

Signals of Opportunity P-band Investigation (SNOOPI): Mission Overview and Progress Update

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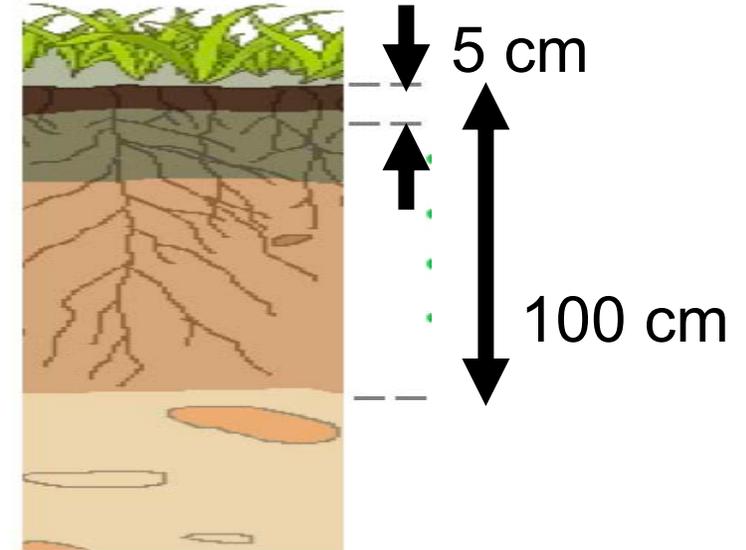
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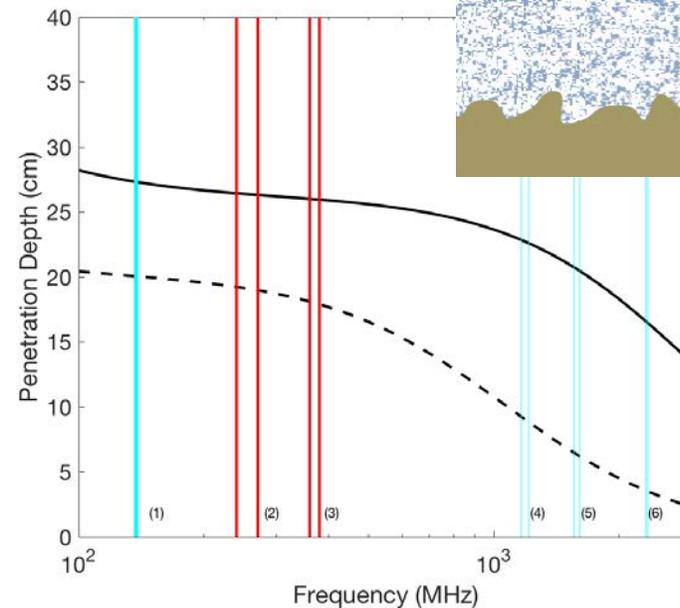
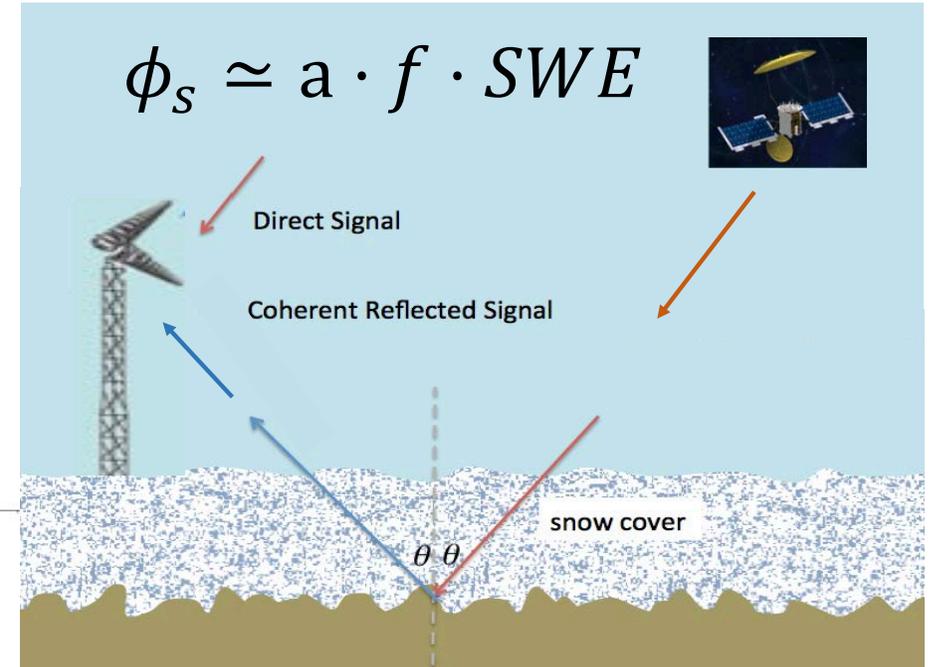
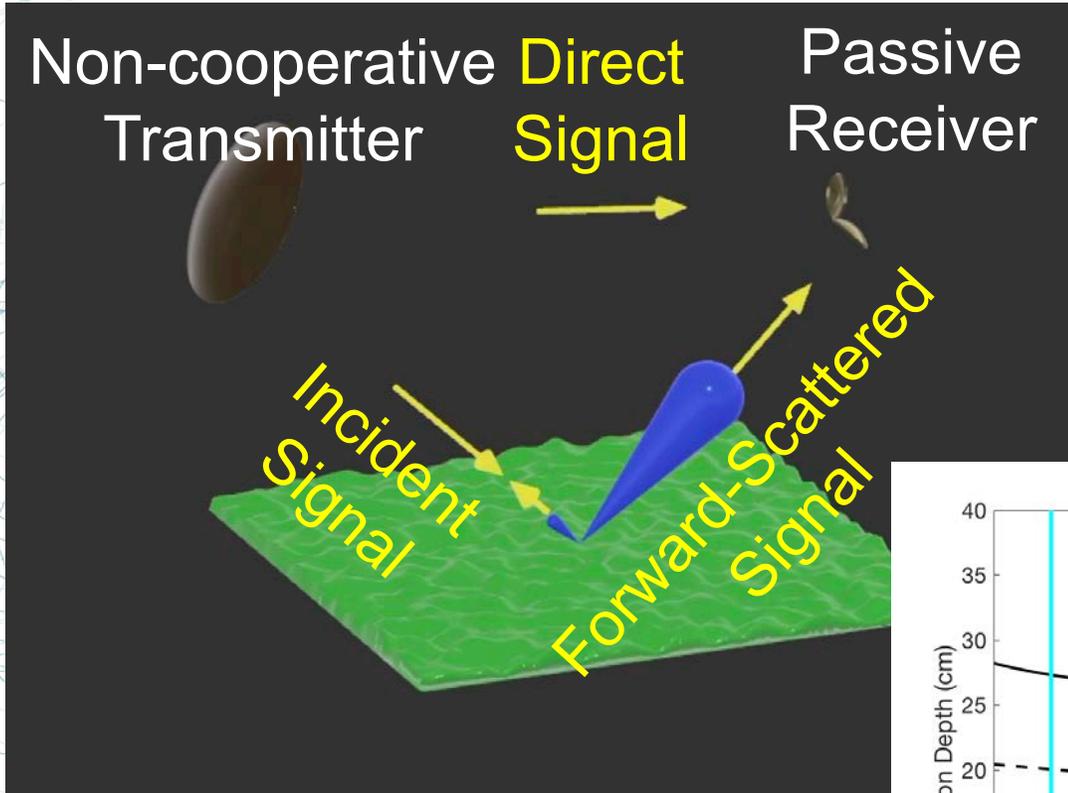
Program: InVEST-17

Problem to Solve

- Root Zone Soil Moisture (RZSM):
 - Water content in 0-1 m of soil
 - Depth of absorption by plants
 - Current: L-band Active/Passive Microwave
 - Sensitive to only top 0-5 cm
 - RZSM through model assimilation
- Snow Water Equivalent
 - Critical role in hydrology and water management
 - Current: estimates from multi-frequency microwave
 - Model spreads of -50% to 250%, - common in mid-latitude regions



Solution: Signals of Opportunity (SoOp)

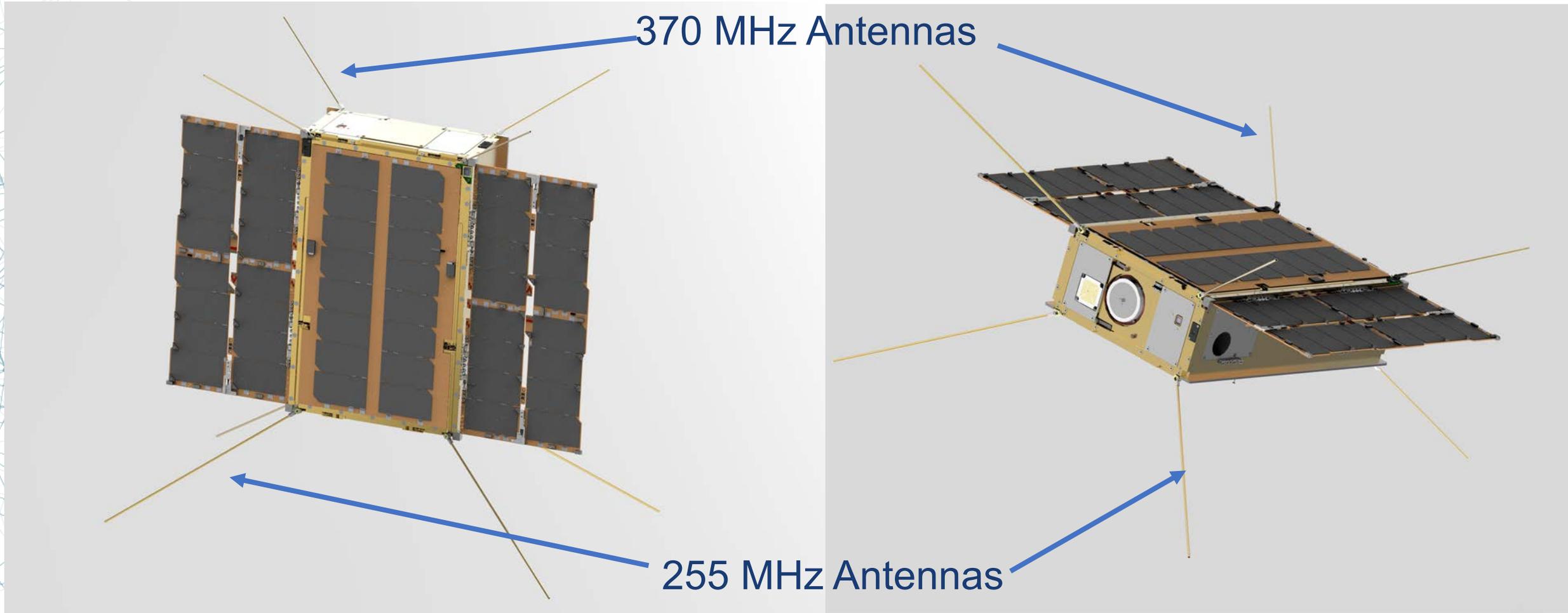




SNOOPI Technical Objectives

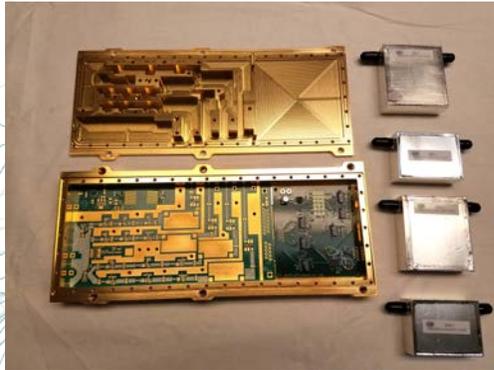
- Demonstrate signal coherence & link budget at orbital altitudes
- Quantify RFI from space (broad field of view, global distribution of measurements)
- Validated model prediction and instrument tracking for orbital delay and Doppler

SNOOPI System Design



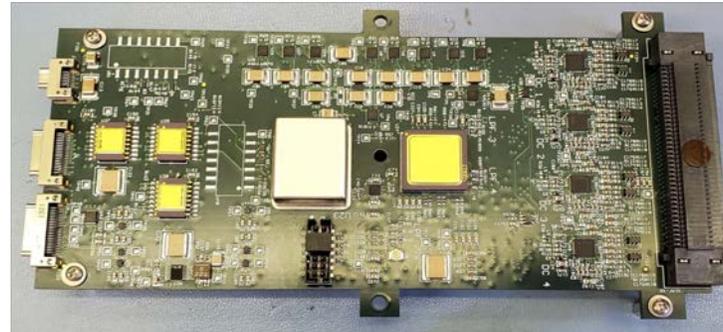
3X2 U Cubesat bus

Technical Details: Instrument Development



- Hardware Built
- Testing underway

Low Noise Front End (LNFE)
NASA GSFC



- Functional and performance testing underway
- SW/FW architecture defined

Digital Back End (DBE)
JPL



Antennas
(GOMSPACE)

Technical Details: Mission Design

SMAP Cal/Val Matchups (15 sites)

- SP within 9 km of site mid-point
- Direct & reflected visible in same spotbeam
- Calibration water body in same spotbeam
- Ground not frozen (SMAP Enhanced L3 Freeze/Thaw)

Snow Arcs

- 30 sec min. 80% snow covered
- Snow climatology from MODIS/Terra Monthly L3 Global Product (MOD10CM)

Generation of Representative CONUS “map”

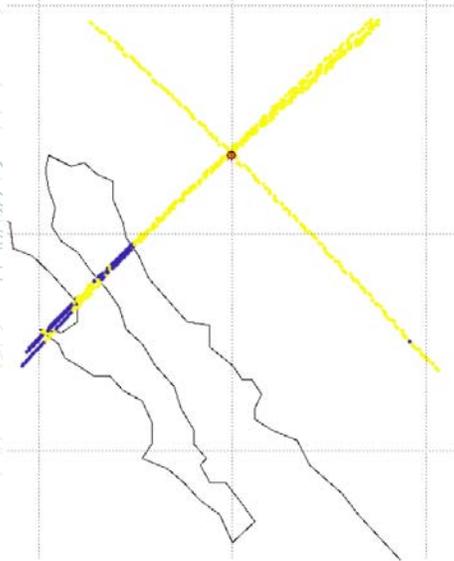


Science operations Center
(SOC) Purdue

Technical Details: Mission Design

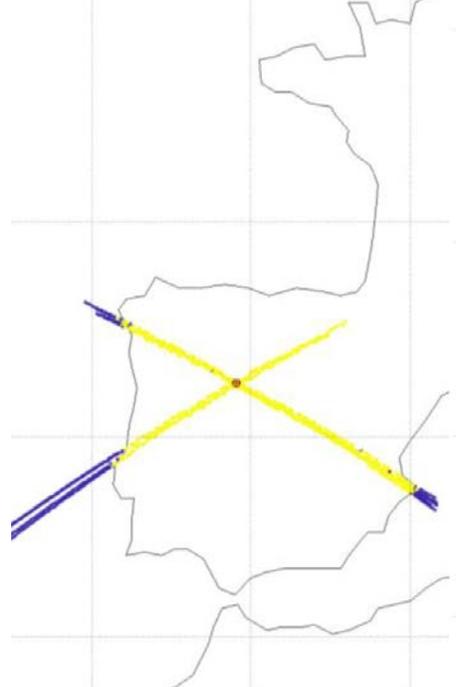
SMAP Cal/Val Site Matchup: ISS Orbit, 1 year.

Walnut Gulch
(31.75°, -110.03°)



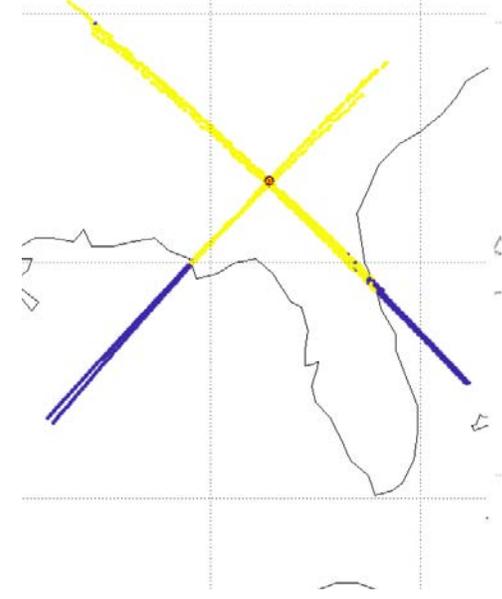
5 arcs

REMEDHUS
(41.29°, -5.46°)



12 arcs

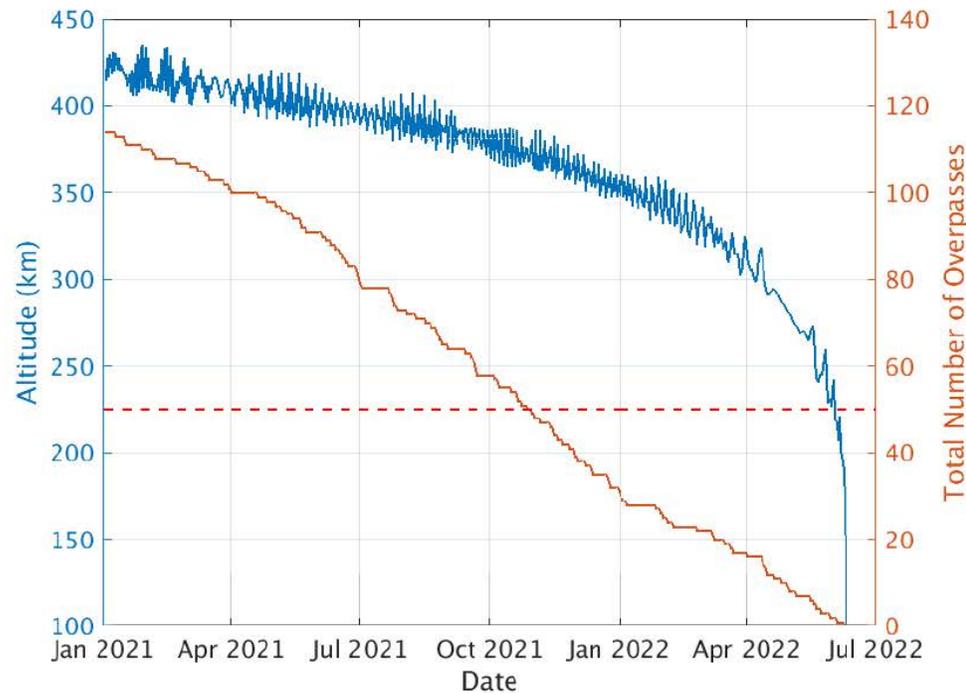
Little River
(31.67°, -83.6°)



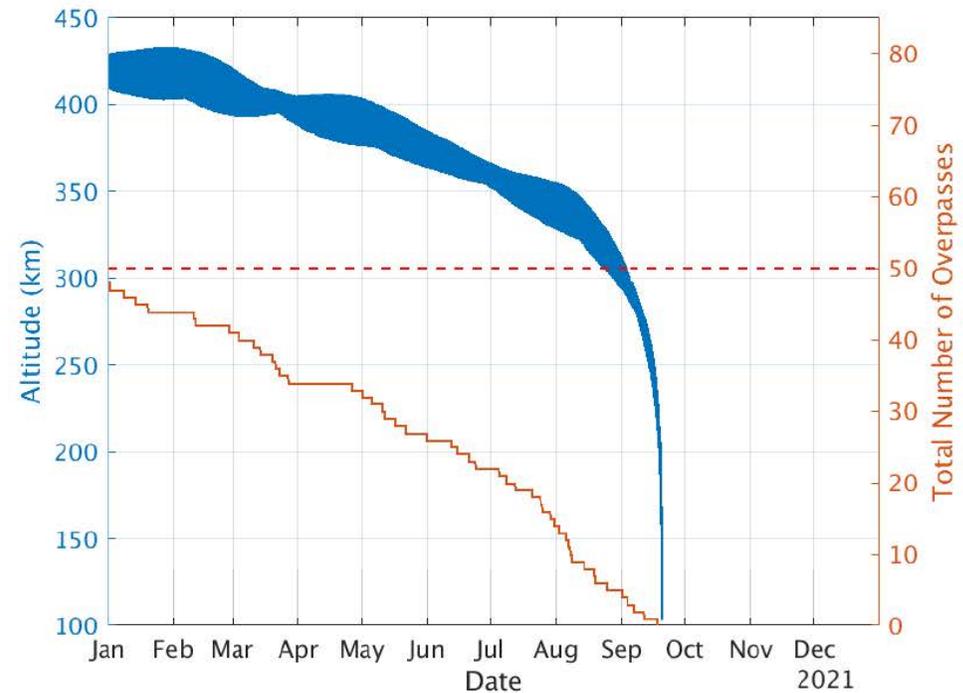
9 arcs

Technical Details: Mission Design

SMAP Cal/Val Site Matchup: Modeling Orbital Decay



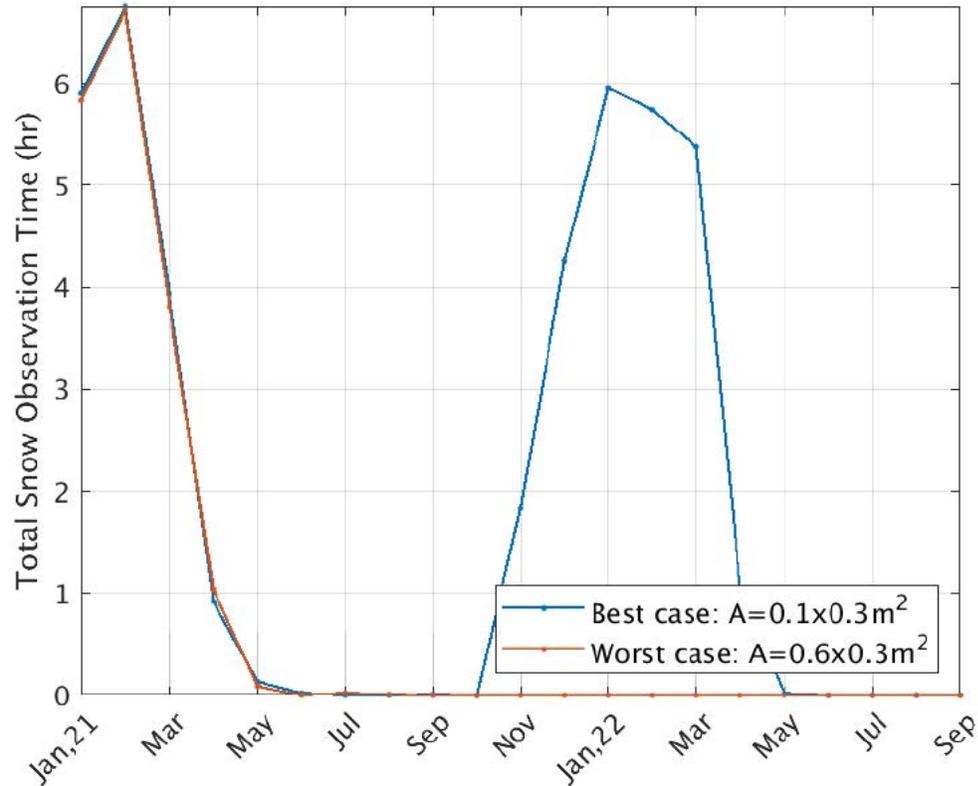
(a) The best case (area = $0.1 \times 0.3 \text{ m}^2$)



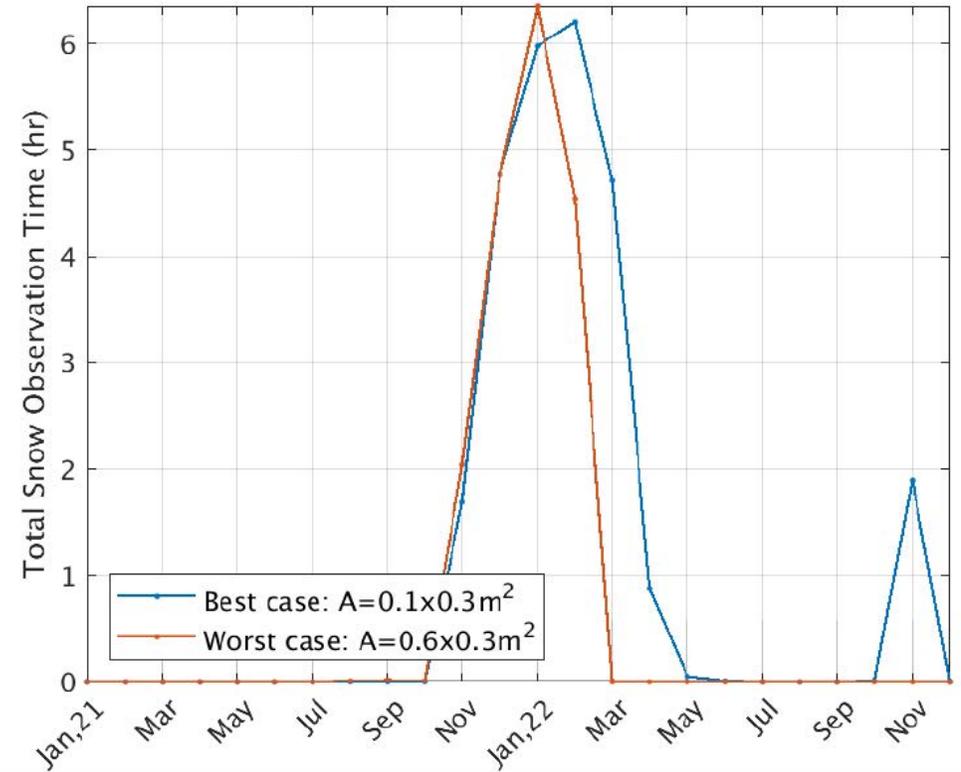
(b) The worst case (area = $0.6 \times 0.3 \text{ m}^2$)

Technical Details: Mission Design

Snow Arc: Modeling Orbital Decay



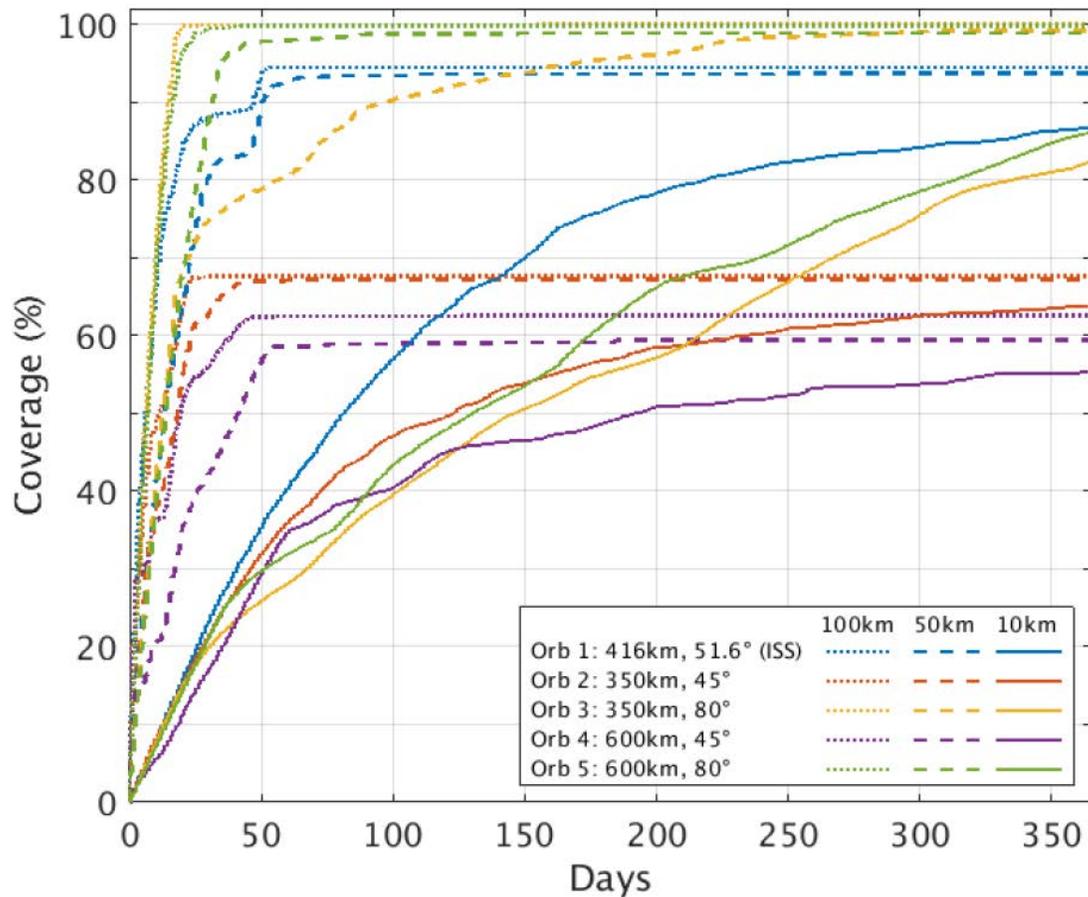
(a) Launch in January



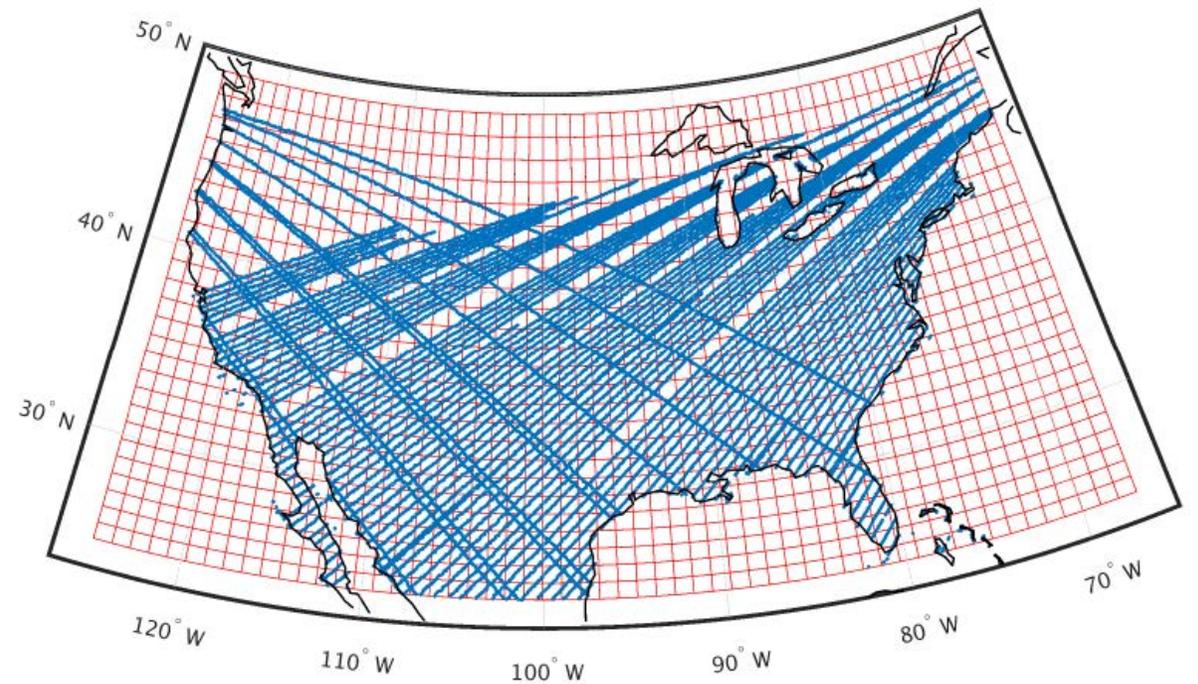
(c) Launch in August

Technical Details: Mission Design

CONUS coverage



ISS orbit coverage





Next Steps / Contributions

- CDR: Aug 5-13/2020 (4 online sessions)
- Delivery: 8/2021
- CSLI Launch (earliest): 11/2021
- In-orbit commissioning: 12/2021
- Instrument Science Experiments 1/22-9/22



Back Up Slides





July 8, 2020