Black Swift
TECHNOLOGIES

Agricultural Applications of UAS

August 15, 2018

Black Swift TECHNOLOGIES

Agricultural Applications for UAS

- BST currently working with Ag professionals and researchers to identify use cases.
- Three primary areas of focus:
  - Aerial Maps
  - Multispectral/Thermal Sensing
  - Soil Moisture Mapping

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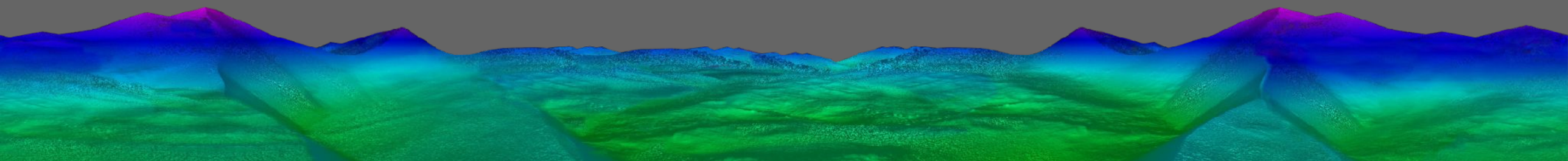
Visual Inspection

- 3D Surveys for drainage, and farm construction work.

- Aerial inspection for livestock tracking, storm damage assessment, and crop monitoring.



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NU-Aire

- Precision watering systems exist, but data to inform watering patterns is scarce
- Working on early detection of water stress in plants on a very small grid.
- Results of the work show that UAS has to be part of a larger strategy:
  - Grid sampling
  - Local knowledge
  - Targeted application

Micasense RedEdge Multispectral Camera

FLIR Tau 2 IR Camera

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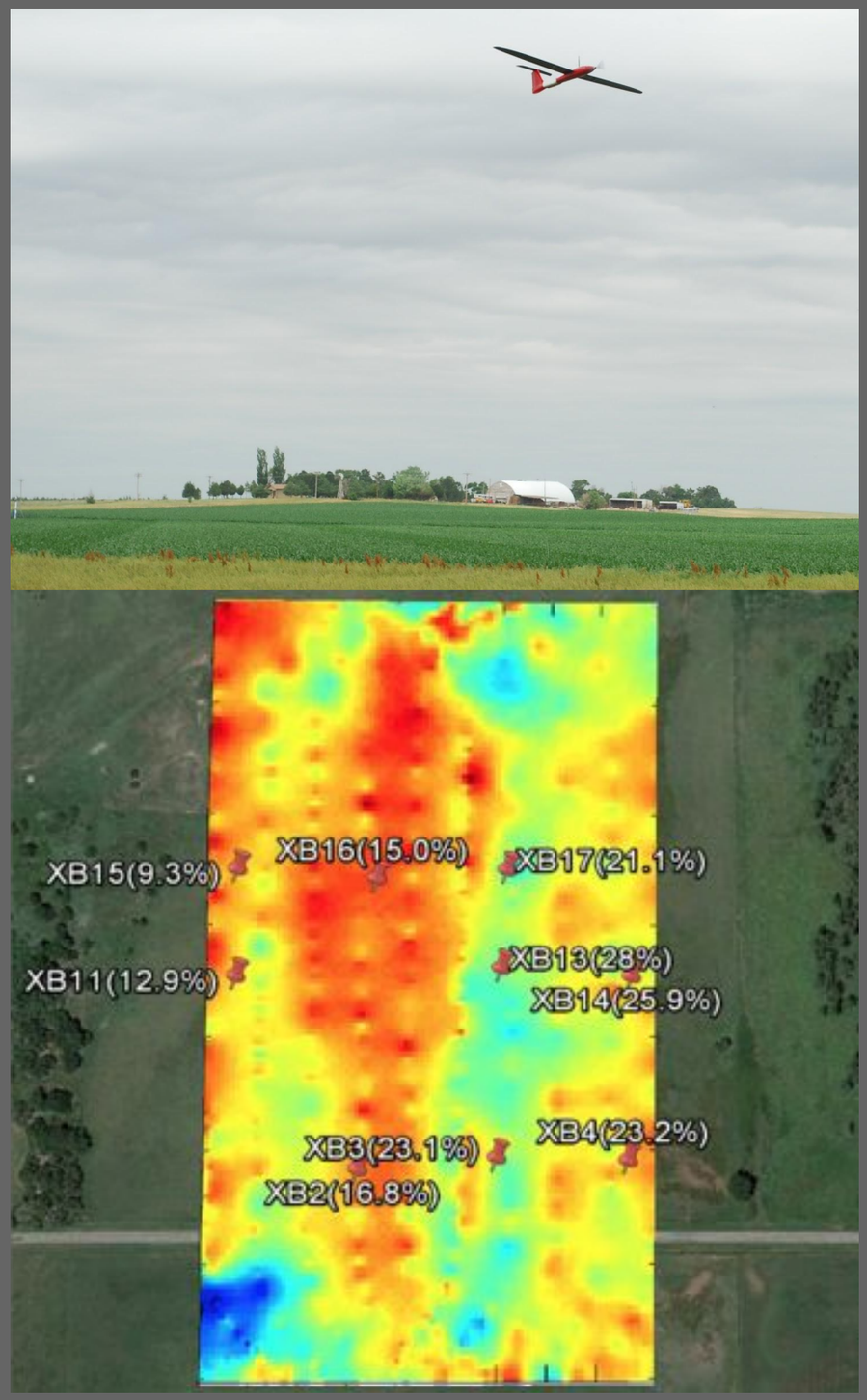
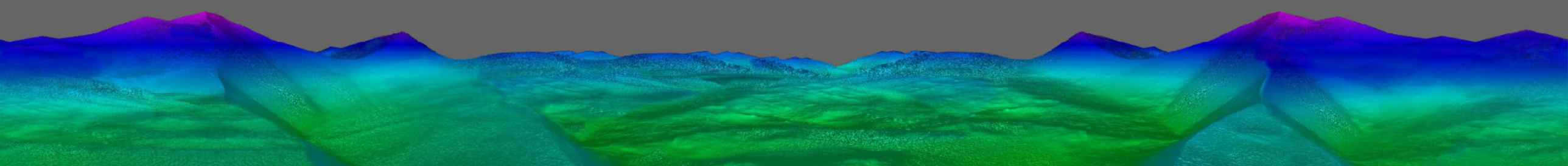
SOIL MOISTURE

- NASA SBIR NNX14CG09C
- Technical Monitor: Geoff Bland, GSFC

- L-band radiometer developed and tested under NASA SBIR
- Capable of measuring soil moisture content up to 5cm below ground
- 600 acres per flight
- Preliminary results correlate with in situ probes
- 12 successful missions flown with S2 at 4 different sites.





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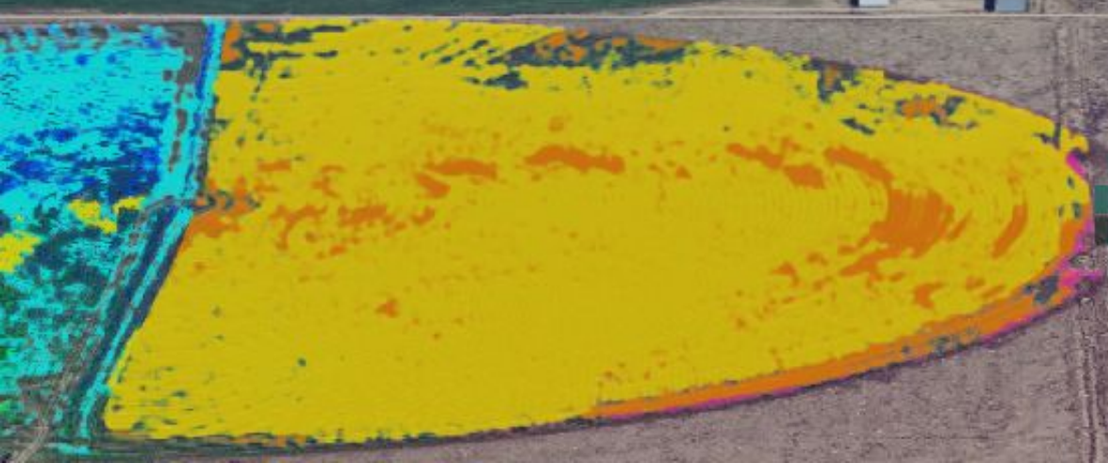
CET Center for Environmental Technology

NASA

Soil Moisture Mapping sUAS

The Measurement Solution for Scientific, Agricultural, and Emerging Applications

Coverage Per Aircraft	
at 15m Resolution	1 km^2 (247 acres) per hour
at 30m Resolution	2 km^2 (494 acres) per hour



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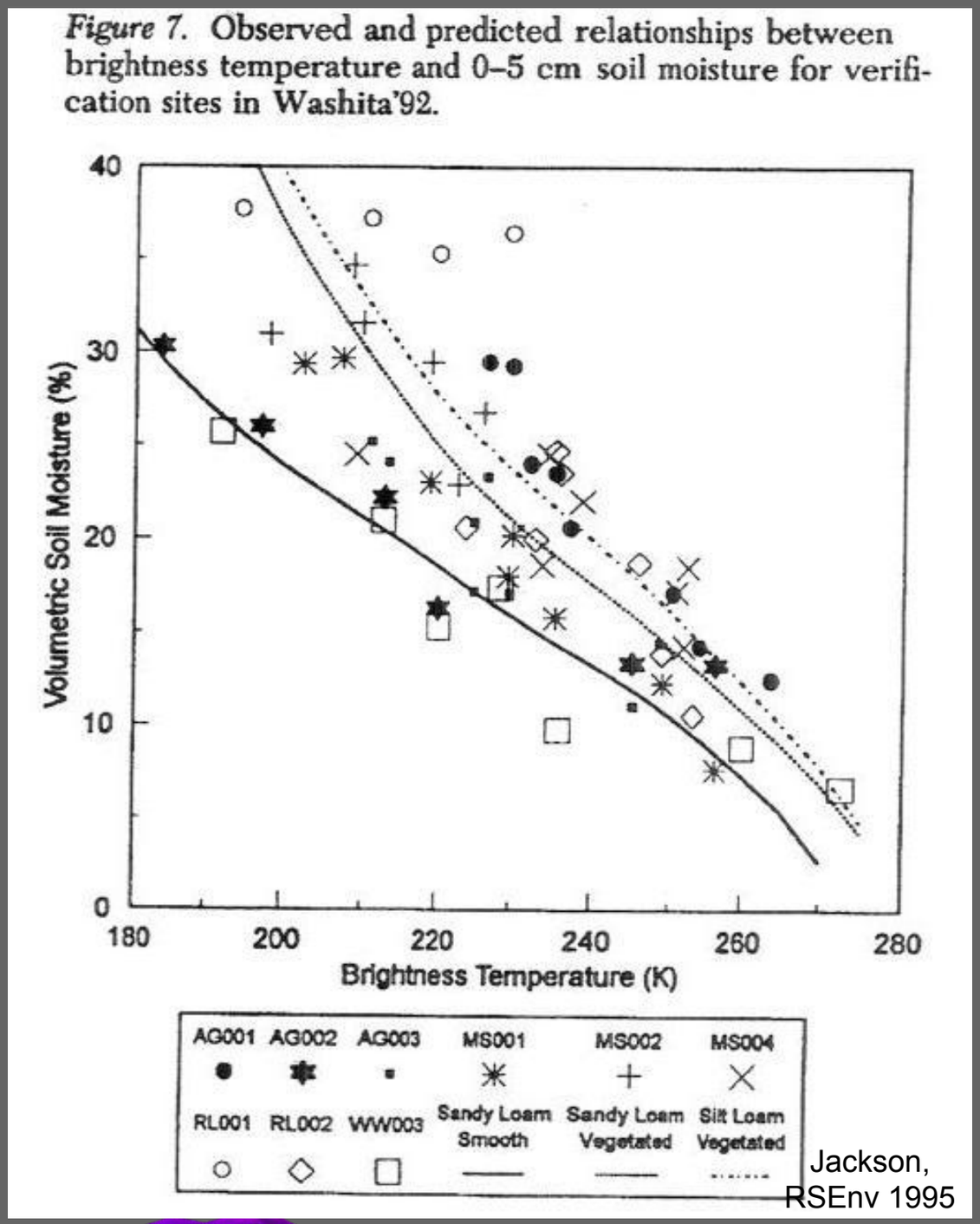
SMM: The Science



Jackson, RSEnv 1995

- Strong correlation for different soil types.
- RMS error of ~3% VSM achievable with vegetation and surface correction.
- 5cm depth.

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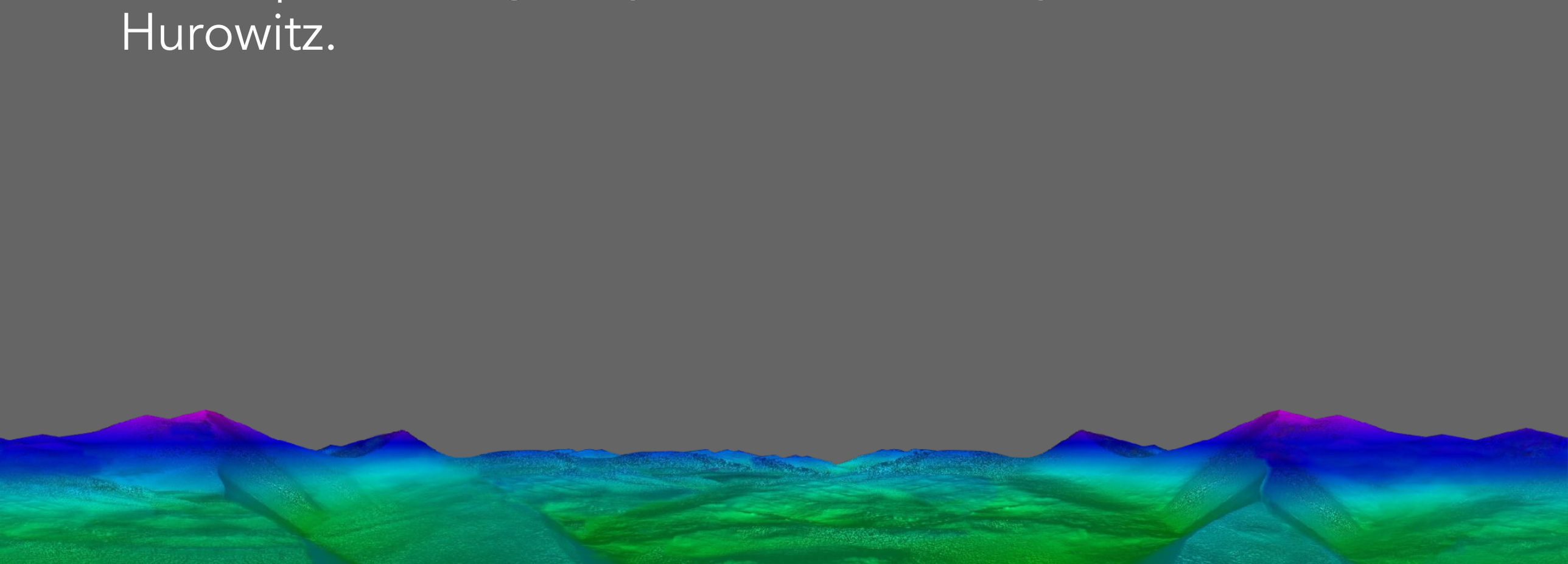
SMM: The Science

- L-band radiometer developed for soil moisture (and sea surface salinity) mapping.
- Uses a unique radiometer front-end design to ensure high sensitivity and stability and rejection of horizontal RFI though a lobe-differencing correlation technique.
- In third revision, original PCB layout by Vladimir Leuski, subsequent designs by Al Gasiewski, Eryan Dai, and Mike Hurowitz.



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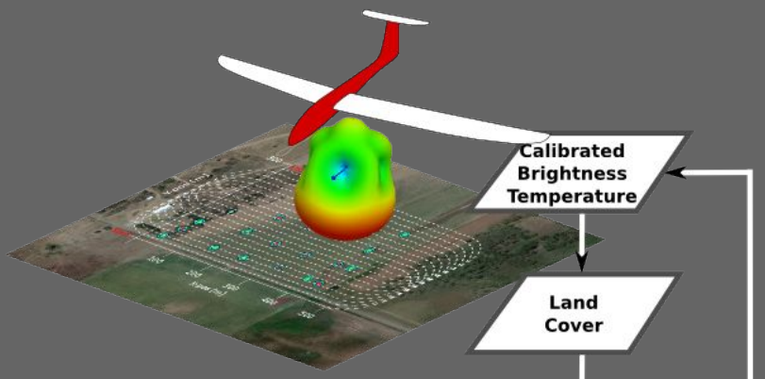
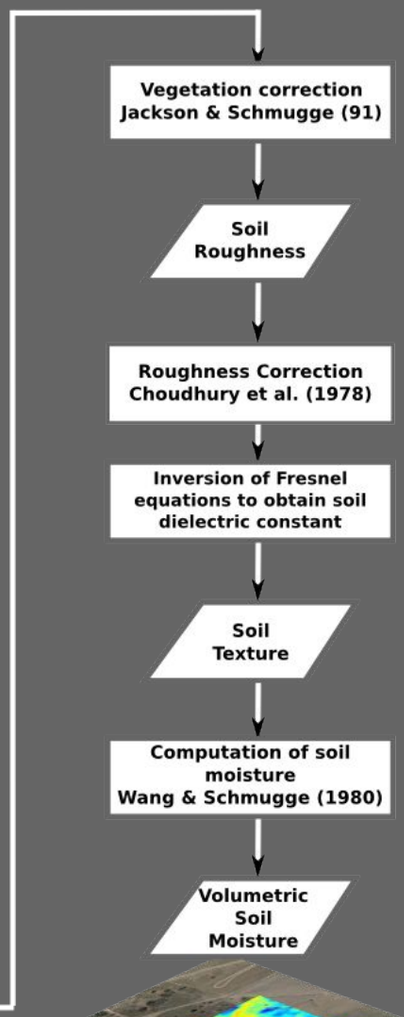
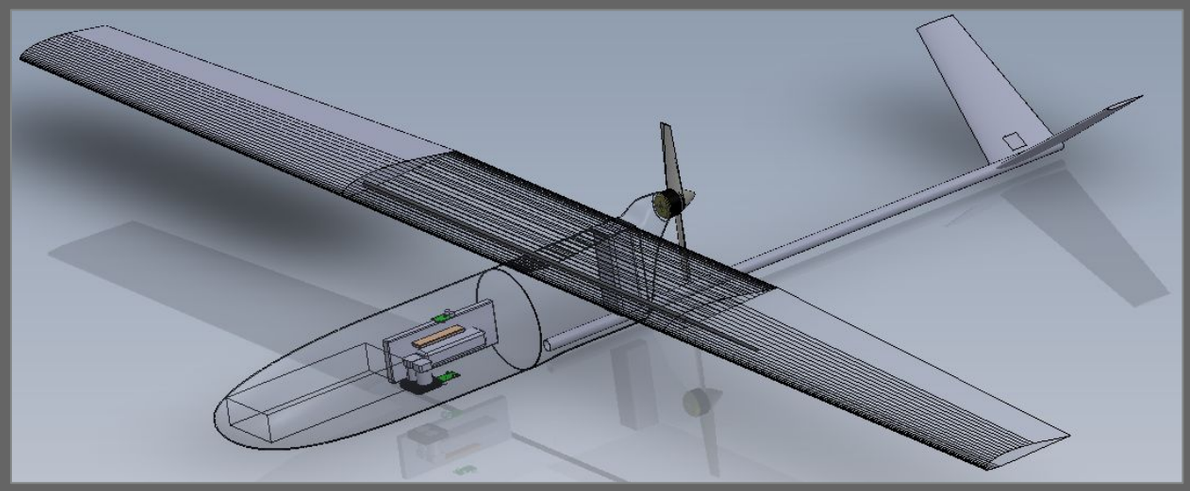
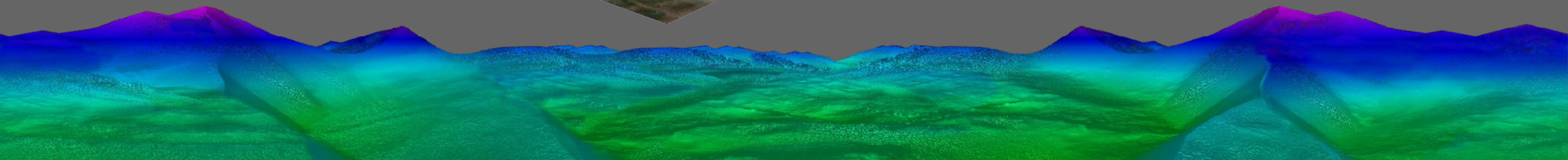
SOIL MOISTURE MAPPING









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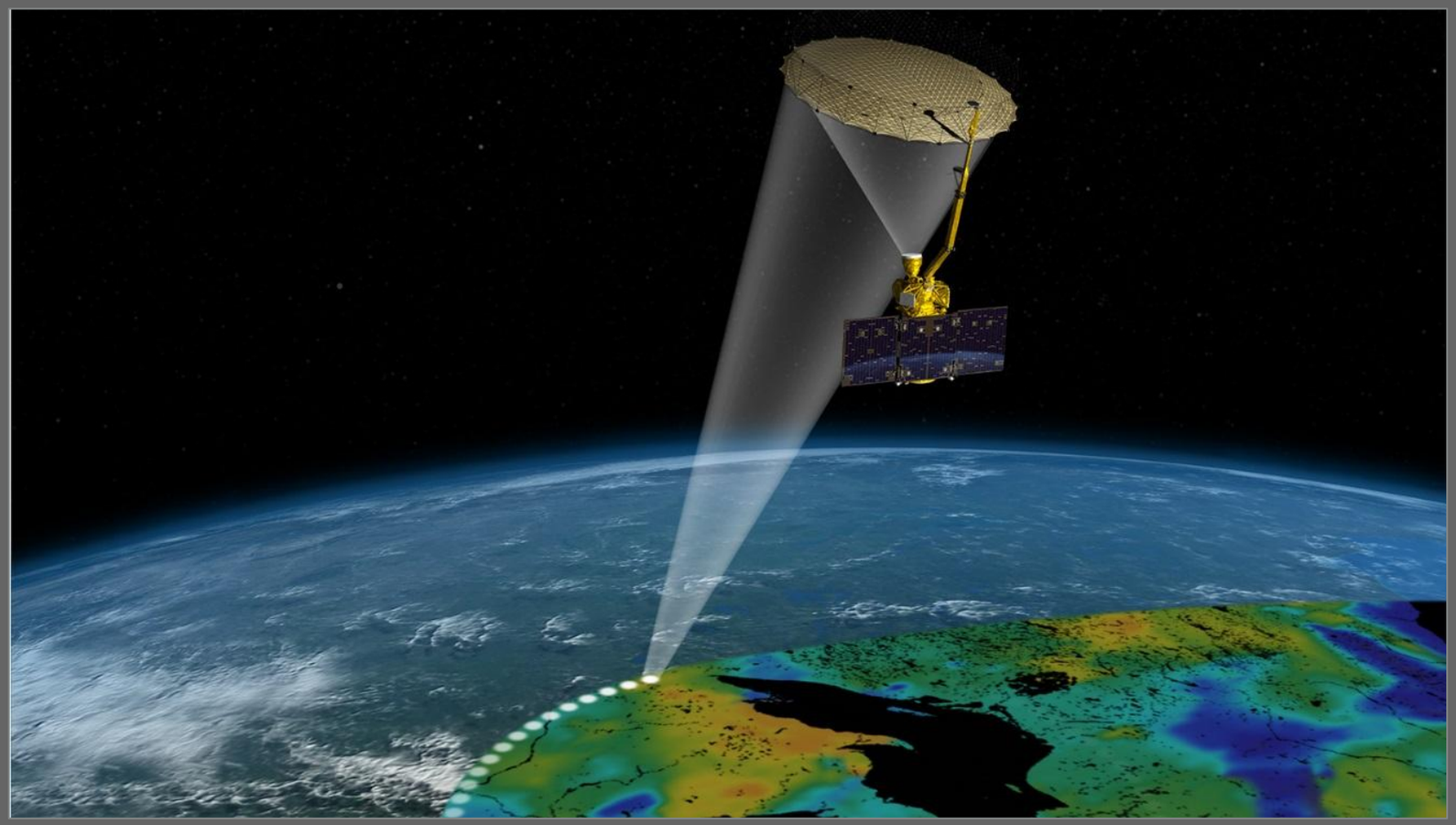
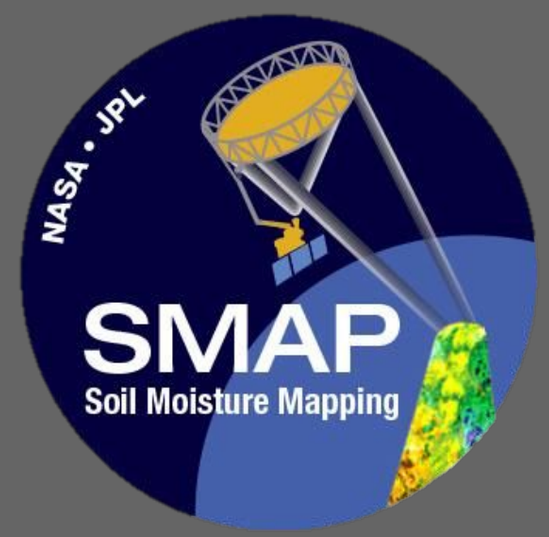
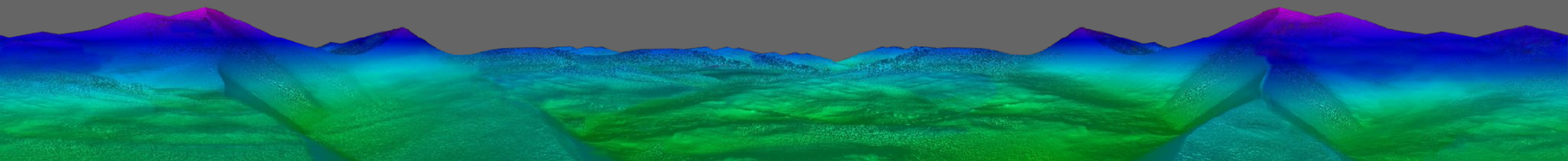
Applications

Scientific Research







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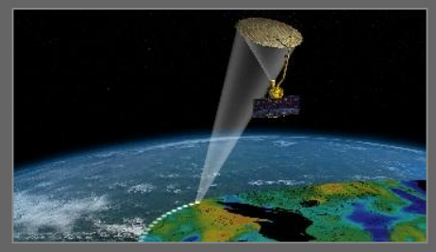
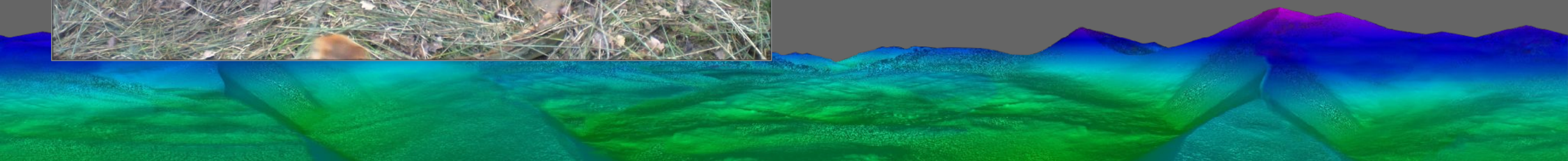
Applications

Scientific Research

Soil Integrity





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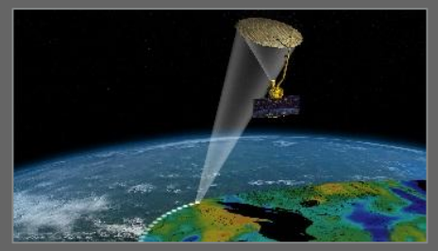
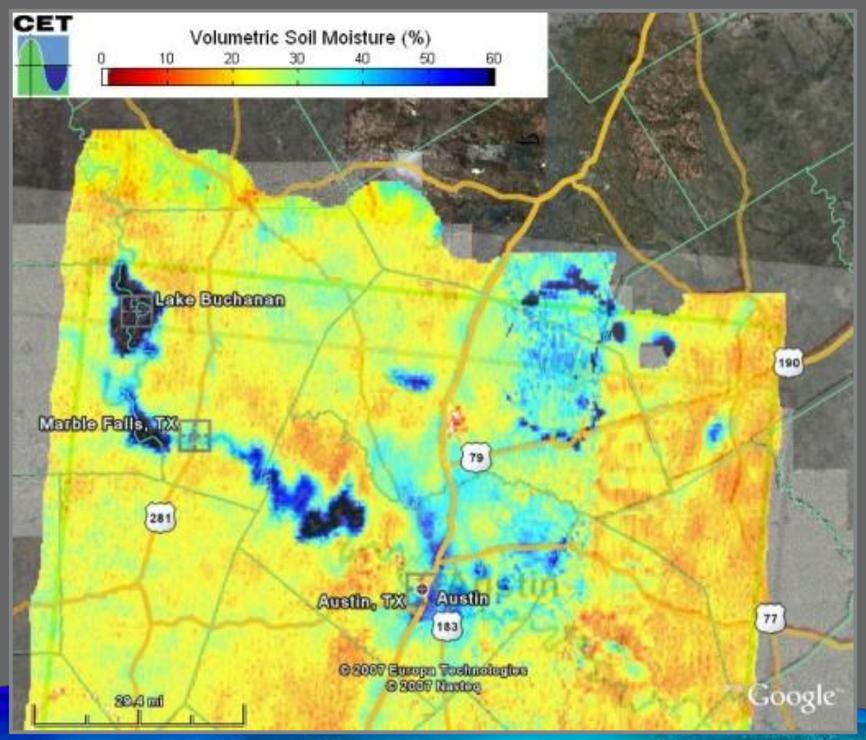
Applications

Scientific Research

Soil Integrity

Flash Flood / Land Slide





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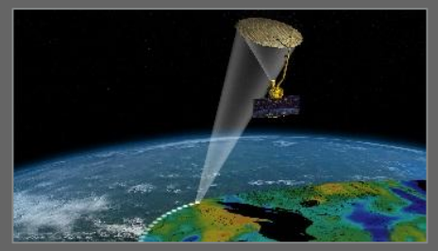
Applications

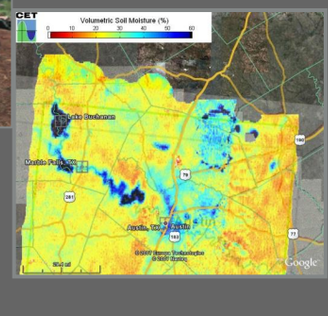
Scientific Research

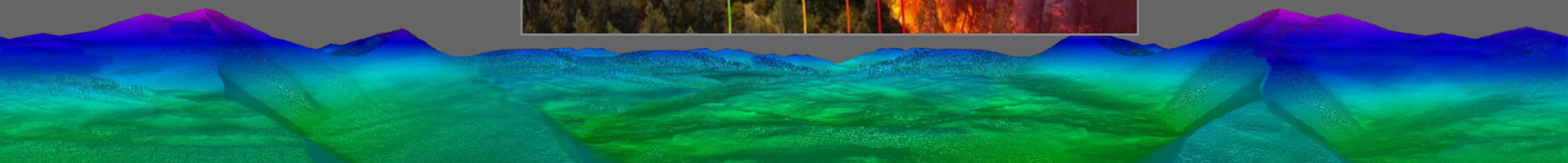
Soil Integrity

Flash Flood / Land Slide

Wildfire



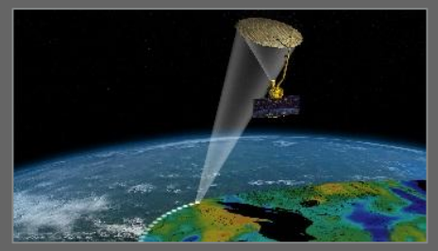


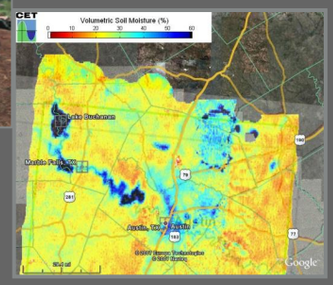


Black Swift TECHNOLOGIES

Applications

- Scientific Research
- Soil Integrity
- Flash Flood / Land Slide
- Wildfire
- Agriculture





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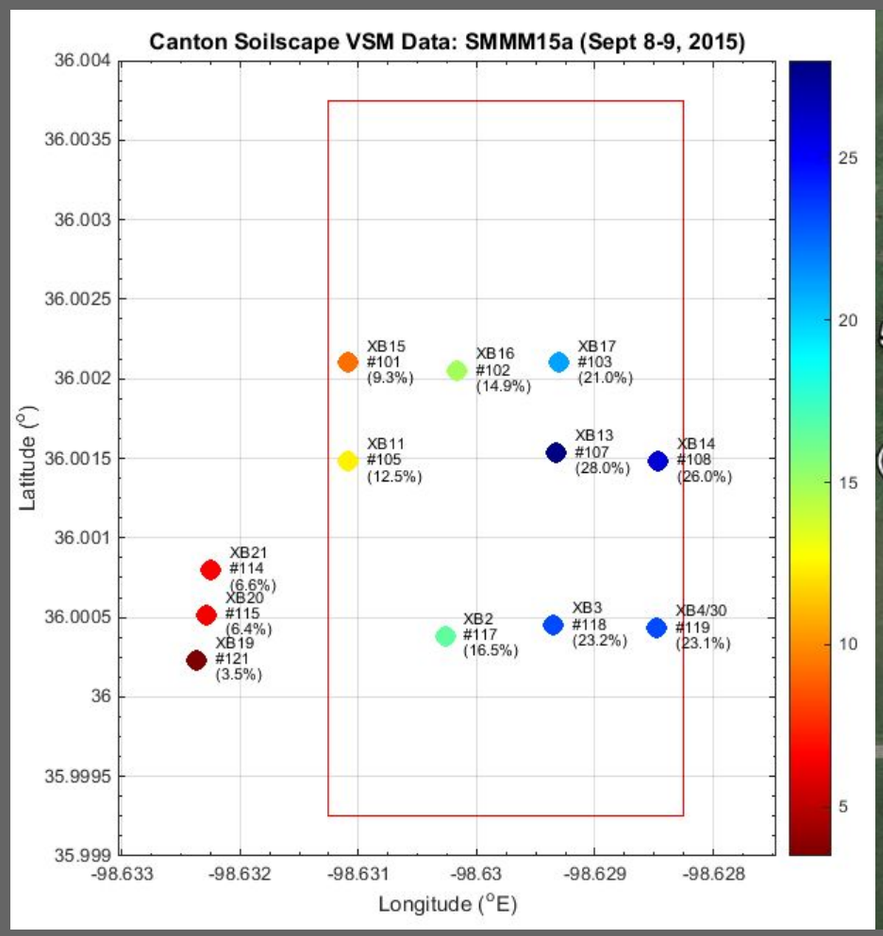
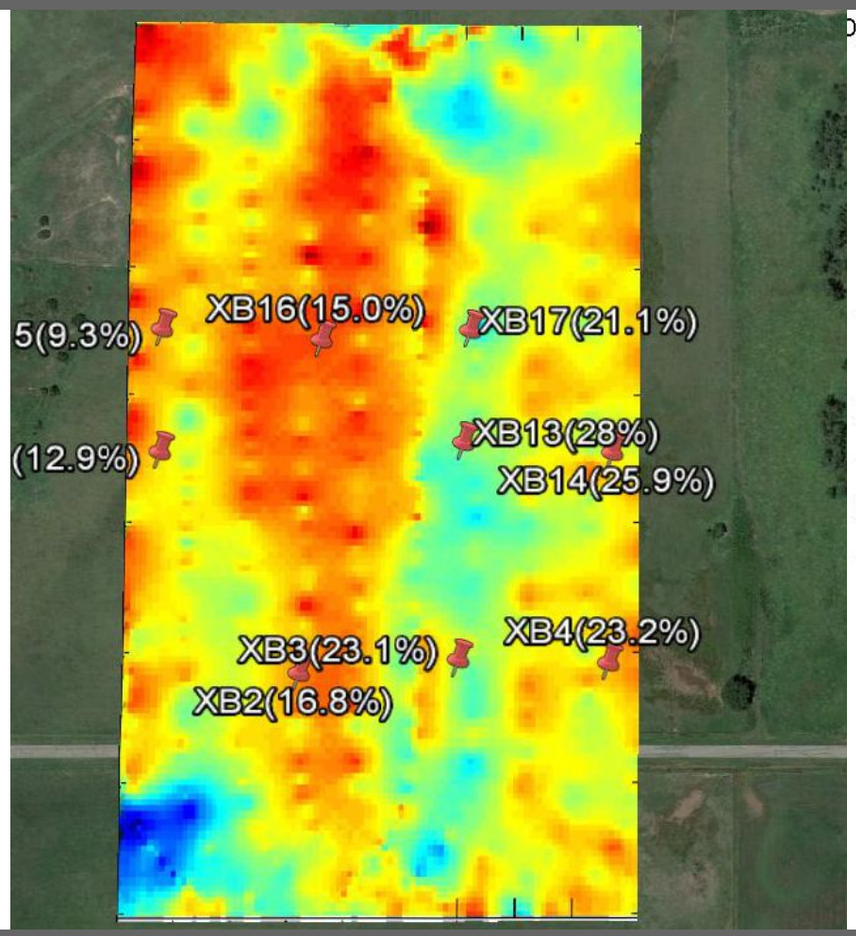
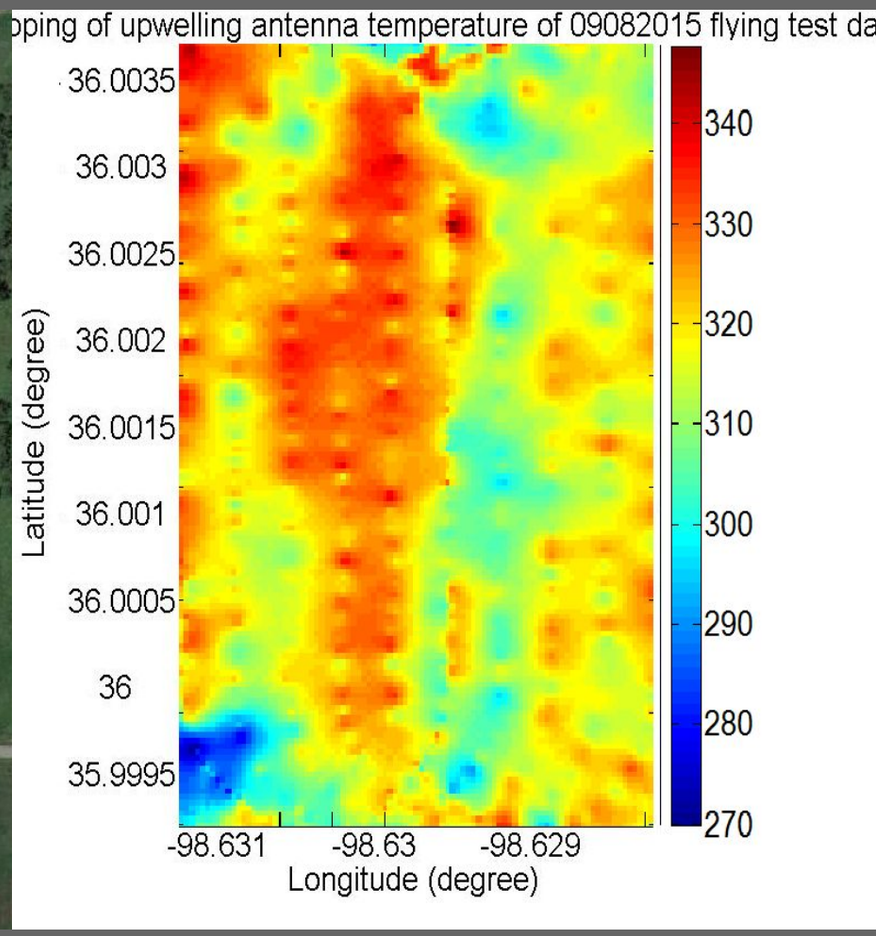
Canton, OK Deployment







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