Stony Brook University

Testing the Incorporation of Portable Infrared Imaging for Future Human Missions

Second Year of Field Work

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Preparation for Future Human Missions to Planetary Bodies

Rapid, in situ analyses of rocks and soils hold great scientific potential during human exploration

Test the performance and applicability of candidate instruments on terrestrial analogs

This study:
Test the applicability of portable infrared multispectral imager

Sampling Workflow

Reconnaissance	Acquire Images before sampling by the crew
Confirmation	Determine the representativeness of samples in the scene
Identification	Find possible unsampled targets for future sampling
Documentation	Record spatial relationships between compositional units

Field Site

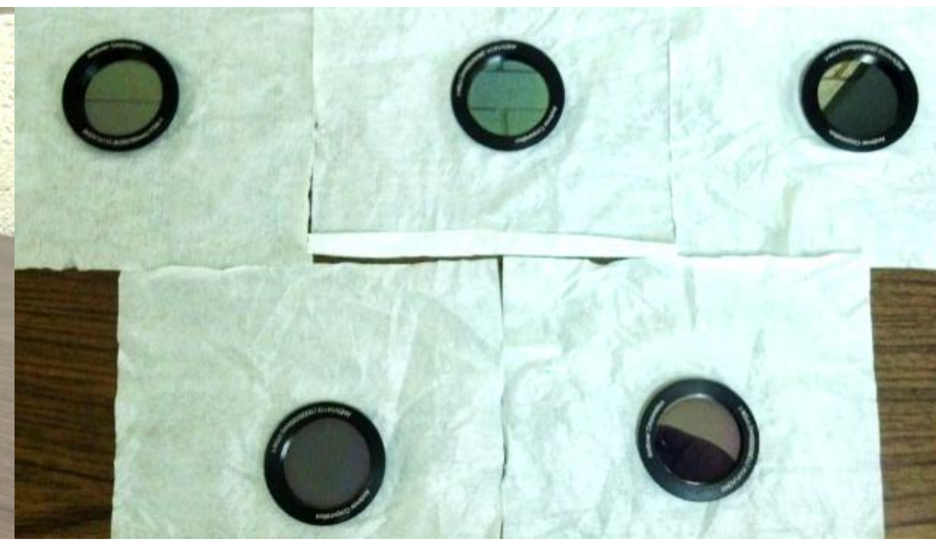
December 1974 Flow in Kilauea Volcano, Hawaii

Multispectral Imager

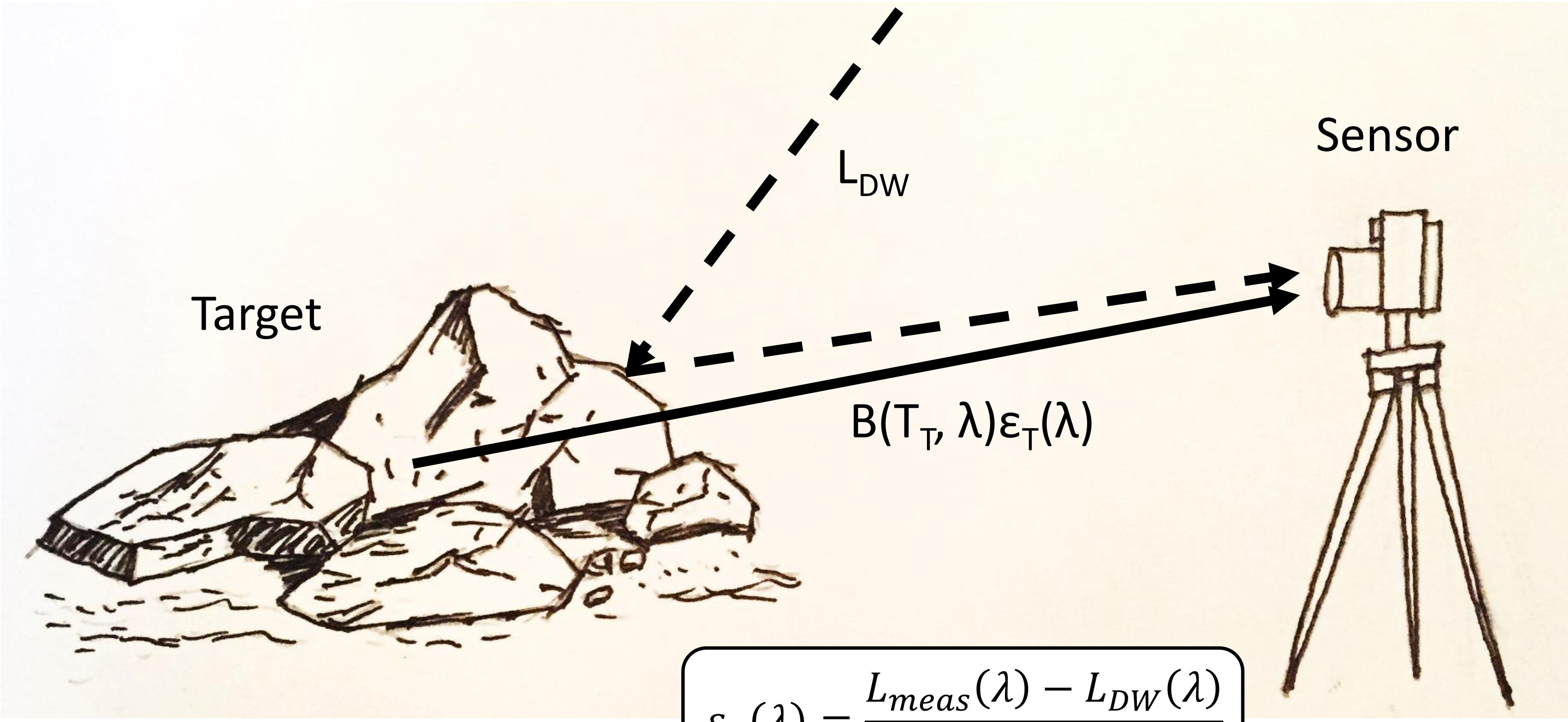
FLIR T-640 Thermal Imager modified with custom filters

Transmitting wavelengths: 8.3, 8.6, 9.1, 10.3, and 11.3 µm

(1204.8, 1162.8, 1098.9, 970.9, 885.0 cm^{-1})

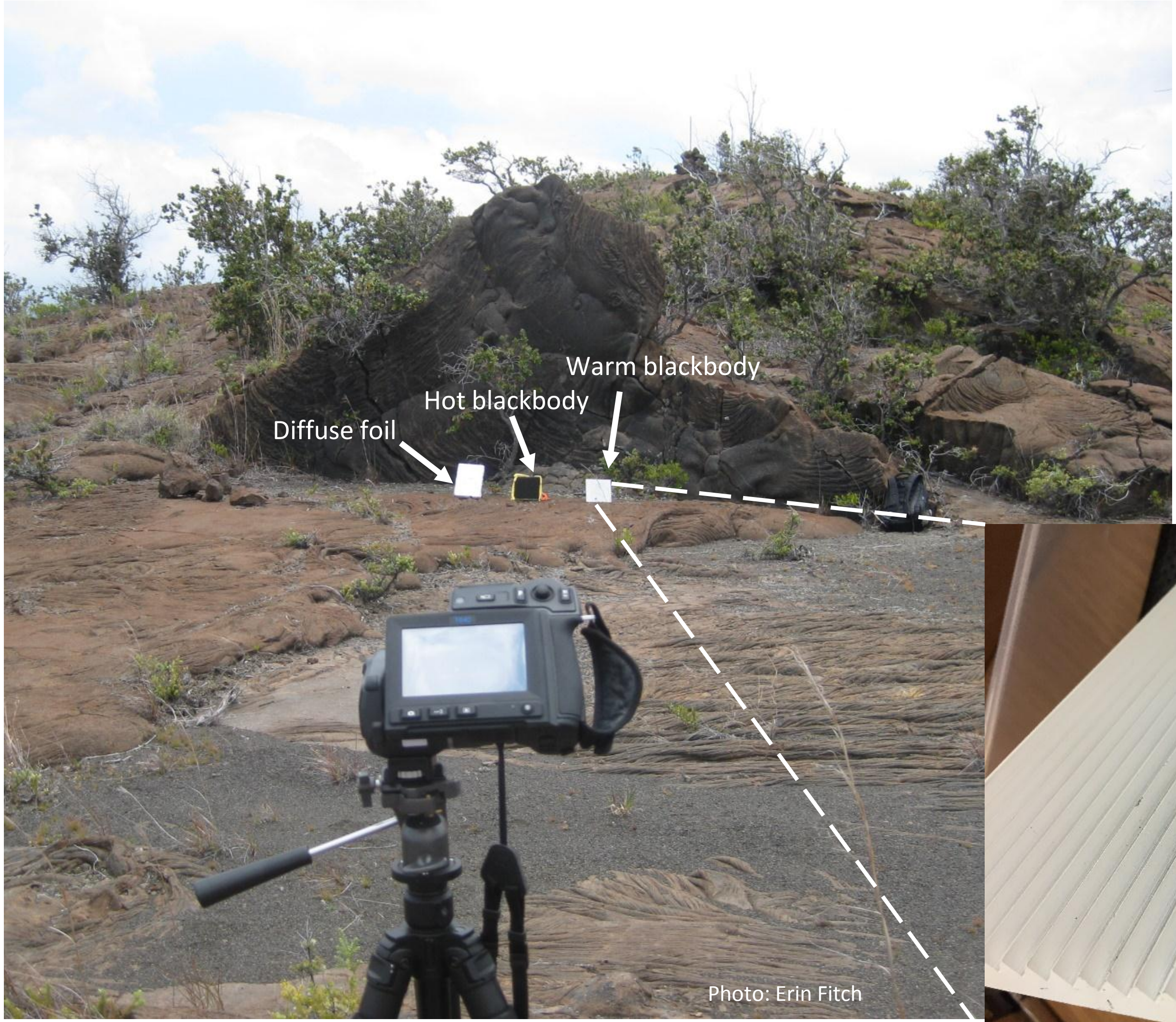


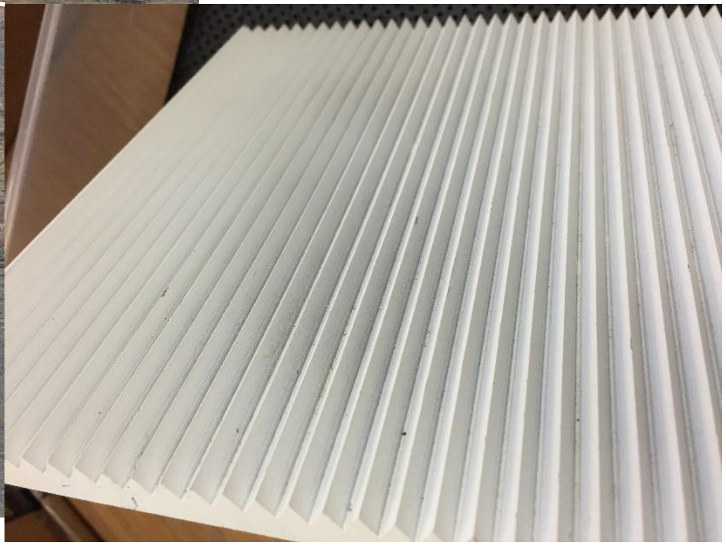
Emission Spectroscopy



$$\varepsilon_T(\lambda) = \frac{L_{meas}(\lambda) - L_{DW}(\lambda)}{B(T_T, \lambda) - L_{DW}(\lambda)}$$

Image Acquisition

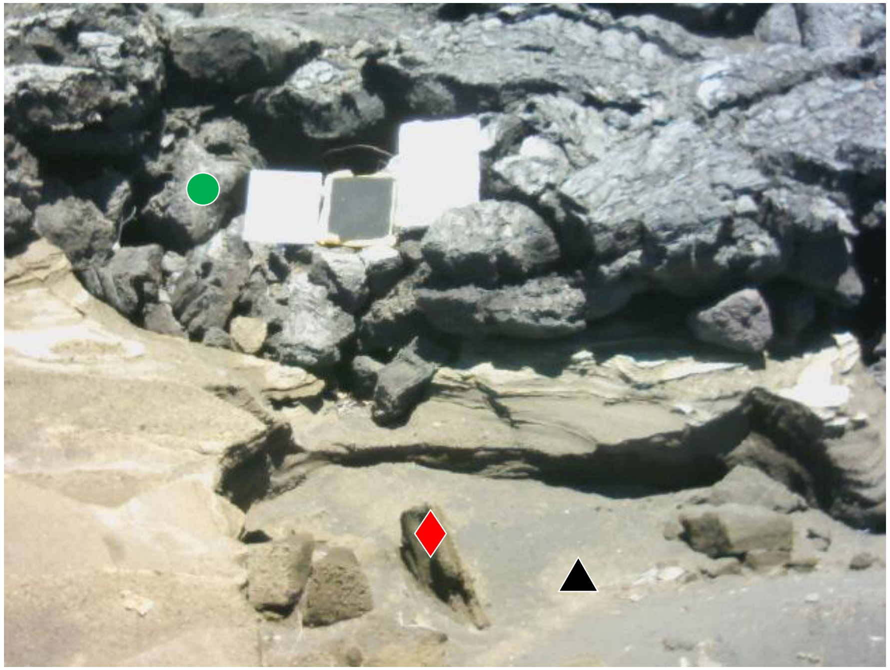


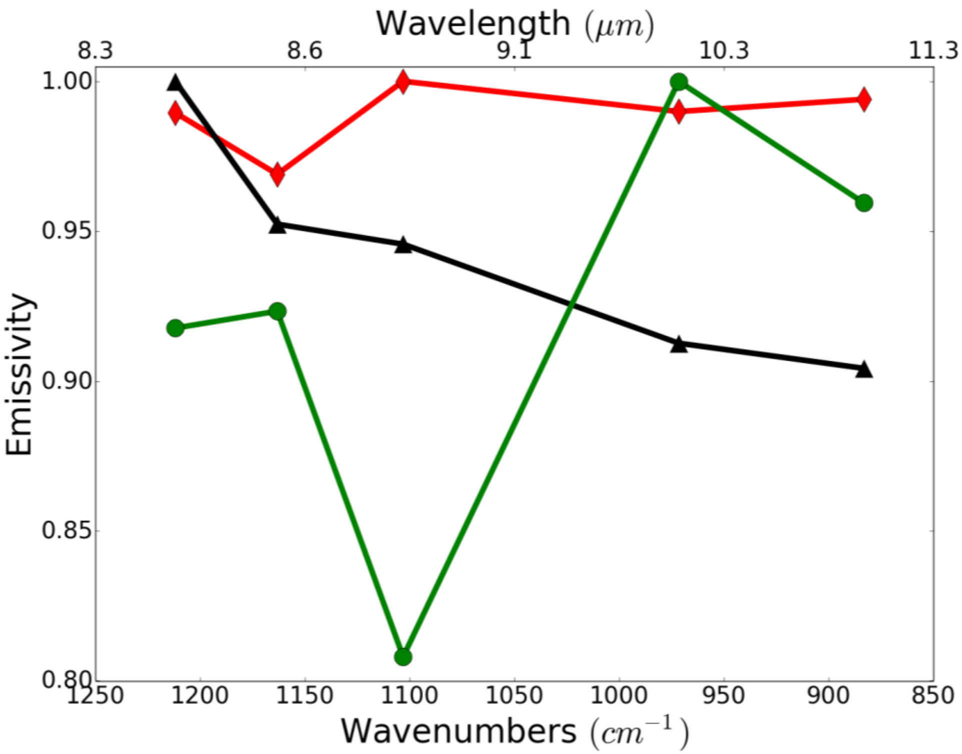


1. Place calibration targets in the scene
2. Mount FLIR camera on tripod
3. Manually change filters
4. Acquire images

Image Calibration

Compositional units are distinguished from spectral differences

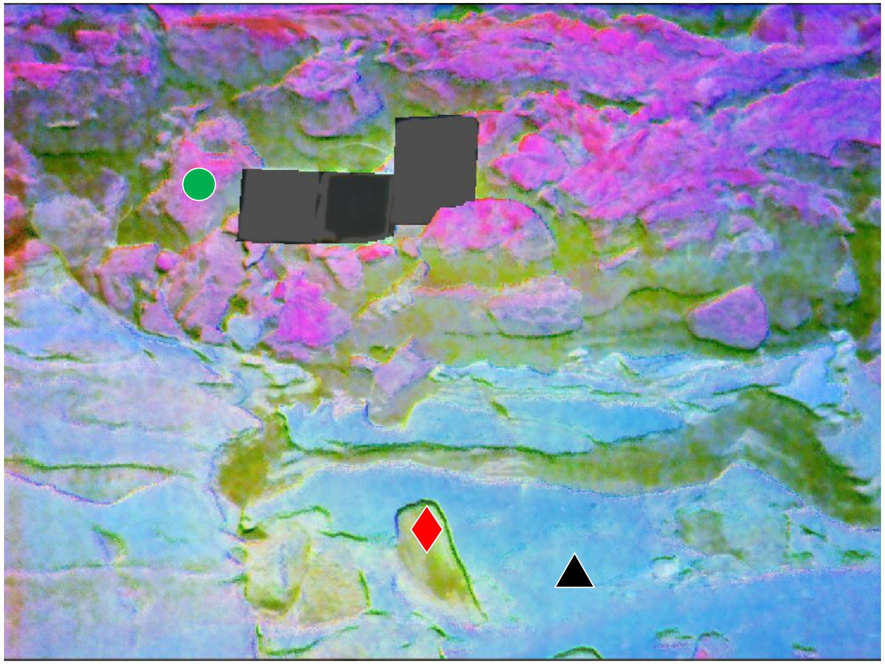


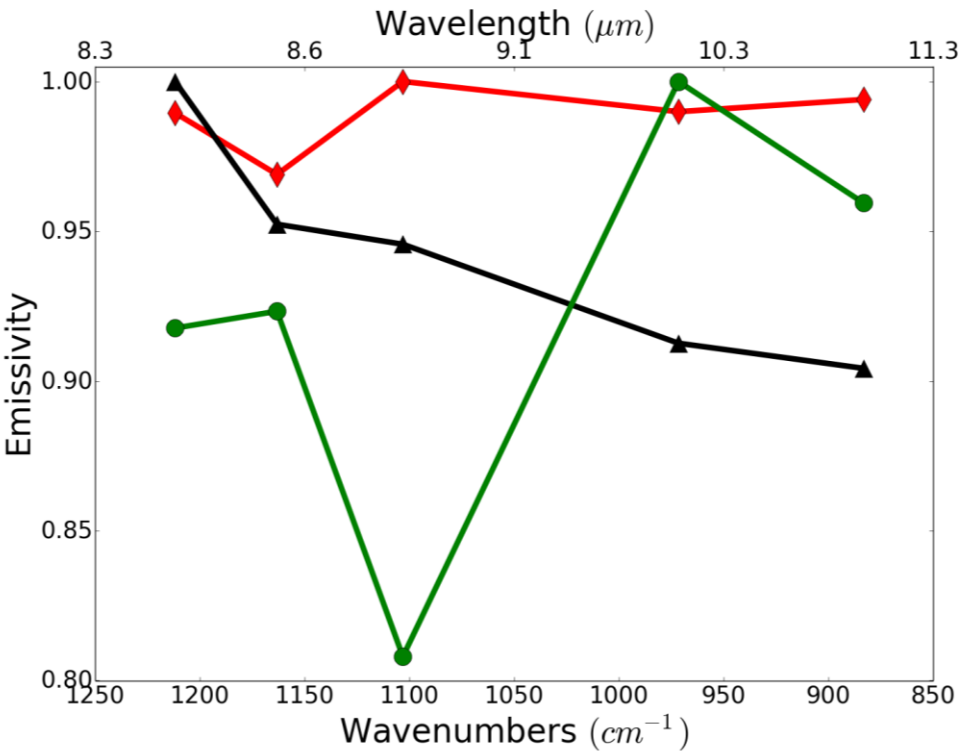


● Pahoehoe Basalt ♦ Consolidated Ash ▲ Soil

Image Calibration

Compositional units are distinguished from spectral differences





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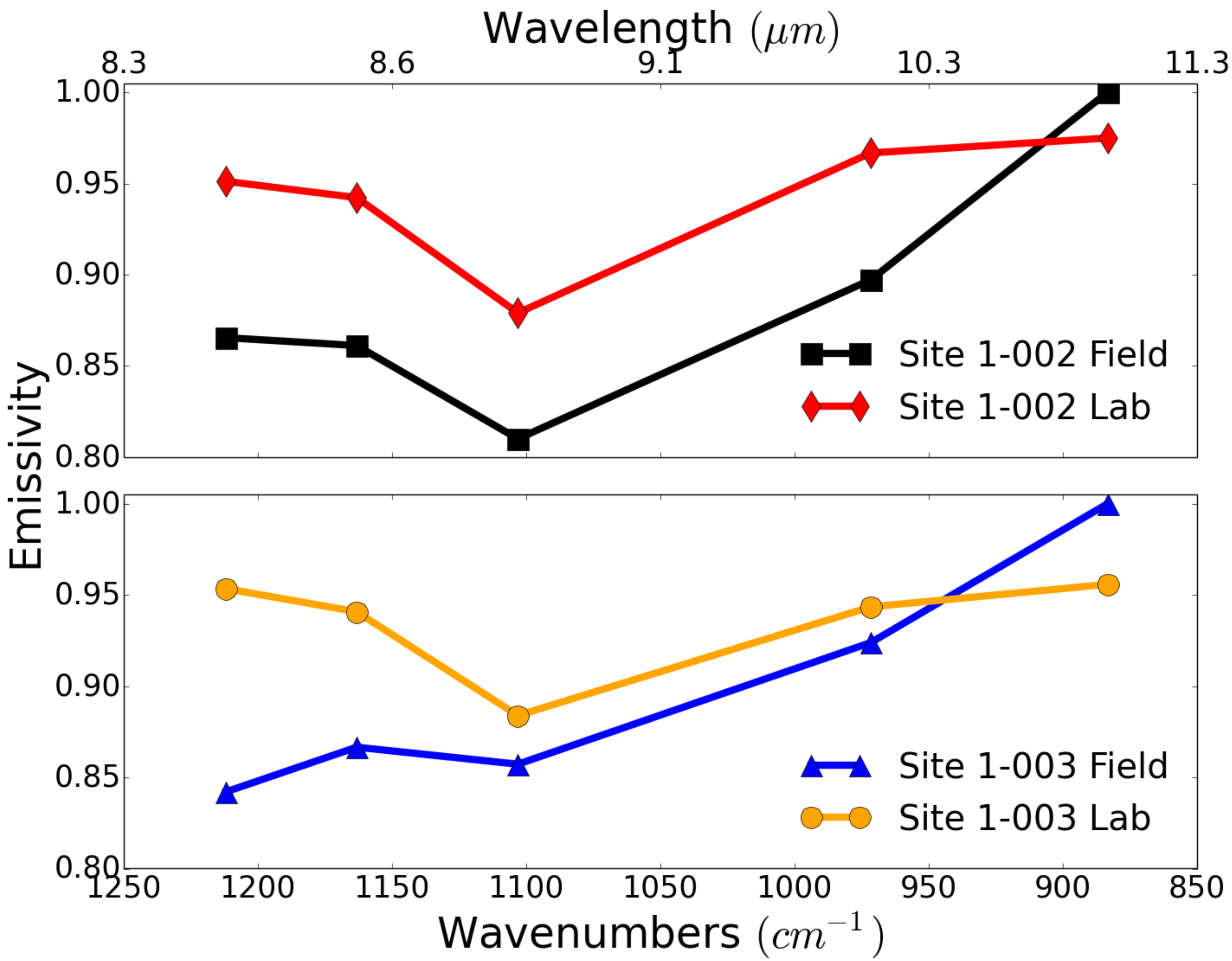
Lab Comparison



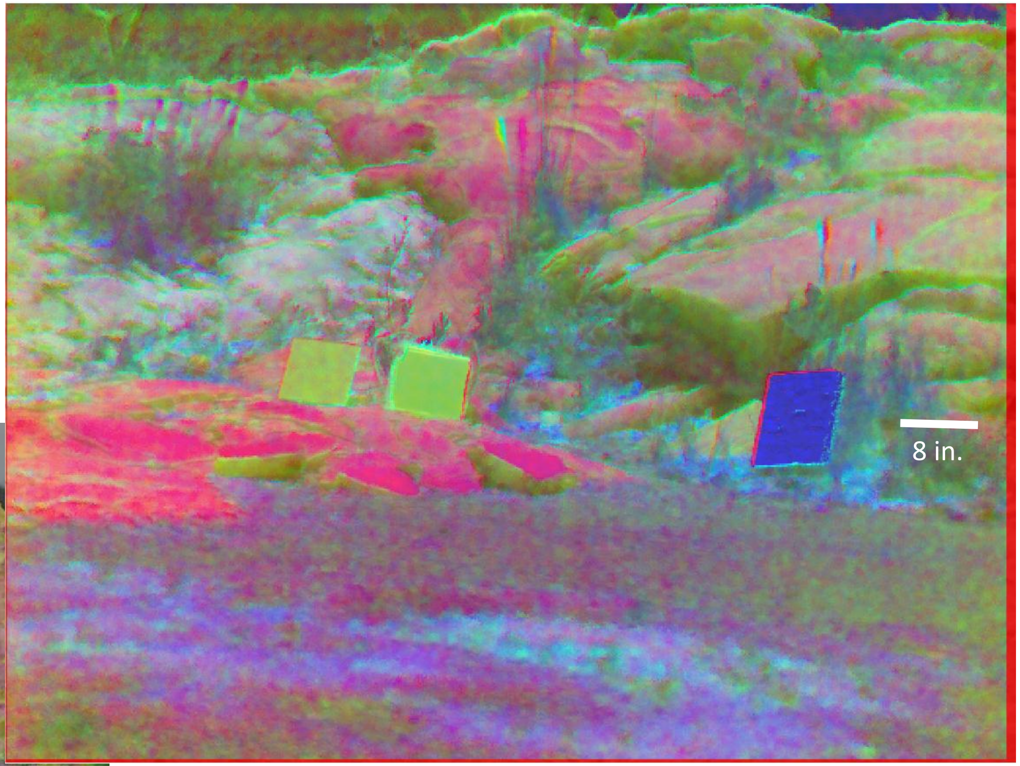
Spectral shapes are consistent

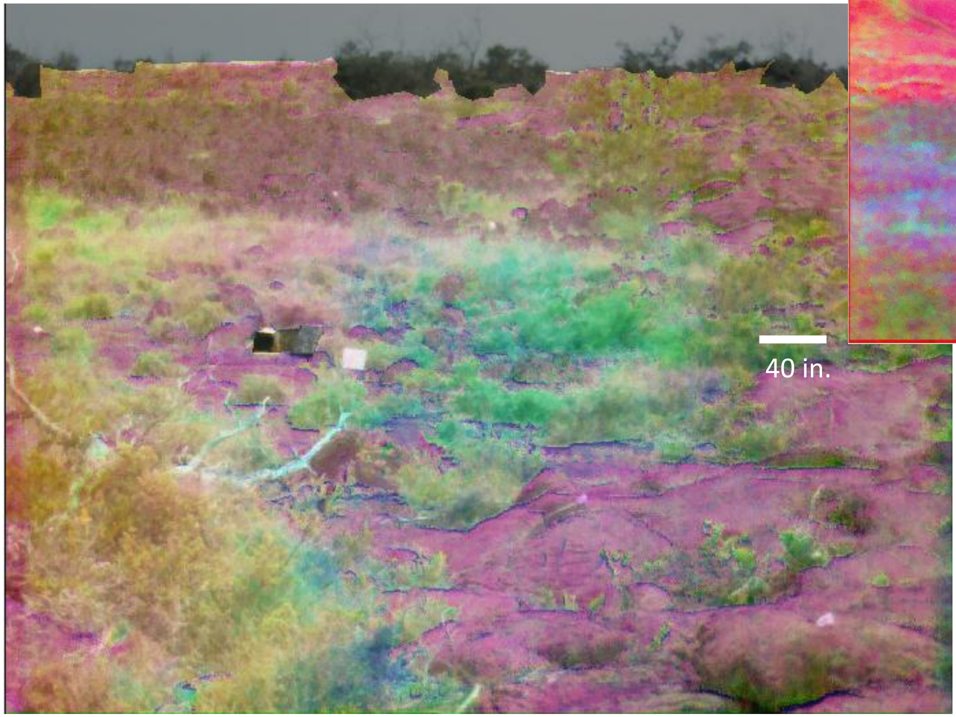
Band depth does not always match

- Likely due to environmental effects

Optimal Field of View

Difficult to cover a wide area and still keep high resolution





Close: 6 – 8 meters

Far: ~ 30 meters

Sample Markers

No perfect way to mark the location of sampling

Conclusions

1. We obtained better experience in using the multispectral imager:
    - Improved data acquisition
    - Improved data processing
    - Improved understanding of its role in sampling workflow

2. Environmental conditions (e.g. time of day, temperature of rocks) need to be considered for highest quality products

3. Assessing the final usefulness of multispectral imager requires more field test

Acknowledgements

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RIS^{4}E Theme 2
members

Photo: Anthony DeNicola, Ali Sundermier
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Thank you
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USGS
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