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# SnowEx: a NASA airborne campaign leading to a snow satellite mission

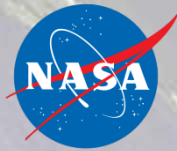
SnowEx update: Sep 15, 2016

**SnowEx Team/contributors to this report:** Edward Kim, Charles Gatebe, Amy Misakonis, Dorothy Hall, HP Marshall, Ludovic Brucker, Kelly Elder, Chris Hiemstra, Matt Beckley, Alex Coccia

**Sponsored by NASA Headquarters/Terrestrial Hydrology Program Manager:** Jared Entin

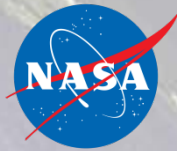
# Outline

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- Welcome – Ed/Gatebe (3 min)
- Schedule & Logistics – Ed (3 min)
- Ground truth/GBRS – Kelly/Ludo/HP/Chris (15min)
- Airborne– Ed/Gatebe/M.Beckley (10 min)
- Website–Gatebe (3 min)
- Winter Participation- Dorothy/Kelly (3 min)
- Q&A – (10 min)

For more information, see [snow.nasa.gov](http://snow.nasa.gov) → snowex

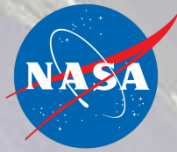


# **SCHEDULE STATUS AND RISKS**

Amy Misakonis

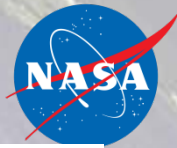
# SnowEx Major Milestones

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- Fall Deployment – 9/25/16 – 10/4/16
  - Ground Truth
  - ASO, GLISTIN-A
- Instruments on Deck @ Aircraft Facility – 12/15/16
- Test Flight – 1/26/17 – 1/30/17
- Winter Deployment
  - Early GT Arrival – 2/1/17
  - Aircraft and GT Campaign – 2/6/17 – 2/24/17
- Final Data Delivery from all Instruments – 6/30/17

# Fall campaign participants



## Ground field work

Kelly Elder  
HP Marshall  
Chris Hiemstra  
Travis R. Roth  
William Currier  
Nicholas Wright  
Karl Rittger  
Mark Raleigh  
Tarendra Lakhankar  
Zoe Courville  
Ty Brandt  
Alex Studd-Sojka  
Clint Boaz

## LSOS/GBRS

Ludovic Brucker  
Roger De Roo  
Mohammad Mousavi  
Eric Small  
Jeff Deems  
Peter Gadomski  
Art Gelvin  
Luke Spaete  
Ann Marie

## Met Station-Related

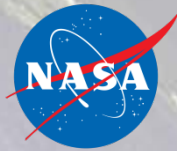
Paul Houser  
1-2 other persons

## Organizing Team

Amy Misakonis  
Ed Kim  
Charles Gatebe

## Airborne

ASO team  
GLISTIN-A team

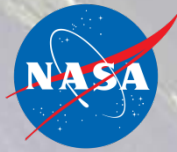


# Ground truth/ Ground Based Remote Sensing update

K.Elder/L. Brucker/HP Marshall/C.Hiemstra

# Ground Truth Measurements

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## Snow Pits

Depth

Density profile

Temperature profile

Stratigraphic profile

- grain type

- grain size

- grain photographs

Snow wetness

Soil moisture

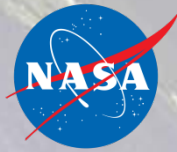
Soil state

Snow surface roughness

SSA

# Ground Truth Measurements

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## Snow Depth Transects

Manual transects

Magnaprobe transects

## Other

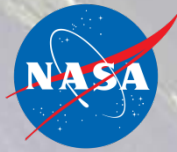
Time lapse photography

canopy

snow stakes

# Ground Truth Measurements

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## Meteorology

Wind speed and direction

Air temperature and relative humidity

Four component radiation

Snow depth

Snow temperature profile

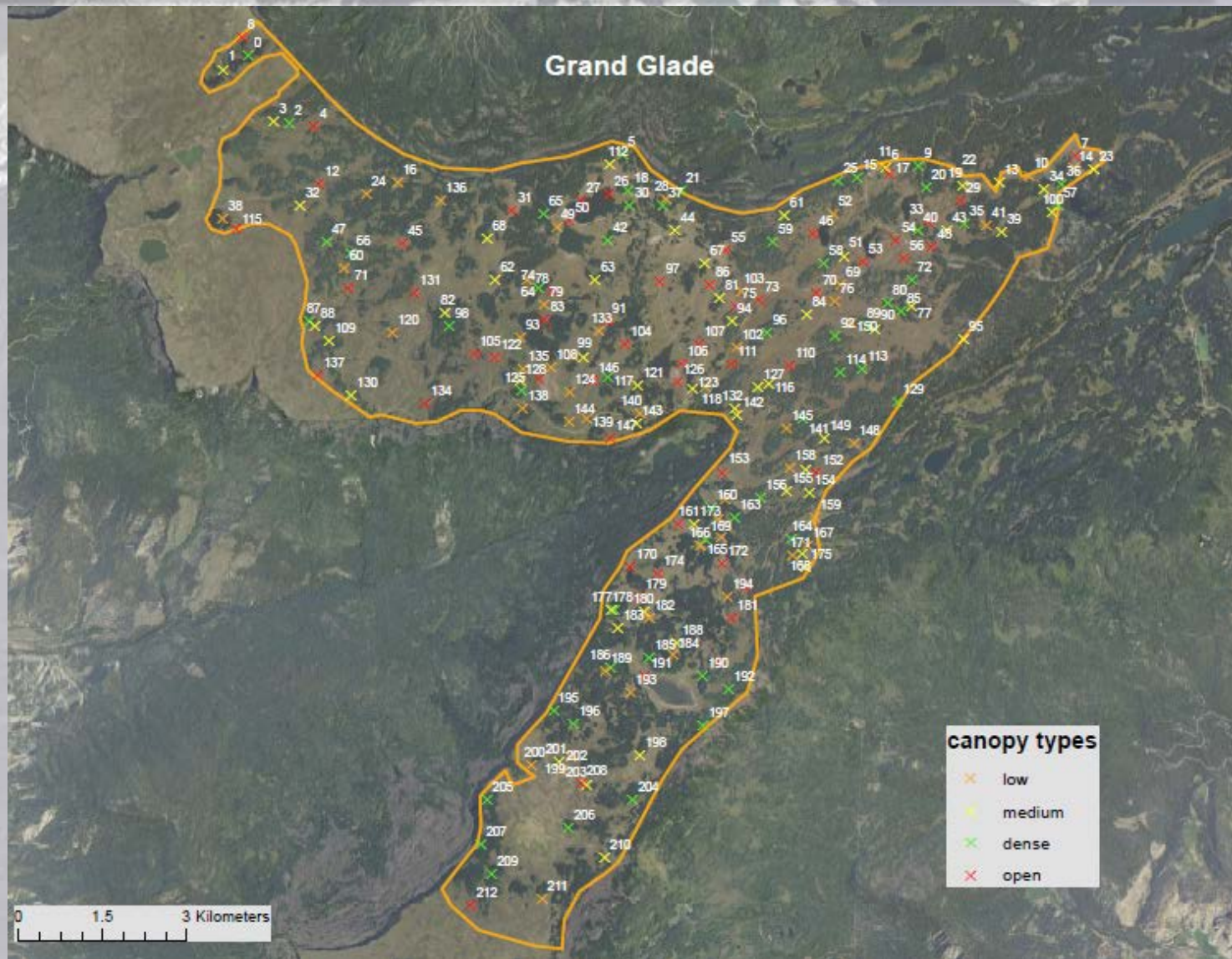
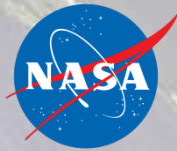
Skin temperature

Soil temperature profile

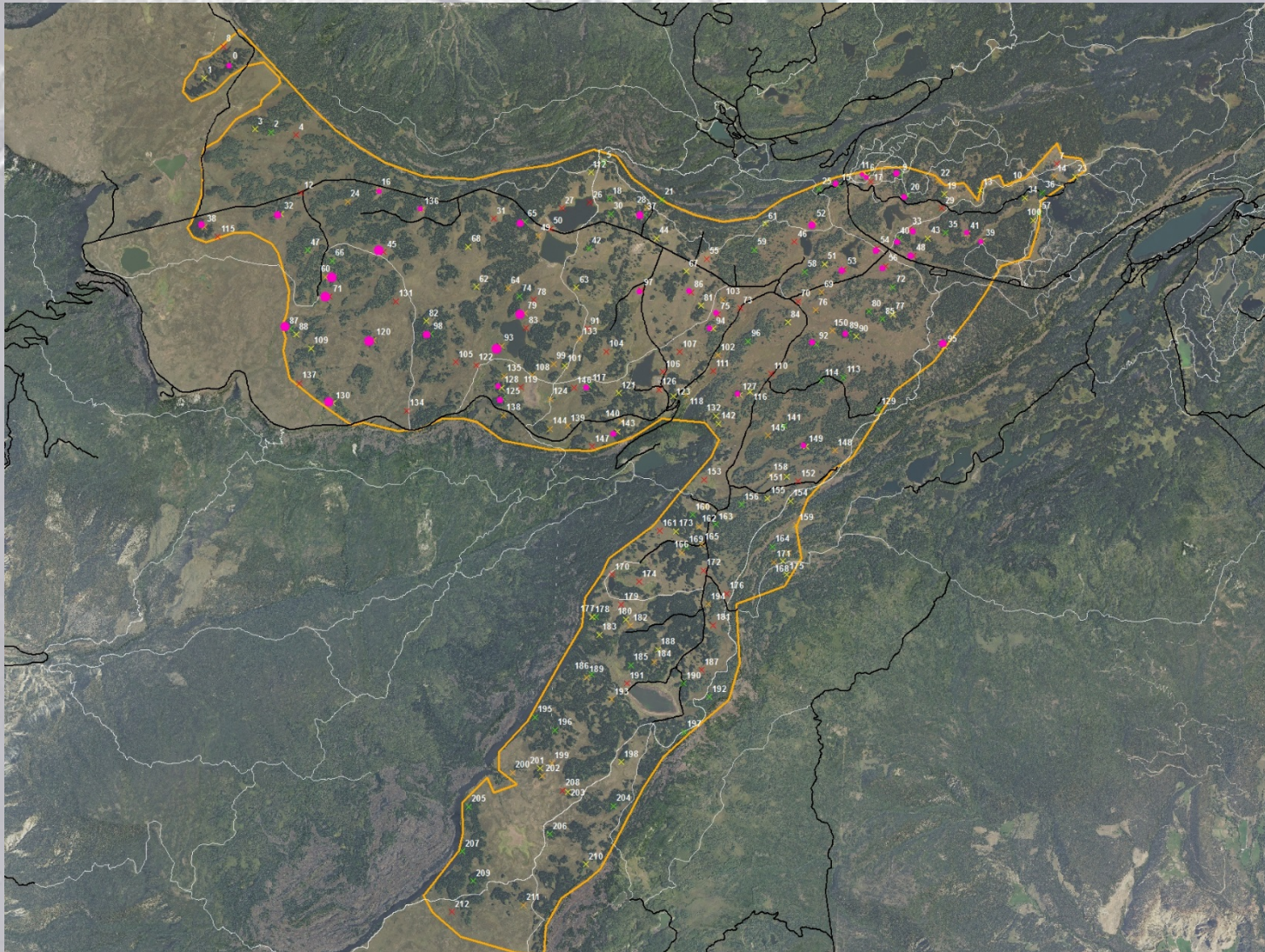
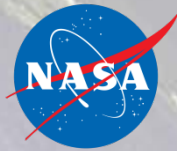
Soil moisture

Snowfall – Pluvio and Disdrometer

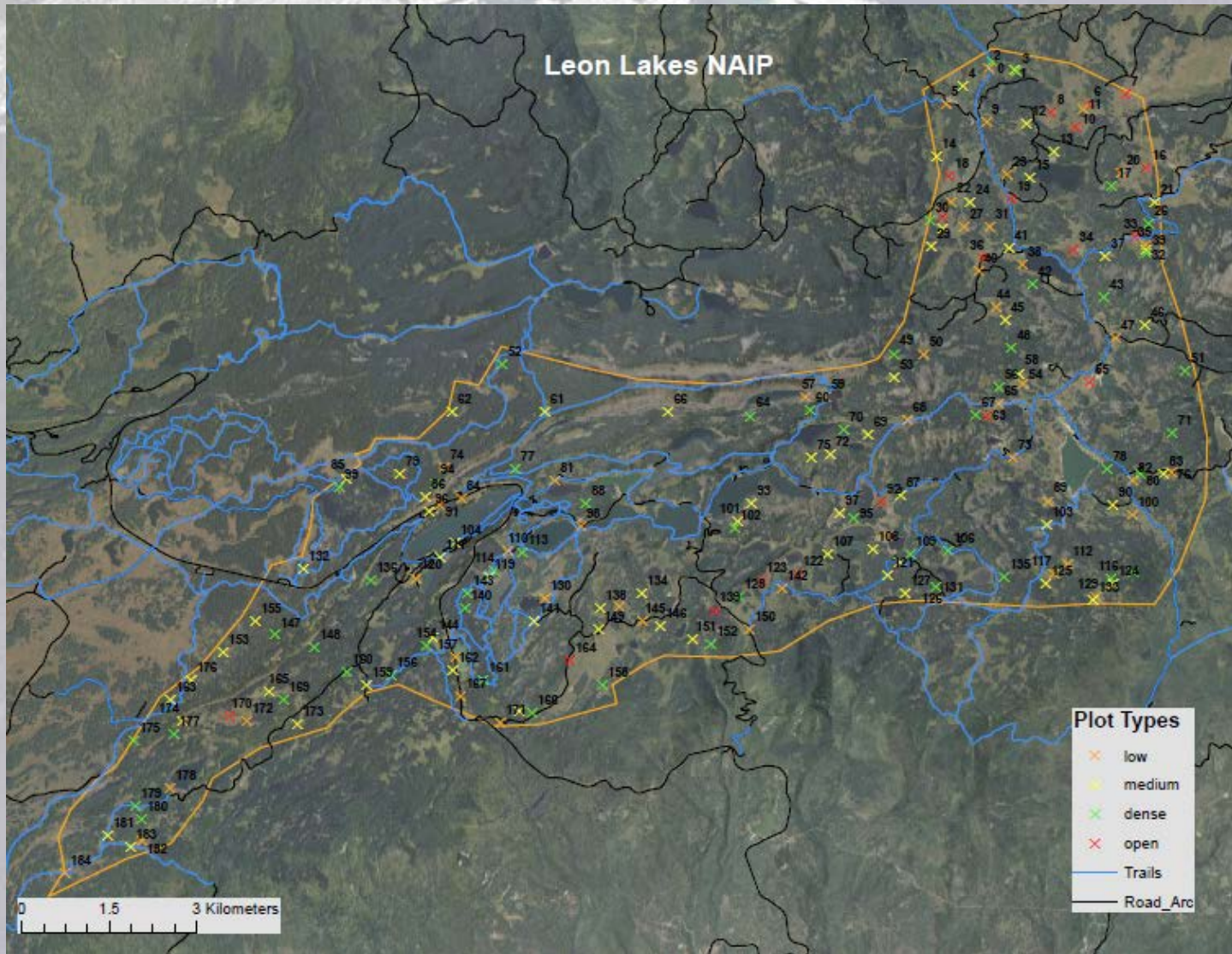
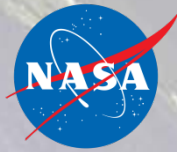
# GM sampling 1



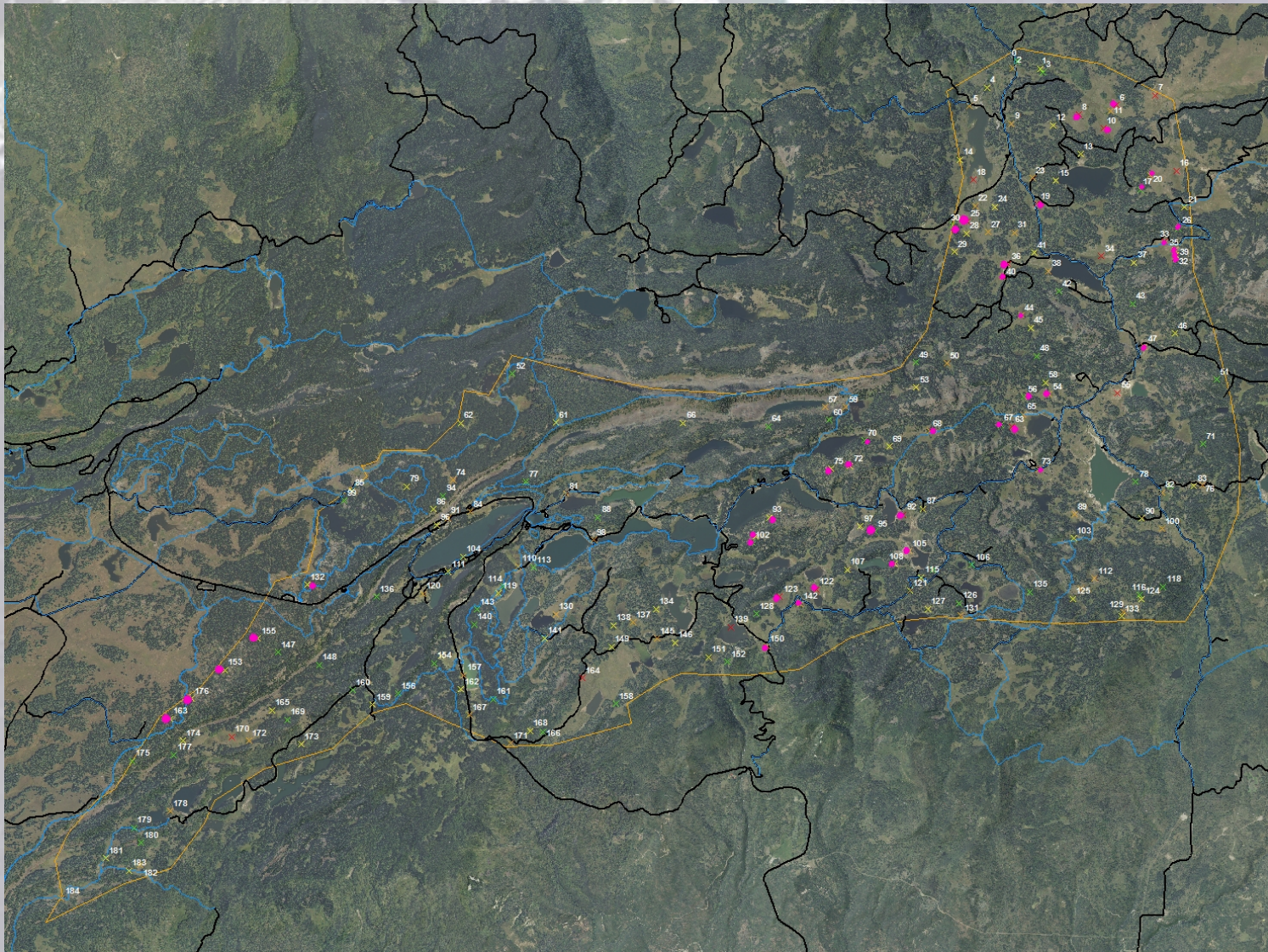
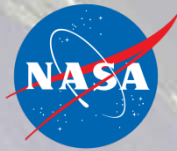
# GM sampling 2



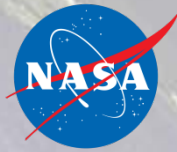
# GM sampling 3



# GM sampling 4



# Ground Based Remote Sensing LSOS and Fall Campaign Overview



- \* Terrestrial Lidar Systems (TLS)
  - VZ400, VZ1000, VZ4000, C10
- \* Survey grade GPS
  - all stakes, some road intersections, building corners, etc.
- \* Microwave Radiometers
  - 1.4, 19, 37 GHz
- \* Radar
  - 1 GHz
- \* Optical
  - Sun photometer (at LSOS and SB/SASP)
- \* Other techniques
  - Time-lapse cameras
  - Tree accelerometers
  - GPS antennas
  - High speed camera for falling particles

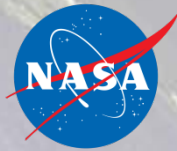


Roger De Roo's boom truck



SB sunphotometer

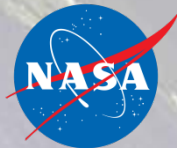
More instruments will be used in February  
(e.g. ASD spectroradiometers, mobile radars, scatterometers)



# **SnowEx aircraft & instrument update**

E.Kim/C.Gatebe/M.Beckley

# Aircraft & Instruments for Each Deployment

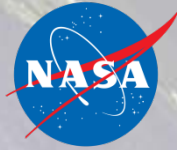


- **Fall 2016:**
  - ASO on its aircraft (King Air)
    - Lidar (1064 nm; 3.5 km/1m @ 3 km alt.)
    - Hyperspectral (350-1050 nm;  $\pm 34^\circ$ )
  - GLISTIN-A on G-III
    - Ka-band InSAR
- **Winter 2017:**
  - NRL P-3
    - SAR (SnowSAR; X and Ku band polarimetric imaging radar, ~5m spatial resolution)
    - Passive microwave (AESMIR; 10, 19 and 37GHz; H and V; 200 m @ 600 m alt.)
    - BRDF (CAR) (multispectral: 340-2300 nm; iFOV:  $1^\circ$ /FOV:  $180^\circ$ )
    - Thermal IR (TBD)
  - ASO on its aircraft
    - Lidar
    - Hyperspectral
  - GLISTIN-A on G-III
    - Ka-band InSAR
- **Summer 2017** (SAR (SnowSAR); aircraft TBD)

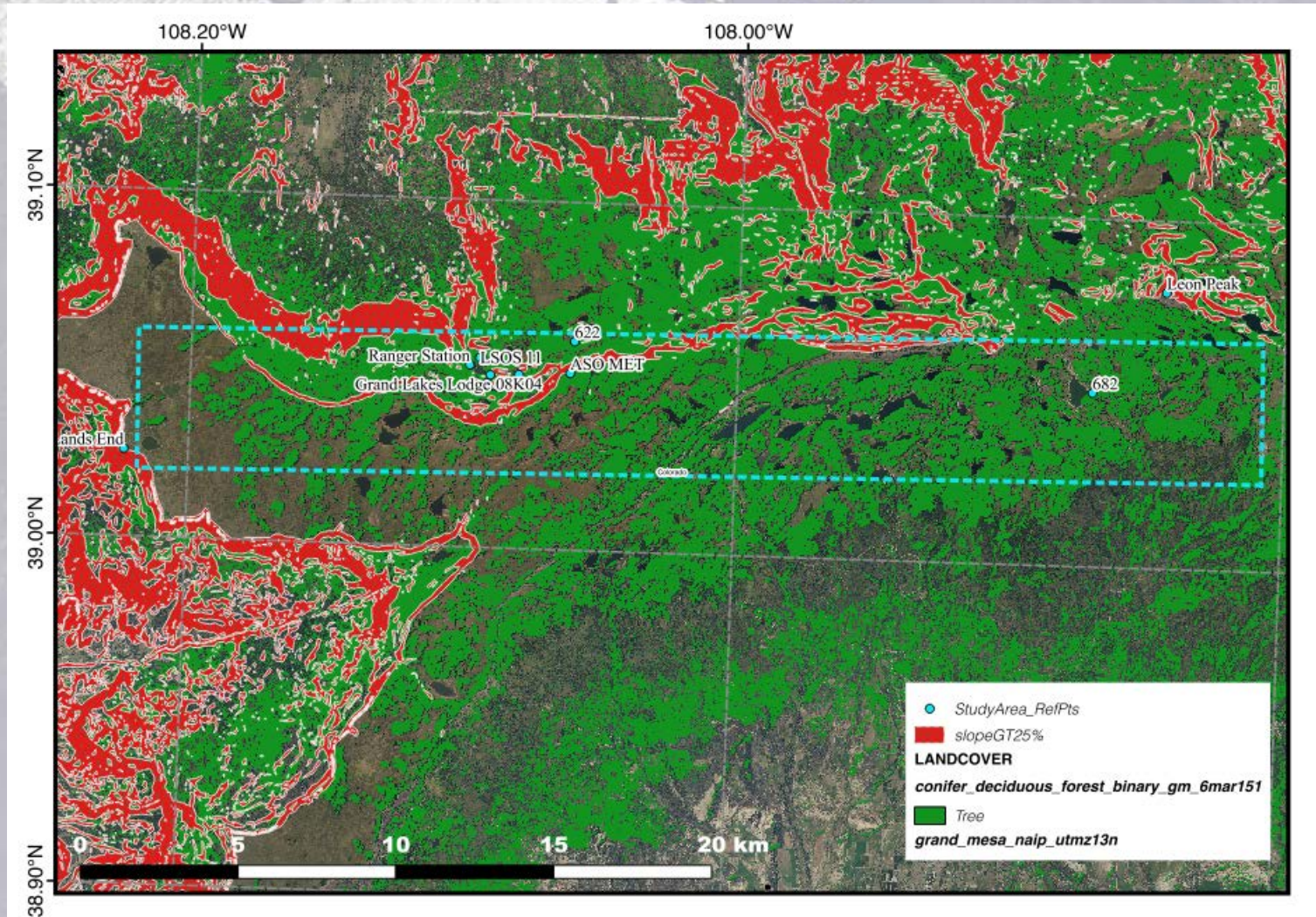
## Other possible a/c, sensors

- NRL radar plane
- UAVSAR

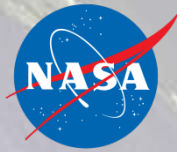
# Airborne Obs box



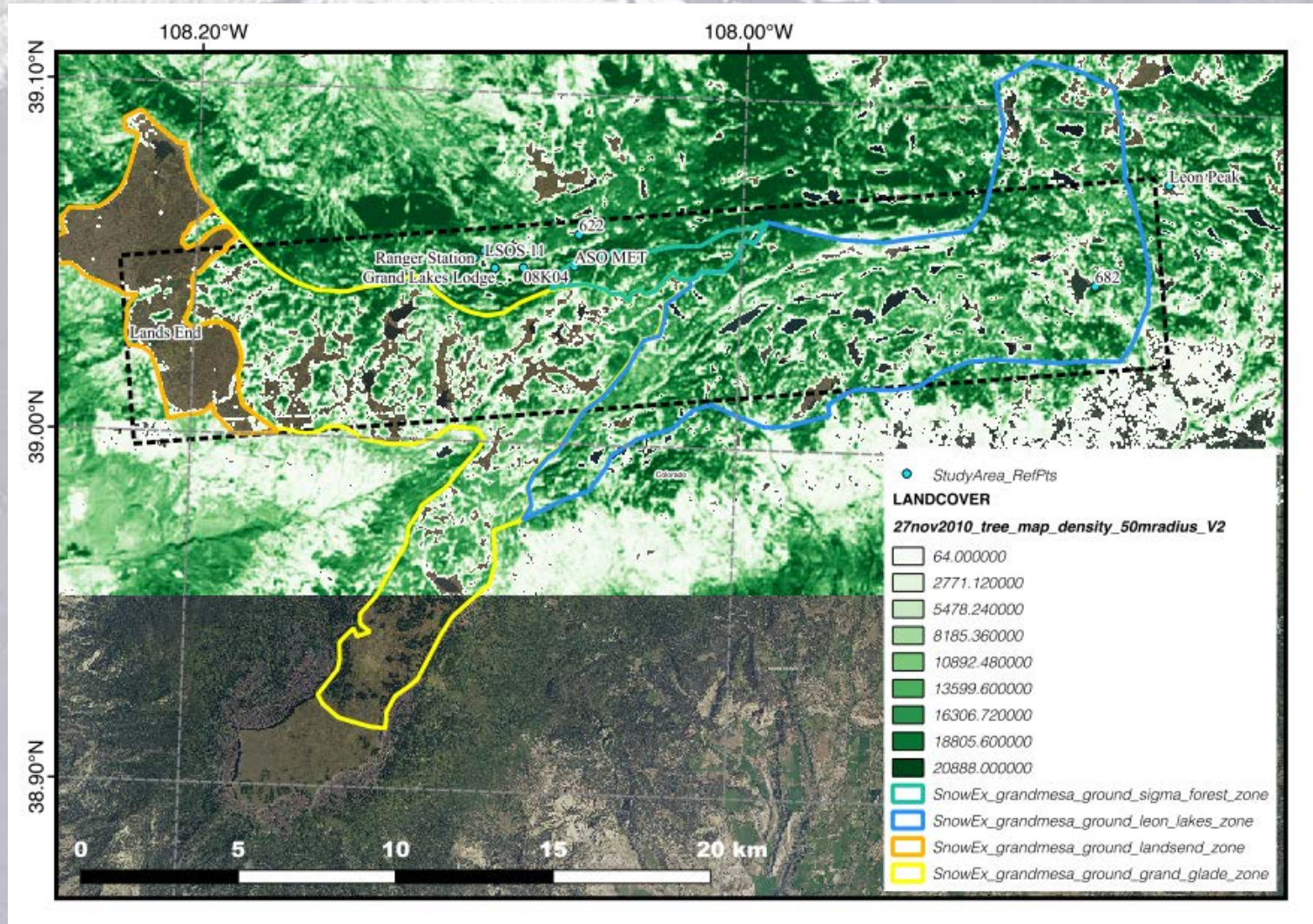
Notional  
measurement  
box for all  
airborne  
sensors

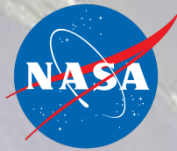


# Flight box--ASO



Notional  
flight line  
box for ASO.  
To be refined  
Before fall  
Deployment!





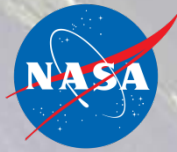
# Website update

Gatebe

Snow.nasa.gov dedicated site going live Sept 21!

# Update on Winter Participation

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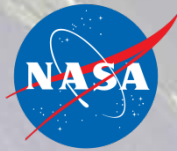


- Dorothy: only ~half of people contacted have responded
- Deadline tomorrow 9/16/16
- Kelly: critical to get your response; holding up the overall personnel logistics planning of entire winter campaign
- Ed: reason is the only way to accommodate the community participation levels everyone wants is to have participants come in shifts



# No Update from HQ this week

Jared Entin



# Q & A