Why Prairie snow?

- Prairies cover almost 1/3 of the Earth’s land surface globally
  - important for agriculture, water management, flooding concerns, energy & carbon cycle interactions, ecological issues, etc.
- Low stature vegetation, wind redistribution, subtle topography, rapidly changing conditions, and shallow snow create unique snow heterogeneity

Winter 2021 planned activities: local-scale campaign at CARC, MT
- UAV Lidar & albedo, hyperspectral, UAVSAR flights, ground meteorology, snow, & soil

Key questions to discuss (not limited)

1. What are the current gaps in remote sensing of prairie snow?
   - Impact of substrate characteristics (vegetation, soil composition & moisture, and freeze-thaw state) on remote sensing techniques
   - Characterizing spatial heterogeneity of snow (especially wind-driven redistribution, sublimation)
   - Rapidly changing conditions (metamorphism, wet snow, etc.)

2. What sensors might be beneficial (shallow, transitional snow) – esp. path to space?
   - L-band InSAR, Lidar, multi-band SAR/radiometer, hyperspectral, Gamma radiation, SfM, others?

3. Which opportunities/collaborations should we be aware of?
   - Agricultural & ecological communities, Canadian agencies & universities, flood forecasters, others?

4. What do we want to achieve, and when?

SnowEx 2020 virtual meeting, Prairie snow group – Sam Tuttle and Eunsang Cho
2021 SnowEx Prairie Activities

Primary Objectives/Goals:

1. Characterize the spatial heterogeneity of snow distribution due to wind, landscape, sublimation, soil properties in a prairie environment
   - Scales at which processes dominate
   - Ability of RS techniques to characterize spatial distribution

2. Quantify the accuracy and uncertainty in SWE retrievals from L-band InSAR in a Prairie environment
   - Shallow snow, wet snow?
   - Quantifying & distinguishing water stored as snow vs. in soil column

3. Assess the requirements of a prototype cal/val Prairie site to support future aircraft and satellite missions.
   - Instrumentation/observations?
2021 SnowEx Prairie Activities

Current plans:

- **CARC in Moccasin, MT**: long-term agricultural research station
- 1 km square study domain
- Periodic UAV Lidar, albedo, surface temp. flights (approx. 7 total)
  - Portable hyperspectral
- 4(?) UAVSAR airborne flights
  - Nearby gamma flights
- Ground stations (4 satellite & 1 central)
  - At all locations: Air temp., relative humidity, wind, soil moisture & temperature (3 depths), snow depth, skin temp., cameras
  - At single location: precipitation (heated, screened), SWE scale, temp. & RH (2 levels), 4-way net radiation, snow temperature profile, pressure, cosmic ray sensor
1 - Thoughts about the sampling strategy?

• Is there anything that you think is missing or should be done differently to address this year’s campaign objectives?
2 - In the next few years, what do we want to achieve, and when?

• e.g. if we have a 2022 prairie campaign, ...

• **What objectives/activities/gaps are missing/essential?**
  
  • Accuracy of other remote sensing techniques in prairie (e.g. multi-band SAR/radiometer)?
  • Impact of substrate characteristics (vegetation, soil composition & moisture, and freeze-thaw state) on snow depth or SWE from remote sensing techniques?
  • Impact of grain size/depth hoar, ice lenses on remote sensing techniques – how much does vertical heterogeneity matter?
  • How to measure wet snow?
  • Scaling issues?
  • Others?
3 - Is anyone already doing work in the Prairies that we should be aware of?

• Which opportunities/collaborations should we be aware of?
  • Canadian agencies & universities
  • Agricultural & ecological communities
  • Flood forecasters
  • Airports?
  • Others?
4 - What are the modeling needs that should be addressed with a Prairie campaign?