

CubeSats for Snow-Covered Area

A novel approach to new earth observation data.

Tony Cannistra, David Shean, and Nicoleta Cristea

University of Washington – Seattle

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W

AGU100 ADVANCING EARTH AND SPACE SCIENCE



planet. a private, commercial satellite imagery company.



Planet Dove Launch, Feb 2014. NASA / Planet Labs

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CubeSats for Snow Covered Area – A novel approach to new earth observation data.

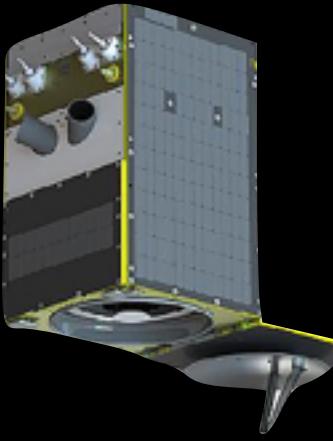
Tony Cannistra – tonycan@uw.edu

INTRODUCTION

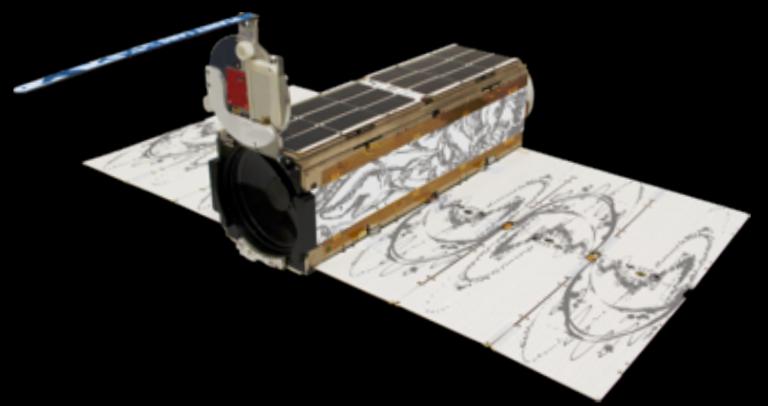


a private, commercial satellite imagery company.

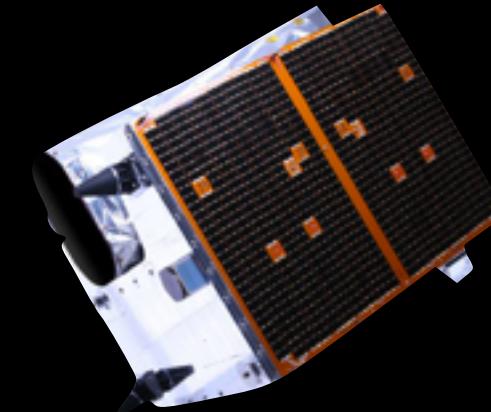
operates three cubesat constellations



SkySat



Dove/PlanetScope



RapidEye

W

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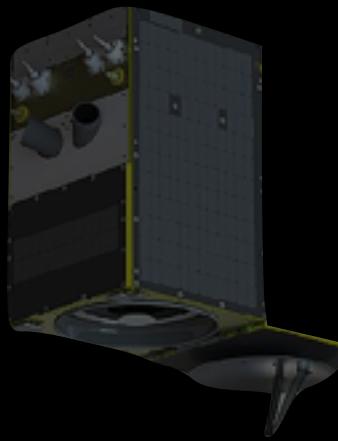
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INTRODUCTION

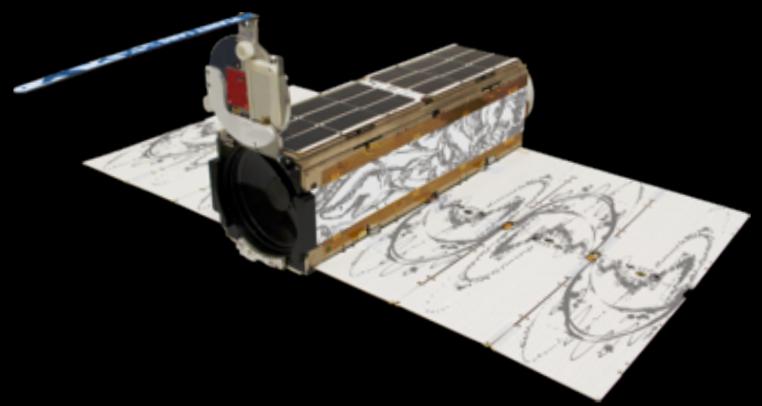


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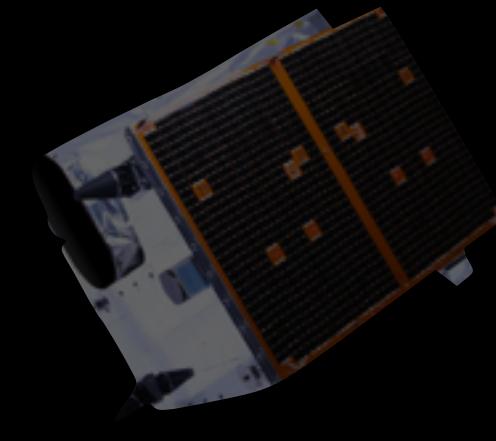
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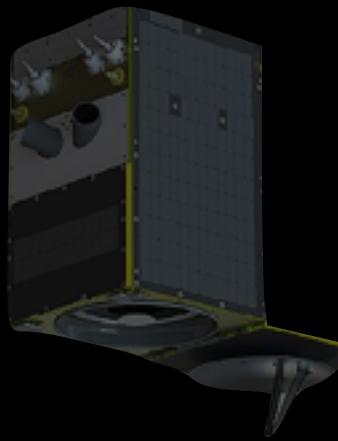
- 120+ Satellites in orbit
- 200M km² / day
- 4 Bands [R, G, B, NIR]
- **Daily nadir revisits** from latitudes $\pm 81.5^\circ$
- **3-5m GSD**

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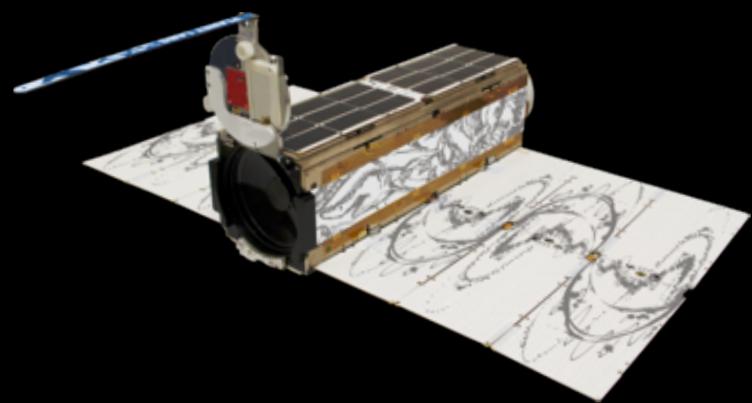


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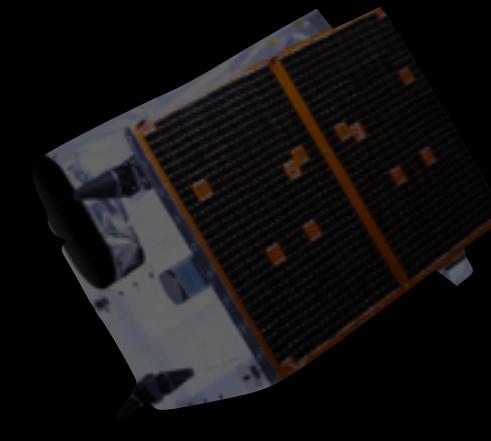
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SkySat



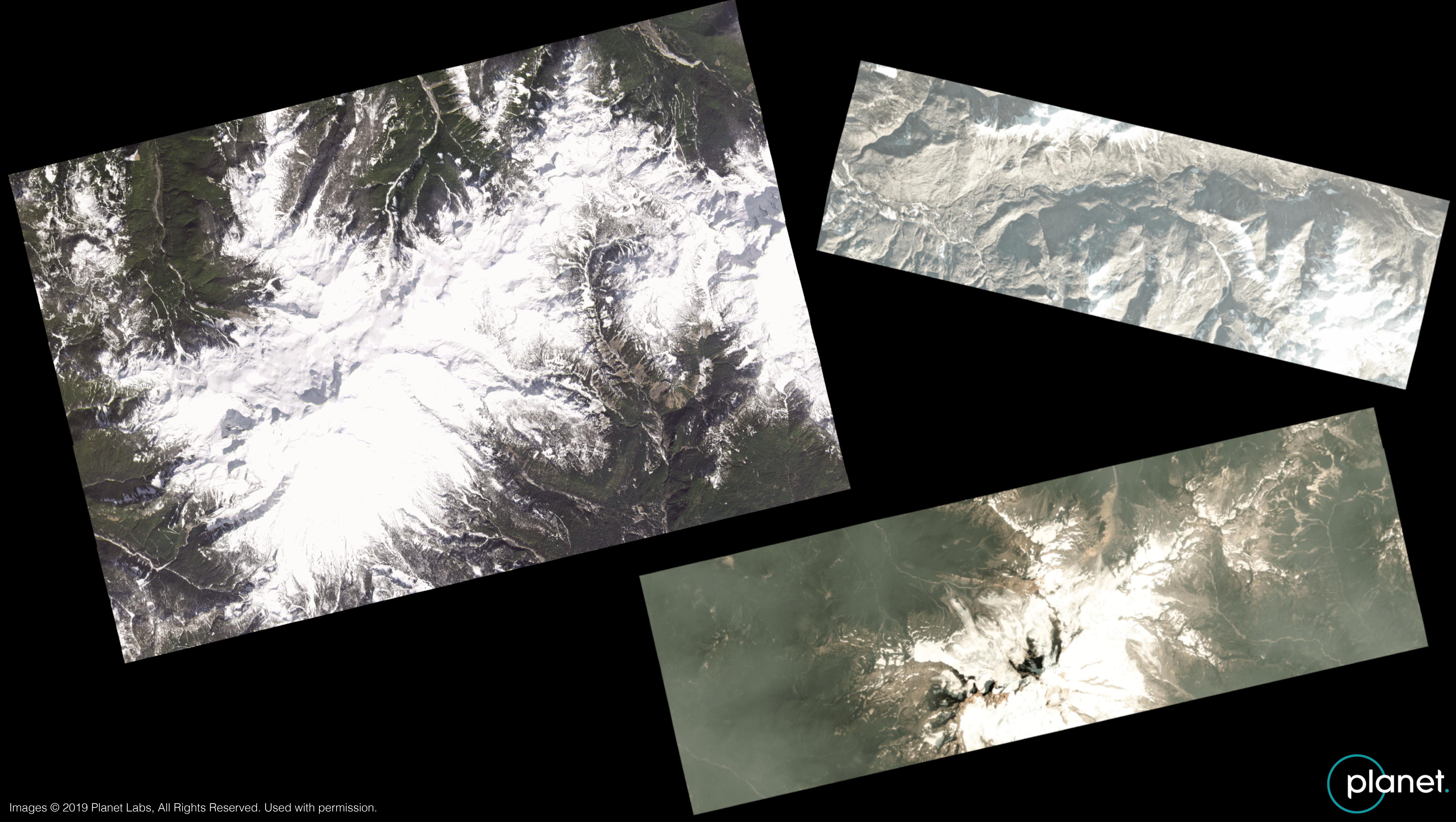
Dove/PlanetScope



RapidEye

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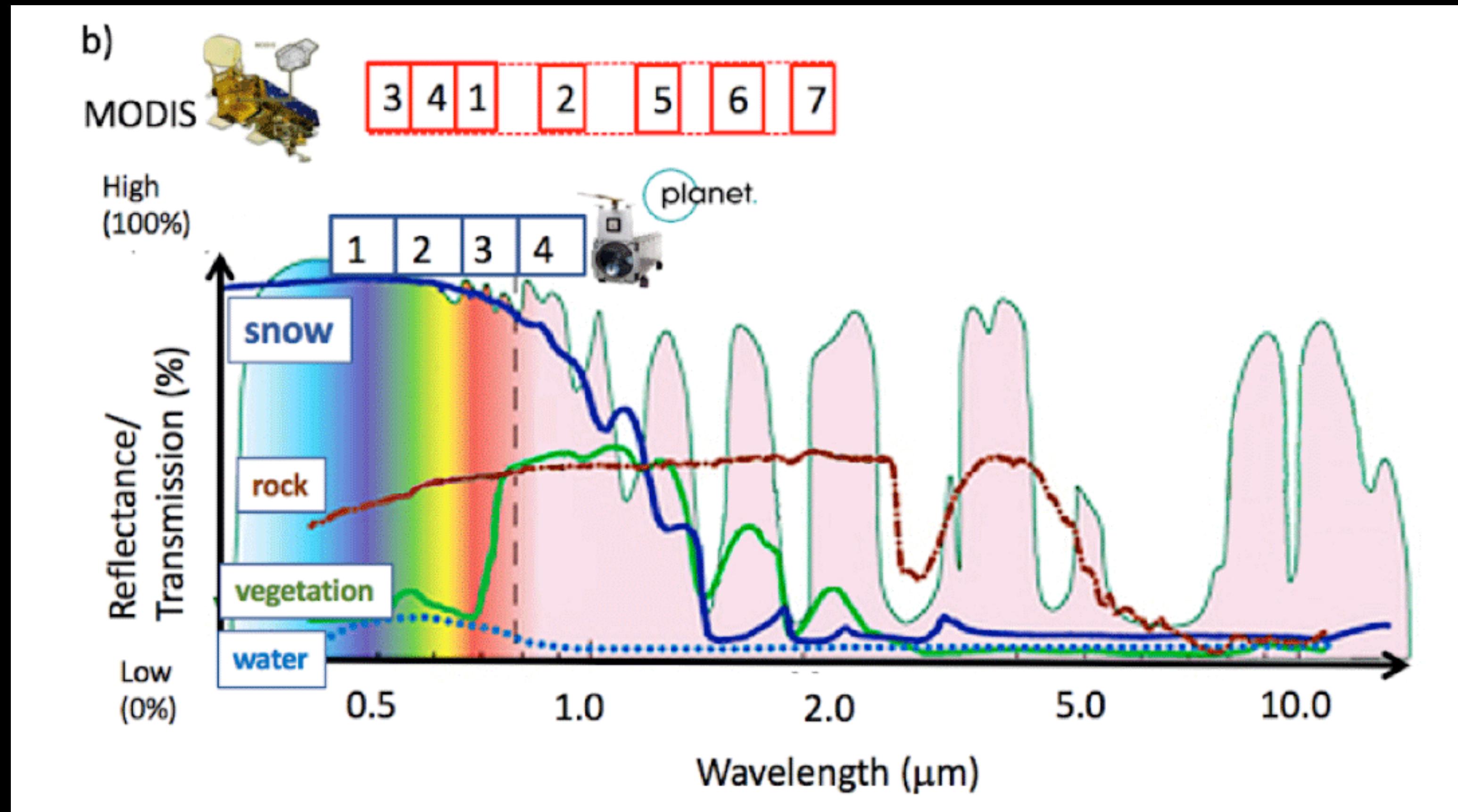


A dark, high-angle aerial photograph of a mountain range, showing deep valleys and rugged peaks covered in white snow.

Can we create an “ASO-like” snow cover product,
anywhere?

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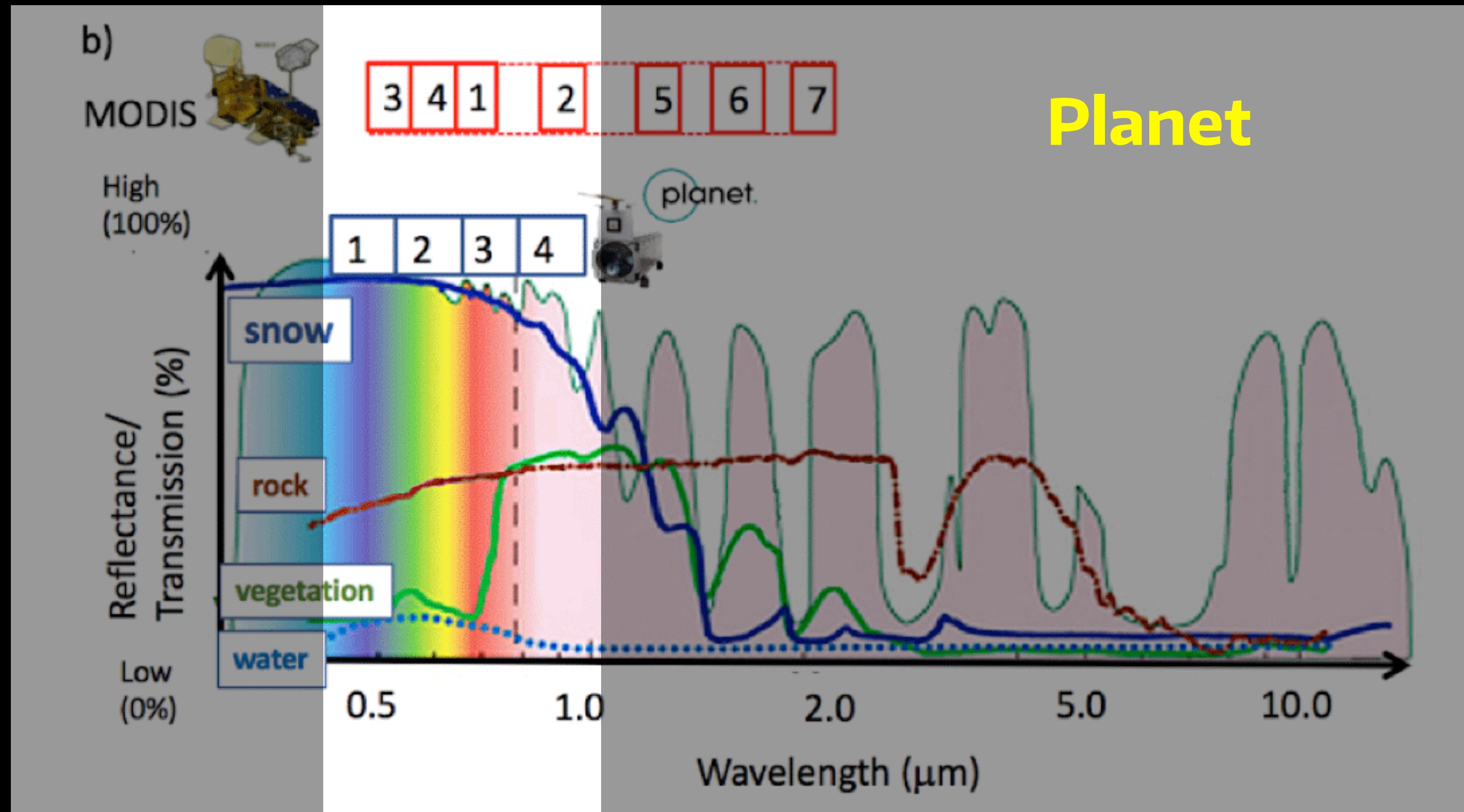
PlanetScope Spectral Bandwidth is a Challenge



NDSI + other similar radiometric methods for snow discrimination are limited.

Andreas Kaab, University of Oslo.

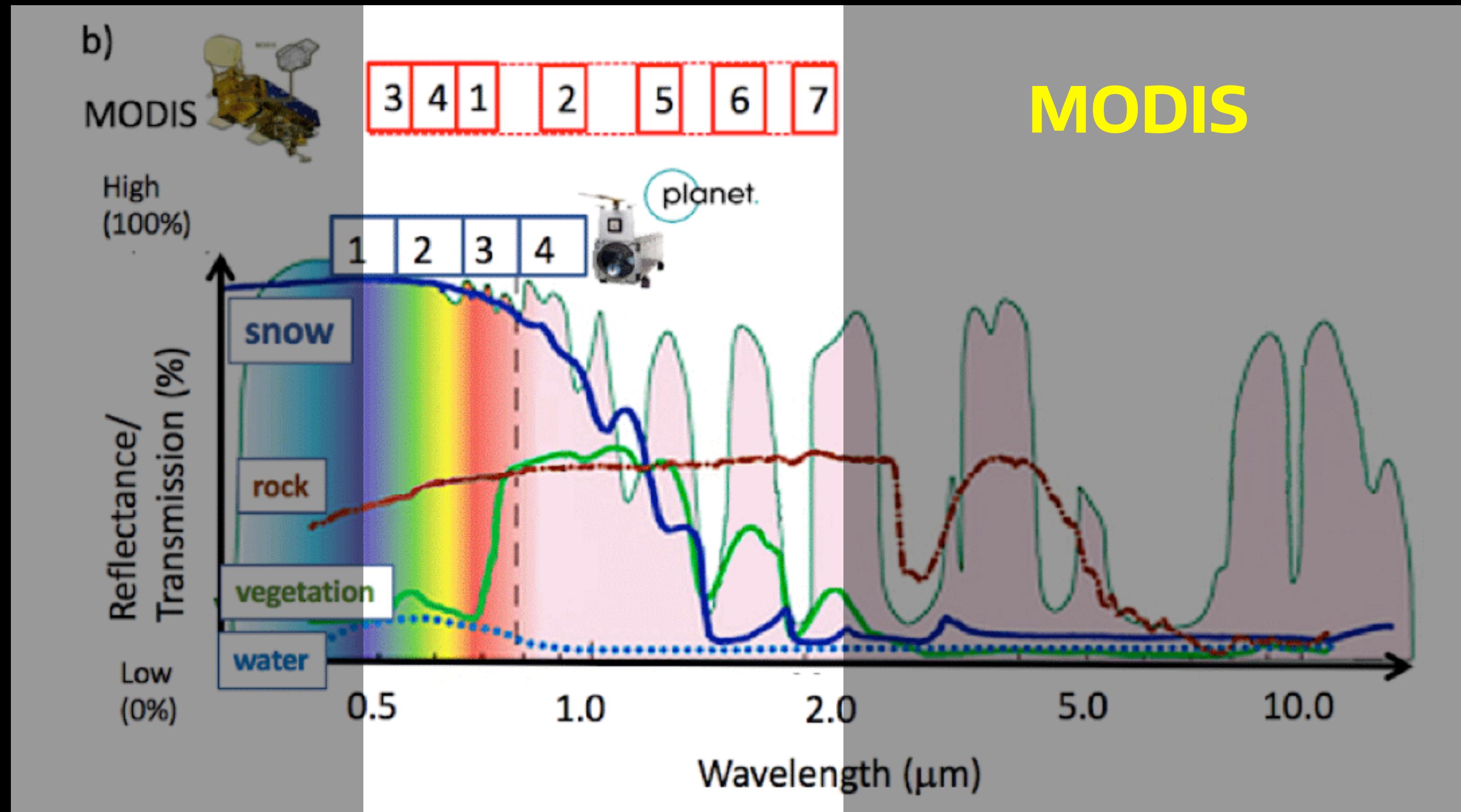
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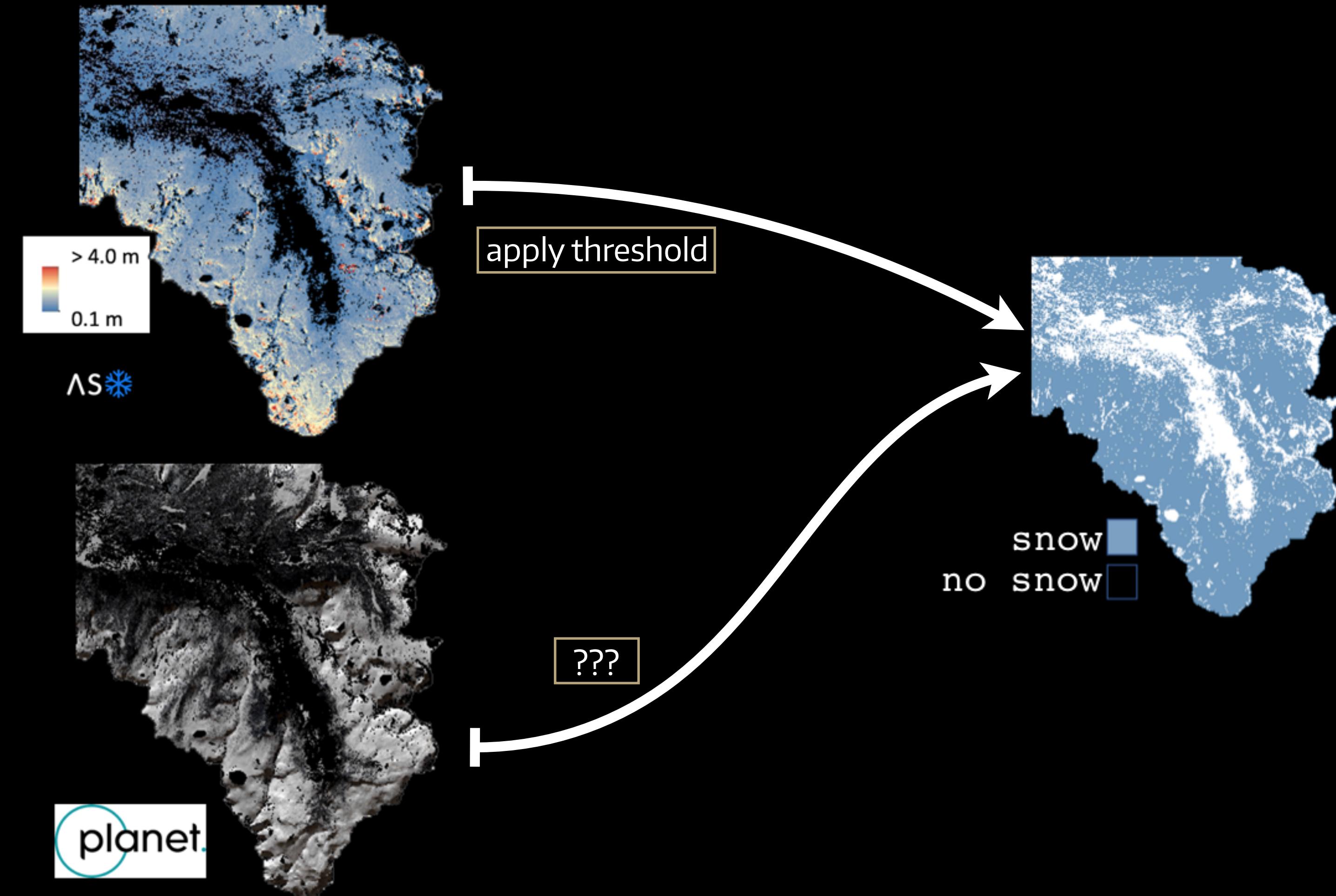
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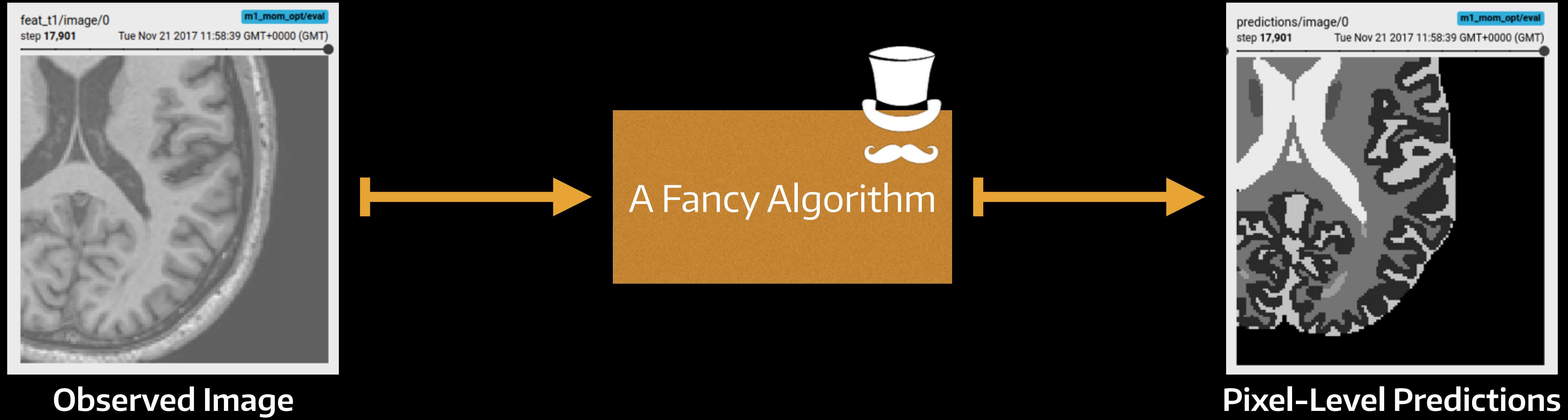
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CubeSats for Snow Covered Area – A novel approach to new earth observation data.

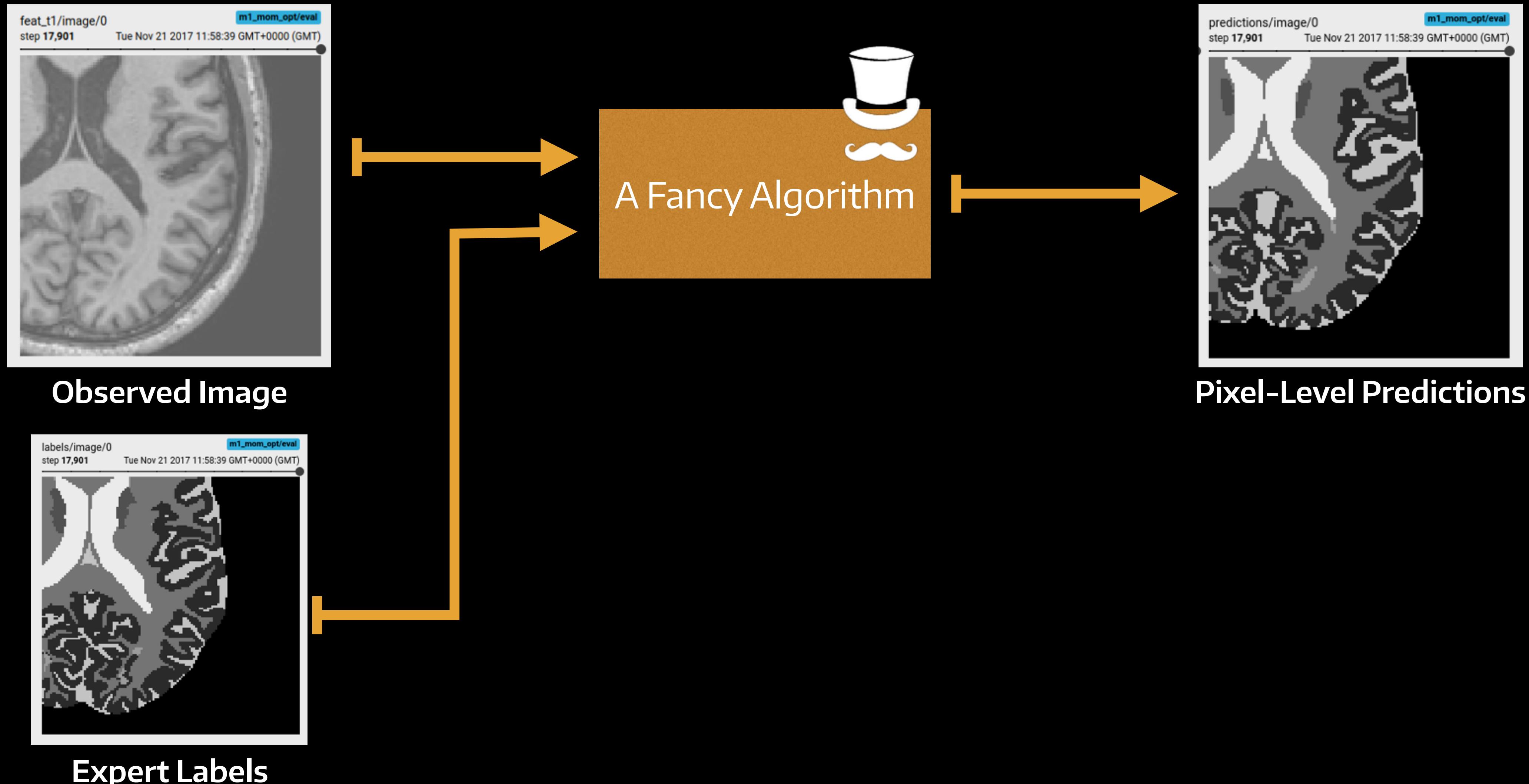
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APPROACH

A similar problem...

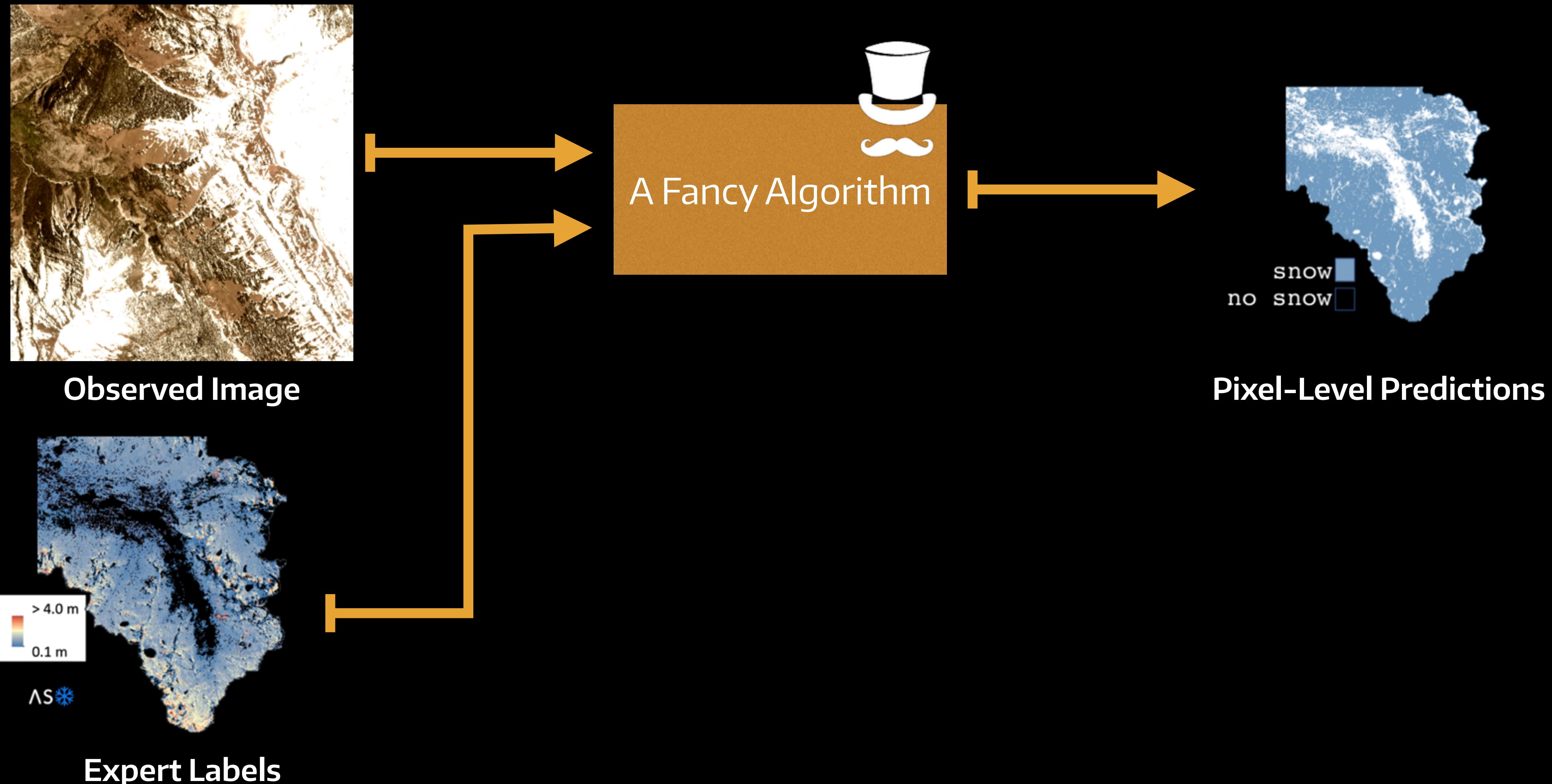


A similar problem...



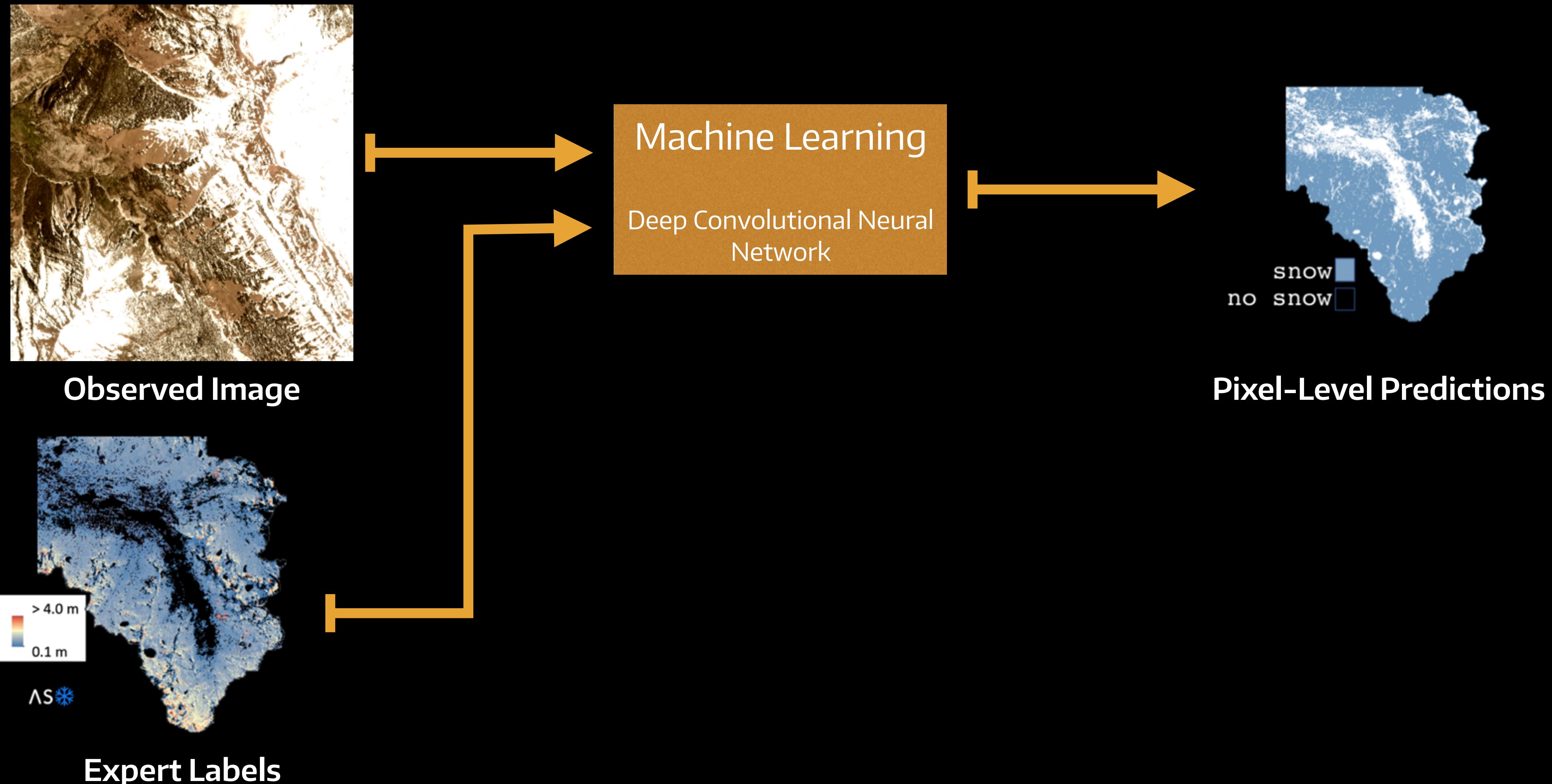
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A similar problem...



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A similar problem...



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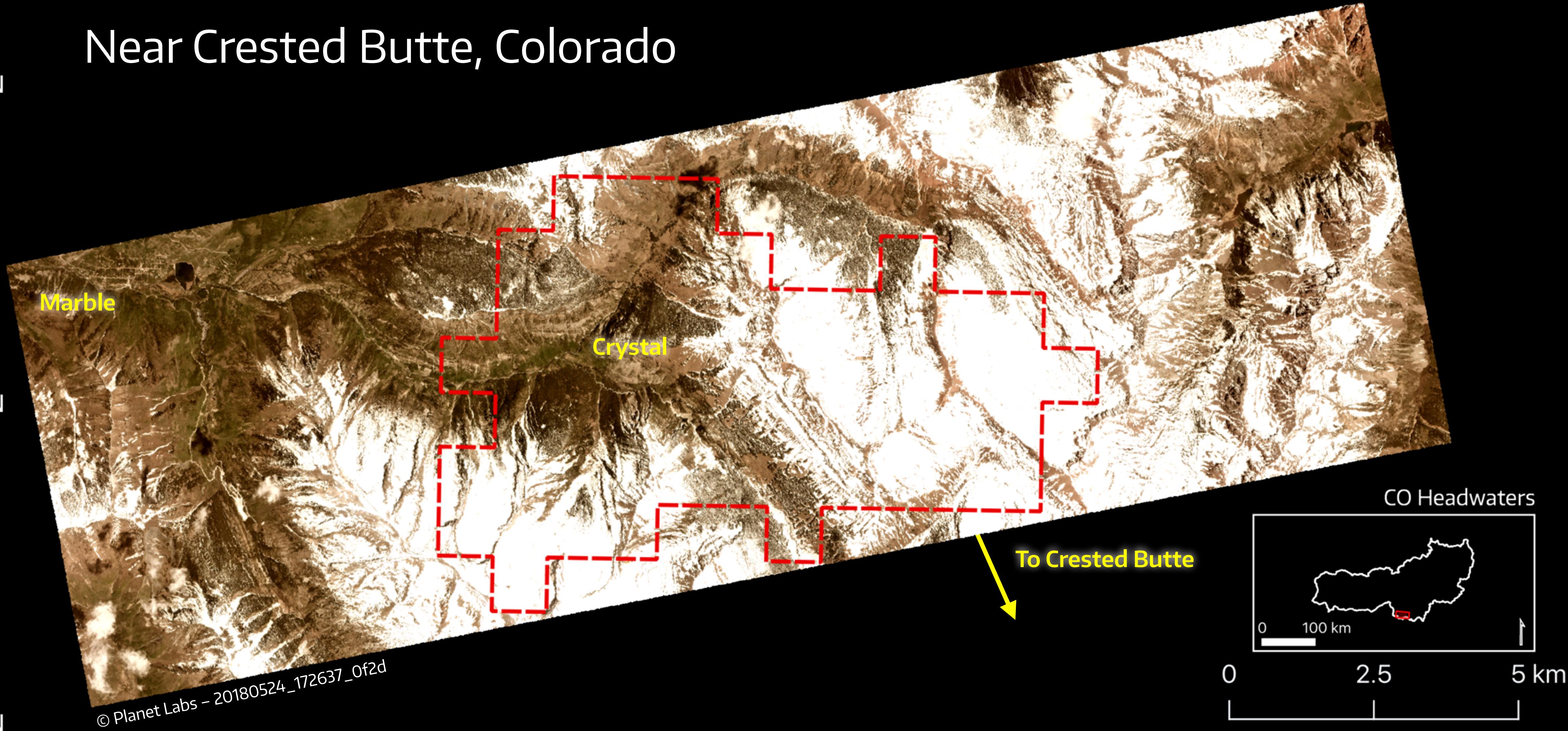
107.20°W

107.12°W

107.04°W

106.96°W

Near Crested Butte, Colorado

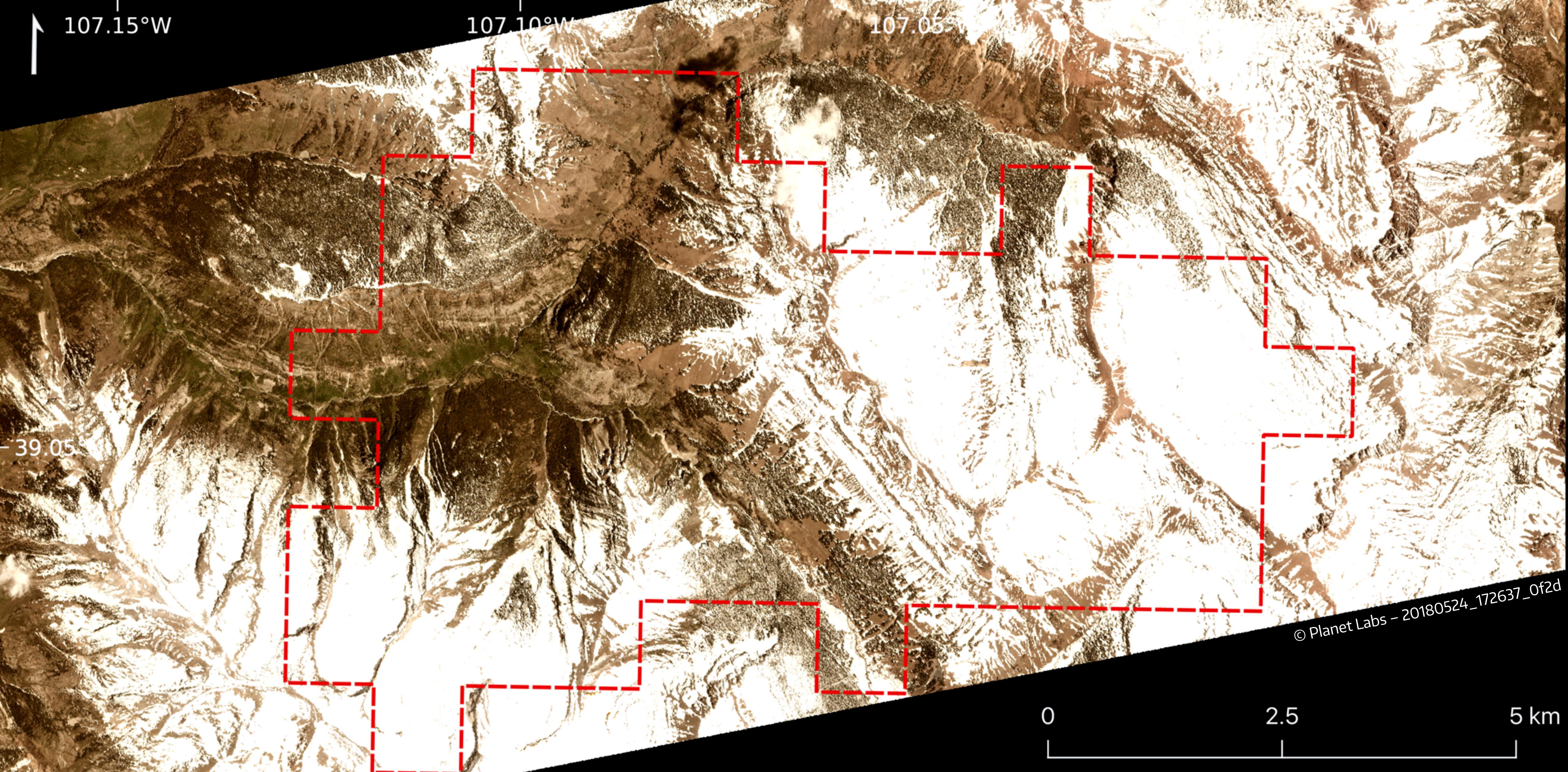


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RESULTS



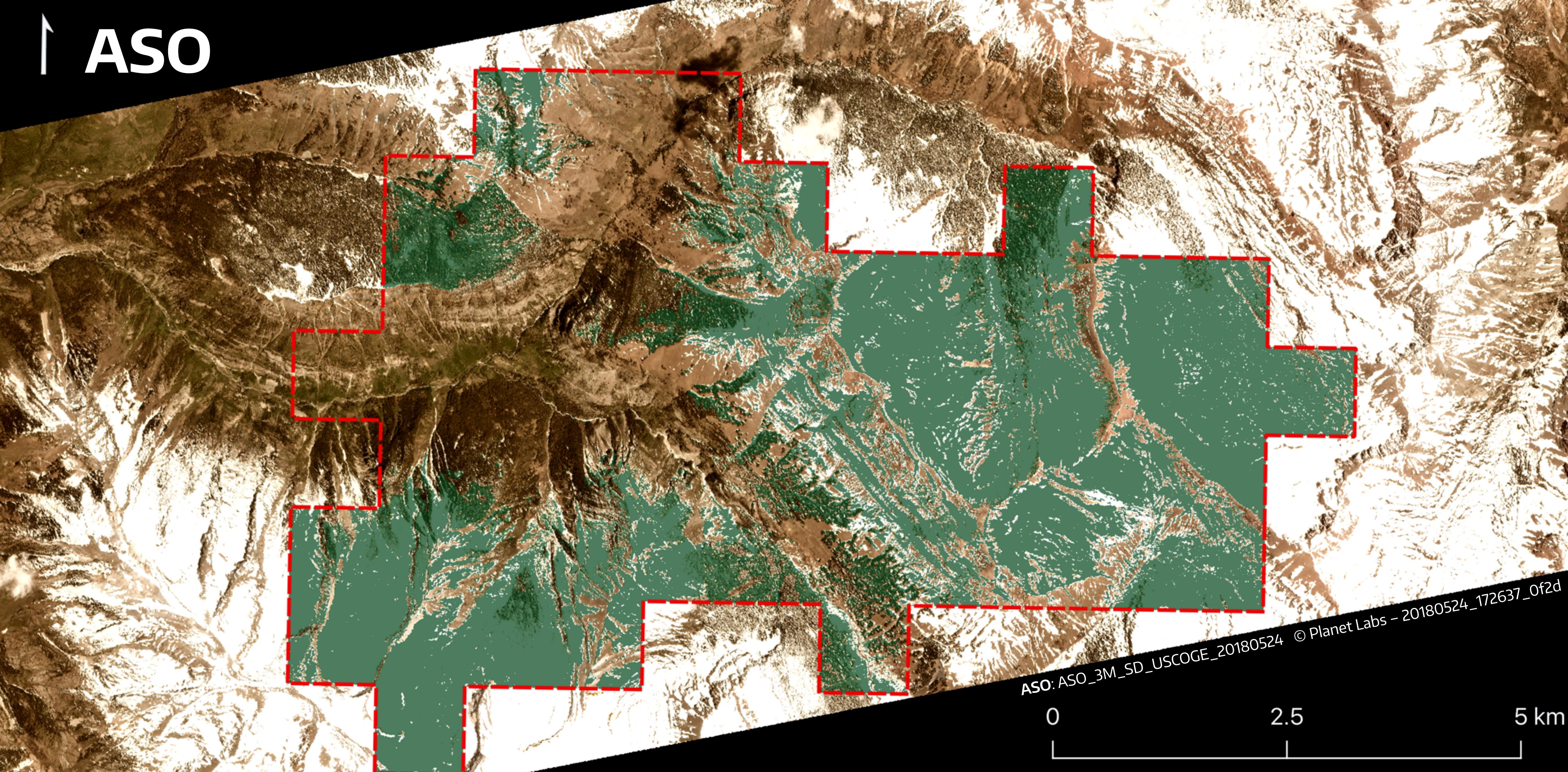
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RESULTS

ASO



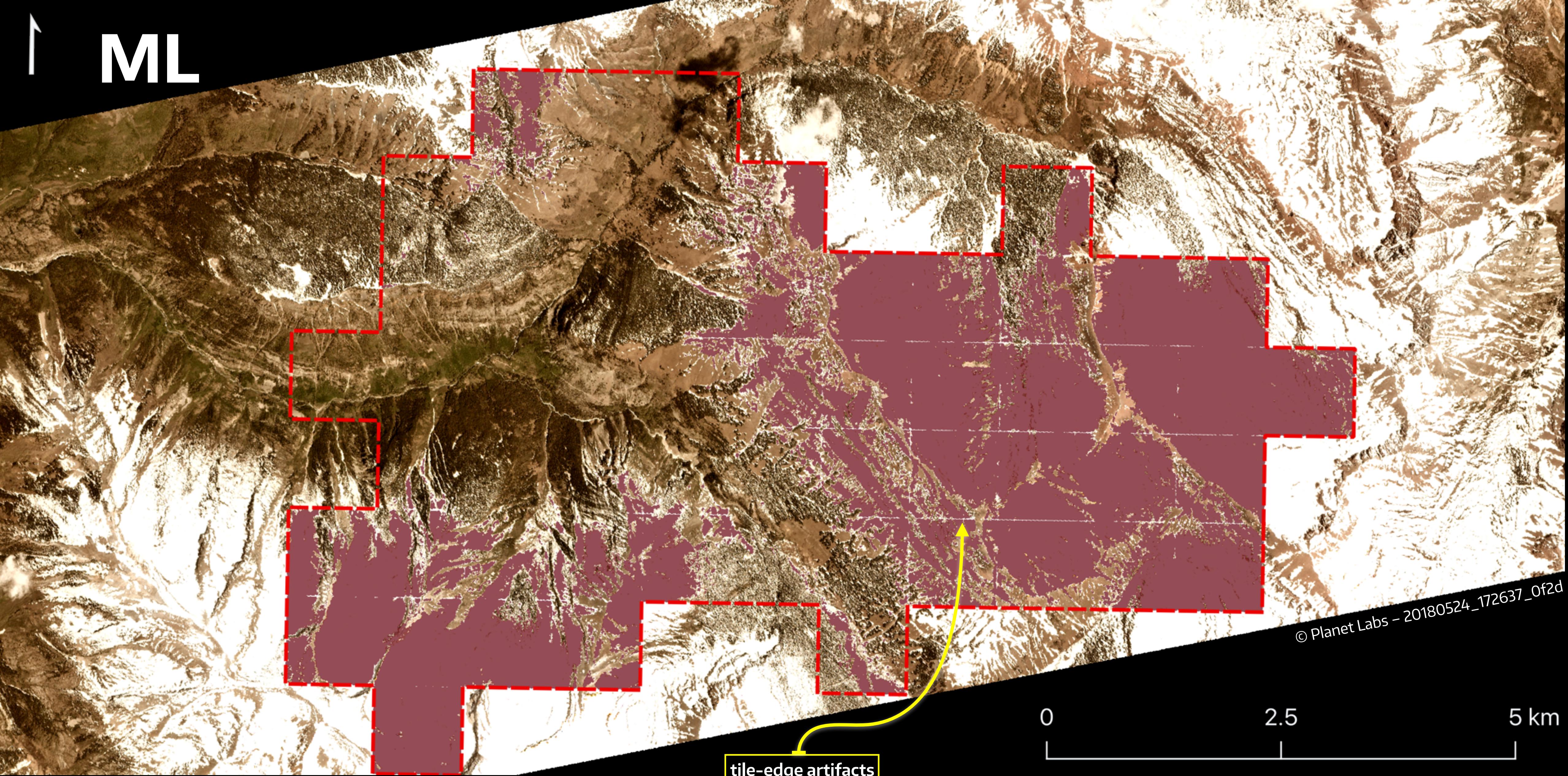
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RESULTS

ML

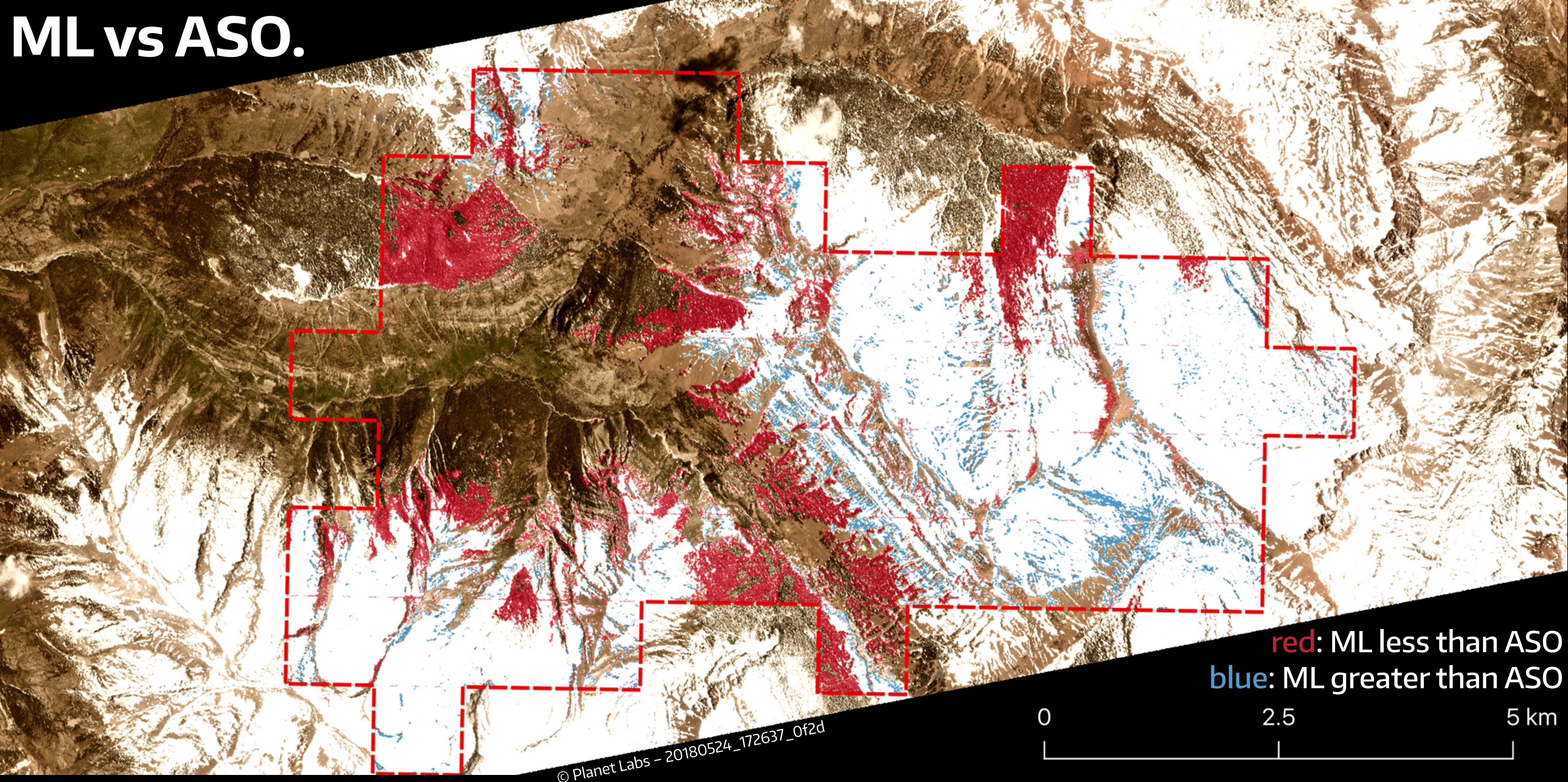


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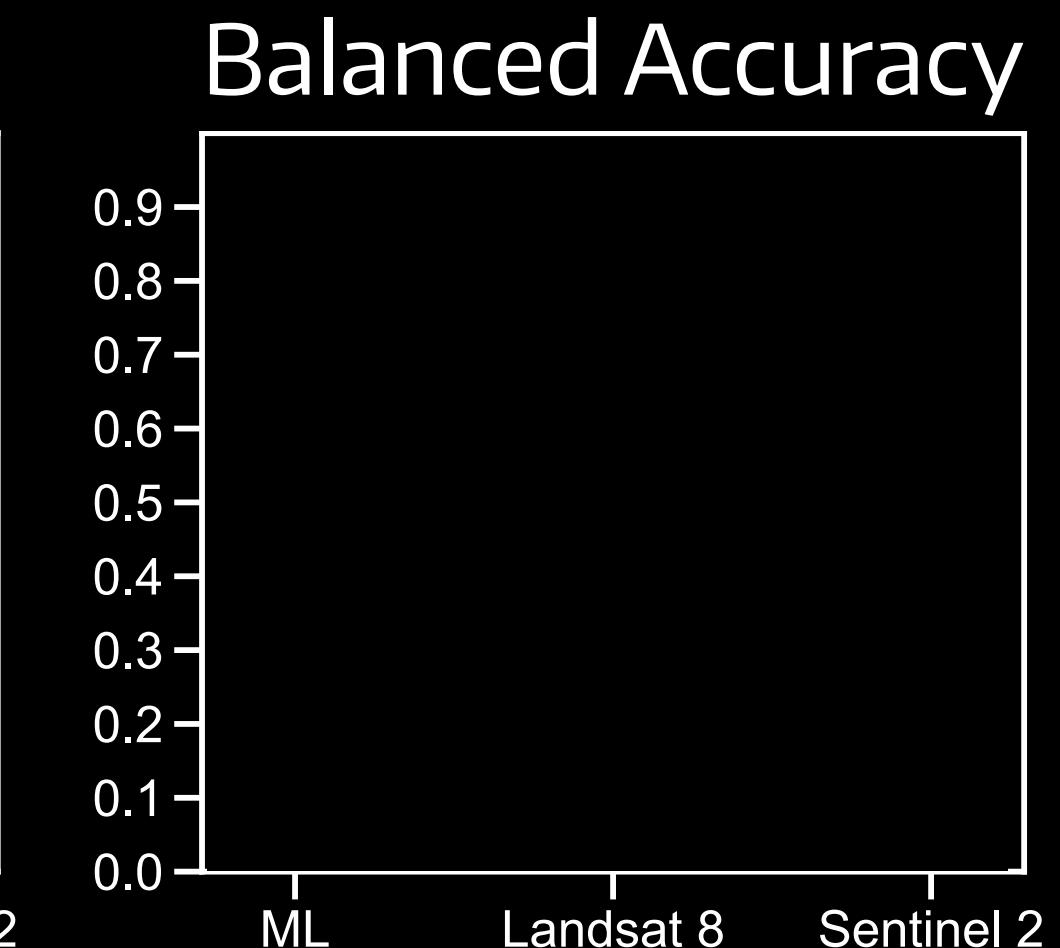
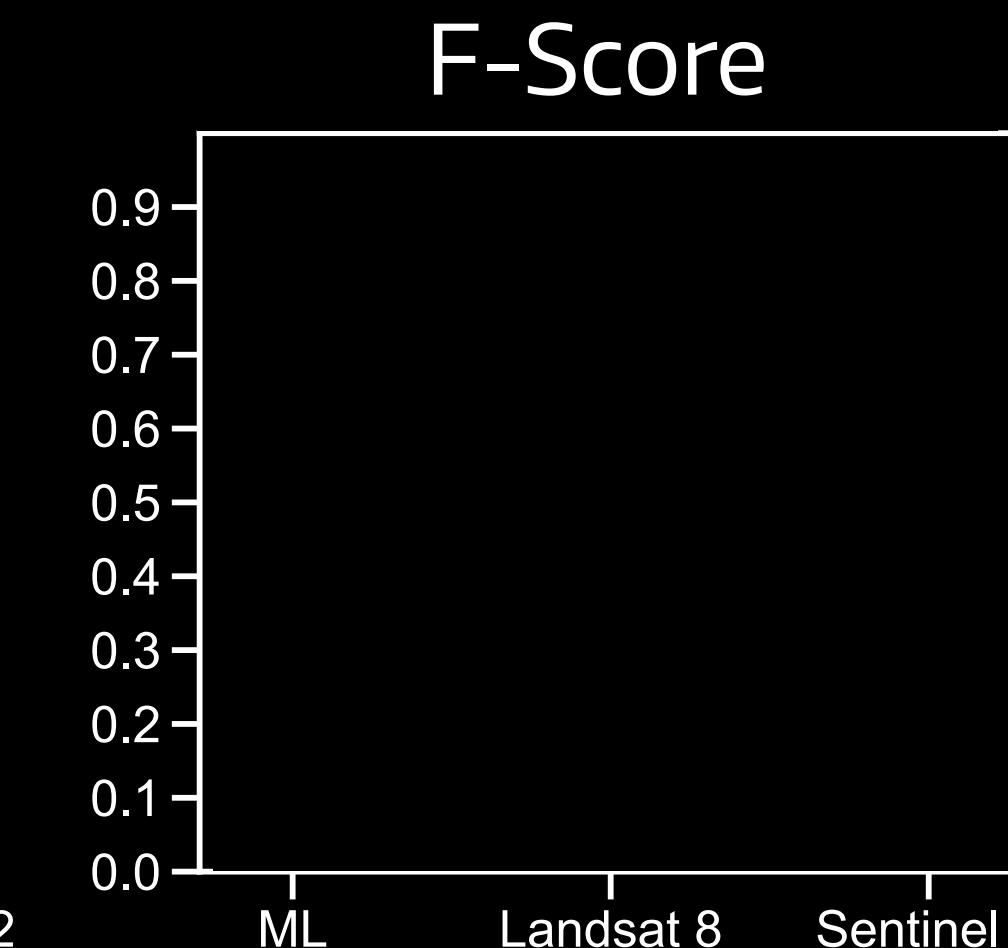
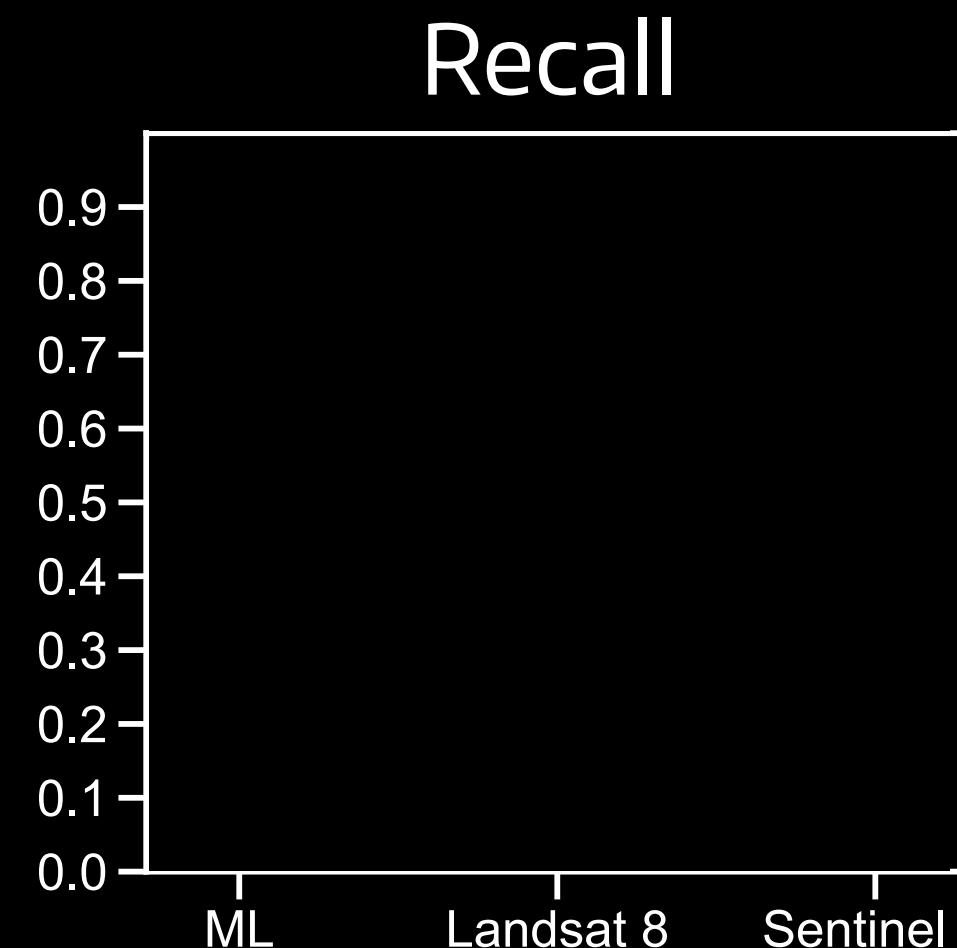
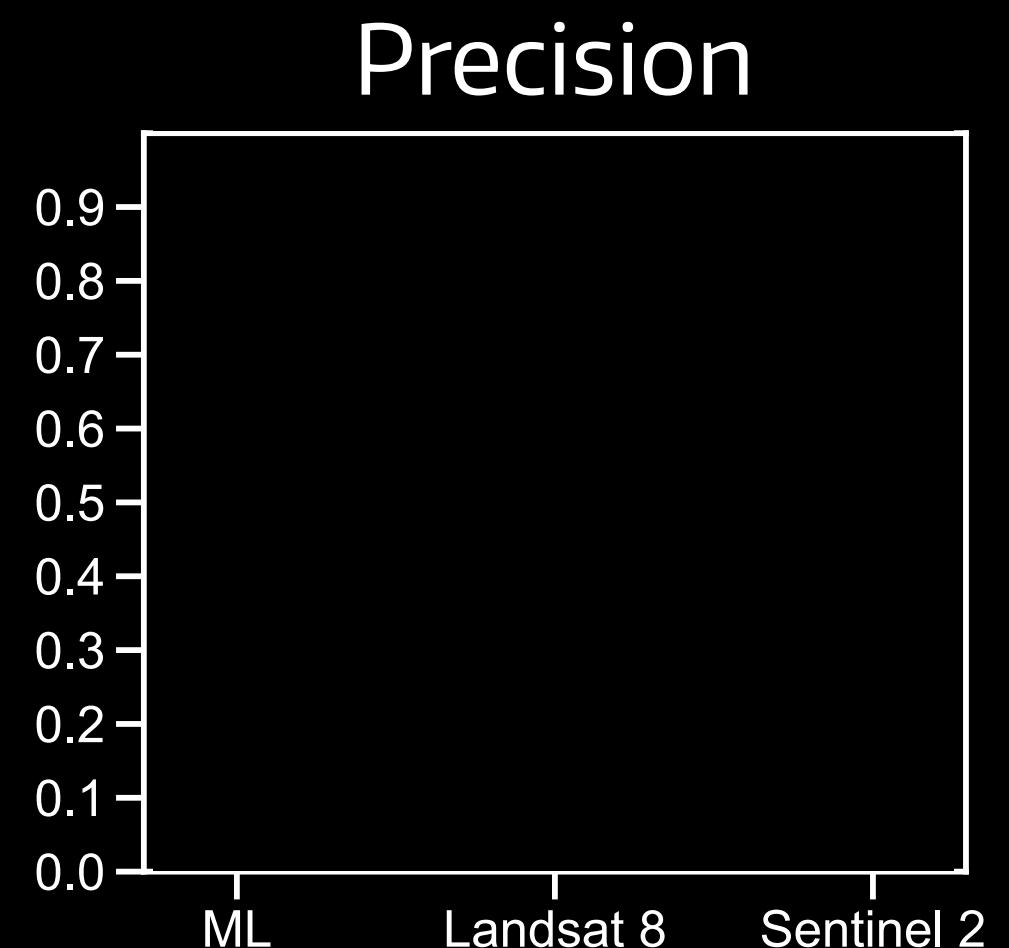
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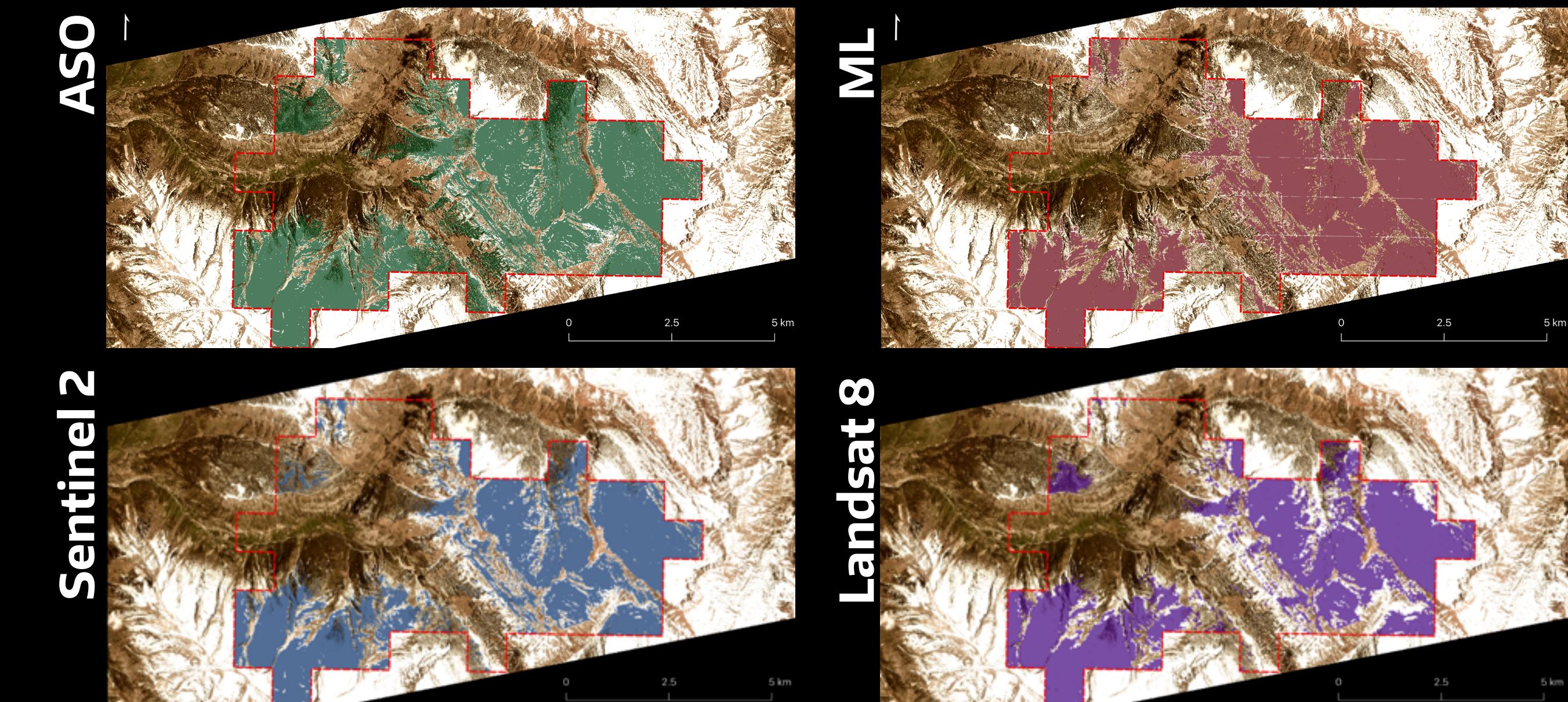


Classification Performance



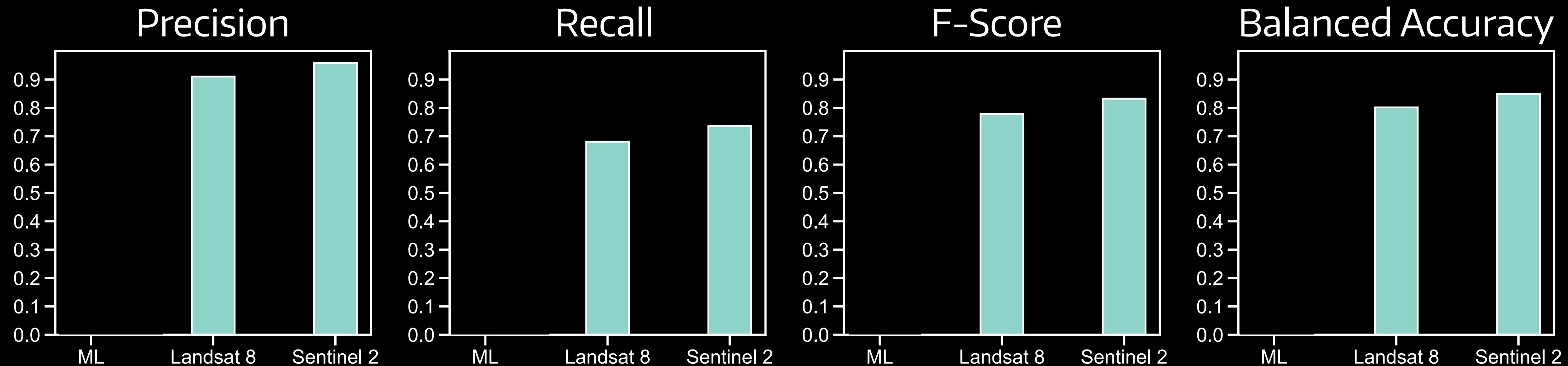
“How well does X compare to ASO?”

- **ML Algorithm**
- **Landsat 8 fSCA > 0%**
- **Sentinel 2 NDSI > 0.42**



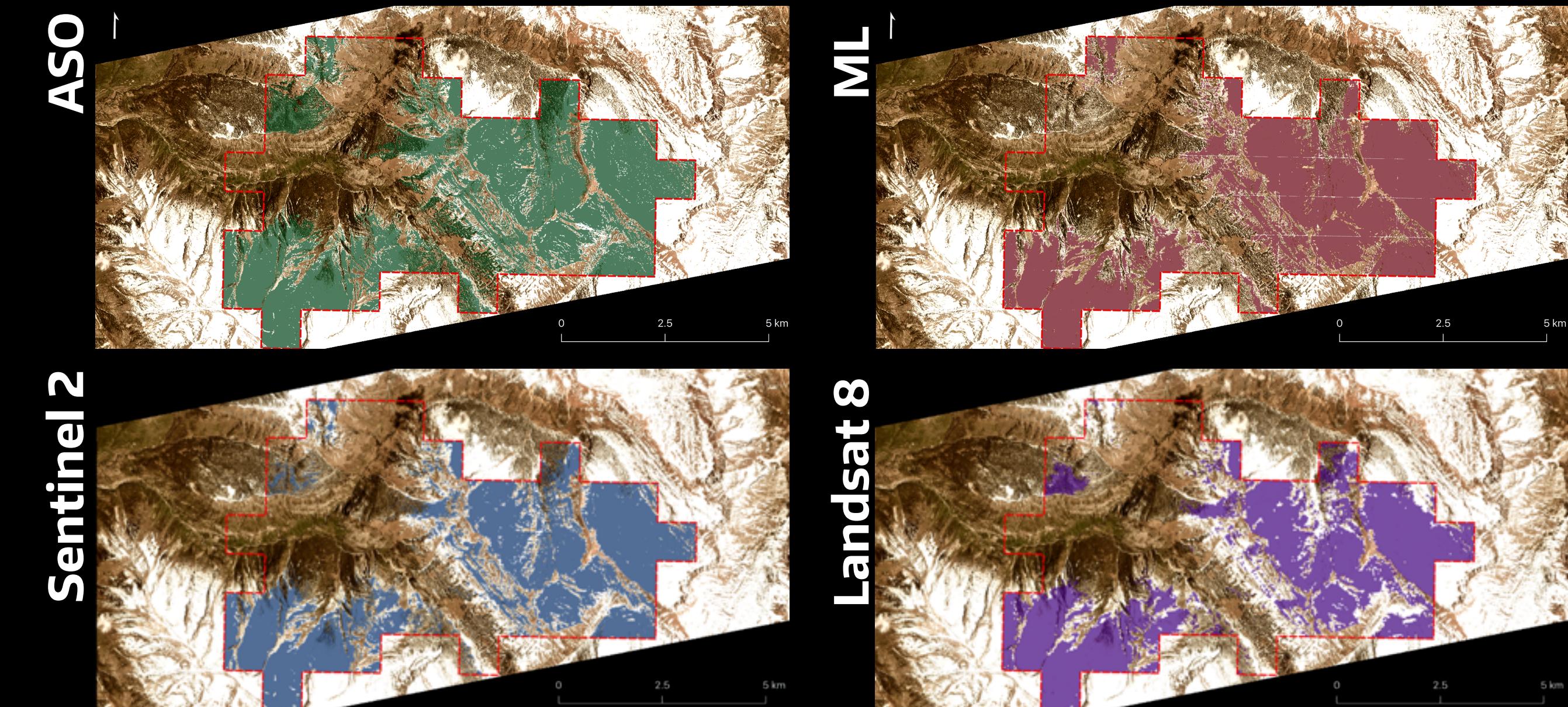
Planet: 2018.05.28, ASO: 2018.05.24, LS8: 2018.06.02, Sentinel 2: 2018.06.06

Classification Performance



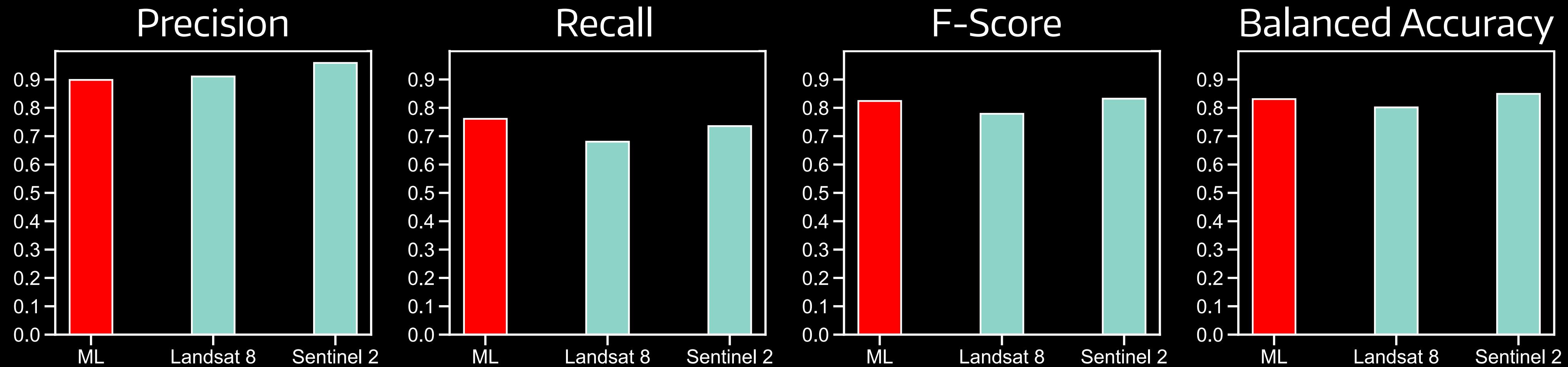
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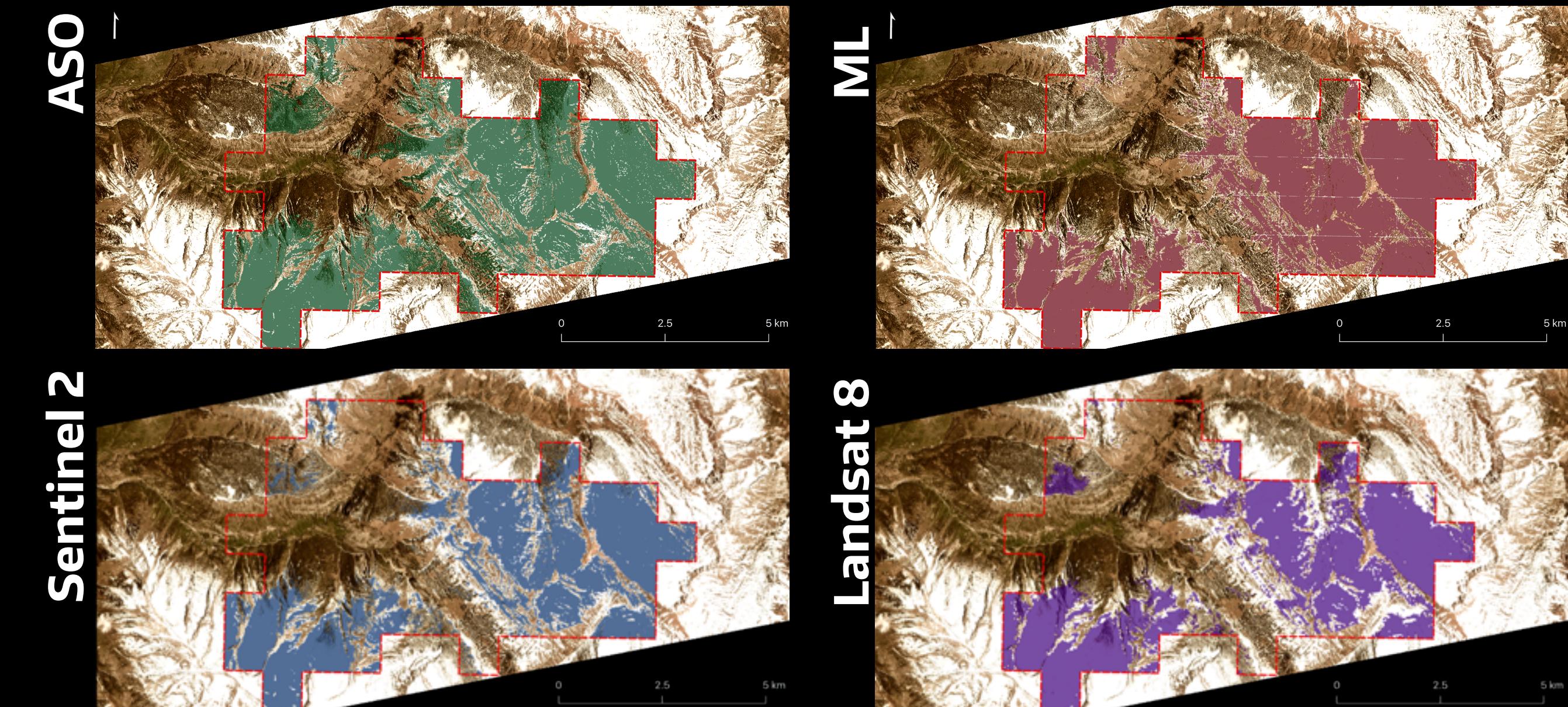
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Classification Performance



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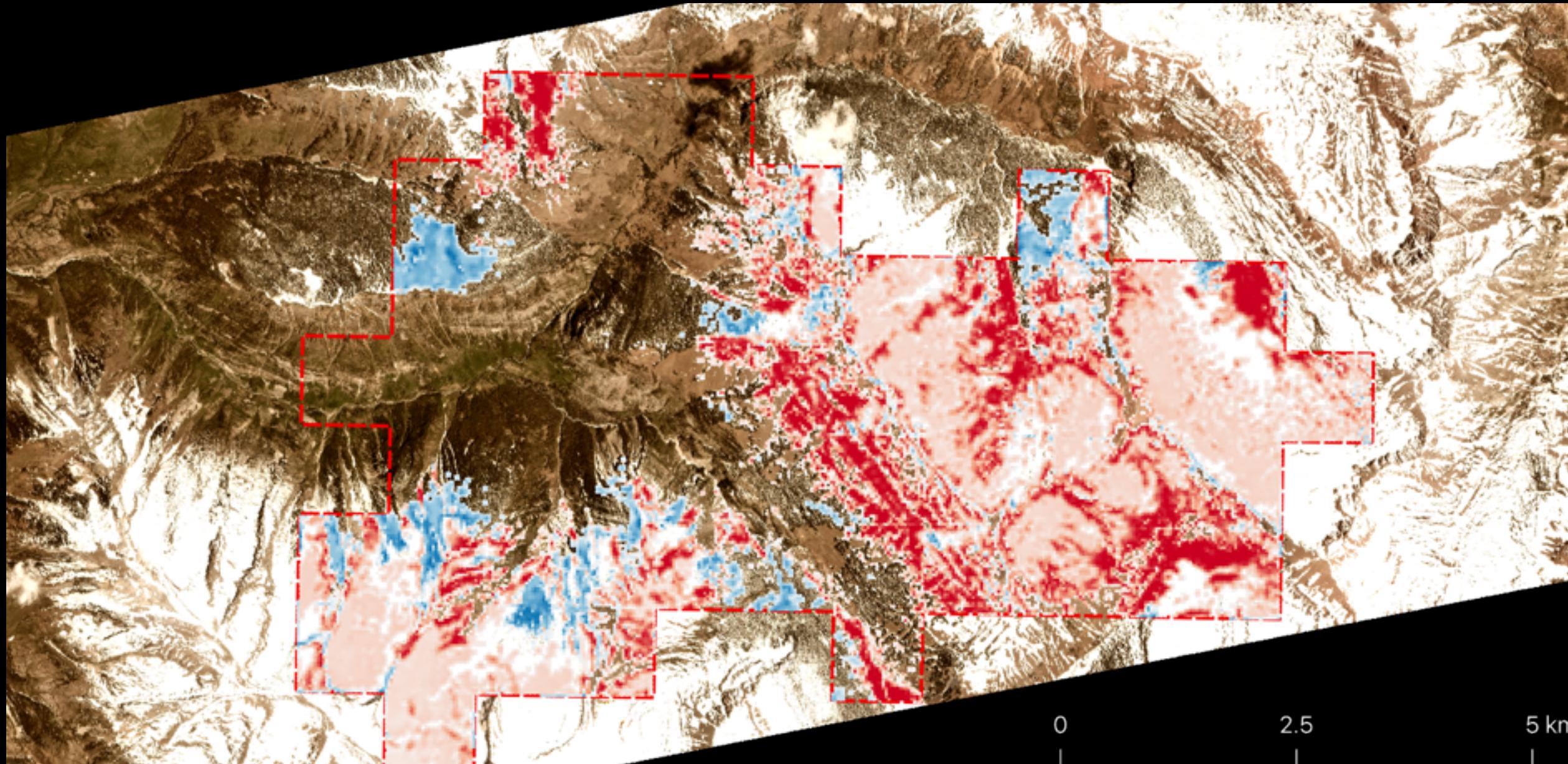
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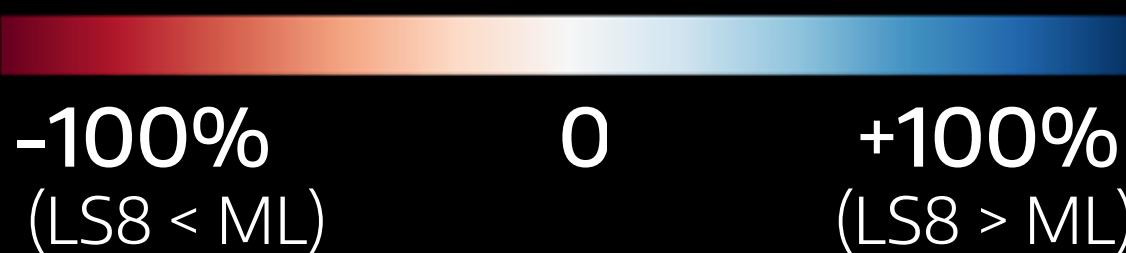
Planet: 2018.05.28, ASO: 2018.05.24, LS8: 2018.06.02, Sentinel 2: 2018.06.06

LS8 - ML Difference

fSCA at LS8 resolution

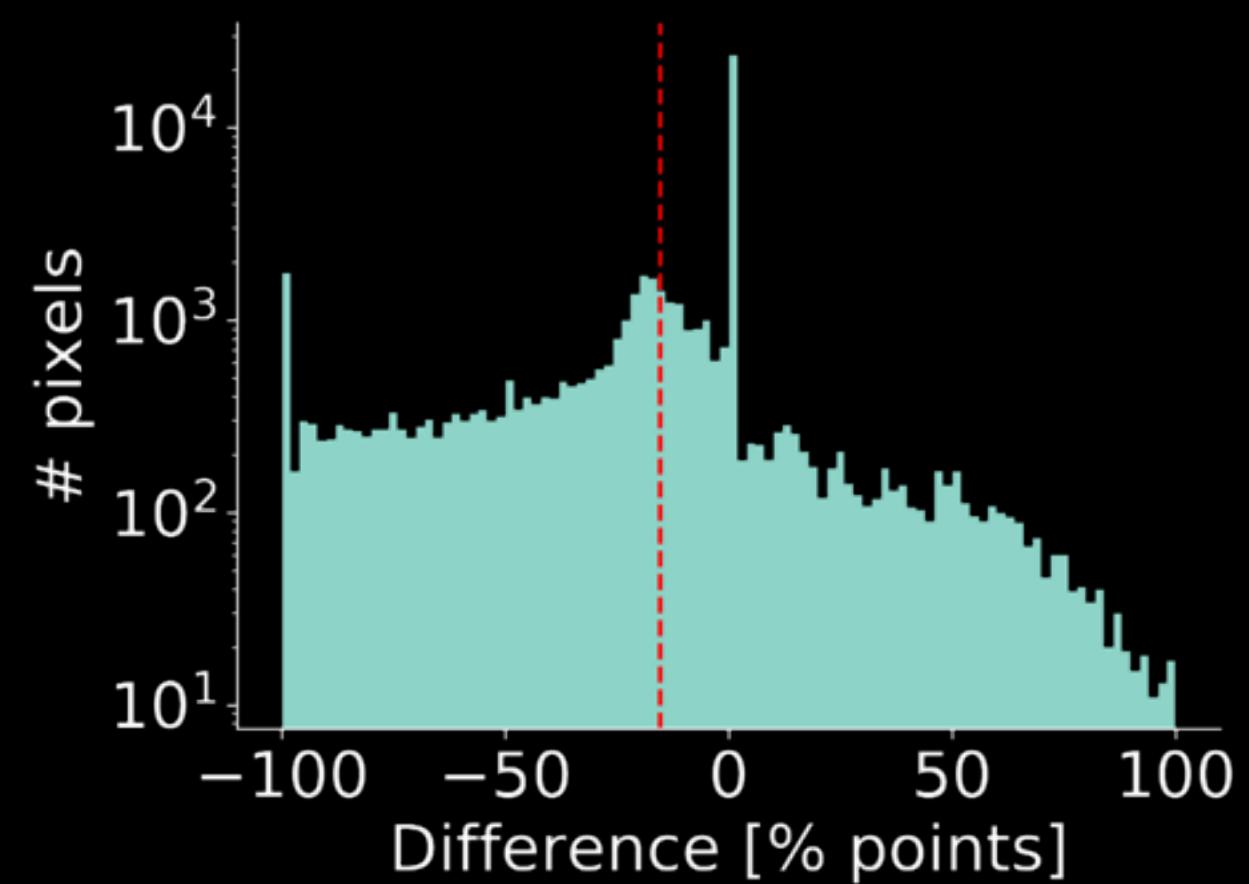


Planet: 2018.05.28, LS8: 2018.06.02



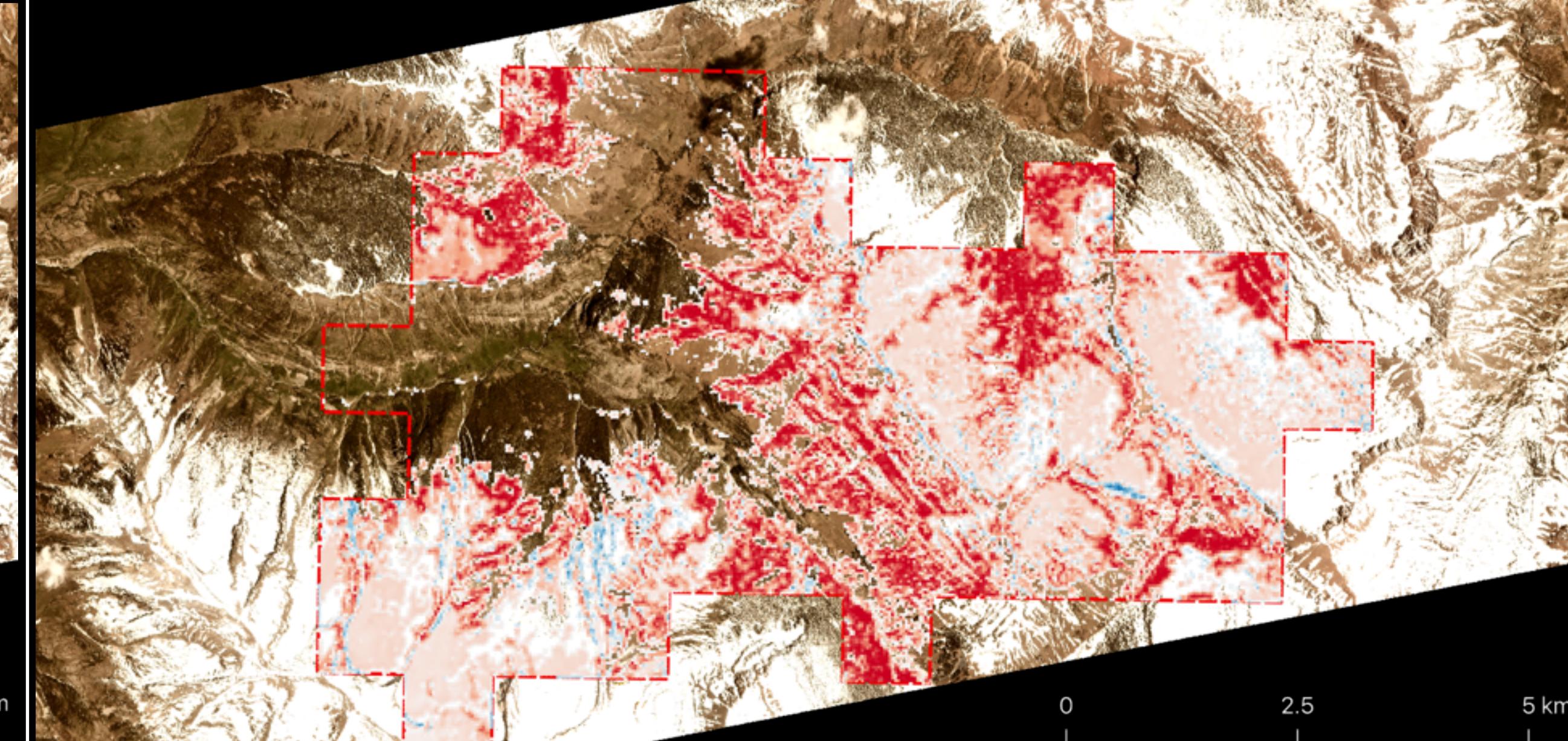
-15.30%

Average fSCA Difference

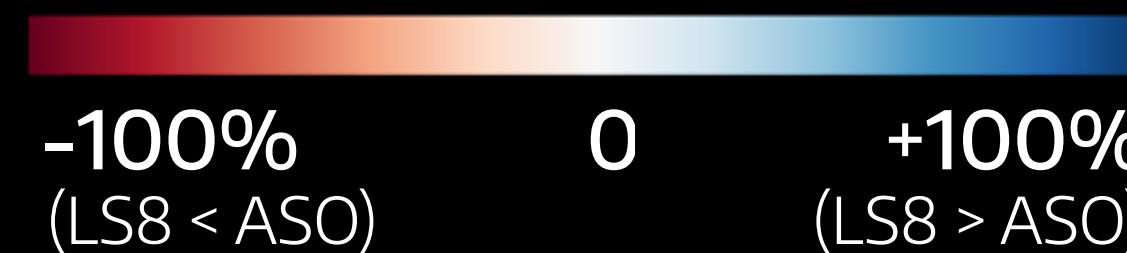


LS8 - ASO Difference

fSCA at LS8 resolution

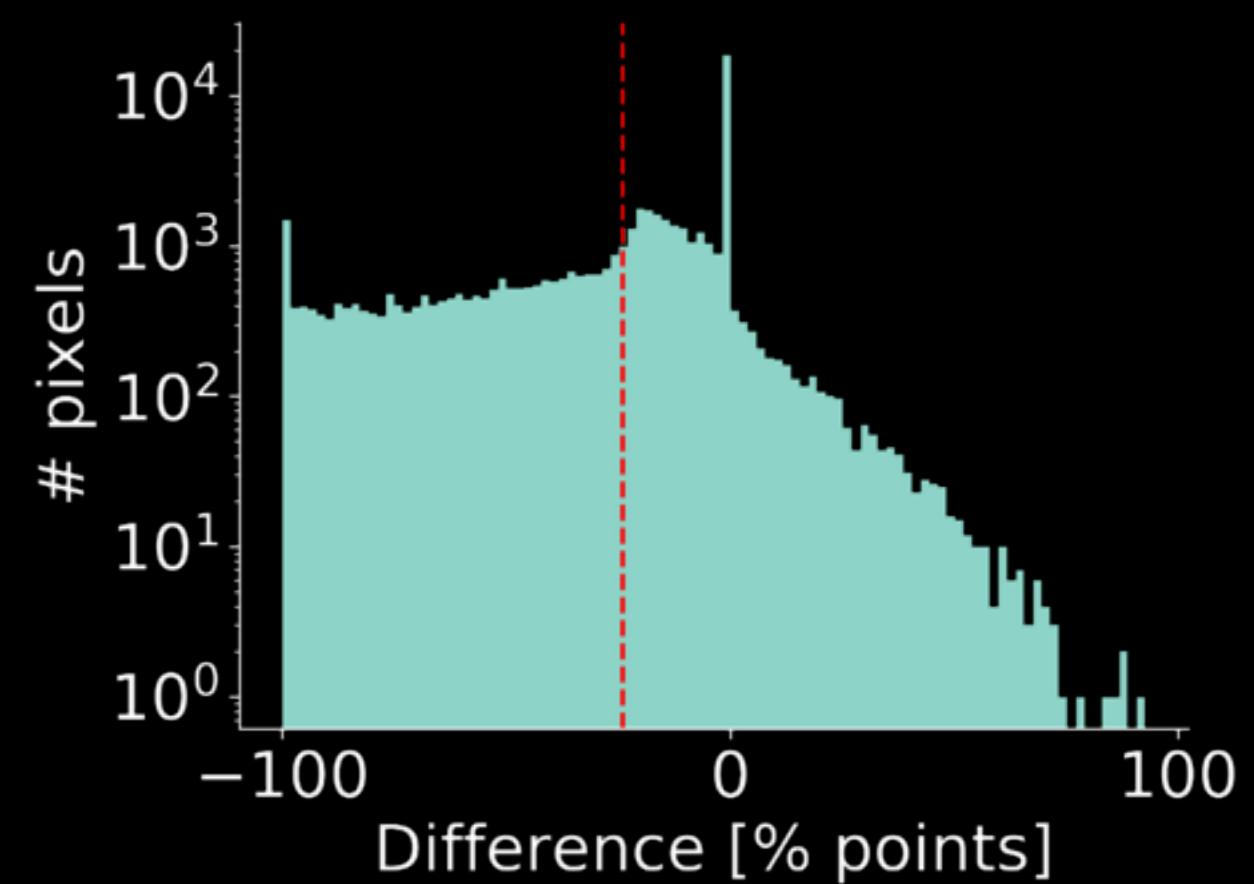


Planet: 2018.05.28, LS8: 2018.06.02



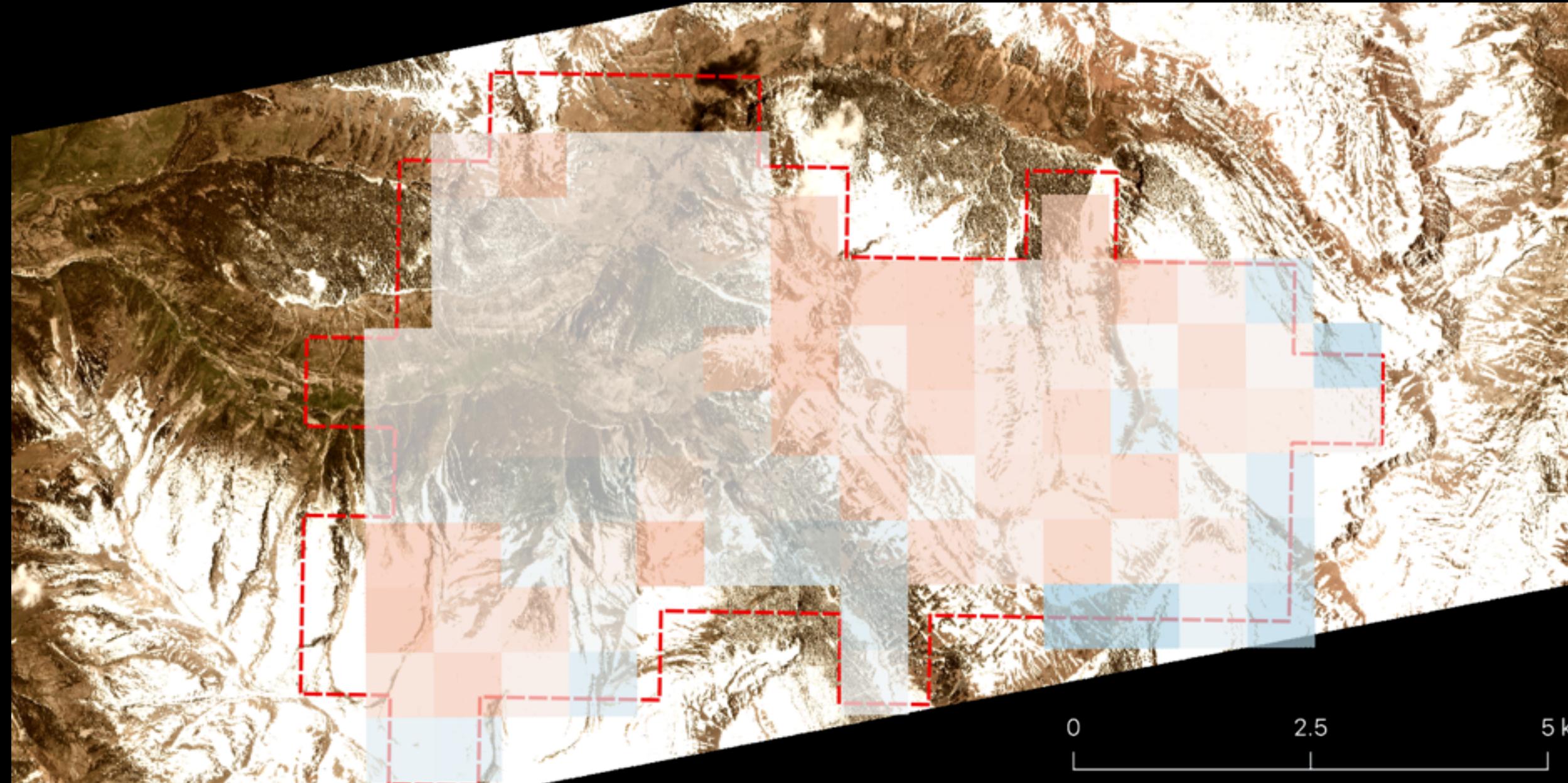
-24.00%

Average fSCA Difference



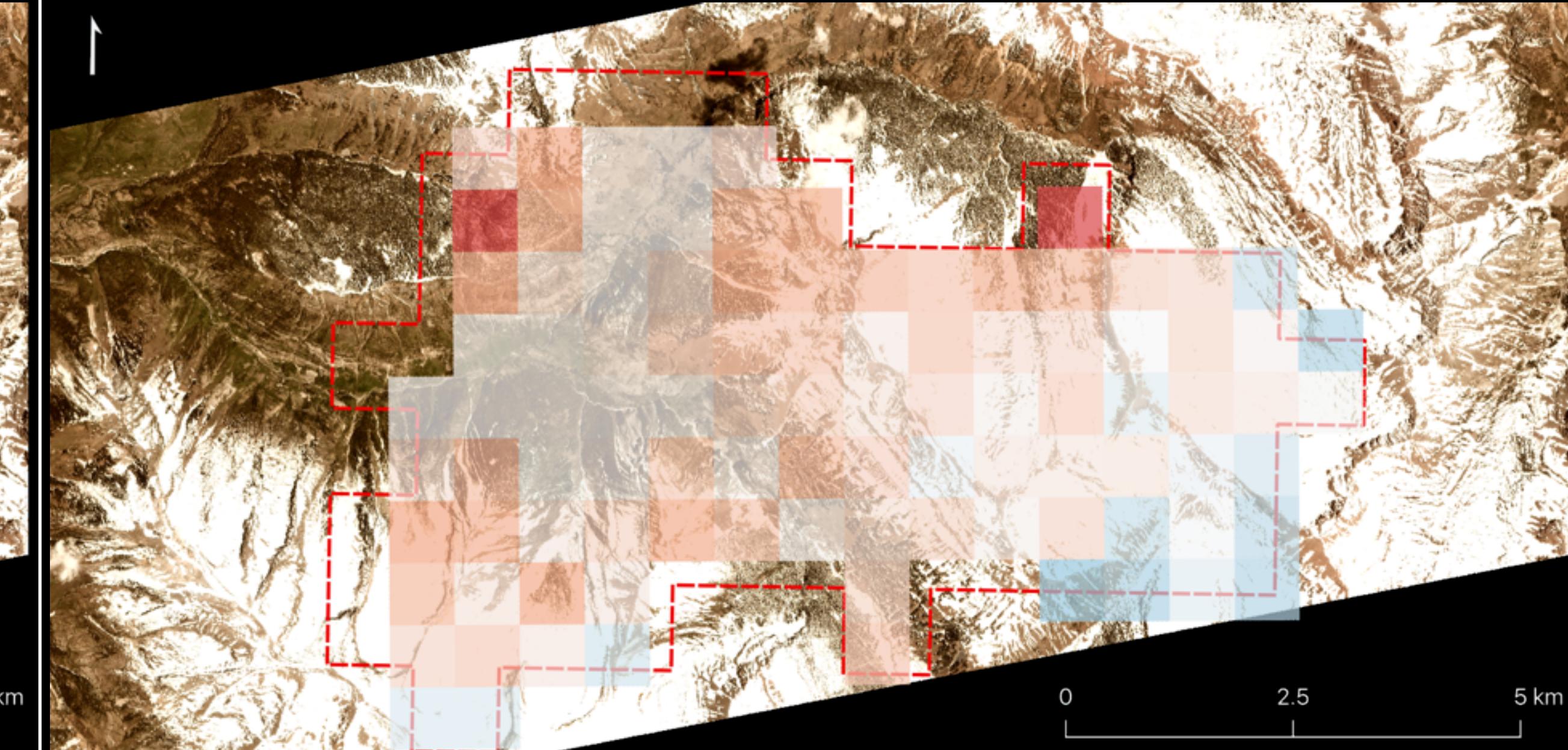
MODIS - ML Difference

fSCA at MODIS resolution



MODIS - ASO Difference

fSCA at MODIS resolution



Check it out!

powered by aws

The screenshot shows a GitHub repository page for 'acannistra/planet-snowcover'. The repository has 330 commits, 6 branches, 0 packages, 0 releases, 1 contributor, and is licensed under MIT. The latest commit was made 17 days ago. The repository contains several sub-directories: analysis, artifacts, deployment, docs, environment, experiments, image_utils, implementation-notes, model, notebooks, and pipeline. The README file indicates that the project aims to use Planet high-resolution imagery to assess snow cover, with a link to a documentation page.



github.com/acannistra/planet-snowcover

Documented, open-source implementation.

Educational tutorials. (in progress... 😅)

Deployment instructions for Amazon Web Services public cloud infrastructure.



python™



mapbox



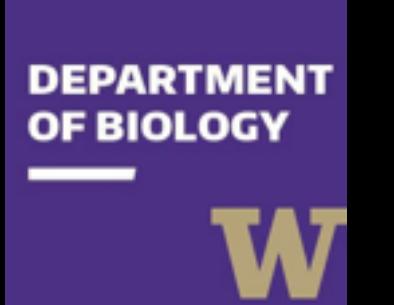
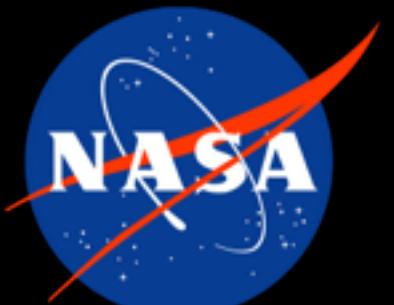
PyTorch

W

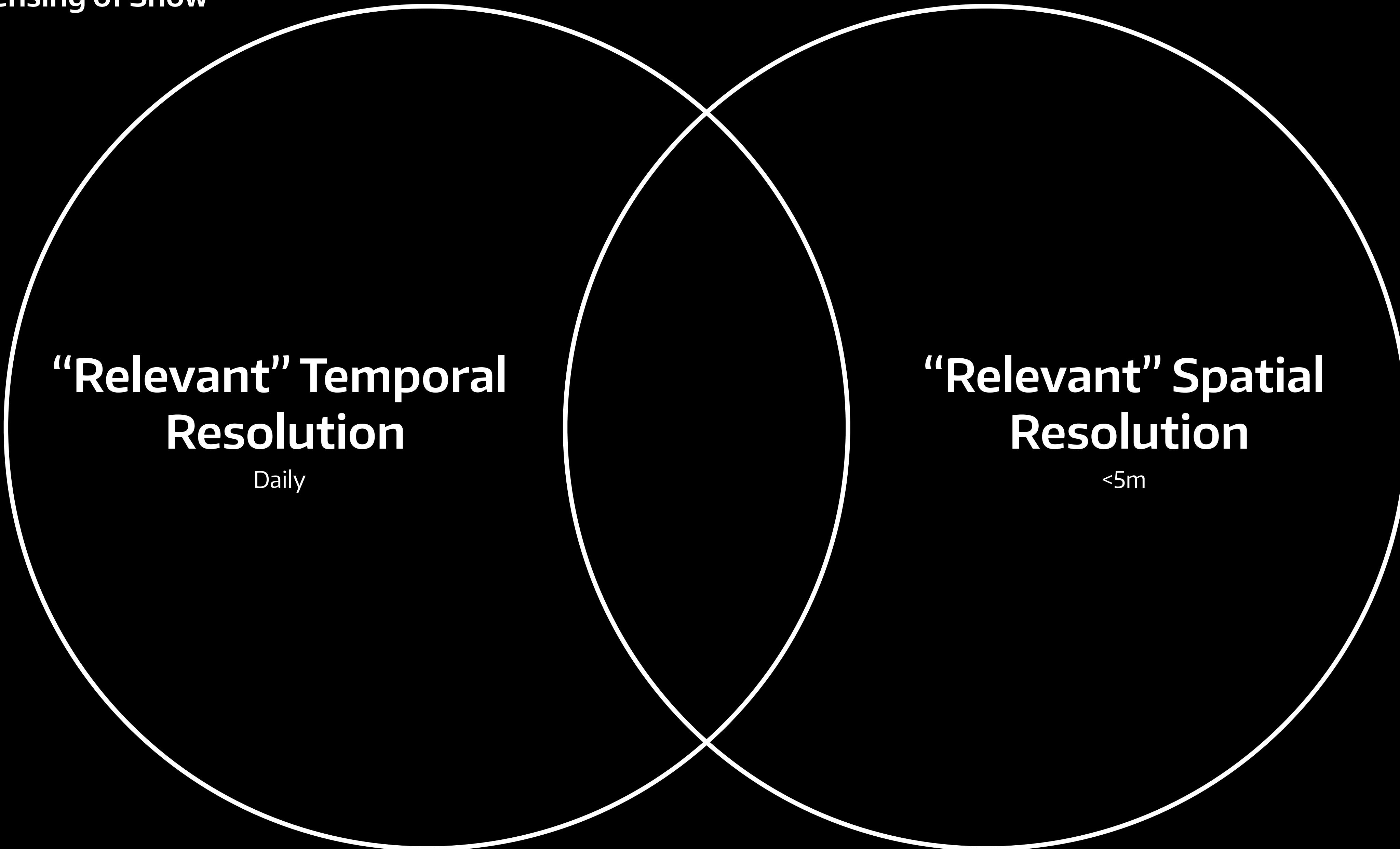
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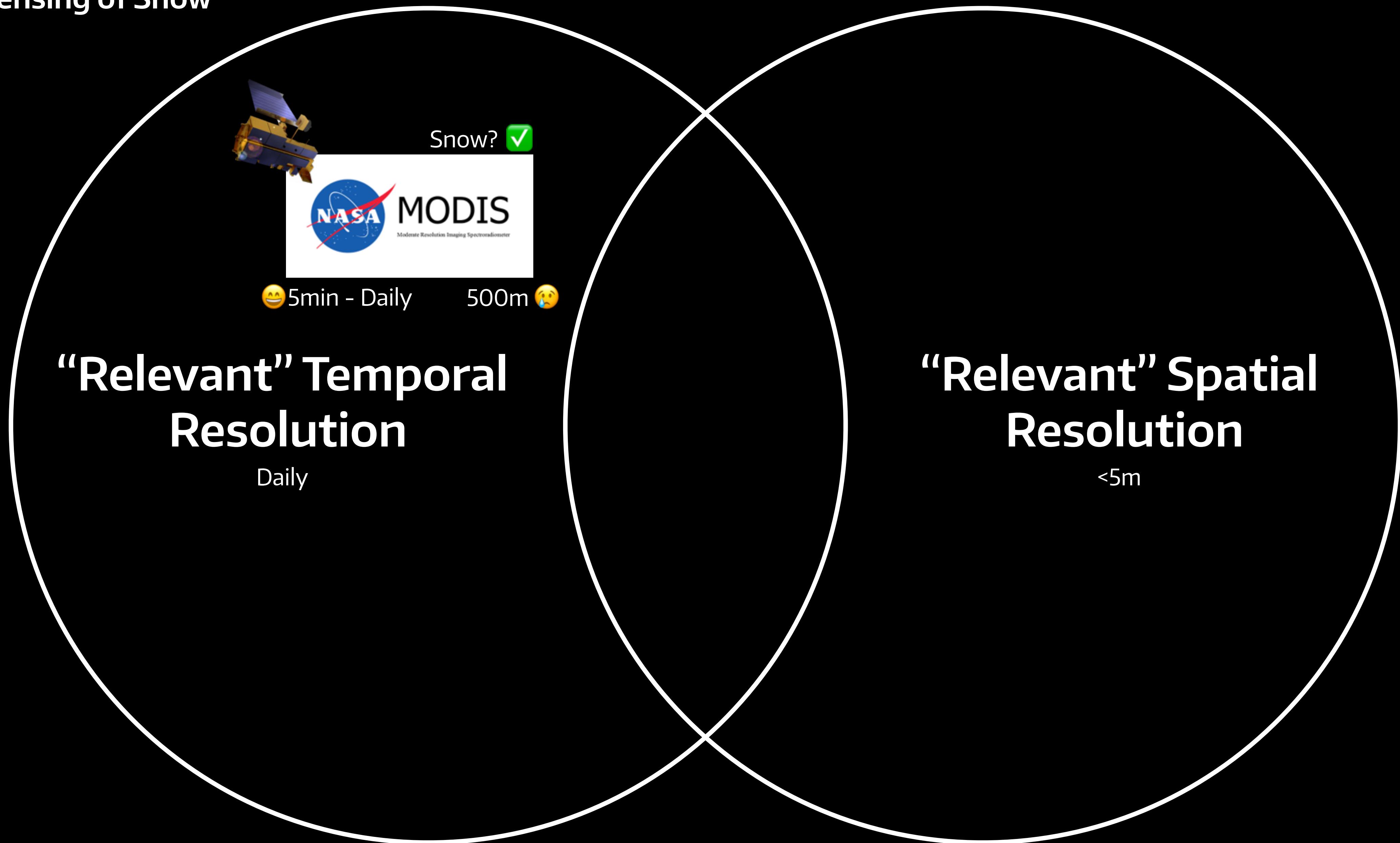
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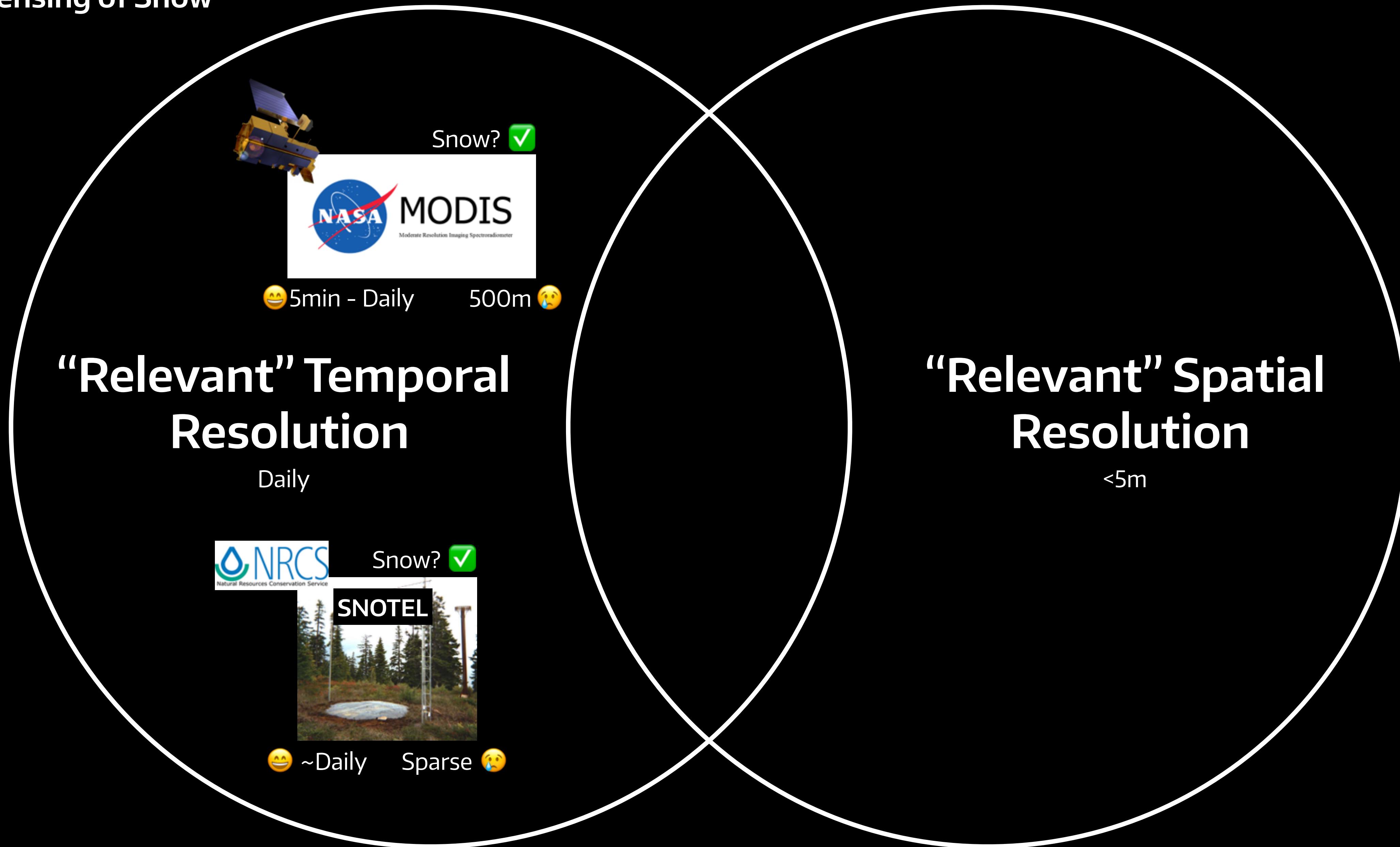
RESULTS



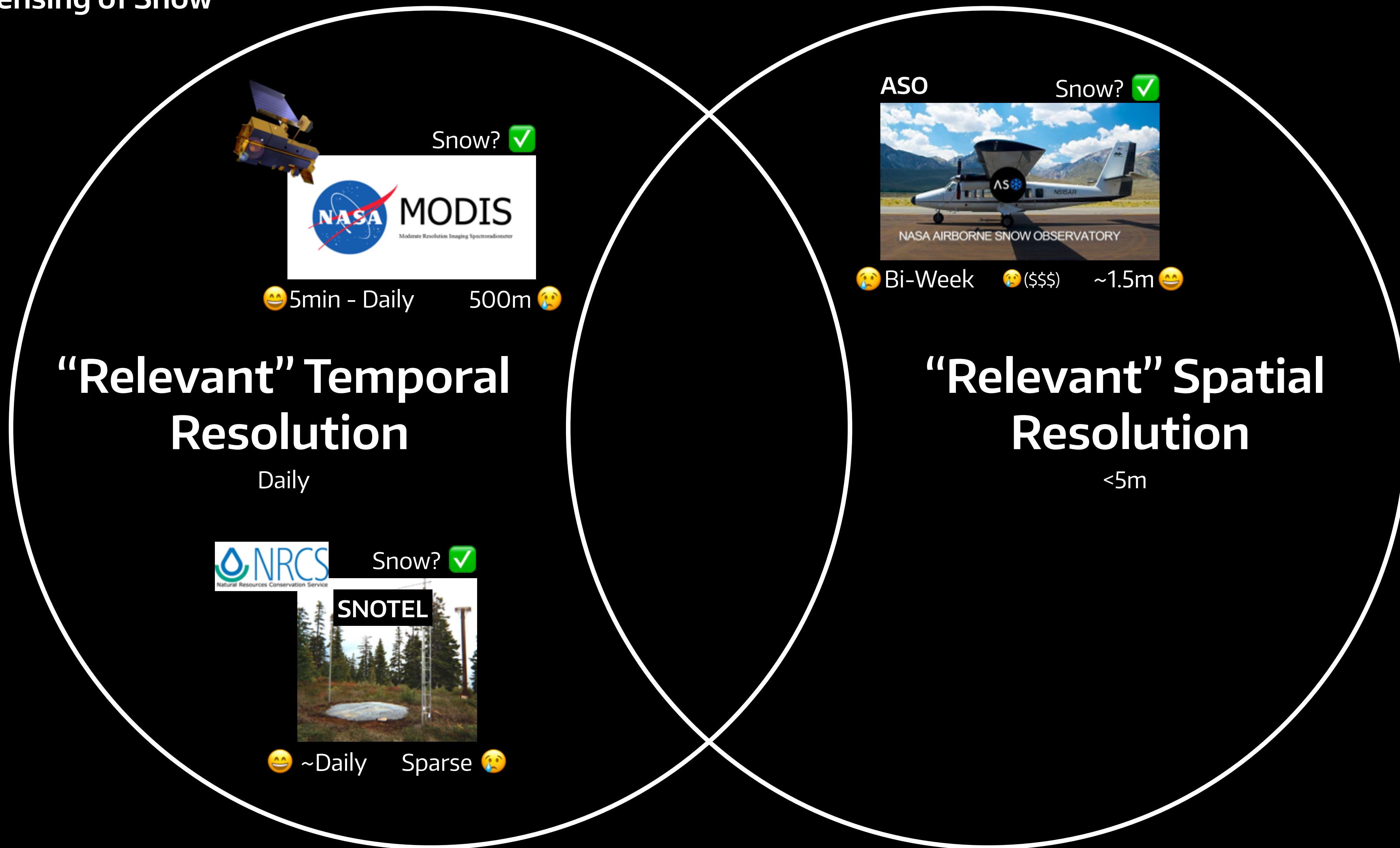
Thank you!





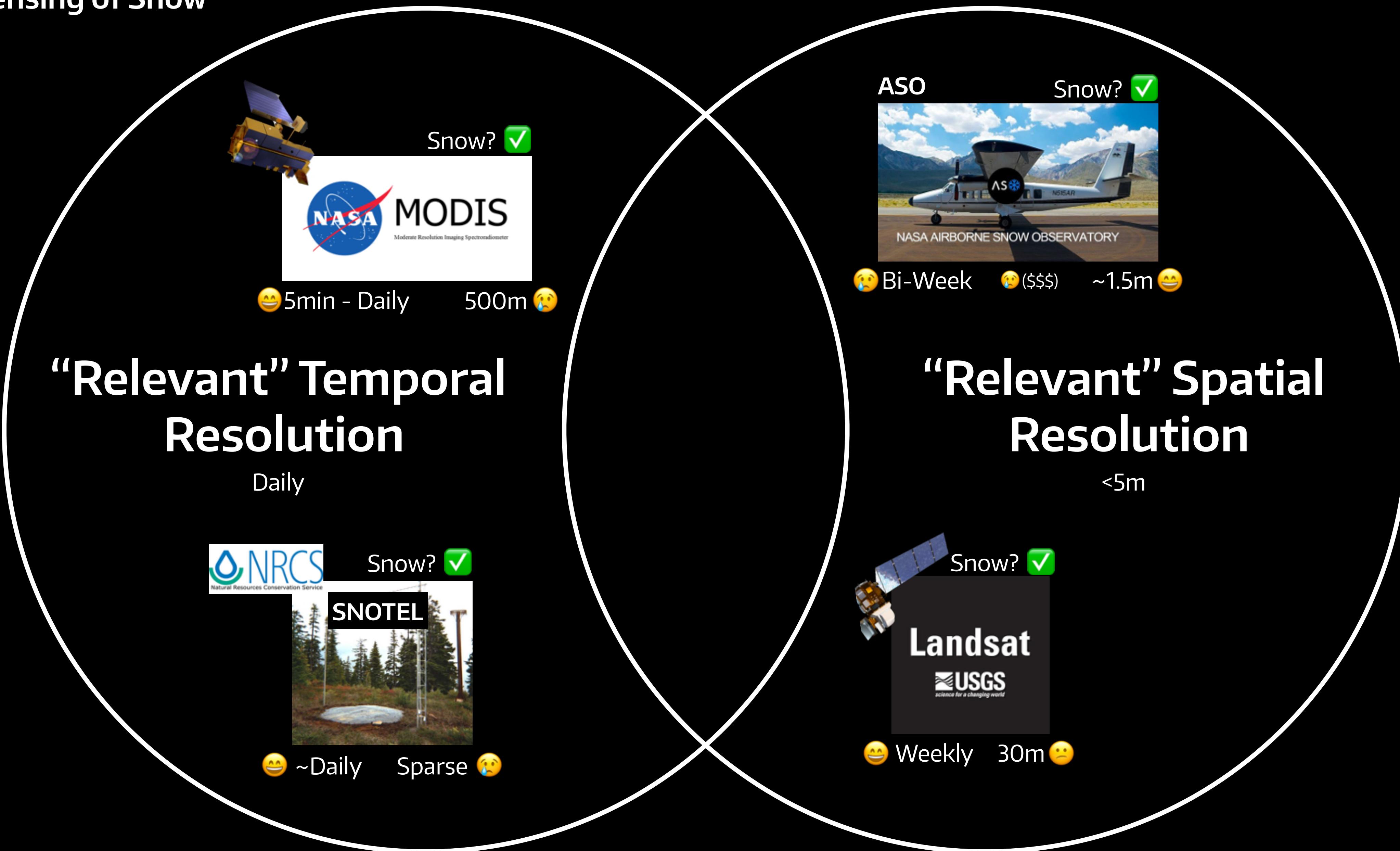


Remote Sensing of Snow



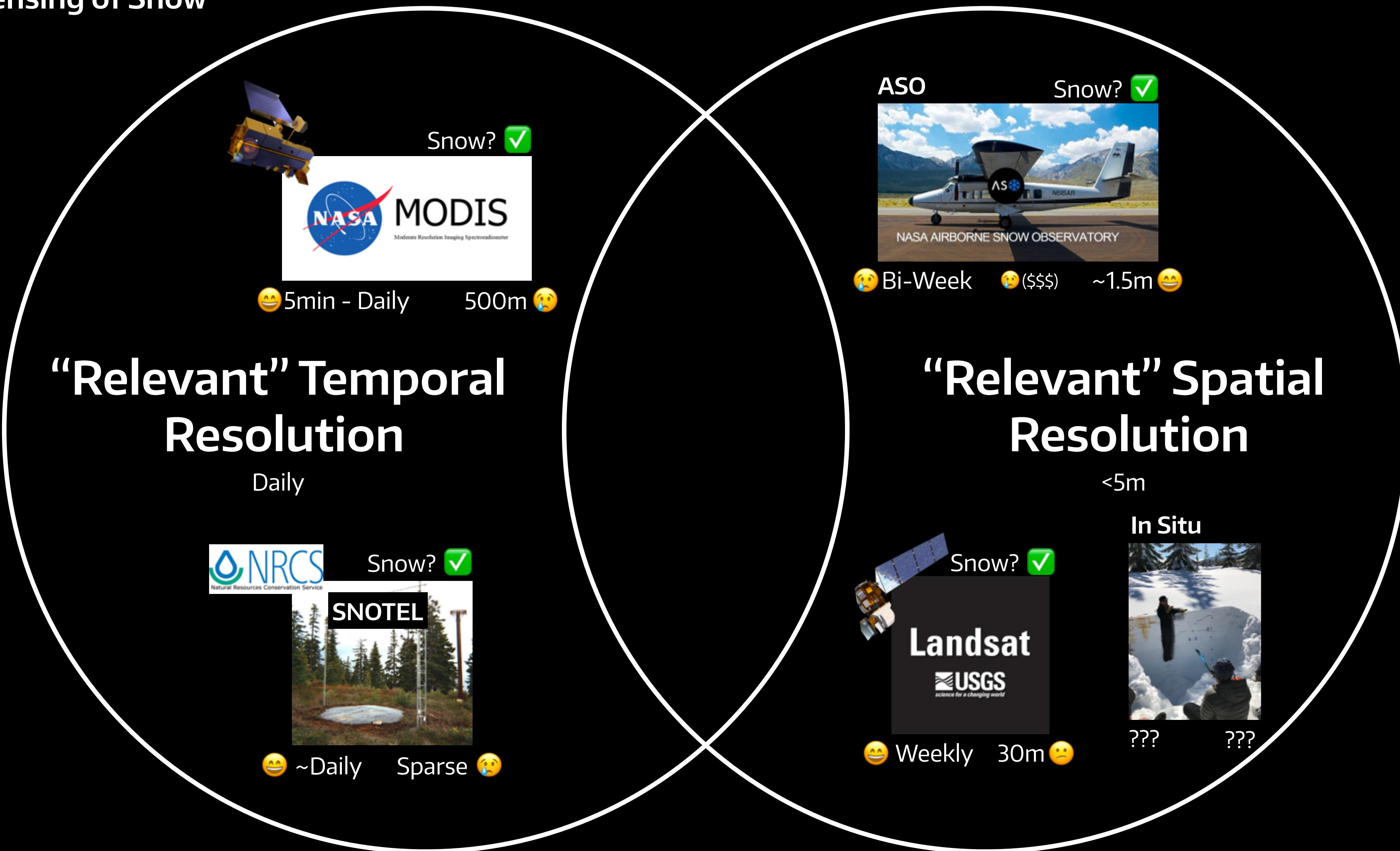
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Remote Sensing of Snow



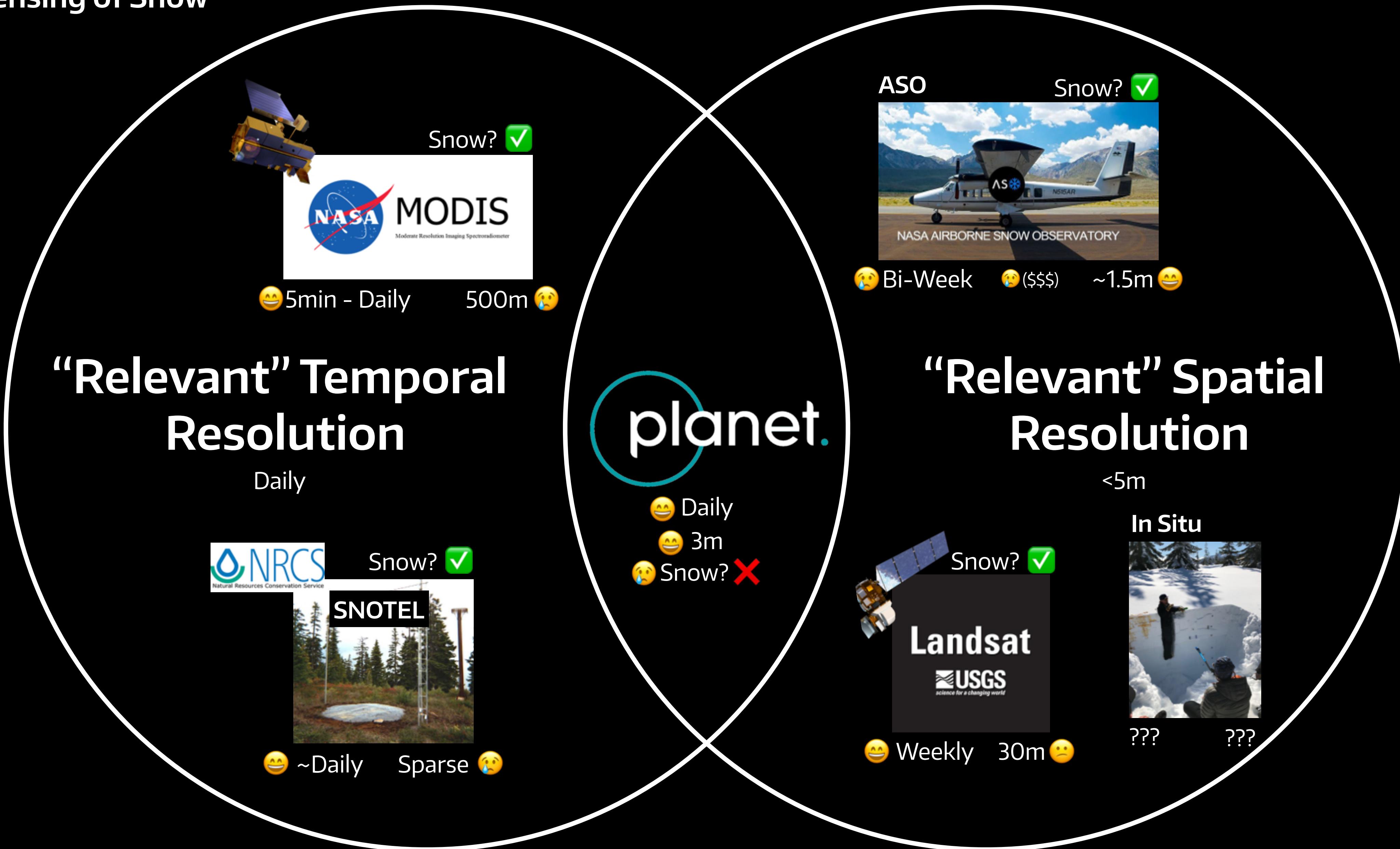
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Remote Sensing of Snow

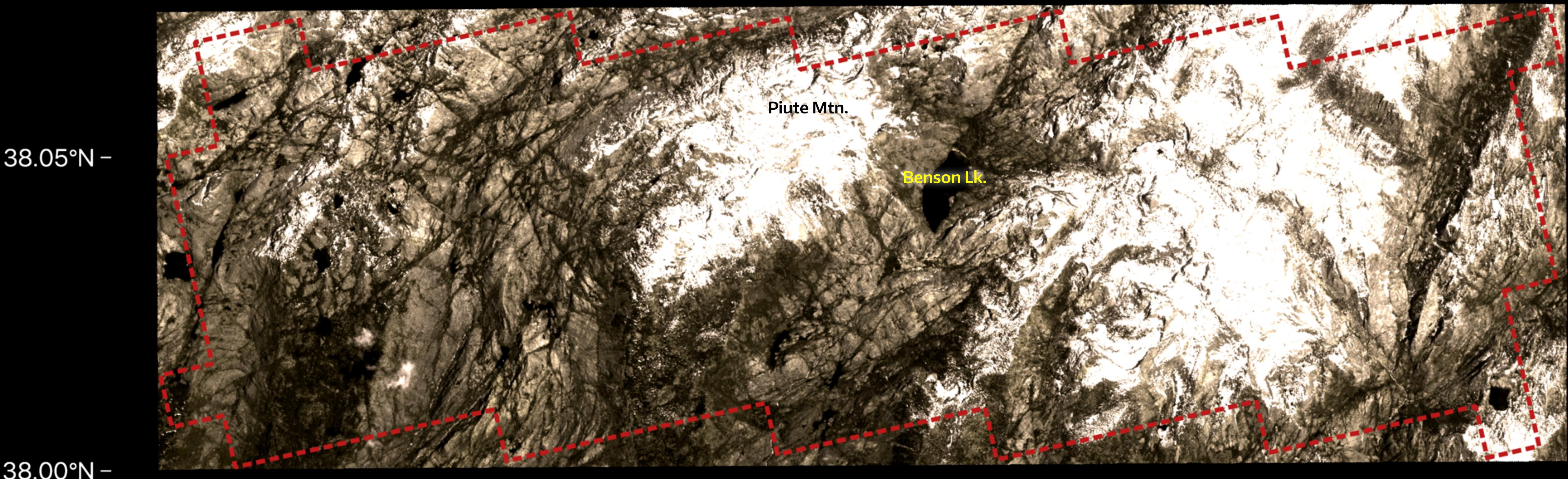


W

Remote Sensing of Snow



W



Tuolumne Basin, CA

CubeSats for Snow Covered Area – A Case Study of new Earth observation data.

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RESULTS

119.65°W

119.60°W

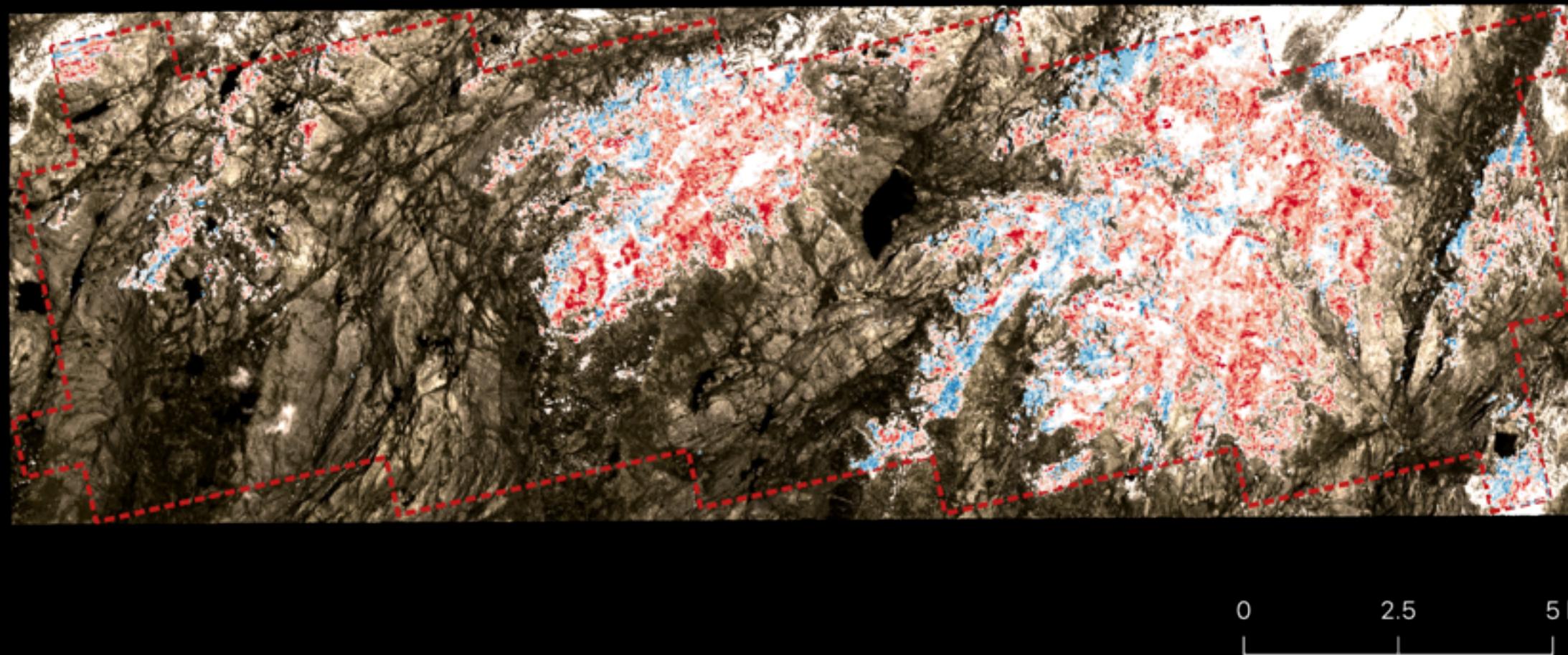
119.55°W

119.50°W

119.45°W

119.40°W

ML / LS8



119.65°W

119.60°W

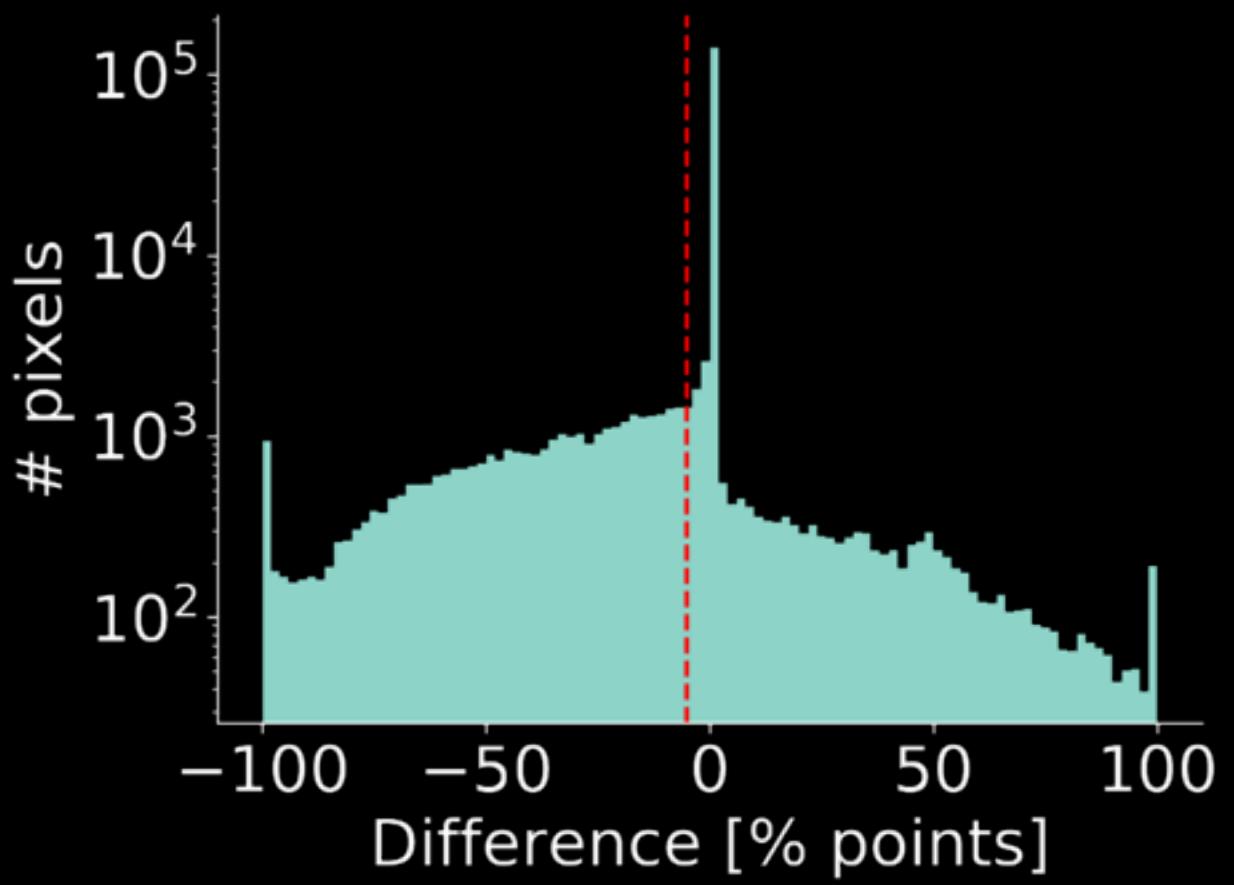
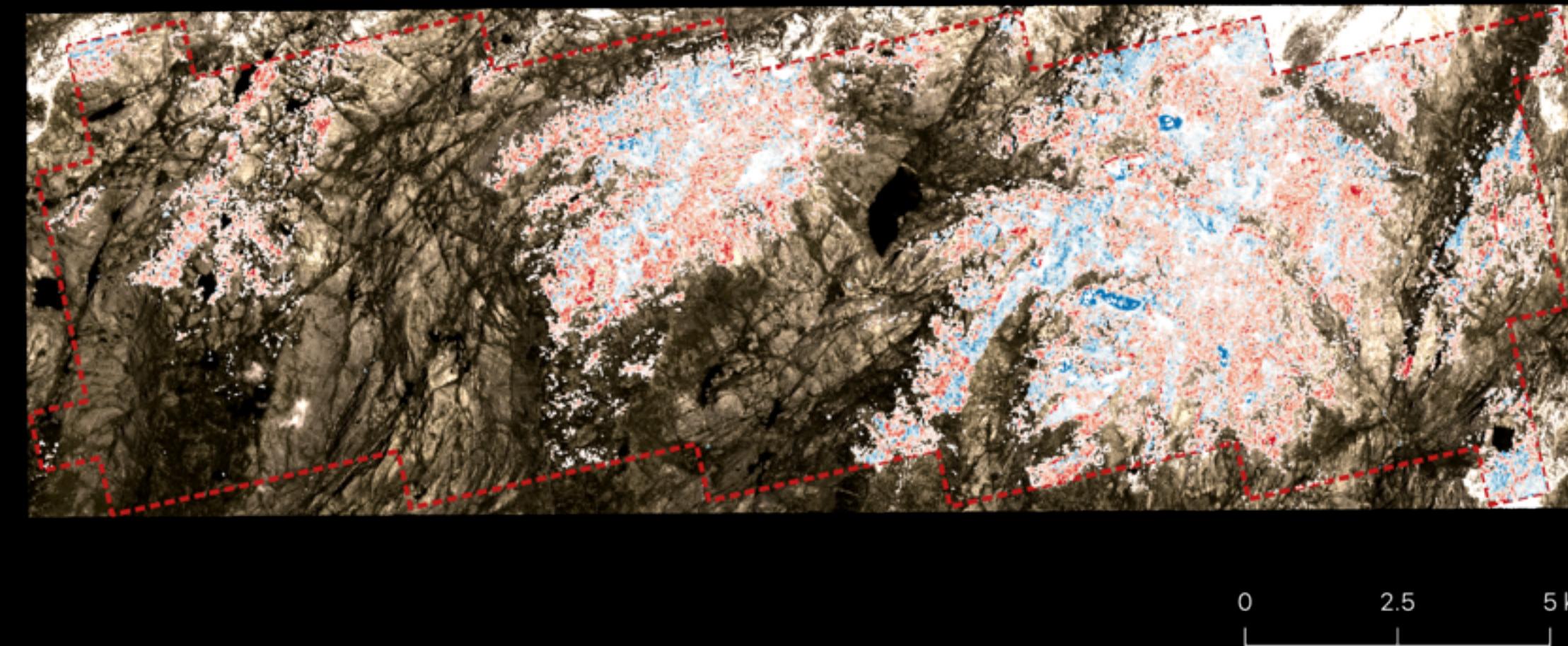
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119.50°W

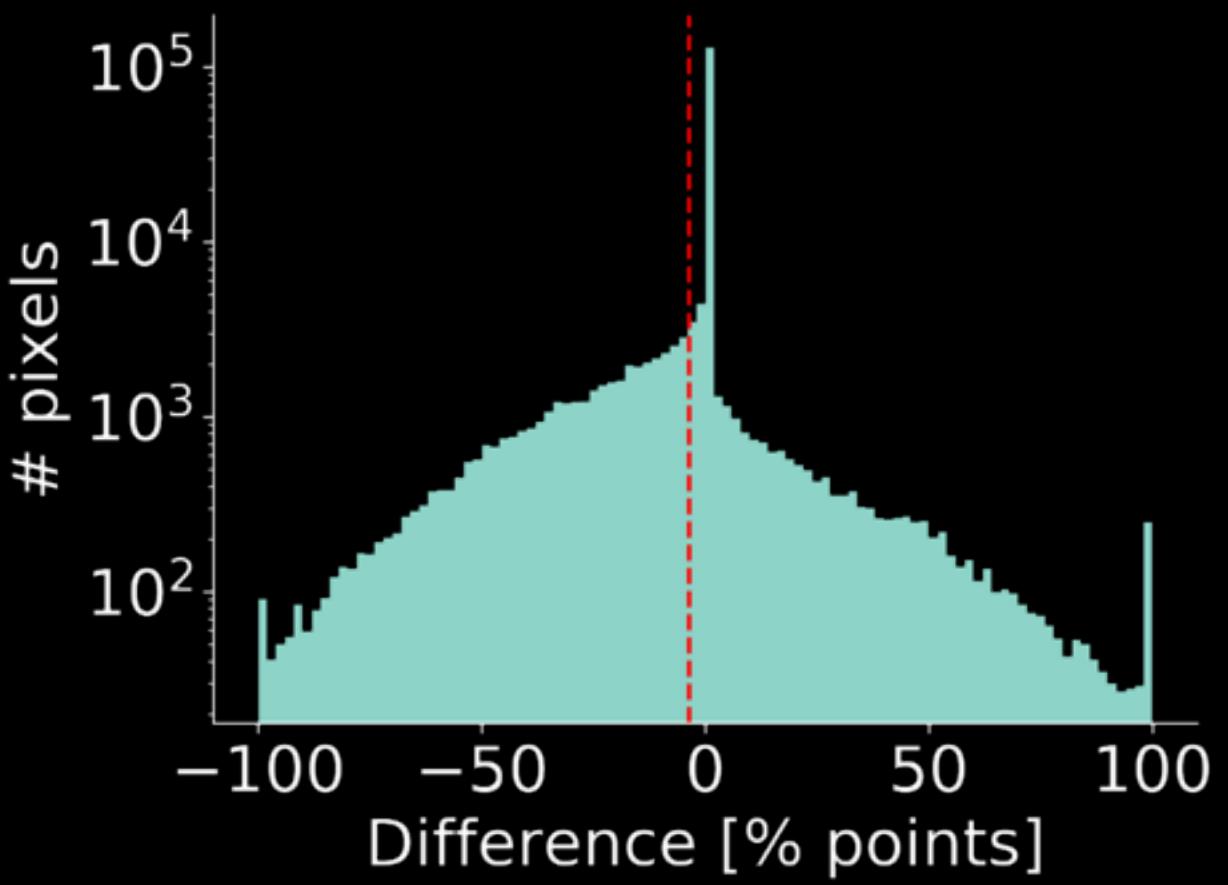
119.45°W

119.40°W

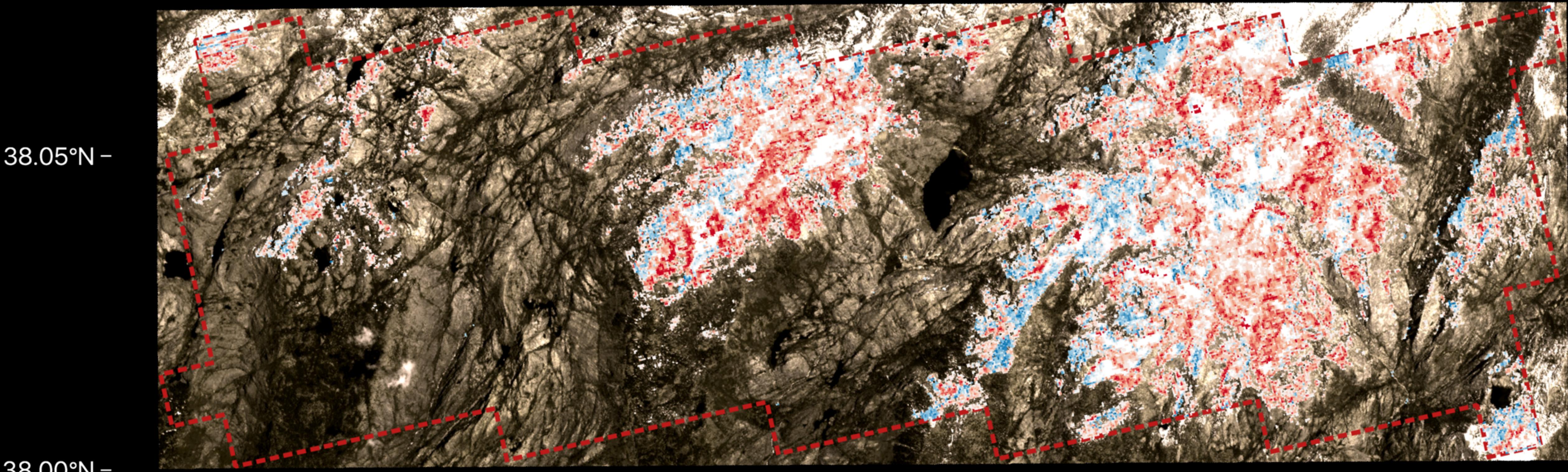
ASO / LS8



-3.57%
Average Difference



W



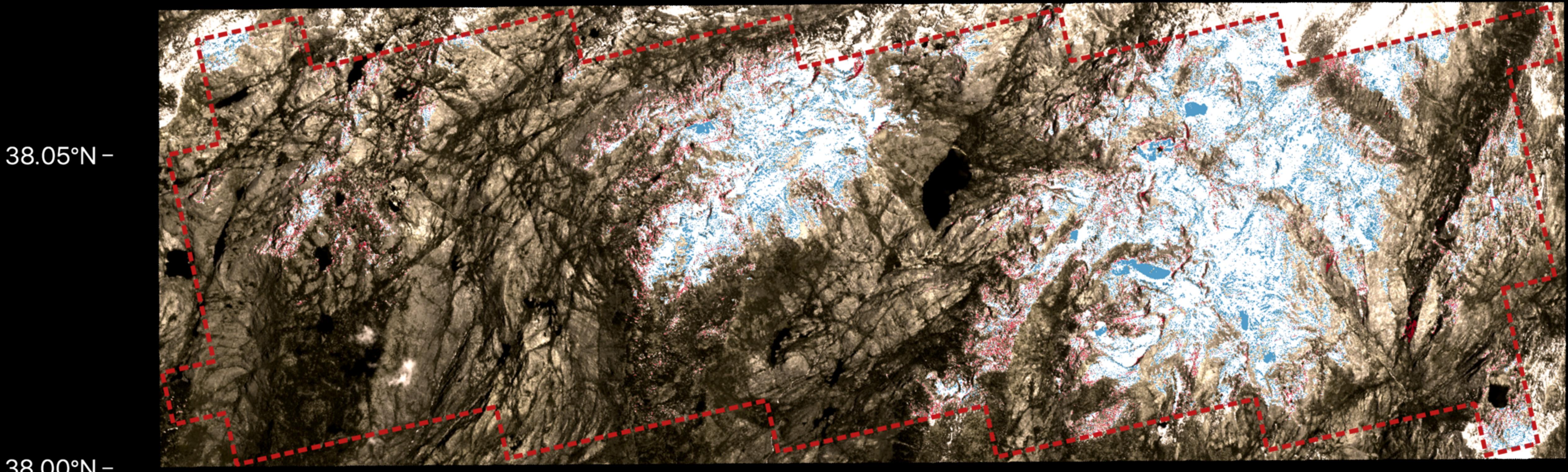
LS8 vs ML.

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RESULTS

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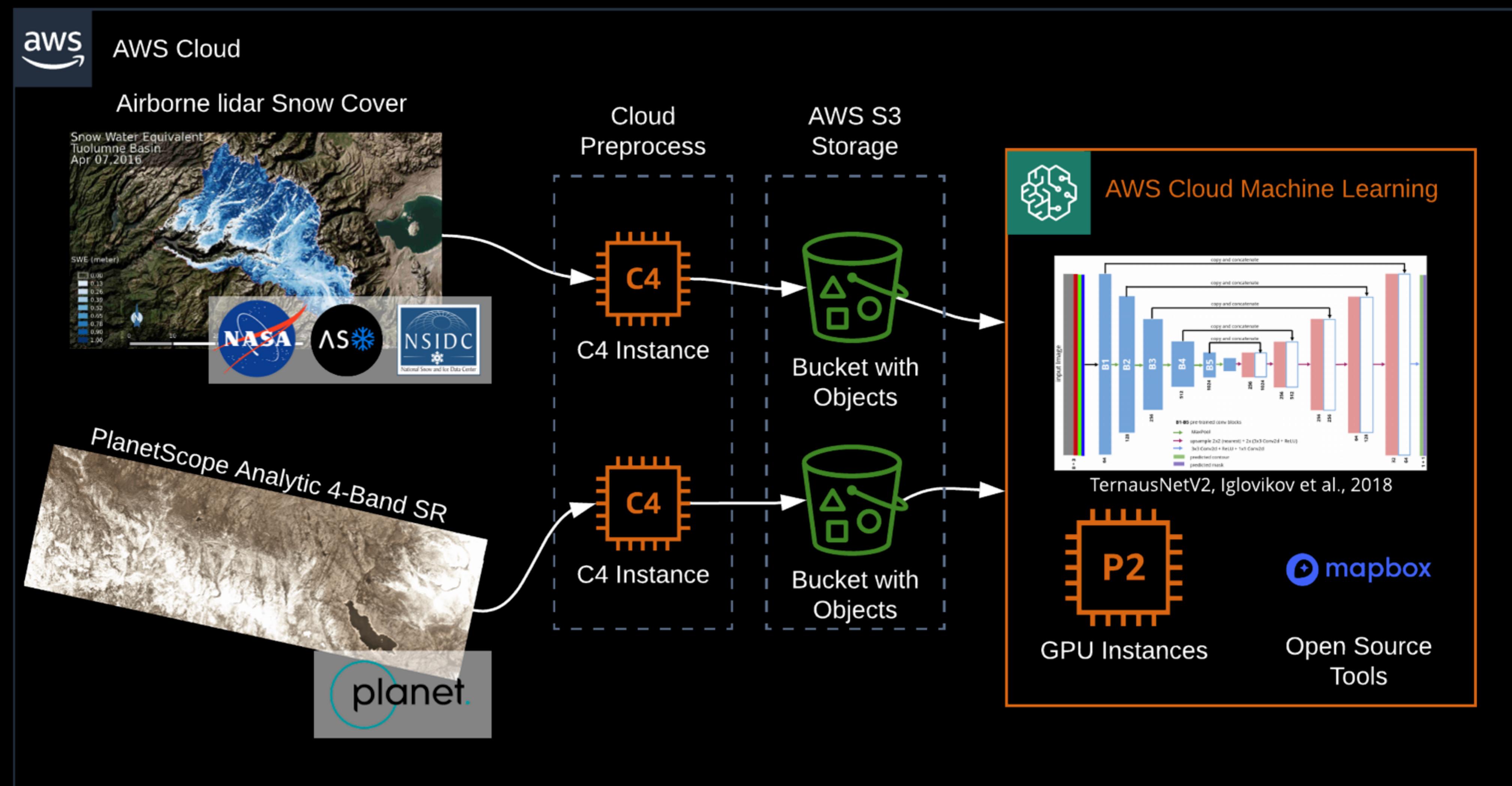


ML vs ASO.

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RESULTS



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APPROACH