

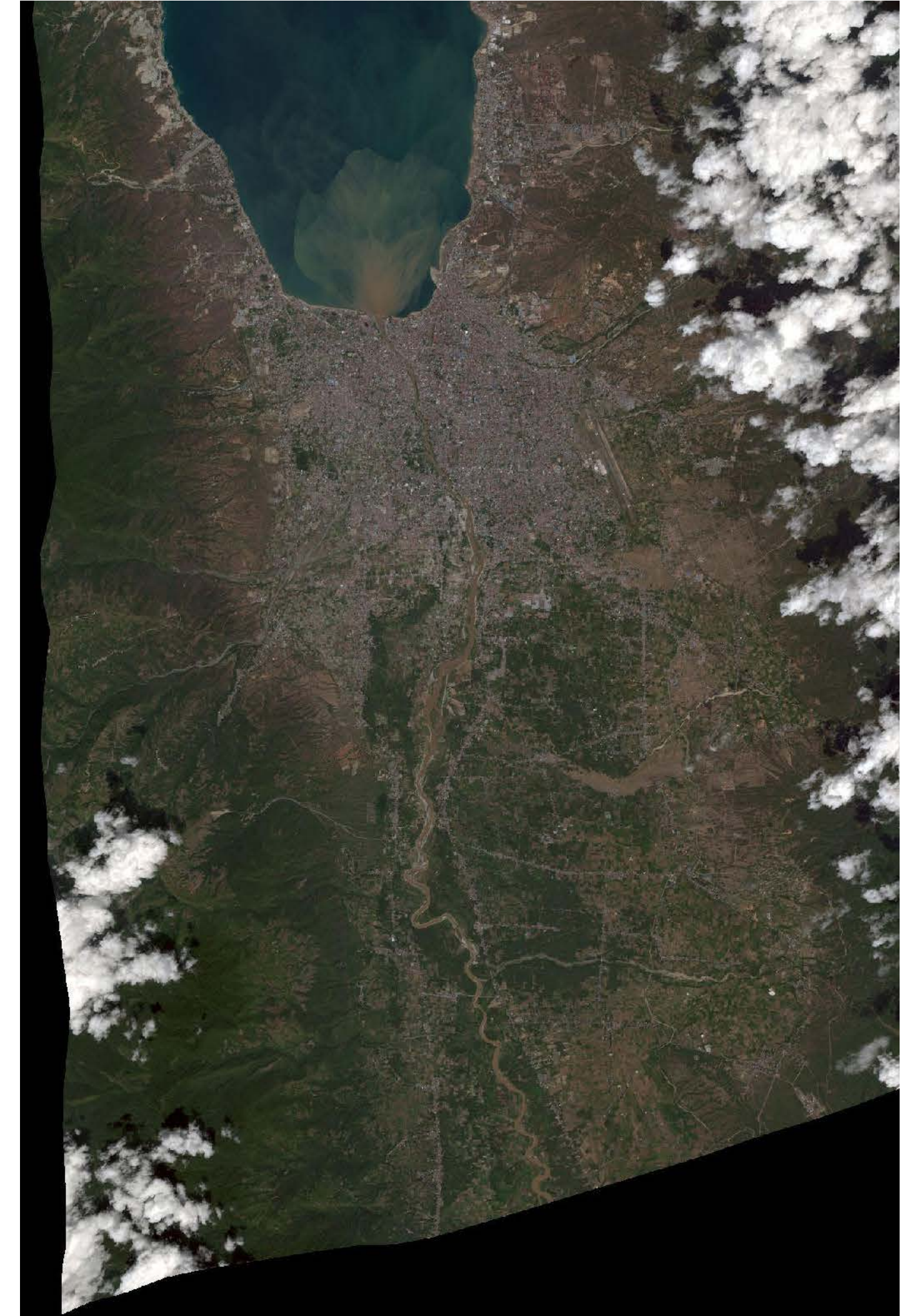
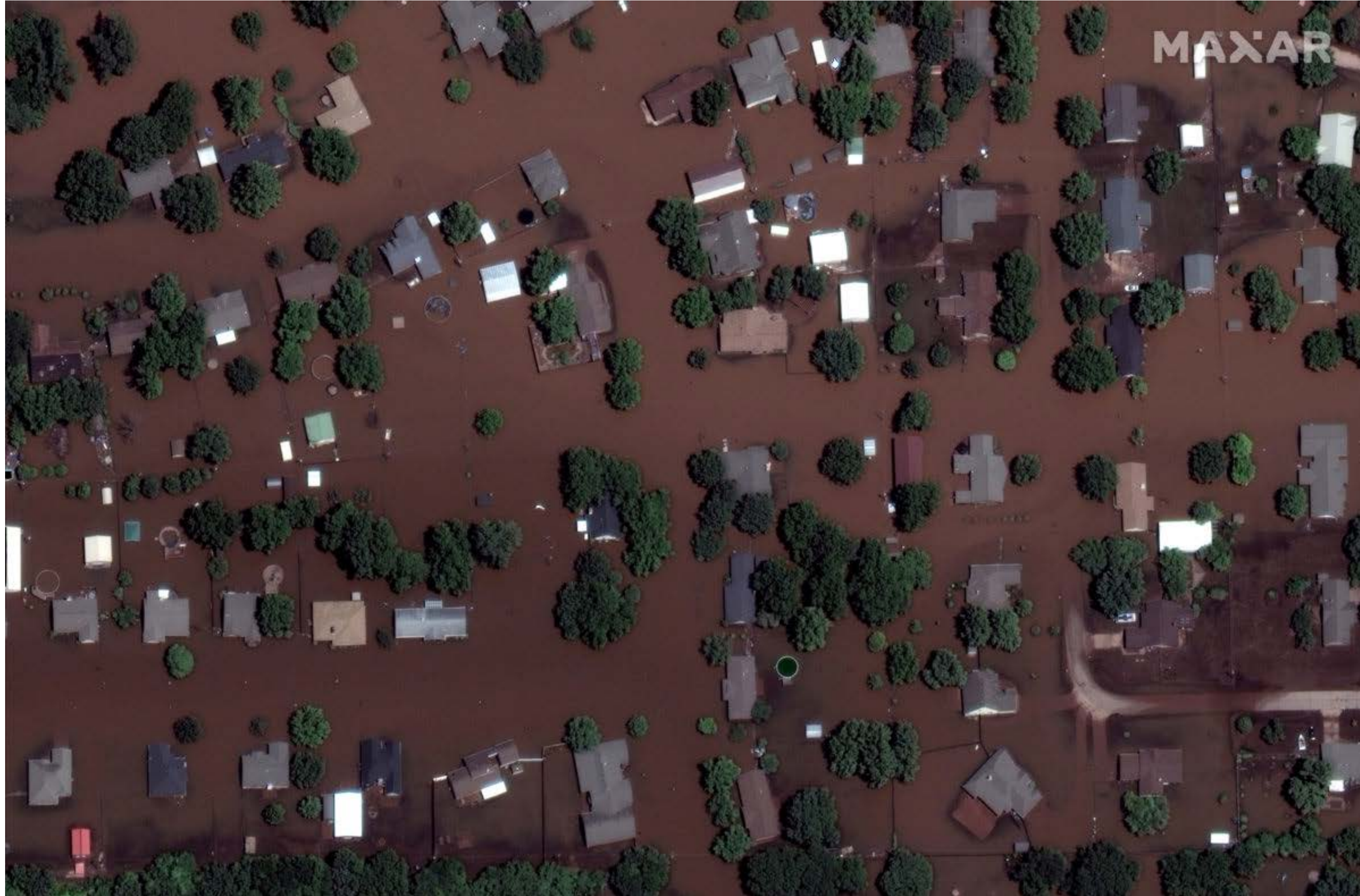
xView2: Assessing Damage From Satellite Imagery

A Case Study from Turkey and Syria

Ritwik Gupta

August 25, 2023

Background



Background



Background

- When natural disasters occur, first responders and disaster planners have to assess where buildings have taken damage and how much damage there is.
- Limited capabilities and manpower for initial imagery analysis.
- Humans on the ground, at risk, with a large potential for automation and risk reduction of this work.

Analysis Agencies

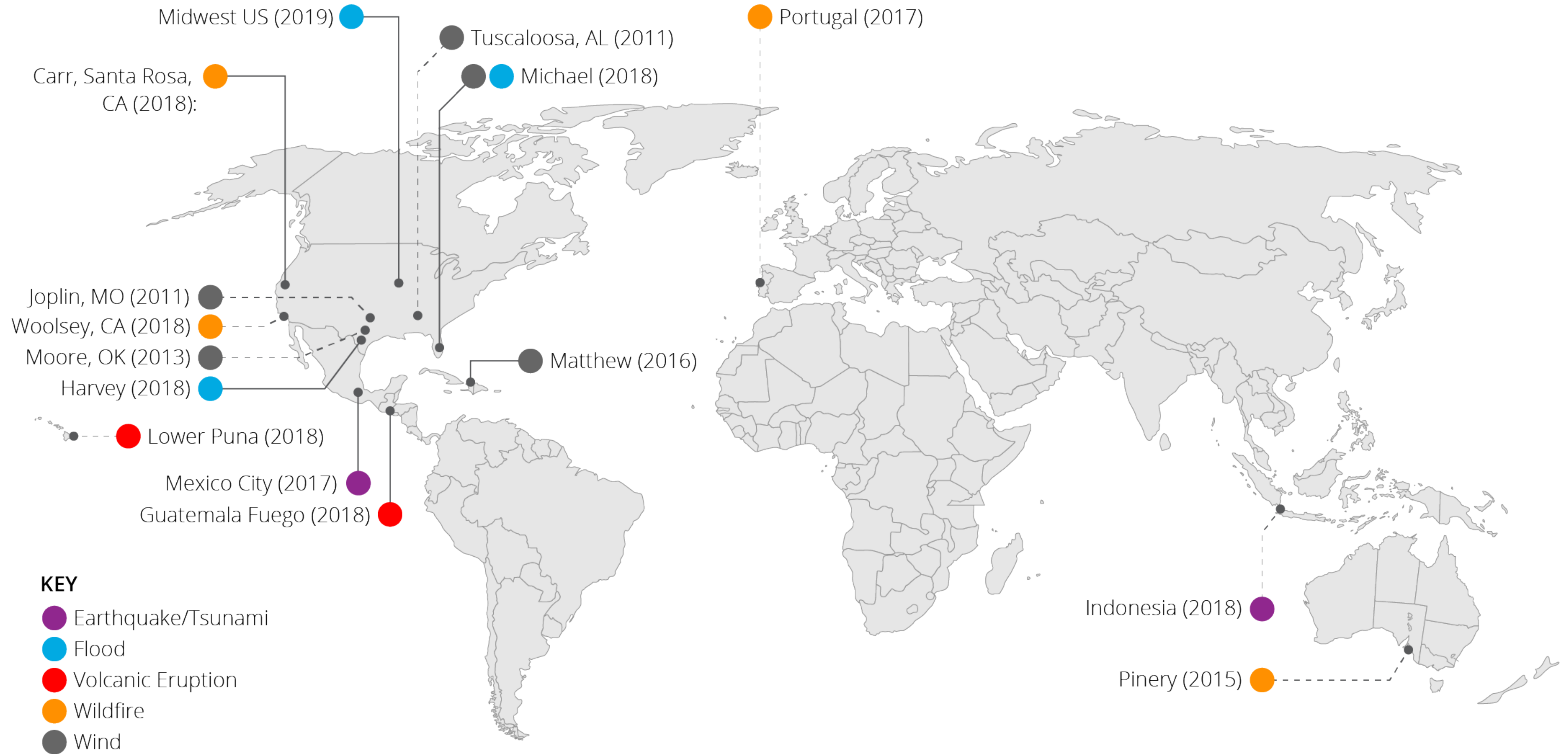


FEMA

Background



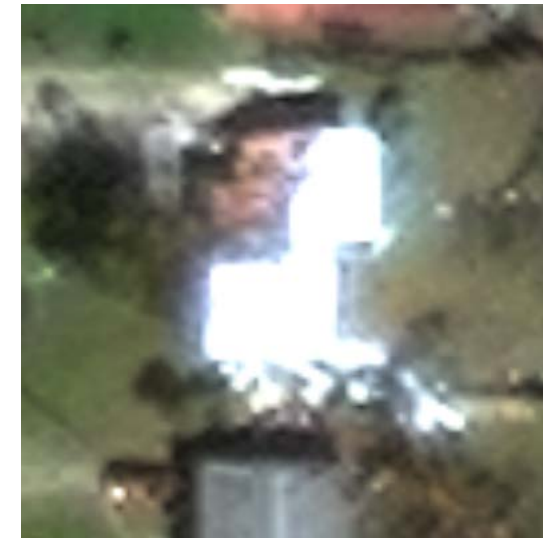
Diversity of Locations



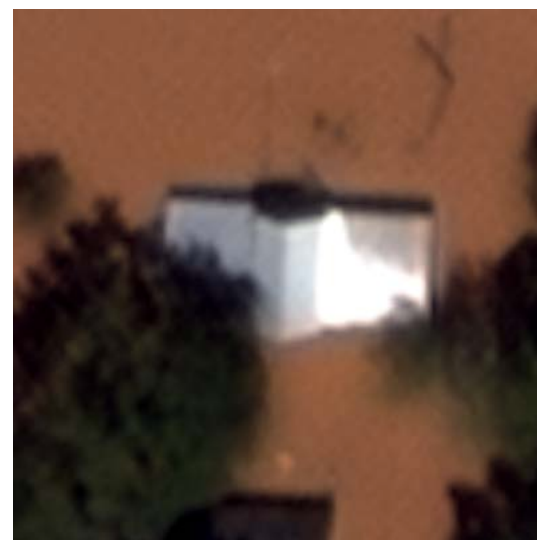
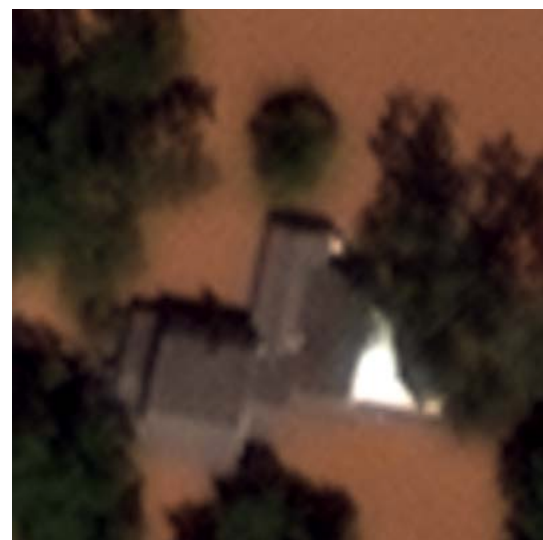
Joint Damage Scale

Disaster Level	Structure Description
0 (No Damage)	Undisturbed. No sign of water, structural or shingle damage, or burn marks.
1 (Minor Damage)	Building partially burnt, water surrounding structure, volcanic flow nearby, roof elements missing, or visible cracks.
2 (Major Damage)	Partial wall or roof collapse, encroaching volcanic flow, or surrounded by water/mud.
3 (Destroyed)	Scorched, completely collapsed, partially/ completely covered with water/mud, or otherwise no longer present.

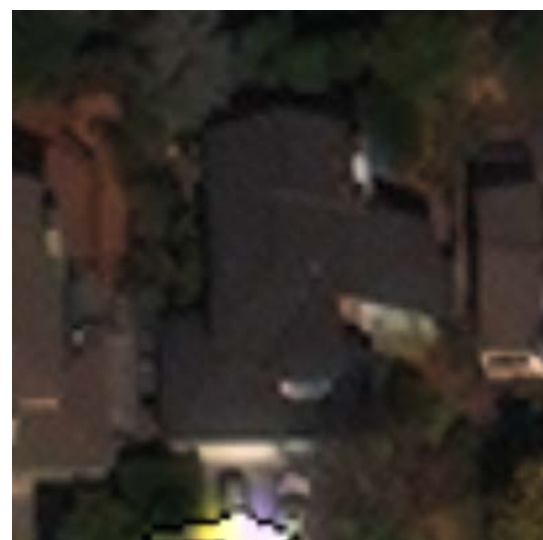
Data



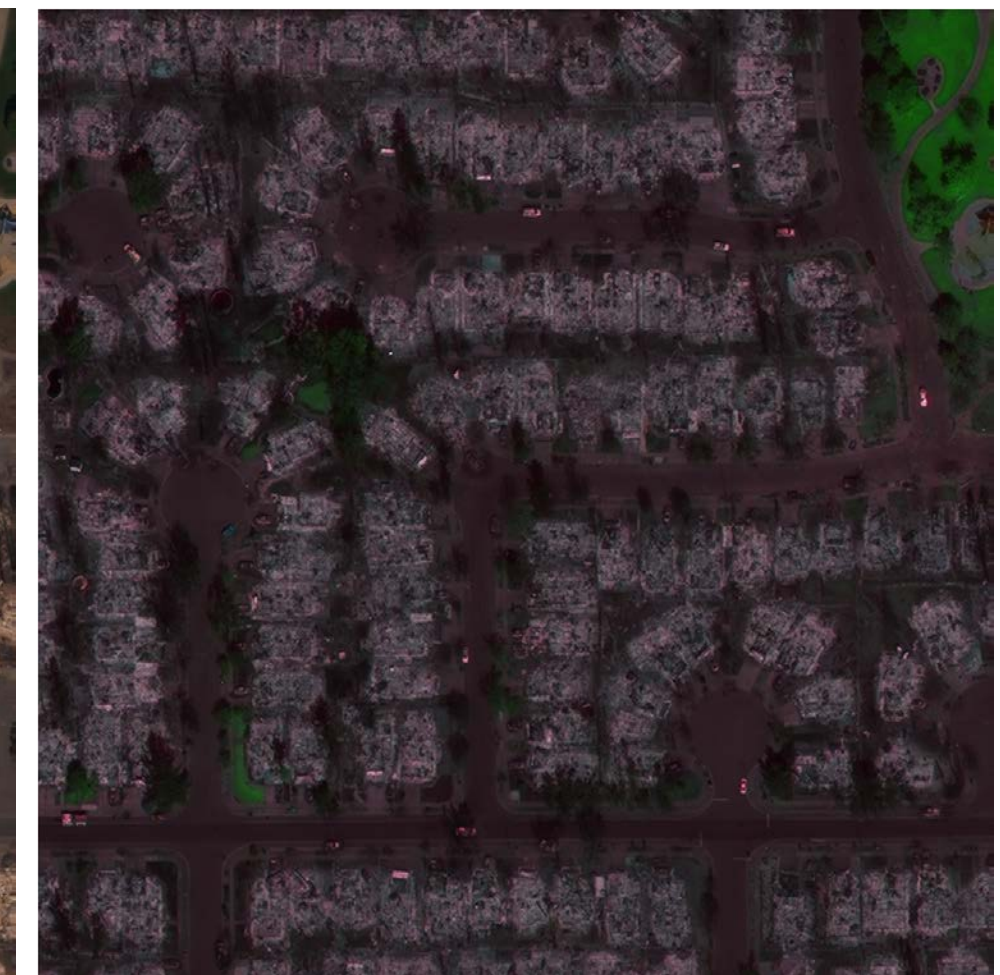
Wind



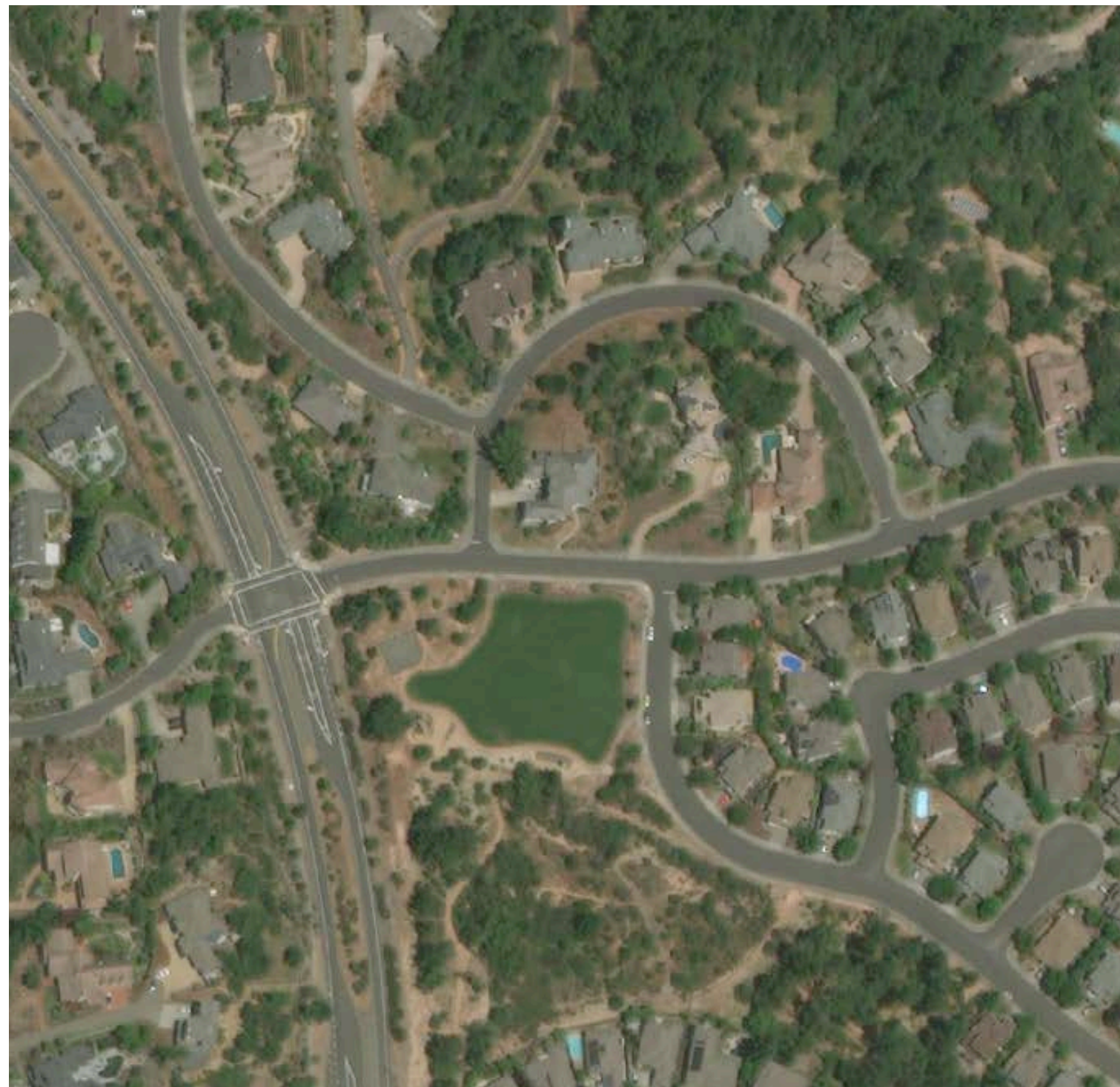
Flood



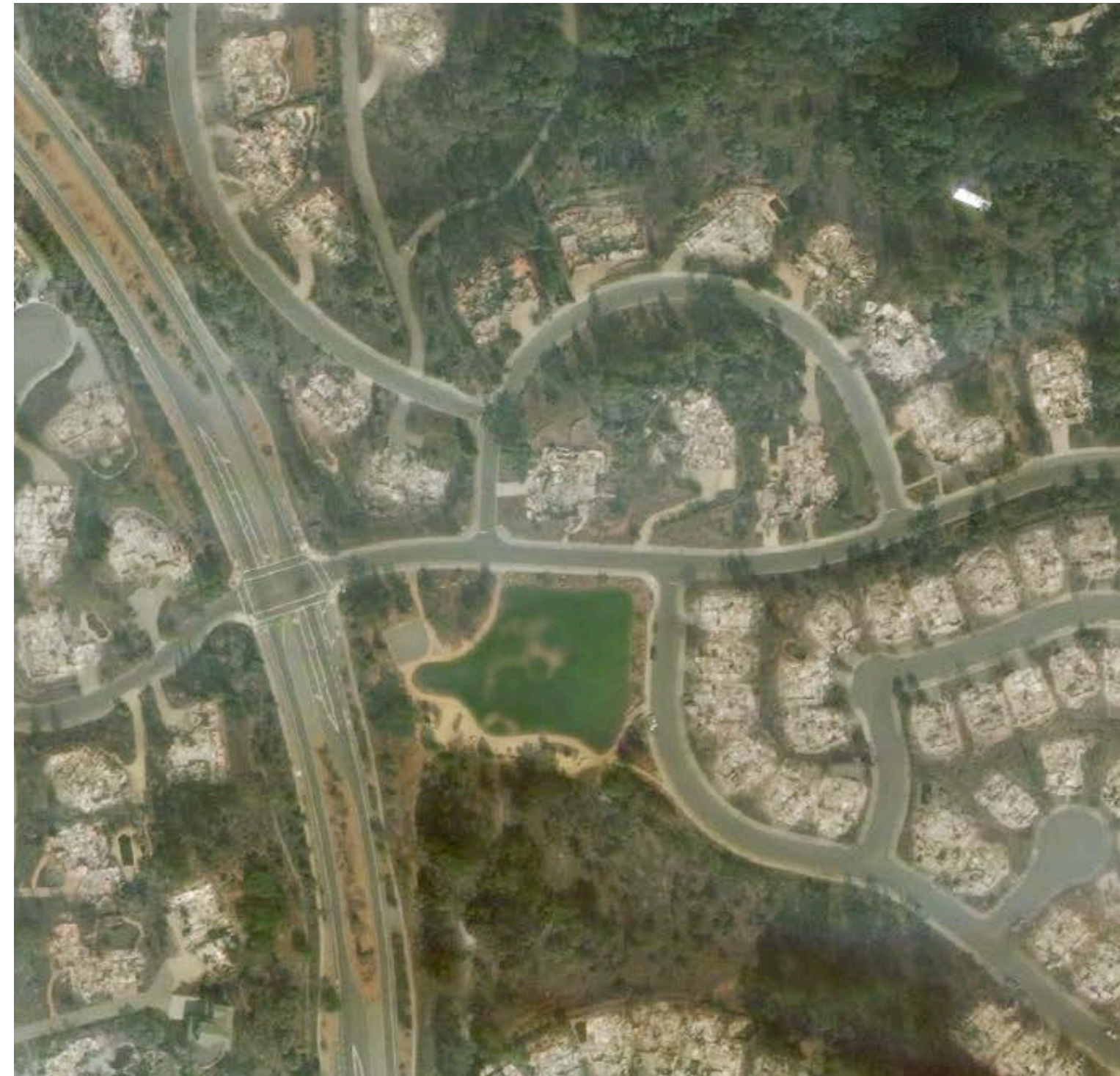
Fire



RGB switched to R(NIR)B



Pre-event



Post-event



Annotations



Pre-event



Post-event



Annotations

xView 2.0 Challenge

- Given pre- and post-event imagery pairs.
- Tasks:
 1. Localize polygons
 2. Ordinal regression for building damage assessment
- Launched on Sept 19!



xView2: Building Damage

Enter your email address to be notified when the xView2 building damage dataset and challenge are available.

You can unsubscribe at any time by clicking the link in our emails. If after clicking the button you do not see a confirmation message below, please enable javascript or use incognito mode.

Subscribe

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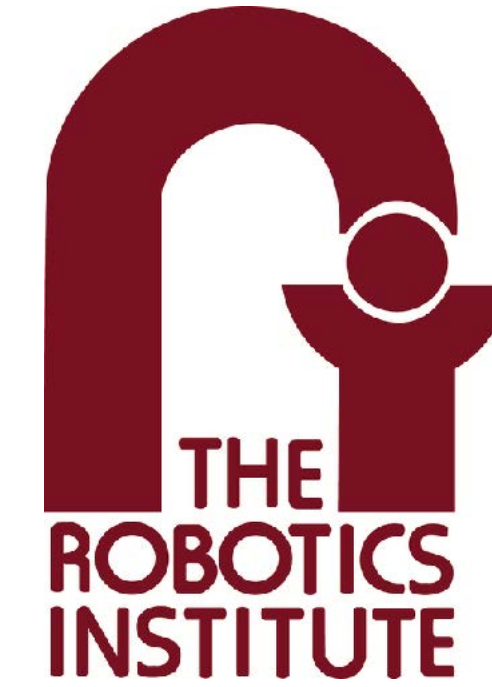
Partners and Collaborators



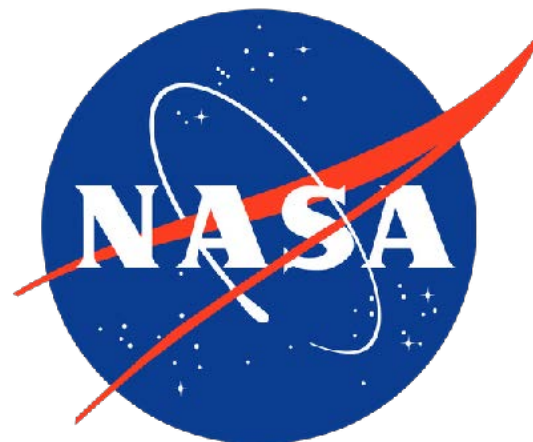
A MAXAR COMPANY



Joint Artificial Intelligence
Center



FEMA



JOHNS HOPKINS
APPLIED PHYSICS LABORATORY



UNOPS



USGS
science for a changing world



Cal OES
GOVERNOR'S OFFICE
OF EMERGENCY SERVICES

Turkey and Syria







Result Overview

Region (Image date)	Number of buildings	Number of damaged buildings	% buildings damaged	Estimated people impacted
Marash (2/9)	40,375	3,005	7.44%	148,388
Turkoglu (2/9)	3,816	185	4.85%	6,202
Nurdagi (2/9)	4,537	331	7.30%	2,163
Islahiye (2/7)	13,215	328	2.48%	3,658

2023 Turkey EQs: Turkey Building Damage Assessment

Table 1: Results over the four study areas in Turkey.

Region (Image date)	Number of buildings	Number of damaged buildings	% buildings damaged	Estimated people impacted
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Predictions of AI model

Differences could be due to:

- Data collection time (2/9 vs 2/19)
- AI model reflecting only collapsed buildings
- "A weakness of this methodology is that rubble that has been identified as "damage", but that falls outside of a building footprint is not able to be attributed to any nearby building, potentially leading to an **underestimate of the number of damaged buildings.**"
- "Another weakness is that the building footprints in the Microsoft Building footprint dataset are derived from Bing basemap imagery that is potentially outdated for the different AOIs, therefore recently constructed buildings will possibly be missing in the analysis."

Damage State	# of Buildings	Perc. (%)	# of Buildings	Perc. (%)	# of Buildings	Perc. (%)
	Gaziantep		Hatay		Kahramanmaraş	
Total	209746	100.00	142284	100.00	106649	100.00
No Damage	125209	59.70	70393	49.47	40255	37.75
Light Damage	38313	18.27	33493	23.54	30595	28.69
Moderate Damage	32351	15.42	9964	7.00	15733	14.75
Severe Damage	9121	4.35	19005	13.36	13260	12.43
Partial Collapse	1492	0.71	3286	2.31	2842	2.66
Collapse	3260	1.55	6143	4.32	3964	3.72

6.38%

Data according to Turkish Ministry of Environment, Urbanization and Climate Change (2/19)



Automated inference over Mariupol. Each building represents a percentage of damage. Runtime ~5 minutes.