

Overview of Cloud and Precipitation Measurements

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Radar Status

▶ KAZR

- Data flowing from SGP, NSA, ENA, Oliktok (AMF1 and 2 in preparation or transit)
- ENA and Oliktok received full characterization in 2017. NSA to be characterized this year
- AMF1 KAZR performed well at CACTI. AMF1 & AMF2 en route or in preparation.

▶ SACR

- X/Ka performed well at CACTI (X/Ka). Prepping for AMF1 and 2 deployments; no data currently flowing.
- Refurbishment and characterization planned for NSA later this year (moved from AMF3)

▶ XSAPR

- SGP systems generally in good condition, data flowing, and polarimetric characterization pending from CSU
- NSA system to be refurbished and characterized this year.
- ENA system is down and will need focused attention – no immediate plans but considering options (contract). Experiencing challenges supporting remote system including significant shipping delays.

▶ CSAPR

- Performed well during CACTI (scanning issues at end). Will be prepped for TRACER.

First Look at Radar Priorities for FY20

- ▶ Completion of b1-level products for CACTI (all radars: KAZR, SACR, CSAPR2)
- ▶ Installation of radars for MOSAiC (KAZR, MWACR, SACR) and COMBLE (KAZR, SACR)
- ▶ Processing and analysis of b1-level products for all MOSAiC and COMBLE radars
- ▶ Continued refurbishment of NSA radars
- ▶ b1-level processing and analysis of NSA radars plus Oliktok KAZR
- ▶ Development of convective cell tracking capability for CSAPR2 in preparation for TRACER

Contacts:

Mentor Team: Nitin Bharadwaj, Joe Harden, Brad Isom, Andrei Lindenmaier, and Alyssa Matthews

Translators: Scott Collis and Scott Giangrande

ARM Radar Products Update

Description	Location/Radar	Timeline
b1 level – calibrated, corrected, masks, KDP, attenuation correction (X/C)	CACTI: CSAPR2, Ka/X SACR; KAZR MOSAic/COMBLE	12/31/2019 As data is available
CMAC2.0 – Attenuation correction, clutter mask, gate id, KDP, Rainfall Rate	SGP: XSAPR i4, i5, i6 CACTI: CSAPR2 ENA: XSAPR2	Aug-Dec 2017 (more soon) Coordinated with b1 FY20 (select periods)
ARSCL	SGP, ENA, NSA, OLI AWARE, MARCUS, LASIC CACTI	c0 Running with short lag c0 Available c0 July 2019
SACR-ADV QVP VAD 3D3C	OLI: Ka-SACR ENA, OLI: Ka-SACR SGP: Ka/W SACR CACTI: Ka/X SACR ENA: Ka/W SACR	Select periods Select periods Select periods Coordinated with b1 Spring 2020
SAPR-ADV QVP QVP, VAD, MMCG	SGP: XSAPR i4, i5, i6 CACTI: CSAPR2	Aug-Dec 2017 (more soon) Following CMAC2.0
OGRE (cloud properties+)	SGP MC3E	End FY19
microARSCL	SGP, ENA, NSA, future AMF	Routine processing starting end FY19

Potential Future Development

Scanning Products

- Hydrometeor ID
- Drop Size Dist.
- Dual Doppler Winds
- Conv./Strat. Classification
- QPE

KAZR

- Drizzle properties
- Cloud Phase/Mixed Phase Retrieval

Operational Paradigm

- Focus on IOPs, Epochs
- Incorporate PI algorithms as open source or ARM products

Radar Wind Profilers

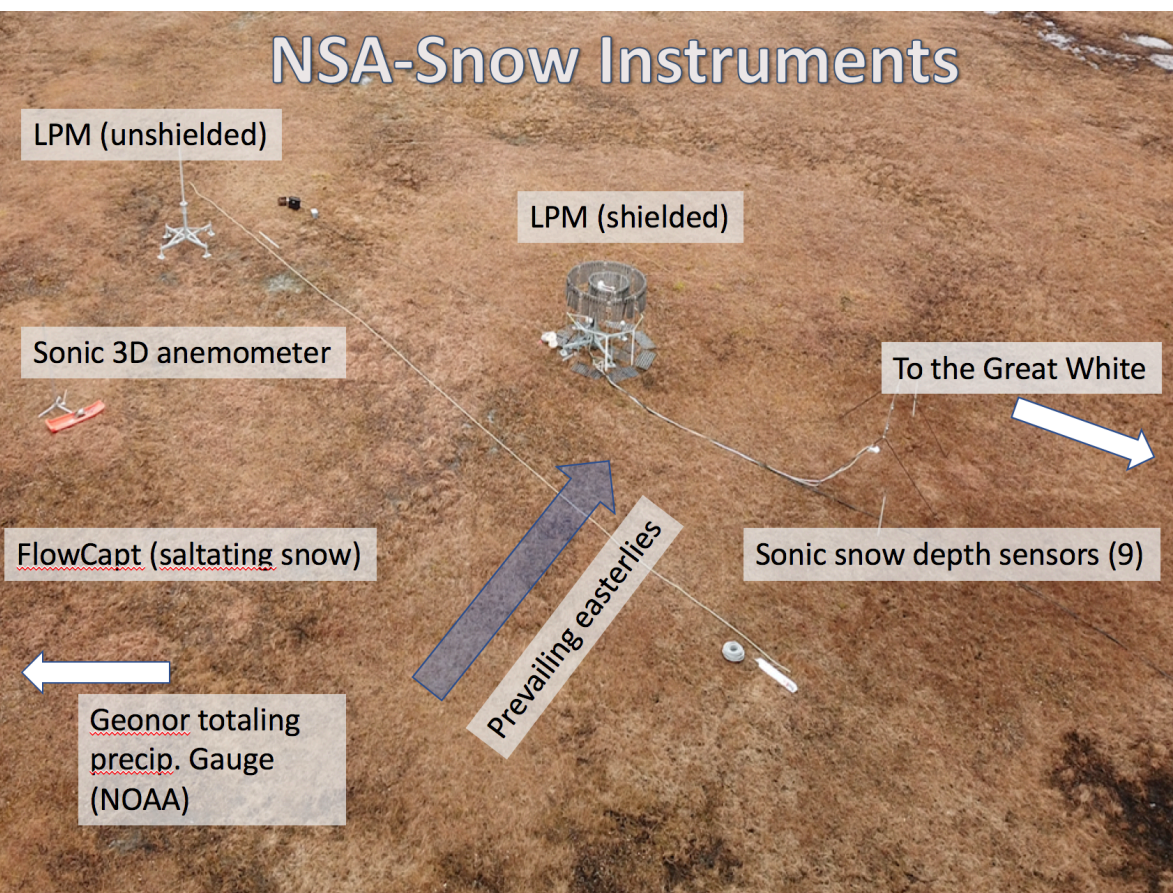
Somewhat complicated status

- ▶ Still have original 915s at SGP, NSA and AMF1.
- ▶ Have 1290 MHz systems at ENA and for AMF2 deployments (different models)
- ▶ Working on replacing older 915s: 1 currently on order for SGP.
- ▶ Question: should we consider replacing the NSA system with a 449 MHz system (significantly more expensive but better sensitivity in cold/dry environment)

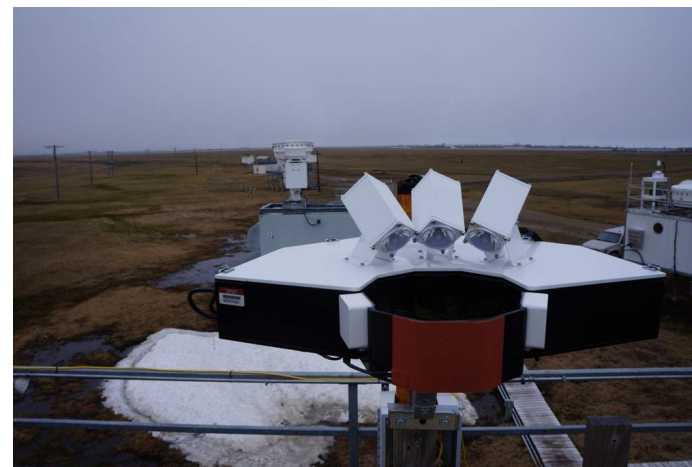
Contact: Paytsar Muryadan

Solid Precipitation Measurements

NSA-Snow Instruments



Extensive sets of instruments have been installed at Barrow and Oliktok to characterize frozen precipitation. The mentors Jennifer Delamere and Matthew Sturm are actively working with these instruments.



The multi-angle snow camera (MASC) provides high-resolution images of ice particles, fall speeds, and particle morphology at Barrow.

Contacts: Jennifer Delamere and Matthew Sturm for bulk precipitation measurements; Martin Stueffer and Telayna Gordon for MASC and PIP

ARM is also collaborating with NASA/GPM to deploy the PIP snow particle imager at Barrow (previously at Oliktok).

Lidar Activities and Status

- ▶ **HSRL Upgrade:** Adding 1064nm and wide FOV channel for improved BL aerosol profiling.
 - Currently upgrading Barrow system. Expected completion January 2020.
 - Planning initial deployment to SGP, coupled with Raman (→ 3 wavelengths) followed by return to Barrow.
 - Will consider AMF2 upgrade following MOSAiC.
- ▶ Also note that Raman lidars are currently deployed at SGP, ENA, and Oliktok
 - Tentative plan is to pair the NSA lidars (HSRL and Raman) at Barrow
- ▶ MPLs are aging. Refurbishing systems for FY2020 operations but will likely need to implement a more permanent solution for this class of lidar within the next few years.

Contacts: **HSRL:** Ray Bambha; **Raman:** Rob Newsom and Ray Bambha; **MPL:** Paytsar Muraydan

ARM Lidar ARM Lidar Measurement Needs Survey

- Survey sent to 728 lidar users. 136 responses received. Respondents were asked to provide feedback on their use, level of satisfaction with the ARM lidars and potential improvements for the following:
- **Cloud base detection**
 - Users generally satisfied with the available systems for this purpose. Ceilometer and MPL most frequently used
 - Lidar characterization and appropriate corrections need to improve
 - Suggestions/Requests: Improve calibration/correction procedures for all lidars
- **Mixed phase cloud identification**
 - HSRL and RL preferred due to higher quality depolarization ratio. Limited availability at ARM sites
 - MPL is advantageous because it runs more consistently and is present at all sites. Corrections historically not available
 - Suggestions/Requests: quality controlled, calibrated depolarization data product is needed
- **High cloud detection**
 - MPL is generally used and users are satisfied with the range. Reduced daytime sensitivity due to solar background
 - Suggestions/Requests: Lufftt CHM15k ceil; Cloud radar; complementary data including stereo-photogrammetry observations
- **Aerosol research (detection and properties)**
 - All lidars have their shortcomings: RL not as good as HSRL for aerosol research; HSRL and MPL not well calibrated
 - Suggestions/Requests: To advance aerosol research beyond “detection”, multi-wavelength lidars with depolarization capability are needed
- **RL for thermodynamic and DL for wind profiling**
 - No widespread use (16 RL and 11 DL users). The available RL products often require extensive post-processing for most uses. DL users are satisfied with the existing data products.
 - Suggestions/Requests: Portable DIAL system for water vapor and T profiling

Microwave Radiometers

There are a variety of microwave radiometers currently in operation.

- ▶ MWR 2-channel: Still have 10 of the original systems; 5 in operation and 5 spares
- ▶ MWR 3-channel
 - Have 10 of the Recovery Act era systems. 5 working and 5 in need of repair.
 - Have 2 newer RPG systems (ENA and OLI) with 2 more on the way (AMF1 and 2)
- ▶ MWRP: 2 units – NSA (working but issues in winter); ENA (not working)

Actions and points for consideration

- ▶ Continue working on refreshing the array of radiometers across the facility
- ▶ Still have work to do establish consistent operations and solid and efficient LWP retrievals
- ▶ How important is it to operate the MWR profilers? (in the context of many other priorities)

Contact: Maria Cadeddu

Total Sky Imagers

The TSI is another instrument in need of refresh. Still operating the original systems with the exception of 1 IR Sky imager

- ▶ Expect to be reviewing requirements for sky imaging in the next year for a facility-wide upgrade
- ▶ How important is the IR capability? And how does this importance differ across locales? The IR capability adds significant expense and is not seeing wide use at SGP.

Contact: Vic Morris