

Health and Air Quality Applied Sciences Team (HAQAST)

Session 5B: Meeting the challenge of satellite data continuity

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How can satellite data continuity make a difference?



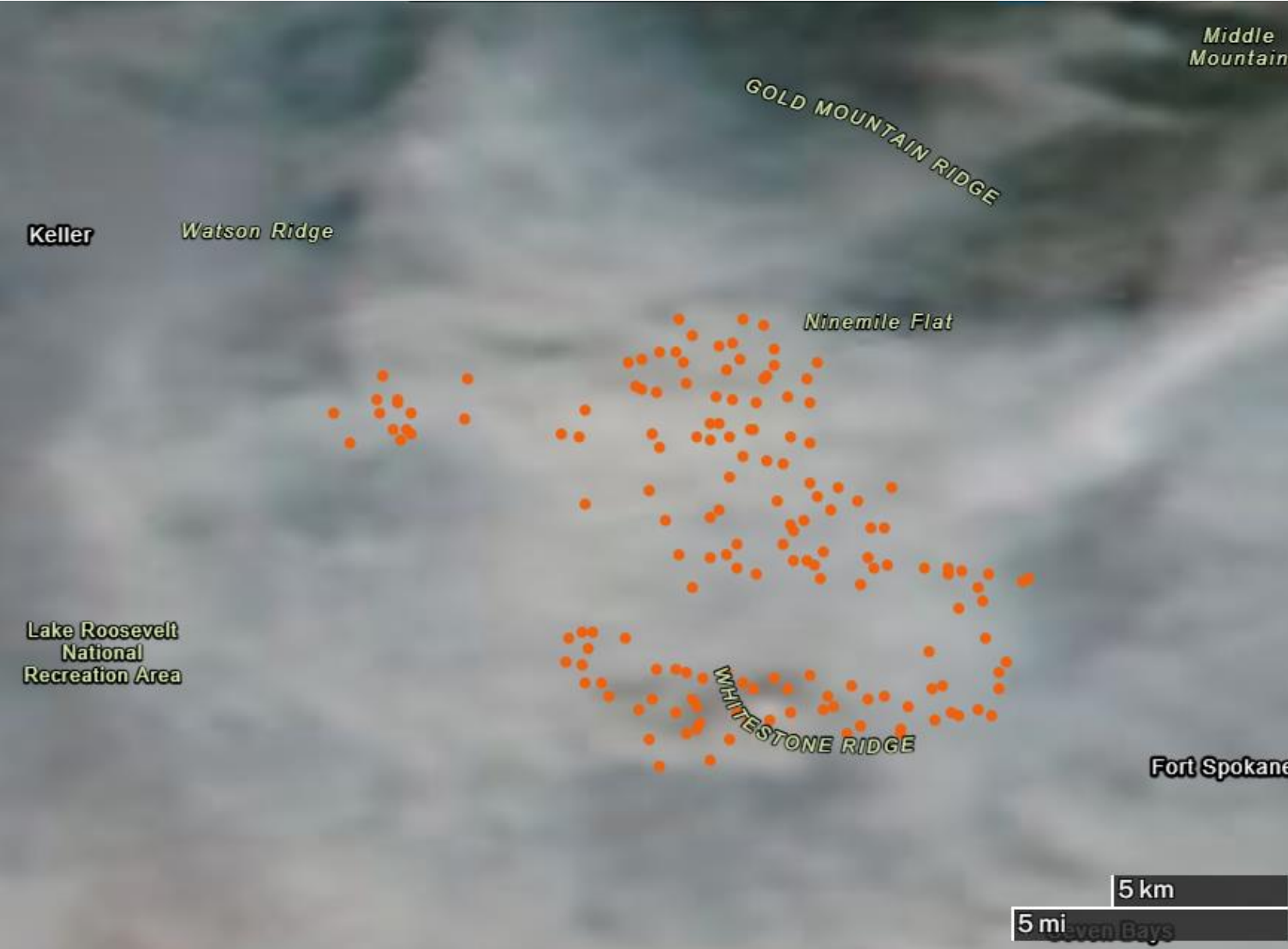
MODIS Terra and Aqua

Williams Flats fire August 3rd 2019

VIIRS Suomi NPP

Fire Detections, fire size, and emissions inventories over time

How can satellite data continuity make a difference?

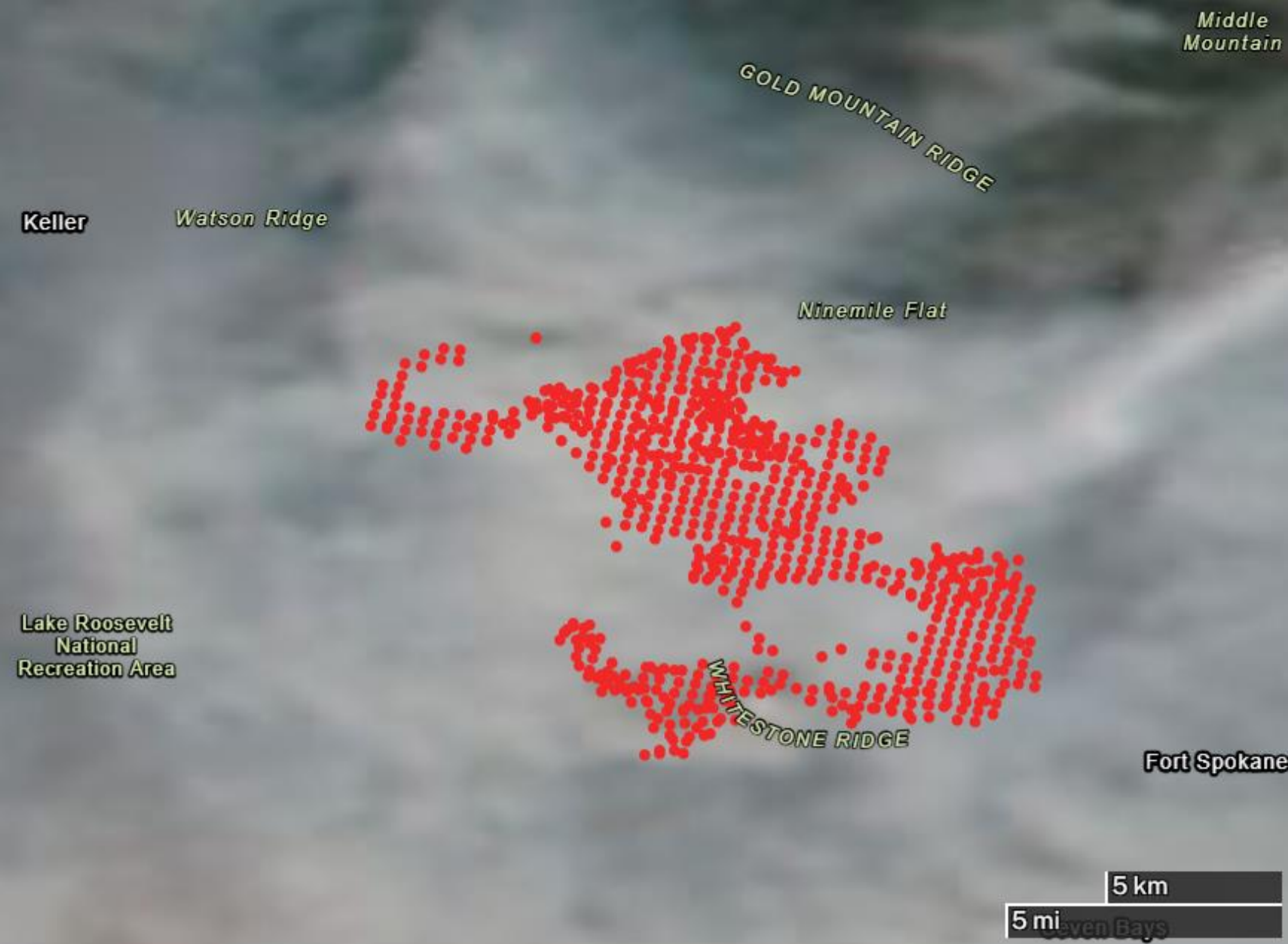


Fire Fighting
Operations
and
Resource
Planning

MODIS Terra and Aqua

Williams Flats fire
August 8th 2019

How can satellite data continuity make a difference?



Fire Fighting Operations and Resource Planning

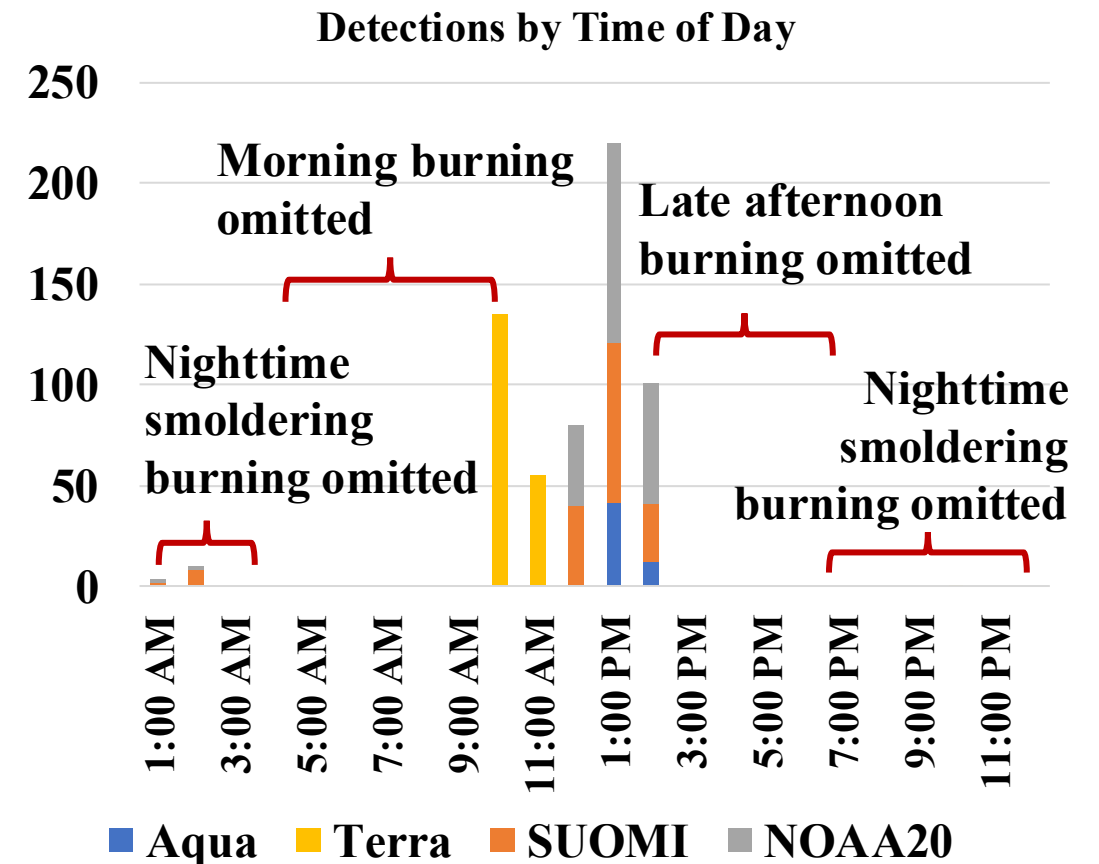
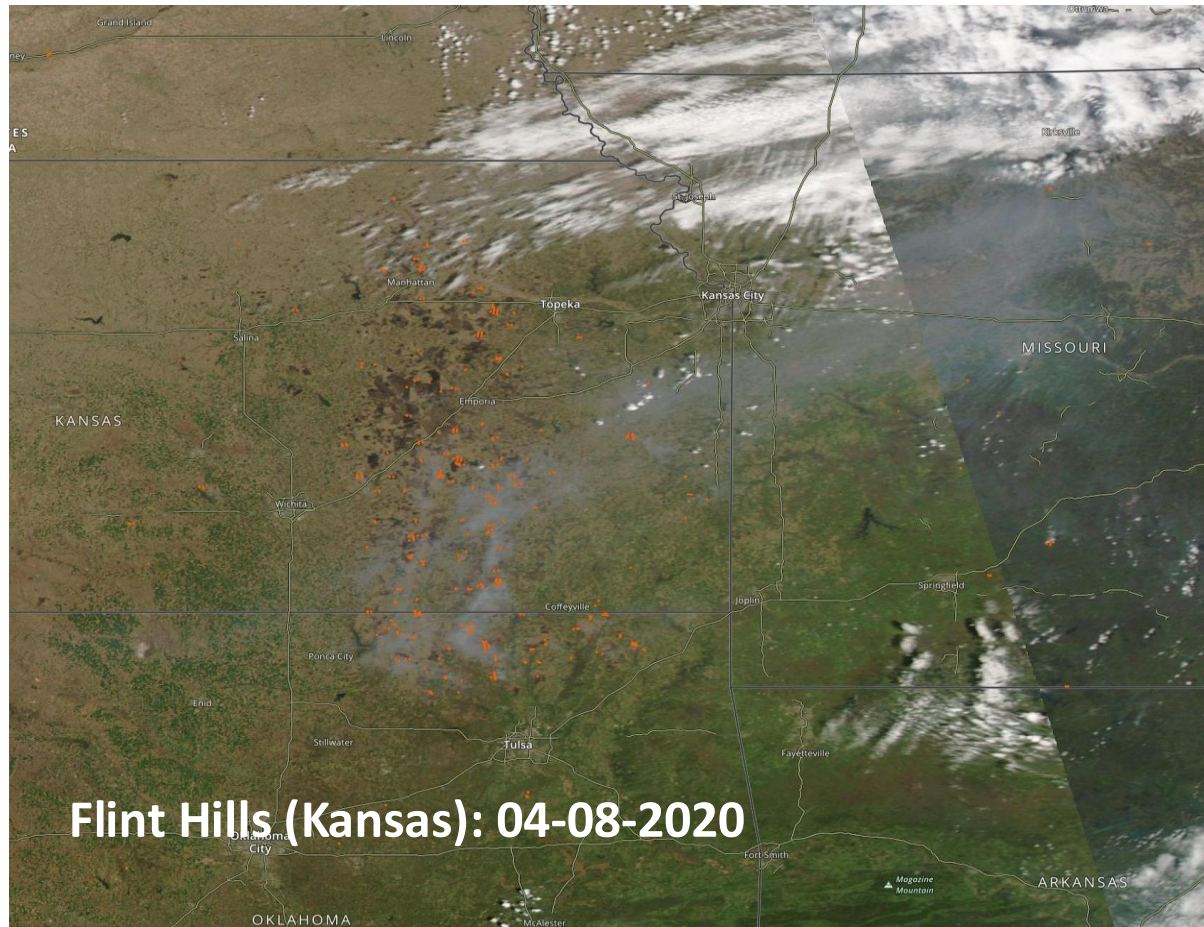
VIIRS Suomi NPP

Williams Flats fire
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How can satellite data continuity make a difference?

Time of Satellite Overpass: Satellites miss when people burn, when the conditions are right for controlled prescribed burns, when it is convenient for farmers burn.

Depending on the satellite overpass time, different fire types will be detected

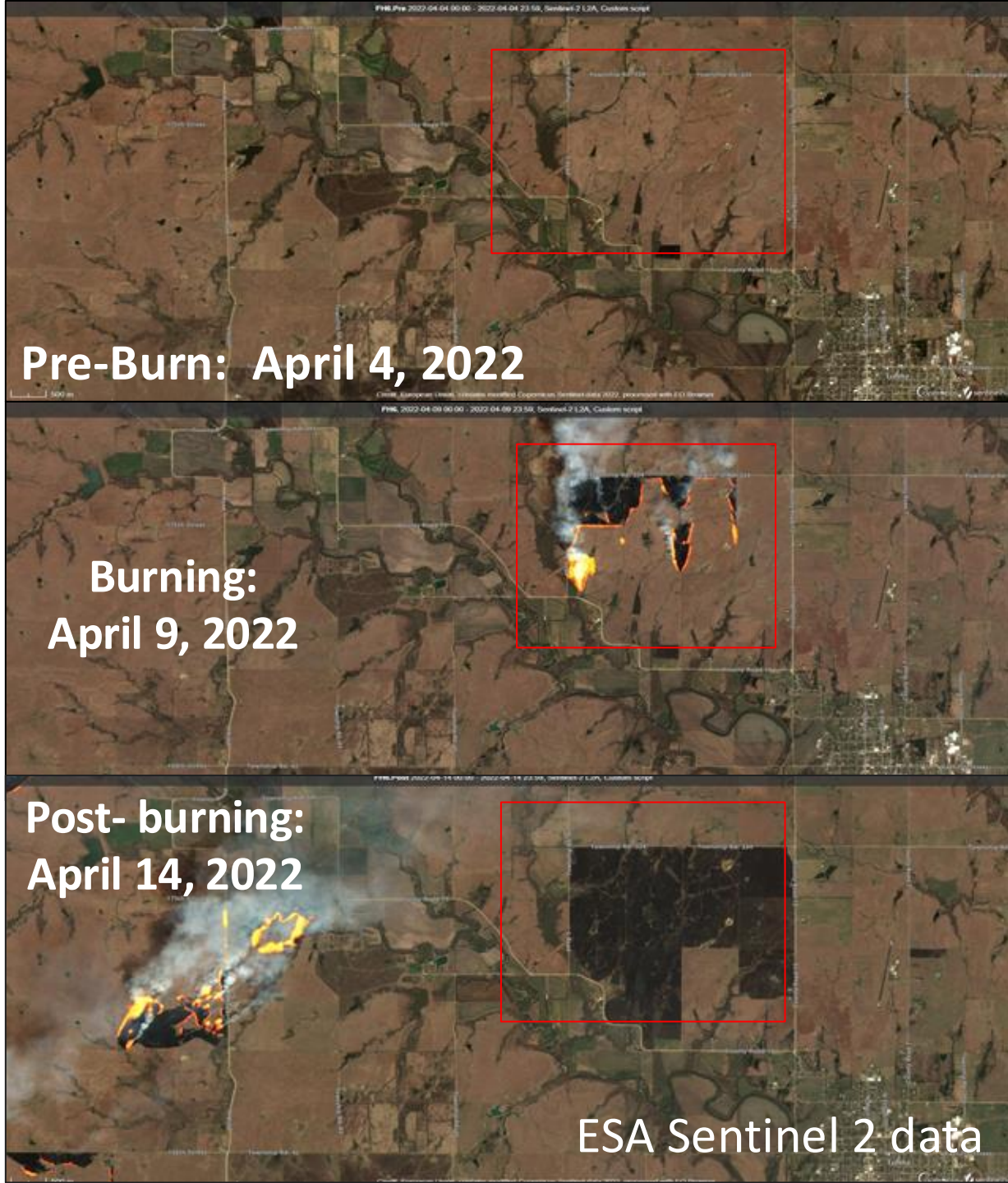


Tiger Team: Ensuring Continuity Across Satellite Transitions: Quantifying Uncertainty in Long-Term Air Quality and Fire Record

HAQAST Investigators: Amber Soja (NASA Langley Research Center, LARC), Emily Gargulinski (National Institute of Aerospace, NIA), Nathan Pavlovic (Spheros Environmental), Jeff Pierce (Colorado State University), Travis Toth (NASA LaRC), Arlene Fiore (MIT), Tracey Holloway (University of Wisconsin-Madison, UW-M.), Jenny Bratburd (UW-M.), Chris Uejio (Florida State University), Meng Zhou (University of Iowa), Aaron Naeger (NASA MSFC); Xi Chen (University of Iowa), Talat Odman (Georgia Tech)

Stakeholder and Partners: Byeong Kim (Georgia Environmental Protection Division), Mary Uhl (WESTAR), Leticia Nogueira (American Cancer Society), James Beidler (Environmental Protection Agency, EPA), Marc Carreras Sospedra (South Coast Air Quality Management District). We will continually engage and welcome interested partners and stakeholders.

- What fires can we see from space? And how do fire sizes, numbers, intensities, emissions change over time
- Patterns and changes in vertical distribution of dust and smoke
- Consistency and harmonization of NO₂, HCHO, aerosol products, and gridded smoke PM
- Misclassification of heat sources
- Consistency and discrepancies of aerosol layer heights



Flint Hills, Kansas

Using very-high to high-resolution satellite data, we analyze these landscapes before, during, and after fires, every day of the 3-6 month burning season.

Fire scars are digitized for full comparisons with satellite data.

Data Sources

- NASA Commercial Satellite Data Acquisition
- (e.g., Sentinel, PlanetScope, Maxar)
- MODIS and VIIRS active fire
- MODIS burned area
- NASA CALIOP on CALIPSO vertical aerosols
- NOAA HMS smoke plumes
- MODIS Aerosol Optical Depth (AOD)
- EPA National Fire Emissions Inventory
- State & Federal Forest Service inventories

Missing prescribed/ small active fires and burned area

Challenges are:

Burn scars recover quickly

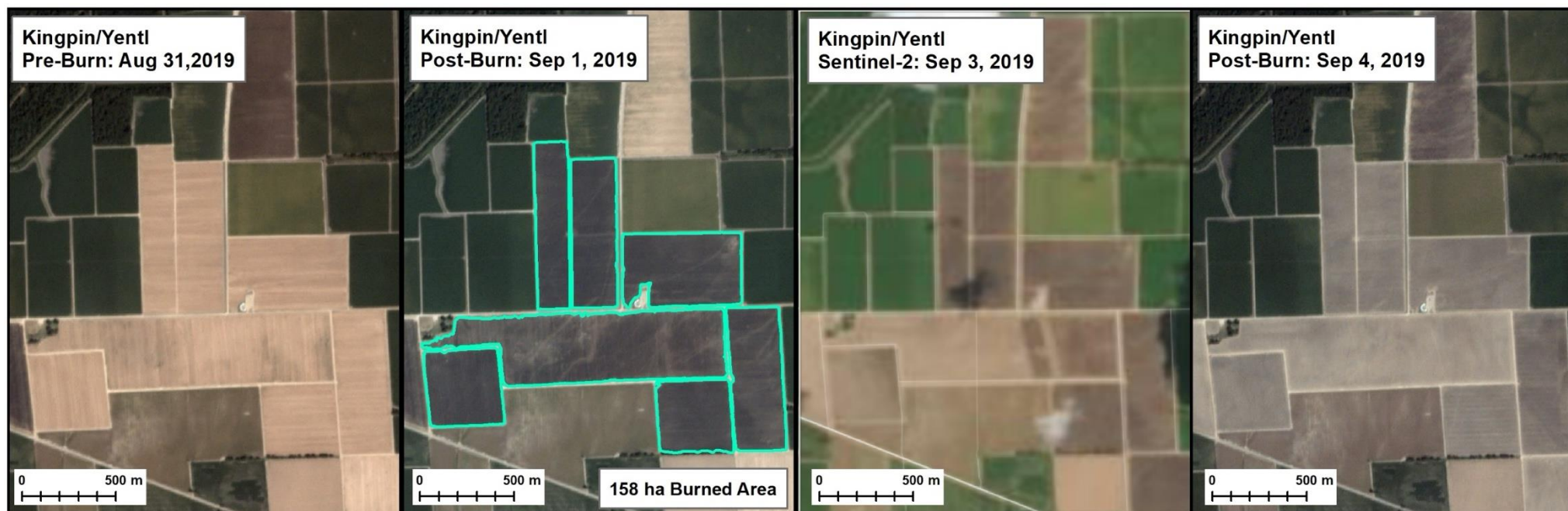
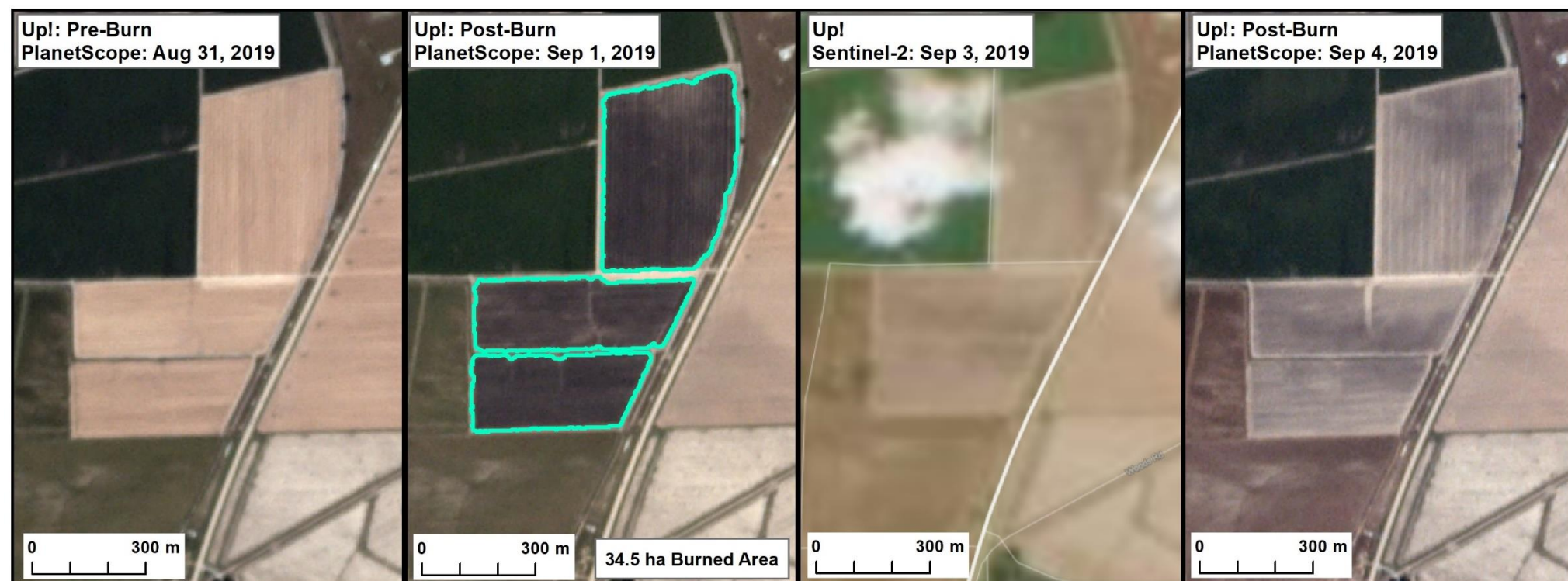
Cloud cover

Incongruous overpass and fire timing.

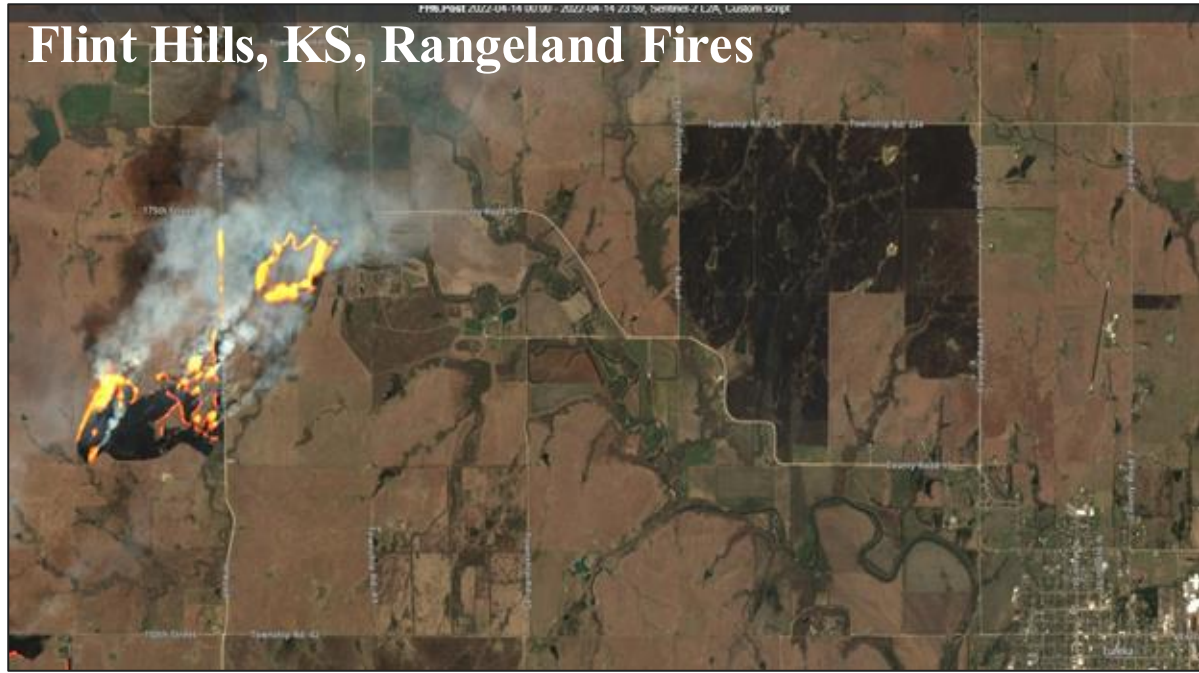
2 times/day each (MODIS, VIIRS)

Intensity/Resolution

Geostationary satellites, lower 2-km resolution



Flints Hills grasslands



A lack of complete fire emissions inventories hinders the ability of federal, state and local fire, health and Air Quality managers and regulators to monitor, evaluate, track, and statistically analyze fire and smoke impacts.

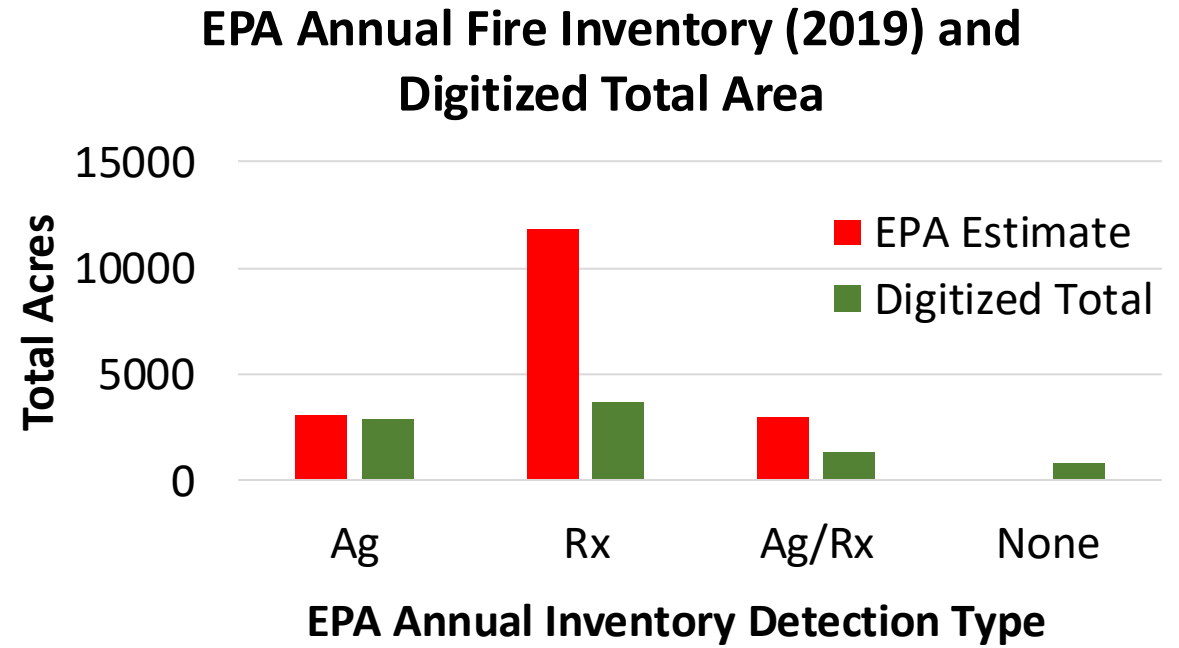
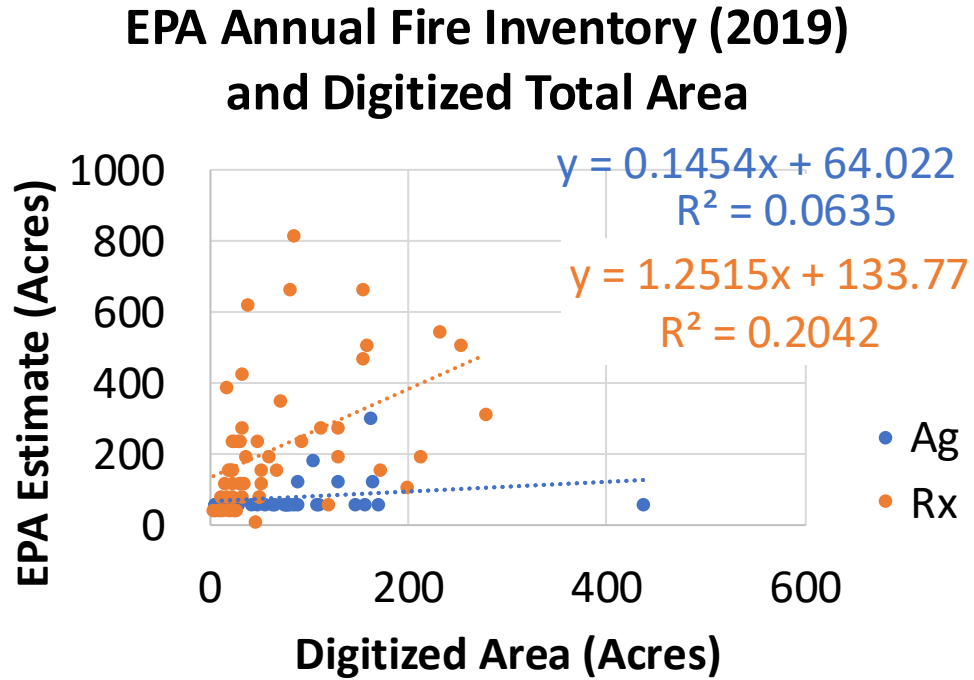
The Goal: Enhance the data and Improve the Process (timing , filters, AC, warnings).

Performance of Satellite products

Fire Detection Products	
Satellite	Flint Hills, KS Captured
MODIS Aqua	8%
MODIS Terra	20%
VIIRS Suomi	35%
VIIRS NOAA20	33%
All satellites	47%

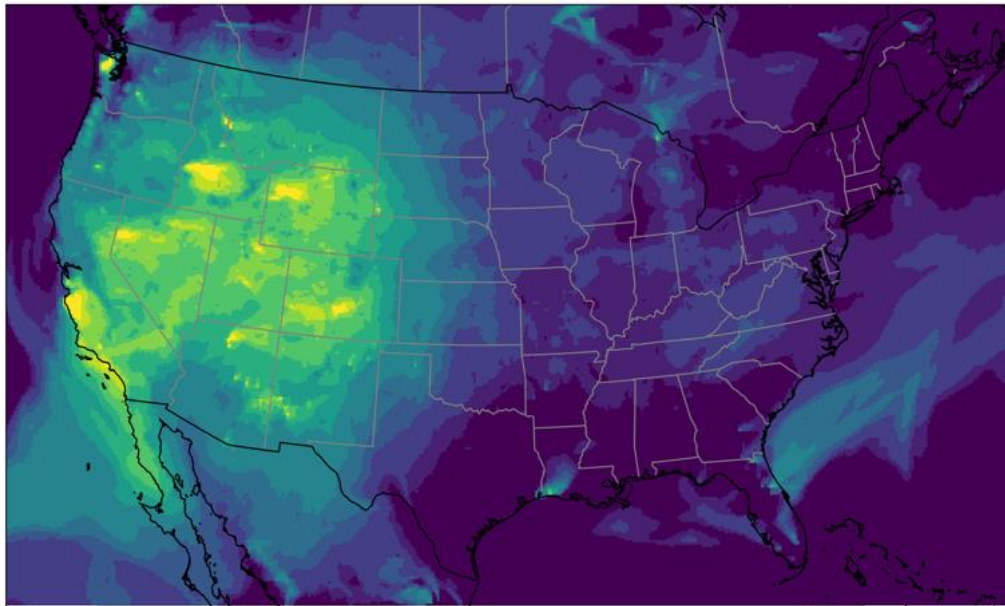
MODIS Burned Area Product			
Region	Intersection (Agreement)	Commission (Overestimate)	Omission (Missed)
Flint Hills, KS & OK	65%	8%	27%

Comparisons of Burned Area in Iowa croplands (ditches, prescribed, agriculture burning)



Distinguishing Prescribed Fire (Rx) versus Wildfire (WF) in the Contiguous US for Fire Management and Health and Air Quality Organizations

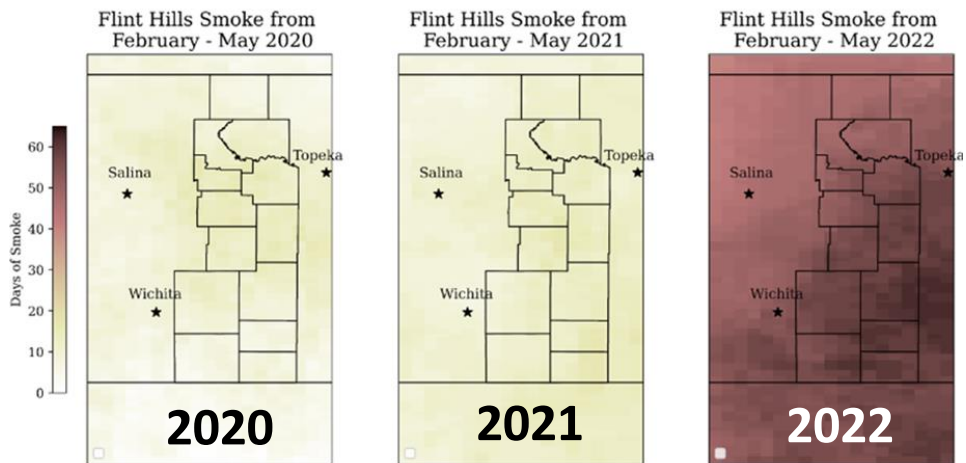
WF Contribution (%) to Surface PM2.5 in Jul 2016



HAQAST Team: Talat Odman, Yongtao Hu and **Jennifer Kaiser** (Georgia Tech); **Amber Soja** and Emily Gargulinski (NASA Langley), Youhua Tang, Siqi Ma and Daniel Tong (George Mason University), Yang Liu and Lei Li (Emory University), and Monica Harkey (University of Wisconsin); **Jeffrey Pierce** and Haihui Zhu (Colorado State); **Aaron Naeger** (NASA Marshall Space Flight Center), and Andrew White and Jonathan Case (NASA Short-term Prediction Research and Transition Center); **Arlene Fiore** and Adam Schlosser (MIT); **Christopher Uejio** (Florida State) and Xiuling Zhao; **Carl Malings** (Morgan State) and Nathan Pavlovic (Sonoma Tech); **Travis Toth** (NASA Langley Research Center); **Xi Chen**, Meng Zhou, and Huanxin Zhang (University of Iowa).

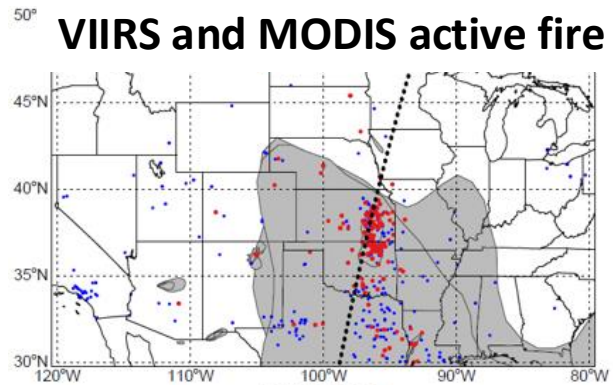
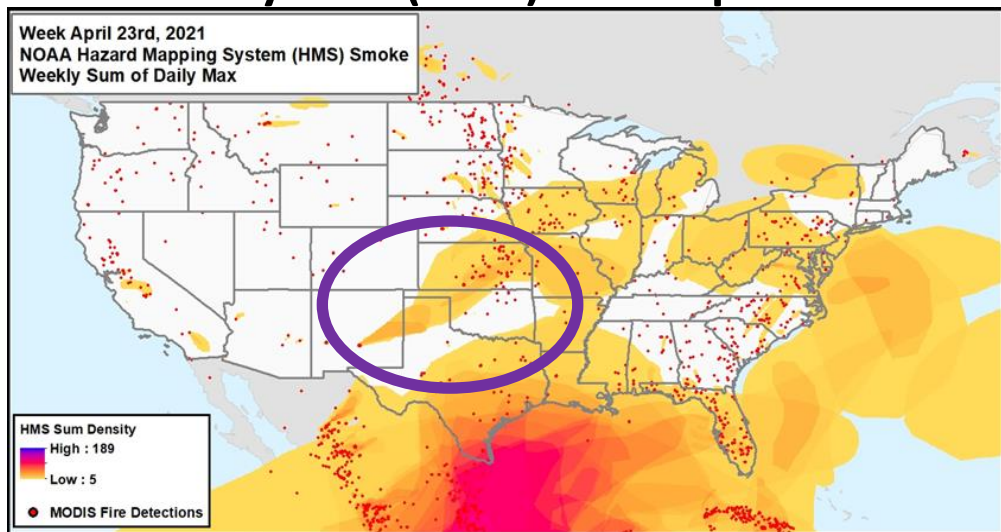
Stakeholders: Laura Myers (Kaiser Permanente); Anny Huang and Eric Rowell (California Air Resources Board); James Bolyan and Byeong Kim (Georgia Department of Natural Resources); Ambarish Vaidyanathan (CDC); Pete Lahm (US Forest Service); Amanda Fritz (Connecticut Department of Energy and Environmental Protection); James Beidler (EPA).

Multiple satellite sensors used to aid and verify with partners

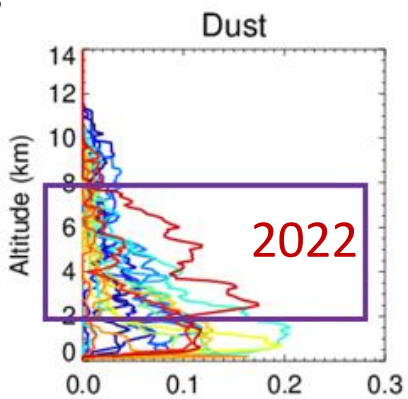
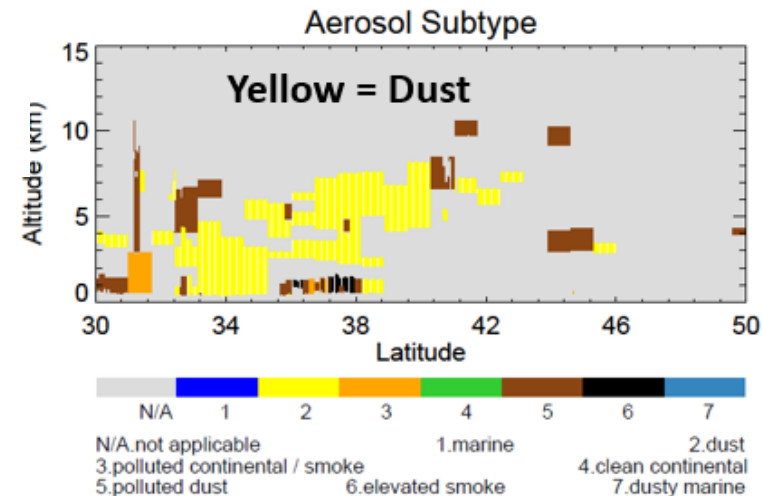


MODIS Aerosol Optical Depth (AOD): Flint Hills

Identify and delete smoke originating from outside the Flint Hills using the NOAA Hazard Mapping System (HMS) smoke plumes



NASA CALIPSO vertical data, MODIS and VIIRS Active Fire detections, and HMS were able to provide insight and validation to our partners in analysis of the Flint Hills, Kansas



Annual Vertical distribution of dust aerosols

