservoir storage contents (including snowpack reservoir), streamflow, weather, customer demand
    - Snowpack is a critical reservoir that was historically poorly measured, necessary for effective management and decision making, climate adaptation
    - Additional funding needed to fully integrate ASO into western water management
    - CASM began in 2020, stakeholder-led movement
        - Planning team: Northern Water, Denver Water, COlorado River District, Colorado Water COnservation Board, Water Conservancy District, LRE Water, ASO, and Dolores Water Conservancy District (DWCD)
    - Integrating SWE with streamflow forecasts
    - CU-SWE Product (Molotch Lab) integrates ASO data
    - Hydrology impacts of wildfires

- **Colorado Basin River Forecast Center applications (Joe Meyer)**
    - RFCs: part of NOAA, CBRFC is one of 11 centers
    - Publish water supply, peak flow, and 10-day streamflow forecasts
    - Methods:
        - SNOW-17 (Anderson, 1976), SAC-SMA (Sacramento Soil Moisture Accounting Model)
        - Baked on hydrological response units
    - Integration platform ensures CBRFCs water supply forecast reliability
    - Increased seasonal snow variability challenge point-based forecasts
    - Higher spatial resolution products from CU Boulder SWE, University of Arizona SWE, and ASO
- UA SWE Produces 4 km resolution SWE and snow depth product, covers continental US, daily updates, record since 1982 water year, available at NSIDC

    - Organizes watersheds by elevation zones
    - SNOW-17 SWE based on areal mean by zones
    - Compare SWE by 'touched' pixels
    - Test regions across upped and local colorado and great basin
    - Compare low and high elevation and latitude sites for areal mean SWE
        - Depending on the year and how anomalous it is, models function better or worse…
    - Next steps: sub-seasonal differences, investigating other SWE extraction methods, use SWE data in CBRFC hydrologic model runs
    - Compare with other SWE datasets
    - Automate to include daily updates
    - Expand use for upcoming water year

- **Questions/Discussion:**
- Who has access to JupyterHub, CryoHub, etc.? What is the funding mechanism to support these Hubs in the long term?
    - Free to anyone in the world (mostly…)! But the funding model is in flux.
    - Model is actively changing, if you're on an HPC system you're funded separately, if you're asking for cloud computing you need real dollars that count against your grant cap. In effect, burdens the system to provide these services for free. Soon, will need to be NASA-affiliated to access the system to manage this financial burden.
- How are data made available for communities relying on Denver Water?
    - Strong effort to make it a state-wide effort, not just a Denver Water effort
    - See it as benefiting state as a whole
    - Aim to reduce transboundary diversions
    - All ASO data is publically available, so anyone can access CASM/ASO data
    -
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Session 4 Moderators: Carrie Vuyovich, Kate Hale (Virtual), **Katie Breen** (Notes)
04:15-04:45 PM

Carrie started by providing an overview of the 3 objectives and highlighted the big takehomes that she observed during the meeting
Objective 1: consensus across snow community

- Importance of training and education, Hackweeks and Snow School were mentioned multiple times, and funding can bring down barrier to entry
- There have been a number of working groups, producing a number of papers, and it helps when the working groups have an objective
- Future snow community meetings should be more regular; future work to decide frequency
- Snow Mission Requirements
    - High resolution data and high temporal resolution at global coverage
    - Multi-sensing modeling approach; still more questions on what are the pieces to fit into the modeling
    - The Snow mission should have agility, and how the algorithm works in different regions

        - It's more than just hardware; modeling is a key component.
    - Science questions
        - We need to think about how does snow affect other disciplines?
        - "High maintenance" snow -- Wet snow, complex terrain, forests,
    - Applications
        - We need to listen and think about attending others' missions
        - We should conduct a economics benefit analysis
        - Applications workshop -- we should bring together those that use the data and gather their feedback

Objective 2

- SnowEx has moved knowledge further for snow! And we have learned more about all the areas in the diagram that we saw on day 1.
- For snowglobe, we got the feedback that the technology was ready, which was an advancement!
- We have a better understanding of how different techniques perform on certain tasks (ie, deep snow, shallow snow); more work is needed to quantity for an uncertainty
- We have made great advancement for how to run a field campaign.
- Have we ruled stuff out? For example, we haven't talked about passive microwave

Objective 3

- White paper topics on the slide
- Can we have a coordinated approach for putting white papers together?

Additional thoughts

- Field/airborne
    - Wet snow! It was mentioned a lot
    - Multi-frequency observations will likely be important
    - P-band maturation
    - Testbed sites
- It will be important to check to see if our websites and repositories are complete
- Missions of opportunity vs. dedicated snow mission
    - M o O: getting information on IceSat-2 and NISAR is great, but none of them are focused on snow. Is there a risk of going after the multiple signals of opportunity? Does that take away from focusing on a dedicated snow mission

Q&A/ discussion session:

- In the L-Band working group, snow was not an objective, but there might be space to create a viable snow product from NISAR. It's likely not too late to think about what NISAR could do for snow. Shadi mentioned this earlier NISAR as a potential pathway. We shouldn't be afraid that if we propose a product for NISAR, that we couldn't not get a snow mission later on
- Jeff Dozier -- The Gravity mission was the only mission focused on snow observables, he fears that getting snow designated as an observable in the next decadal survey might be a heavy lift. We should think about setting up a mission that observes something else. He participated in the 2007 and 2017 NASA decadal surveys, and its importance to know how

the surveys use white papers. He thinks that some operate more as peer-reviewed papers, but they do read them

- There was a point raised about good and bad data -- could there be a comparison that compares good and bad data. There is something like that in the glacier community. That could also be led into a white paper because it would be assessment of the current sources
- The climate community doesn't highlight our snow needs as much as they should The climate chapter of the survey only cares about snow cover, and not doing snow mass and water budgets, and there is a cost that snow gets deprioritized. They only need snow at 10-km. It's up to us to ask for that rigor from climate scientists. When we are writing RFIs we need to "stand our ground." We need to find allies in the climate community
- NISAR will provide some form of a swe, and it will be helpful to find where are the gaps, and what we want to add to it in the snow mission
- THe publications can support the white papers,
- Taylor's summary of how a water manager can tell you exactly how much is in the reservoir, but we can't tell you the volume in a basin. We don't know what the bar is of what we are looking for, and what we are comparing to the bar to (what is our benchmark?). Then, once we know the bar, what is the incremental gain once we get the new tool?
- CMAP-7 -- globally intercomparisons of earth system models, what are the important variables from each discipline?
    - Summer works at NCAR and is on the working group for CMAP-7
- There is a working group to look at the assets from all three agencies, how different data products could be developed. Since 2016, we have had survey and they might make a rec for the variables to focus on for CMAP-7
- NOAA puts in a need for snow, Bureau of reclamation puts a need in for snow, DOE for snow, Carrie did look at evaluating NISAR
    - We need to demonstrate the application of NISAR to an applications group
- It's important to network and when we hear things ad put people in touch. NASA and the federal gov will do what the collective good wants, not what any one person wants.
- Suggestion: recruit people from multiple agencies to put in a formal request
- There is a lot of data to support a lot of questions that we are still interested
- Craig said that we should look to other agencies for funding, to take the burden off of THP
- A HUGE THANK YOU TO EVERYONE :) :) :)