

Application of Unsupervised Deep Learning for Smoke Plume and Active Fire Identification

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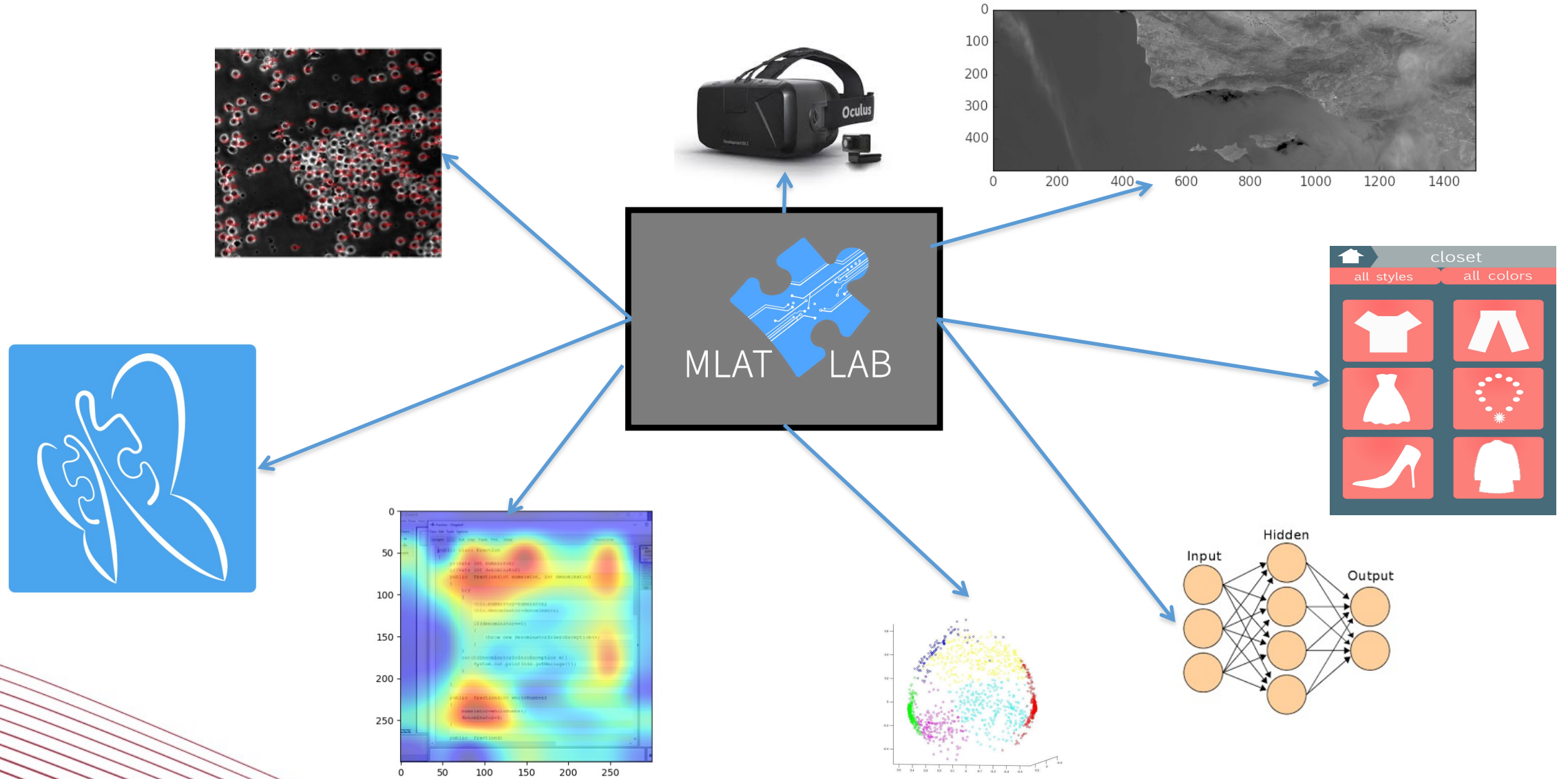
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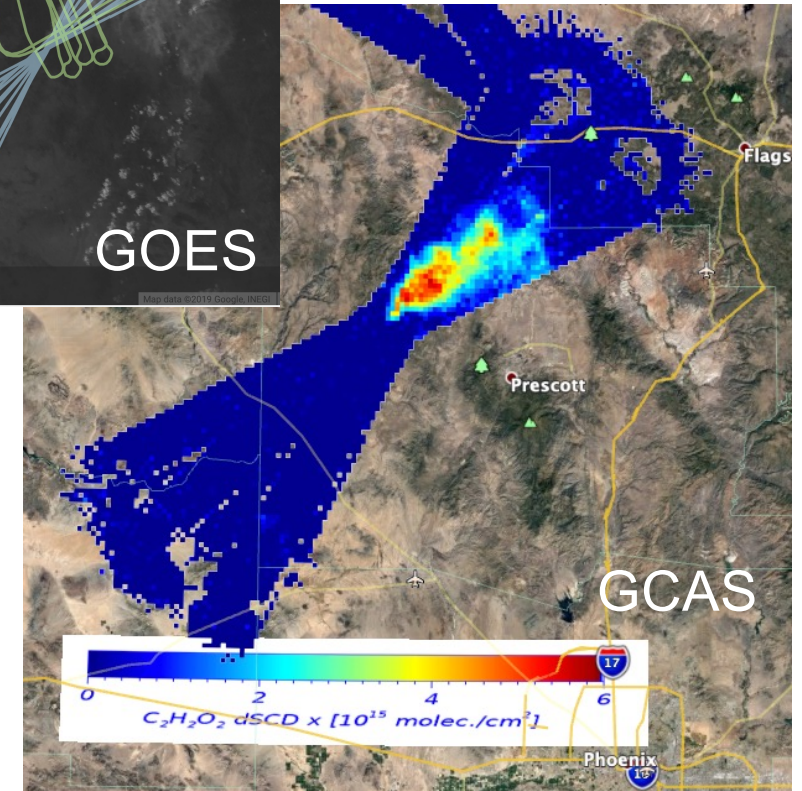
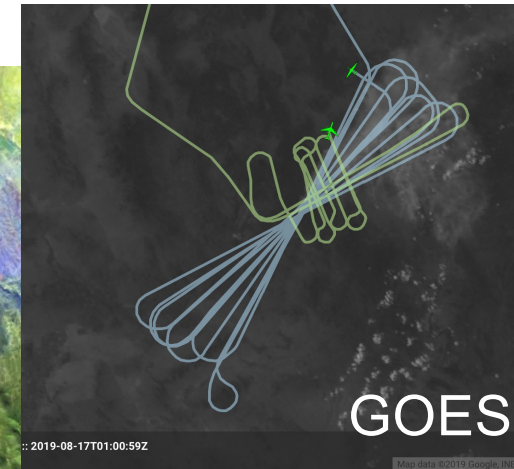
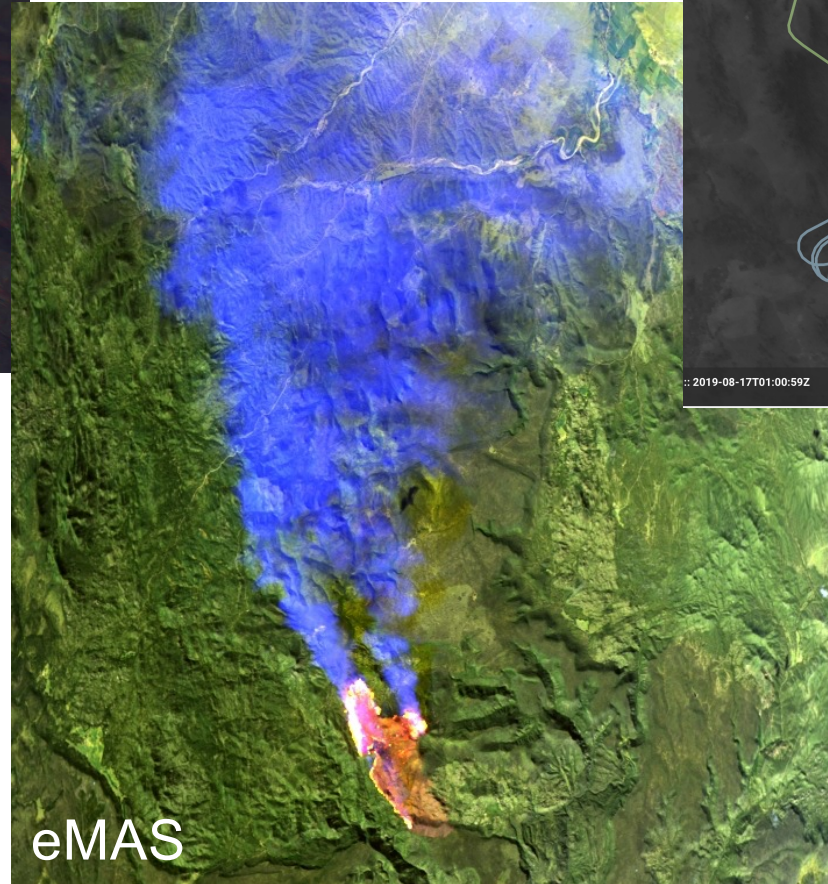
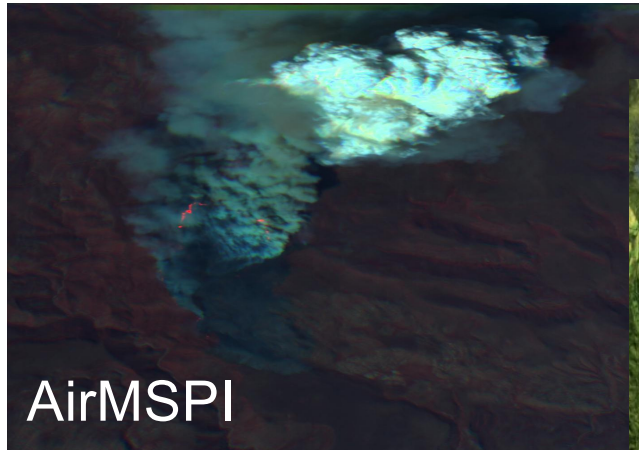
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Background

Remote Sensing Views of the Sheridan Fire from FIREX-AQ (16 August 2019)



Background

Vision for the Future

- Sensor Web
 - Ways to use the data generically
 - Automatic recognition of latent patterns
 - Simple combination of information
 - Tiered, interconnected view of data
- Issues
 - Different resolutions/grids
 - Instrument-specific modalities
 - Complexity increases with more data



Current Application: Detection of Smoke Plumes and Active Fires

Foundation for multi-modal/multi-sensor object detection and tracking

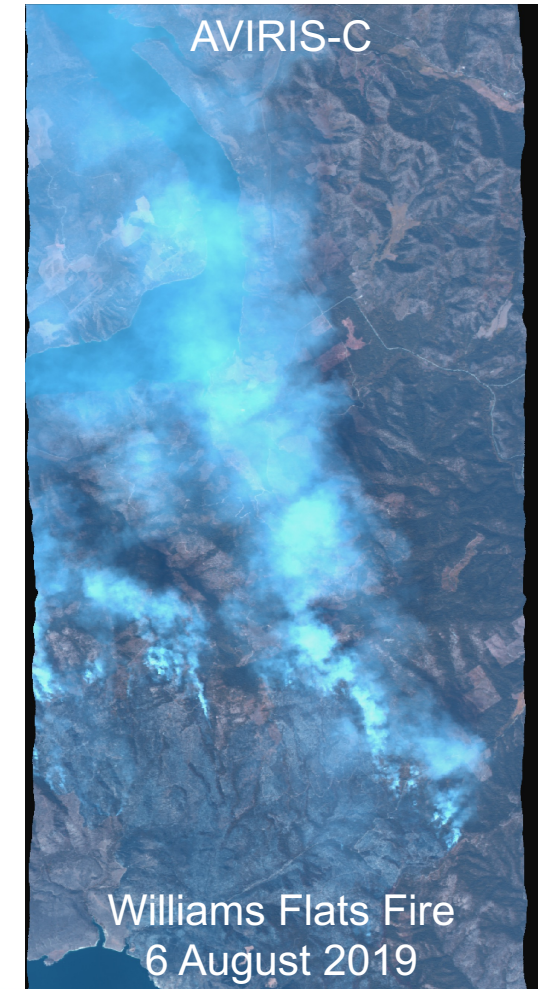
- Needs

- Fire and smoke products are available from some instruments
 - Not easily accessible
 - Different data formats, content, structure
 - Not interoperable
- Instrument specific implementation

- Issues

- Confusion with clouds
- Limited fire identification

- Methodology to make data more “plug-and-play”



Current Application: Detection of Smoke Plumes and Active Fires

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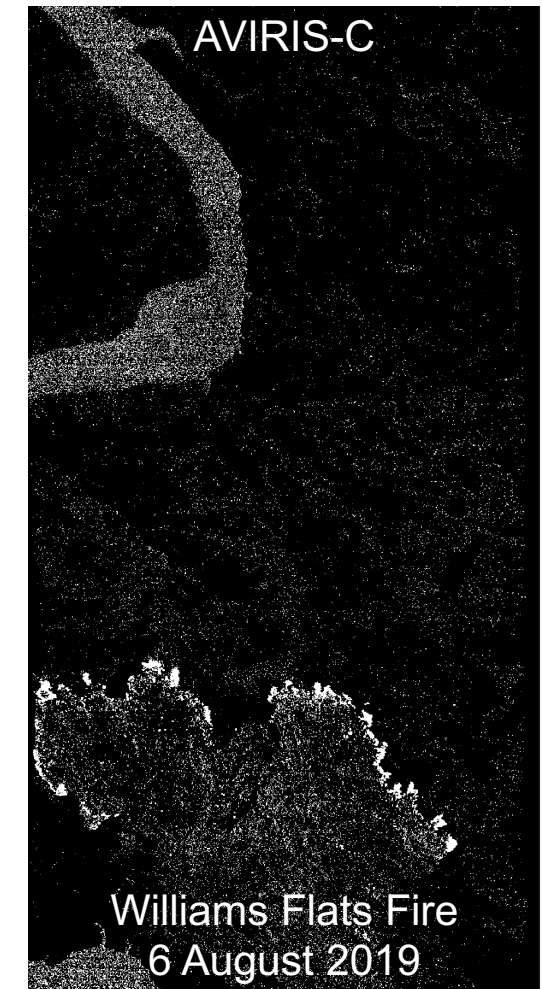
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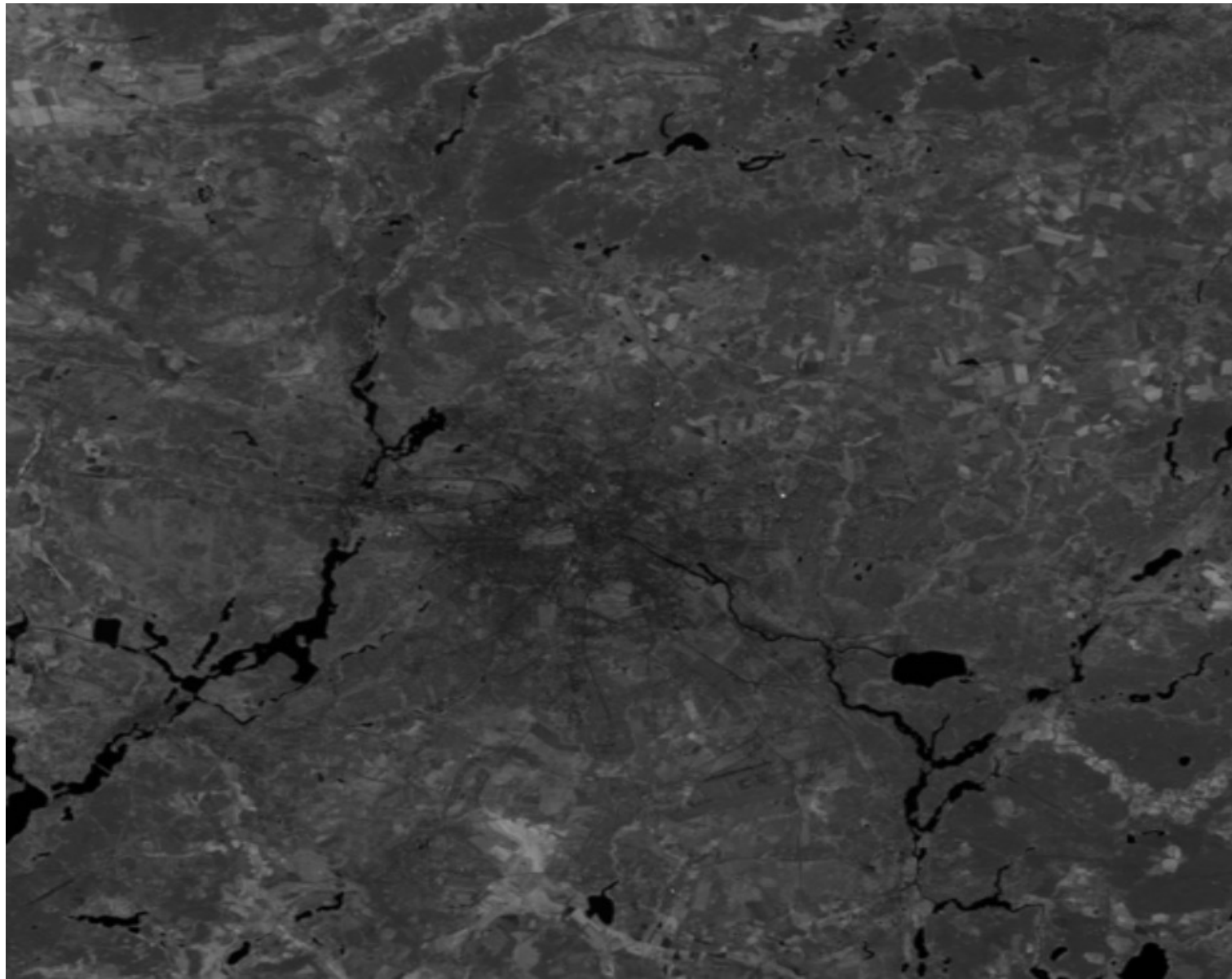
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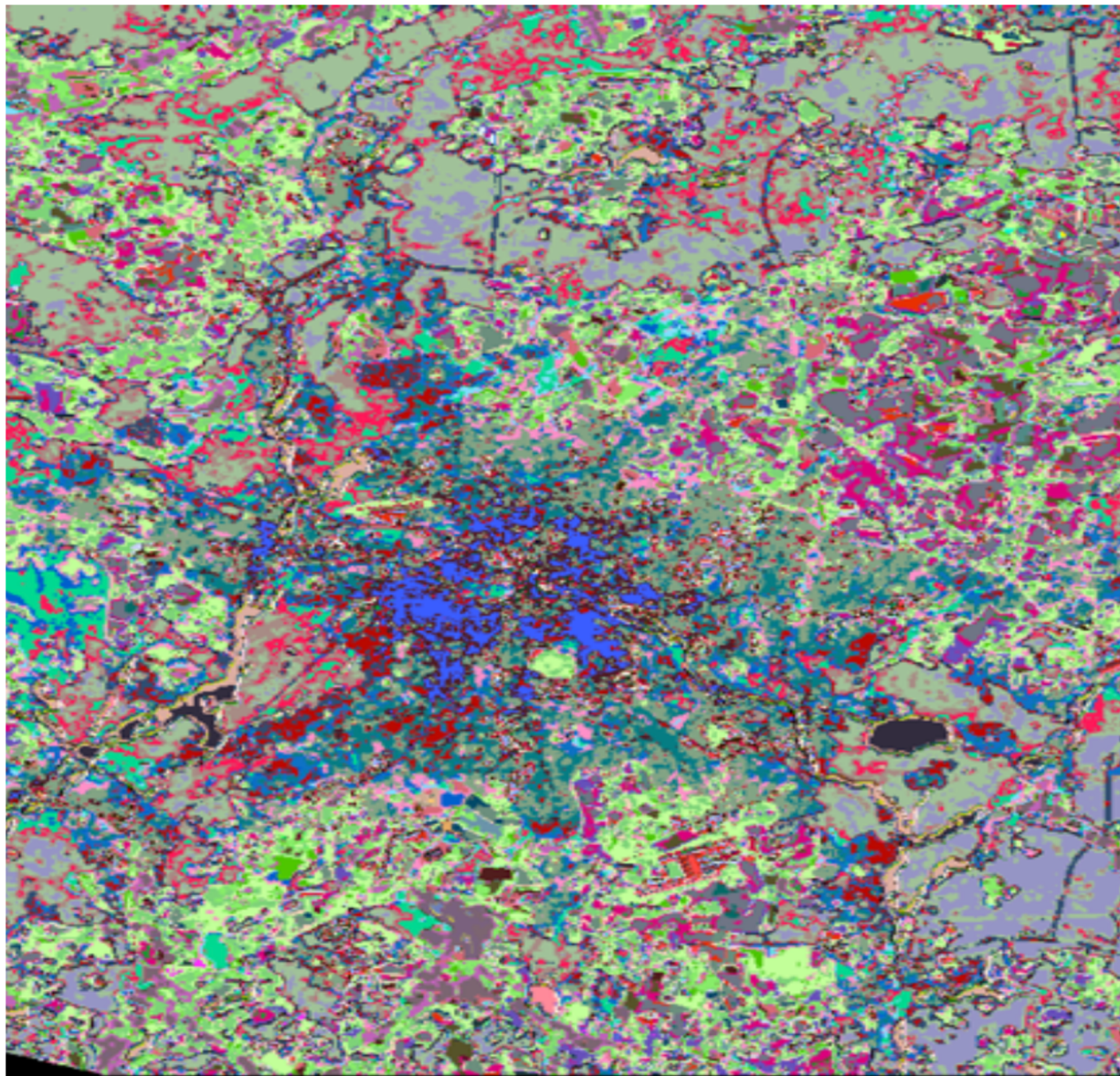
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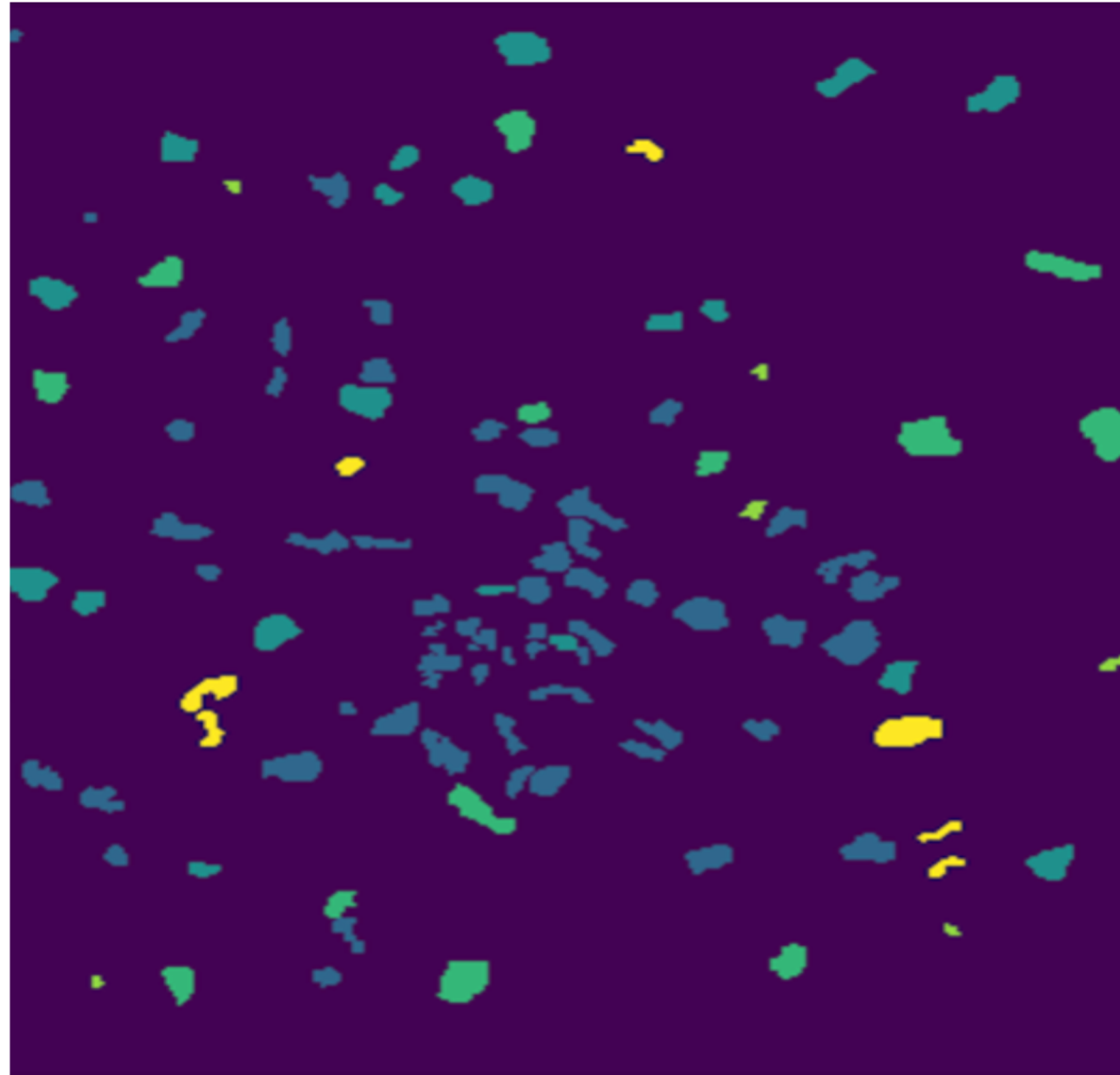
Reference
Image
Berlin
from
LandSat-8



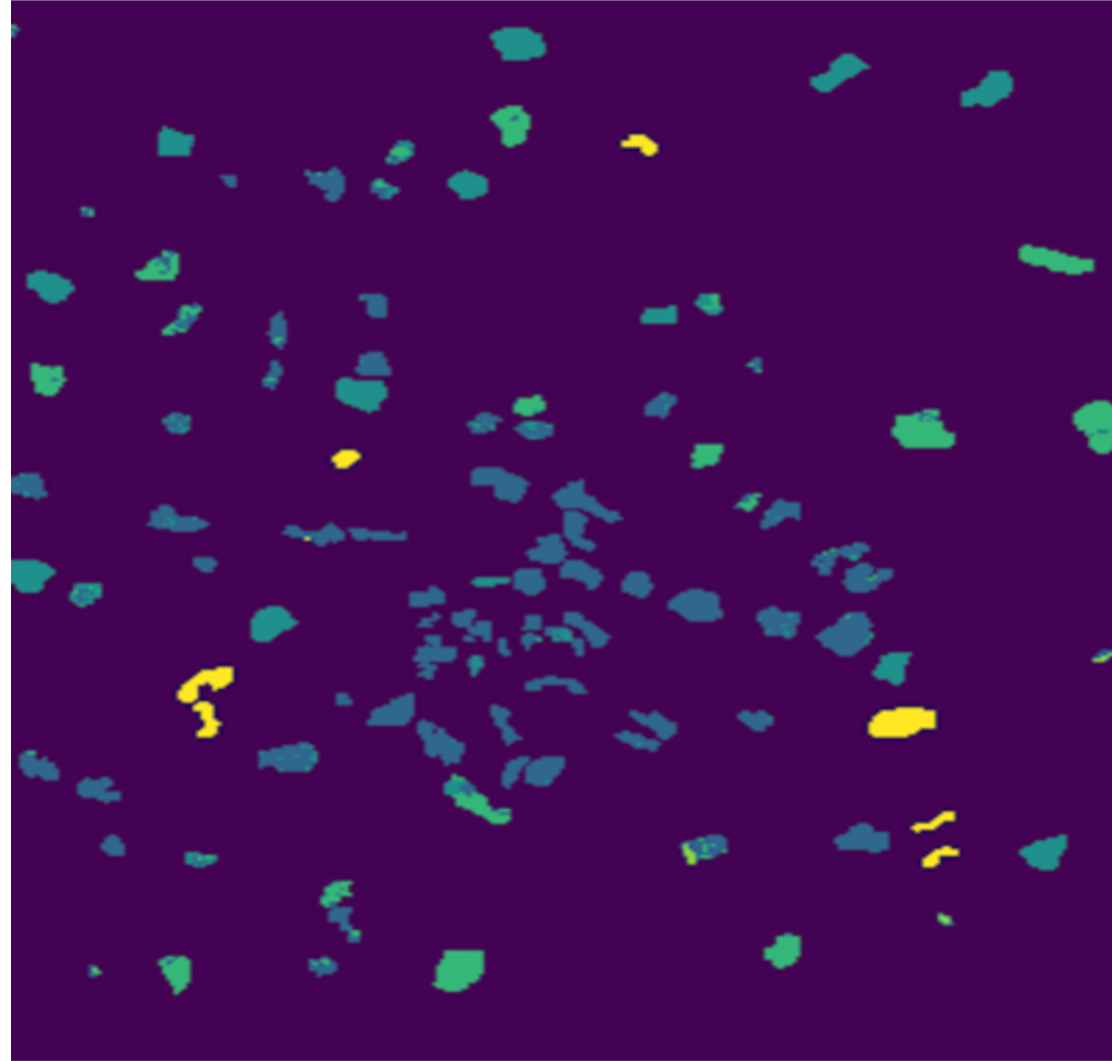
Unsupervised Classification



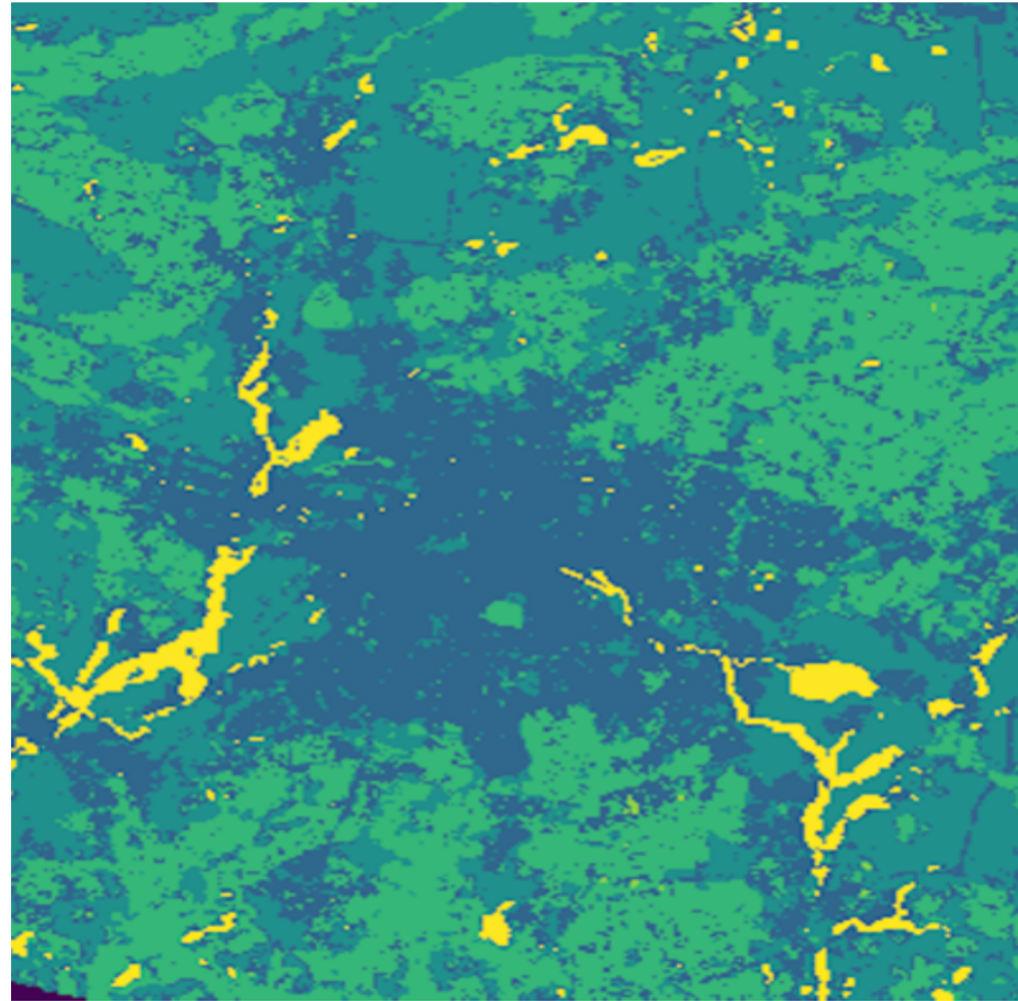
Truth Labels



Mapped Clusters



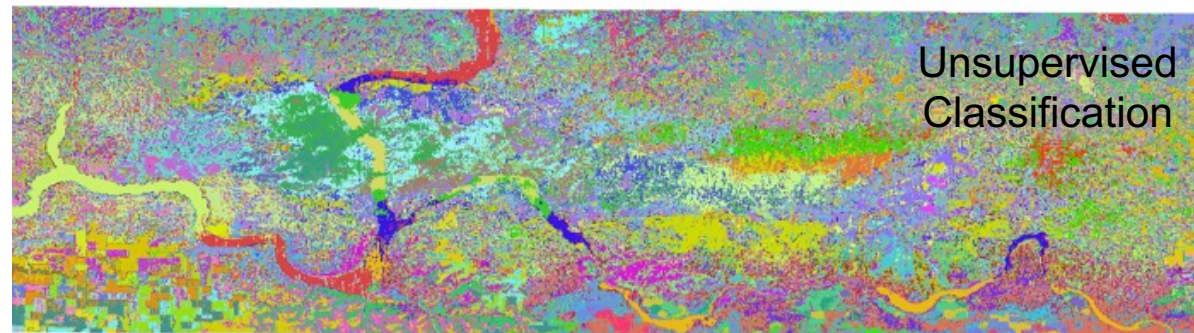
Expanded Mapped Clusters



Reference
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Berlin
from
LandSat-8



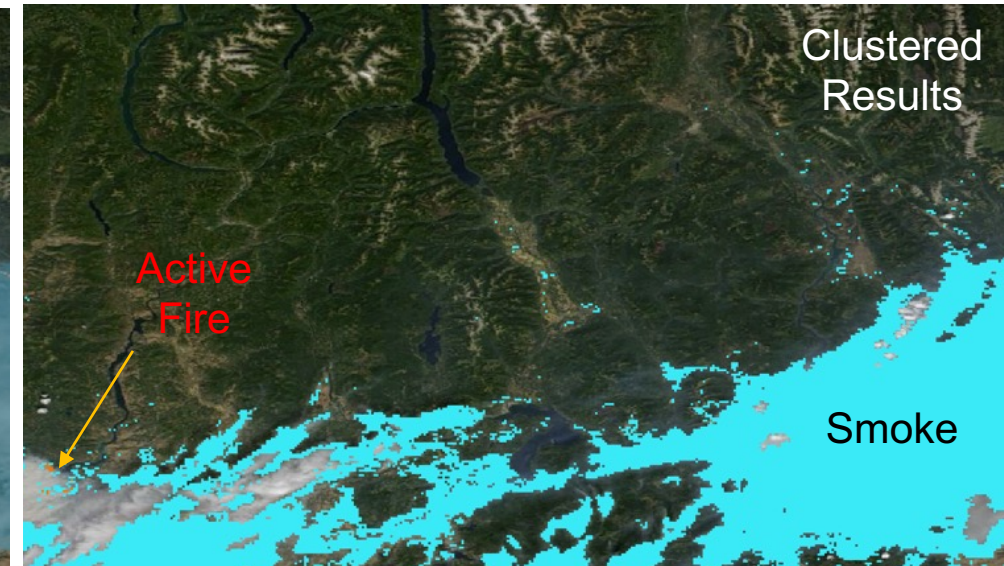
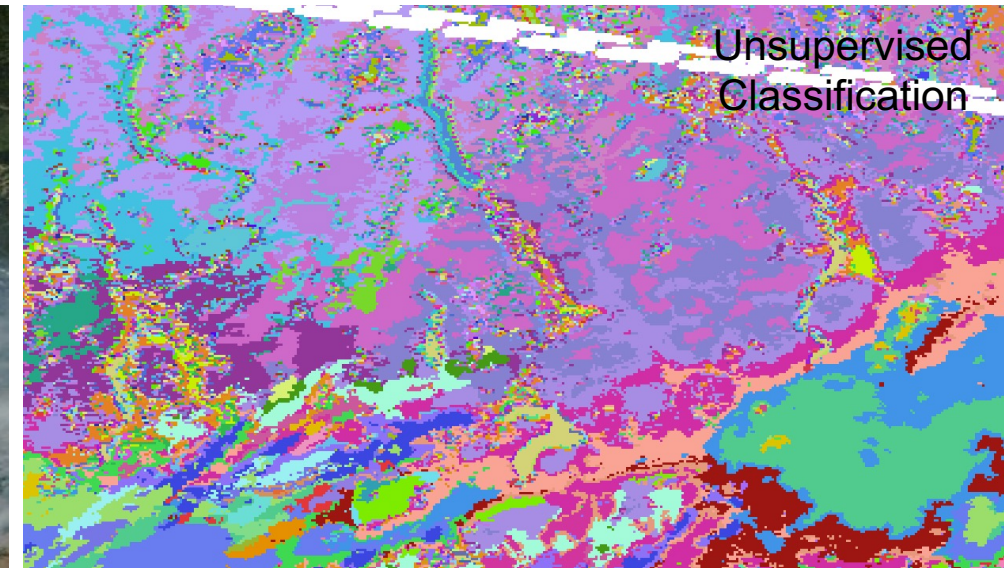
Williams Flats Fire
7 August 2019
Single Instrument



Williams Flats Fire

8 August 2019

Multiple
Satellite
Instruments

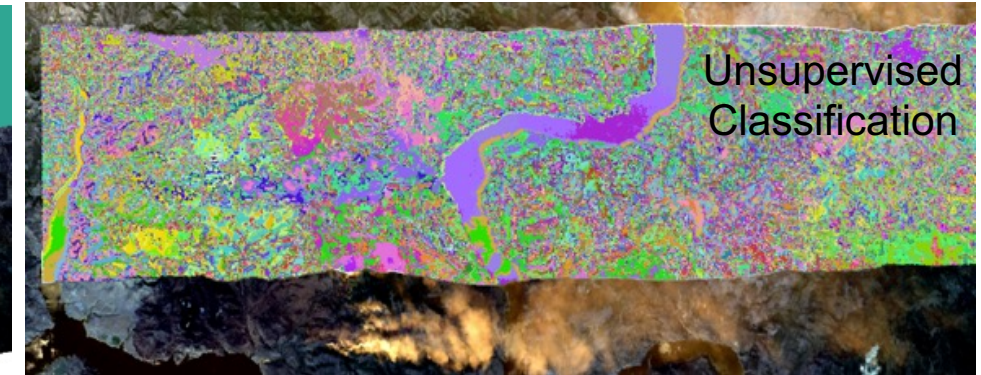
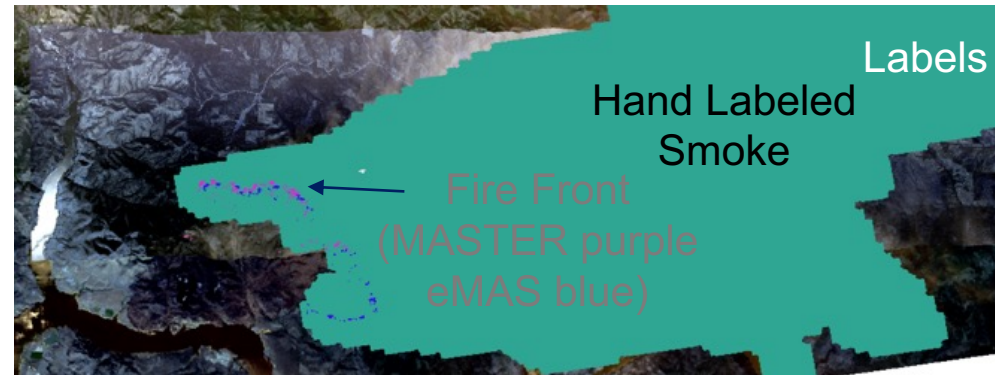
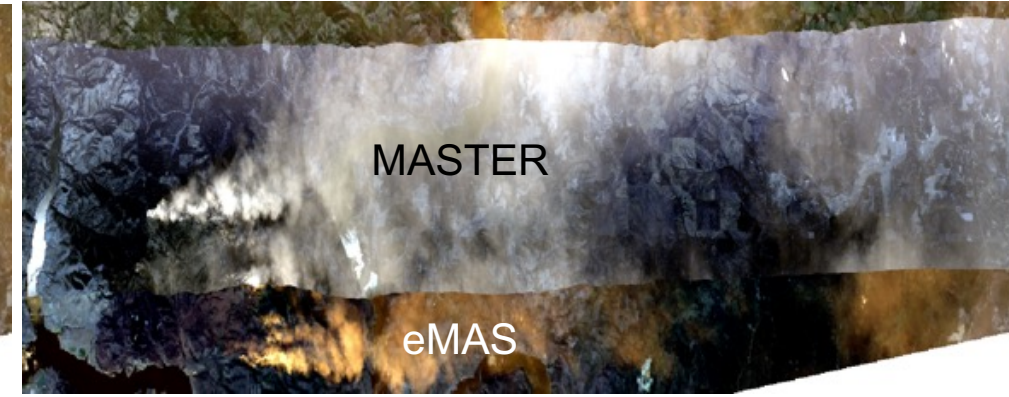


Williams Flats Fire

6 August 2019

Multiple
Instruments

Multiple
Platforms



Future Work

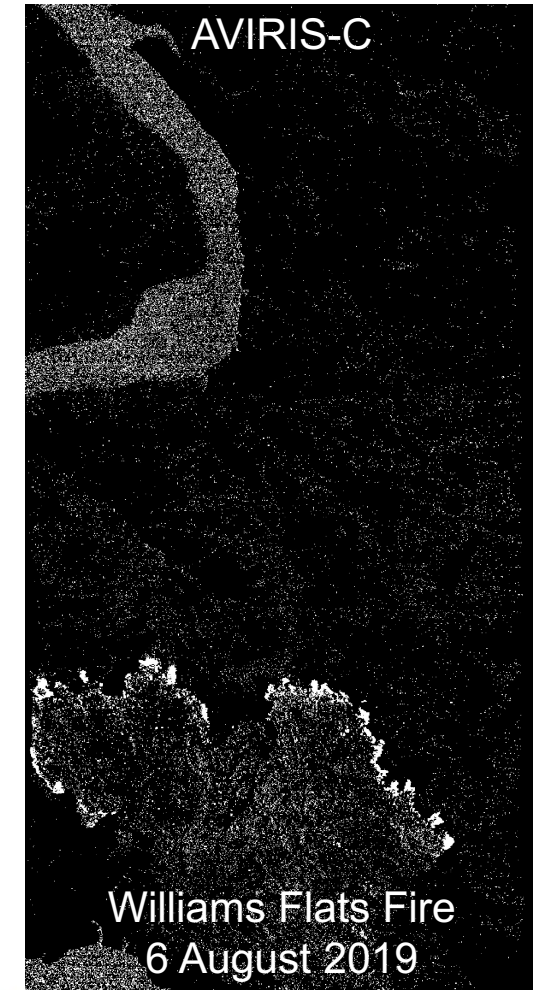
- Addition of more instruments
- Expanding the number of fires from FIREX-AQ
- Application to other use cases
 - Harmful algal blooms
 - Ice in inland water bodies
- Transfer learning for automated onboard detection
- 2-D and 3-D reconstruction of objects
- Machine-learning (informed) retrievals



Concluding Remarks

Advantages of Unsupervised Learning

- Allows for label application separate from machine pattern identification
 - Can handle both minimal labels or cases with large label sets
 - Can use labels from different instruments, retrievals (where appropriate)
- Enables fusion of collocated data
- Can effectively identify objects (smoke and fire) in static scenes
 - Mapping to pre-existing label sets
 - Supervised CGANs can aid in cleaning up misclassifications



Questions?

