

NASA Community Snow Meeting

Day 2 Breakout Session II Final Merged Summary

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This is a designated space for compiled notes from the summary slide presentations. *Only the listed note taker will update this document.* The purpose of this document is to compile unique takeaways presented across all breakout session groups.

Questions:

What efforts are needed in the near term to mature technologies?

- a. Field campaign, airborne campaigns, instrument development, etc?

Finalize and publish existing datasets.

Develop standardized, preferably automated supersites of ongoing snow observations targeted at constraining the physical processes contained in weather, snow and hydrology models and run as long-term (e.g., decadal) infrastructure (like the AWS and SNOTEL networks) in order to capture extreme events.

Publish 'best practice' protocols for field observations that can be used globally.

Be steered more by the needs of the weather-model community, particularly for precipitation.

Design field surveys to be more hypothesis-driven, and with a focus on error quantification (prioritized using e.g., 'stop light' system).

Conduct field experiments around P-band radar.

Aim for more simultaneous multi-instrument surveys.

Provide more detail about the forest properties of forest study areas.

Run a snow product 'bake off' - intercomparison of recent Snow-Ex-derived products from various groups.

- b. Model advances, OSSEs (Observing Systems Simulator Experiments),

Explore hybrid of physical and machine-learning models for SWE retrieval.

Use airborne L-band surveys to understand NISAR InSAR.

- c. Data merging, cloud computing, etc

More intercomparison exercises.

- d. What questions did SnowEx not address? What forward-thinking ways should we approach the next major campaign?

Gaps include some Sturm classes e.g., 'high-maintenance' snow that is problematic (e.g., maritime, wet snow) plus complex terrain, forest canopy and floor, and prairie areas (note that prairies experience particularly extreme events).

Focus on extreme events, which are most important societally but require longer time series to capture. These have most societal impact (i.e., costs most), e.g., crop damage etc.

More focus on capturing spatial variability, on observing snow liquid-water-content and experimenting with P-band radar.

Better coordination to ensure coincident measurements (e.g., ground with airborne with space at same time and place). Better contingency planning in case of fieldwork problems e.g., aircraft can't fly at the right time, when field workers are deployed. Particularly important to coordinate snowpack surveys with precipitation, soil moisture and streamflow measurements, to help snow/hydrology modelers.

Better coordination with other snow field campaigns out there. Have a clear contact person for outside field groups to coordinate data gathering with.

More workshops.

Focus on full-watershed scale field campaigns to capture complex terrain etc.

Better involvement of modelers from the start of the field-planning, and potentially in the field as well.

Promote ongoing incremental progress wherever possible e.g., by focussing on pinning down uncertainties in particular parameters based on existing SnowEx.

2. How can we better engage the applications & operational communities in future missions or campaigns?

Good examples include Western Snow Conference that engages both users and snow scientists, and links to operational avalanche-patrol community.

Key question: what scientific knowledge would help in making better operational decisions?

Engage early to plan based on user needs. Keep users engaged during the mission, to adapt products when needed.

Question the community re temporal and spatial resolutions needed, and inform them of practical limitations.

Encourage proposal submissions (even if proposal ultimately unsuccessful) as these prompt community engagement.

Reduce data latency before release.

Have on-going working groups running, plus model-developer meetings, and more meetings like this one on a regular basis (e.g., annual).

Go to meetings of other communities, as well as inviting them to ours.

3. How do we foster a community that is welcoming of new members?

US mountain-snow community is seen as already quite welcoming. There is scope to seek more feedback after outreach/field course events, and for better involving indigenous knowledge, but note that this takes time to build. SnowEx MAIANSE outreach/ed program is a good example. Hackweek and snow schools are good examples, particularly their focus on teaching rather than just informing.

Work to involve more water managers etc, e.g., as there are only two Colorado water managers at this NASA snow meeting in Colorado, where snow is v. important.

Ensure data accessibility.

Highlight linkages of snow to other communities (ecology etc).

Workshops: directly invite wider community members to engage. Highlight on the meeting website the range of specialists attending the meeting.

Publish 'best practices' documents, particularly for new members, to help break into snow work.

Promote an equipment pool for snow science, particularly for new members to learn/use.

Advertise more widely the snow schools, hack weeks etc.

Use NASA's PR machine to promote SnowEx-type work.

Have travel support planning that is available at a consistent level each time, so can be planned for.

4. Who are the partner user communities? Can we leverage advances or lessons learned in other communities for snow?

Globally: work to engage more with e.g., WMO (who already have weather-observation guidelines) and, for example, the Google Earth Engine / Climate Engine communities.

Do an end-user survey to learn what is needed.

Also engage with scientists on different (related) satellite missions.

Promote more data standardization.

Introduce 'application workshops' to involve end users earlier in the product release process.

Employ 'early-adopter' program to bring in users at an earlier mission stage (as used by NASA with other missions).

Have a 'researcher liaison' person to interface with the wider science community.

Collaboration with economists could be very useful in building the socio-economic case for funding.

Run a comprehensive snow-product intercomparison/evaluation study.

Connect more closely with the rest of the NASA cryosphere communities.

5. What white papers should go toward the next Decadal Survey?

Generate a community 'position paper' (e.g., from this meeting) in advance of white paper - to ensure a common community voice for advocacy. Produce a concise list of community talking points to help lobby funders.

Produce white papers around a) each of the key snow parameters, e.g., SWE, albedo..., and b) on methods, particularly those that are applicable globally.

Elevate SWE as a 'designated variable' equally important as albedo.

Describe the power of long-term validation study sites (time series more valuable than snapshots).

Describe the need for and economic value of a global snow mission (similar to that from SWOT and TSSM), done by economists.

Produce an overview of existing modeling and data assimilation work relating to snow.

Publish early-career perspectives.

Review synergies between different satellites (inc those not originally intended for snow).

Describe lessons learned on methods: what SnowEx observations worked and which did not?

Which datasets are being used and which not?