Town of Green Mountain Falls

Regular Fire Mitigation Advisory Committee Meeting Agenda
January 26, 2025, at 6:00 p.m.

Join the meeting now
Meeting ID: 233 464 572 972
Passcode: Tv9co6bf

To make a **public comment** please **pre-register** by 4pm on the day of the meeting via email: FMAC@gmfco.us

REGULAR MEETING:

TIME*		ITEM	DESIRED OUTCOME
6:00	**1.**	CALL TO ORDER / ROLL CALL	
6:00	**2.**	ADDITIONS, DELETIONS, OR CORRECTION TO THE AGENDA	**FMC Action Desired**
6:05	**3.**	PERSONS PRE-REGISTERED OR PRESENT NOT ON THE AGENDA: 3 MINUTES PER SPEAKER a.	Info only
6:10	**4.**	CONSENT AGENDA a. Minutes from Previous Meeting	**Action**
6:15	**5.**	OLD BUSINESS a. Budget Update (Paul Yingling) b. Iona / Cottage Fire Mitigation (Chris Noonan) c. COSWAP Update (Paul Yingling) d. Tip of the Month (Kelly Hunter) e. GMF Owner/Resident Database – 281 / + 0 (Paul Yingling) f. ASIP - 0	 Info only **Action** Info only Info only **Action** Info only Info only
7:00	**6.**	NEW BUSINESS a. NASA Flood and Fire Grant (Paul Yingling) b. Next meeting: February 23, 2026	 Info only Info only
7:15	**7.**	REPORTS a. None	Info only
7:30	**8.**	CORRESPONDENCE: None	Info only
7:30	**9.**	ADJOURN	Info only

*Please note: Times are approximate.
**The Town shall provide reasonable accommodation for those with disabilities on a case by case basis. Please send accommodation requests to clerk@gmfco.us by 4pm on the date of the meeting.

Fire Mitigation Advisory Committee meeting minutes
Monday, Dec. 8, 2025
Green Mountain Falls, CO Town Hall
In person and TEAMS video

Committee Members Present

Paul Yingling, chair (TEAMS)
David Douglas (TEAMS)
Lisa Huizenga
Kelly Hunter (TEAMS)
Chris Noonan

Trustee Members Present

None

Recording Secretary

Carolyn Bowers (TEAMS)

Staff members present

Nicole Woods, Town Clerk/Treasurer

1. ROLL CALL AND CALL TO ORDER

Vice Chair Huizenga called the meeting to order at 6:01 pm.

2. ADDITIONS, DELETIONS, CORRECTIONS TO THE AGENDA

Douglas moved and Yingling seconded to adopt the agenda with no additions or corrections. Motion carried on voice vote.

3. PUBLIC COMMENTS

There were no comments.

4. CONSENT AGENDA

Yingling moved and Douglas seconded a motion to approve the Oct. 29 minutes. Motion carried on voice vote.

5. OLD BUSINESS

a. 2026 Budget update

1. Yingling reported that Trustees had approved an $8,000 operating budget for the committee and a $14,000 contingency budget to be shared with the Parks, Recreation and Trails committee.

2. FMAC will receive $7,000 from the contingency fund, thus bringing its total budget to $15,000.

b. Election of FMAC officers for 2026

1. Douglas moved to elect Yingling committee chair and Huizenga as vice chair.

2. Motion approved by consensus.

c. Tip of the Month

1. Yingling proposed holiday safety (heaters, candles, trees) as the subject.

2. Hunter moved to adopt the proposal, Douglas seconded. Motion carried on voice vote.

d. Owner-resident data base – no update

e. ASIP - no update

6. CORRESPONDENCE

No correspondence

7. NEW BUSINESS

a. Yingling reported Teller County's chipper is not available for June 22, FMAC's chosen date for spring/summer Chipper Days. The schedule calls for June 21-22.

b. He moved that the committee recommend new dates to the Fire Department: June 20-21. Douglas seconded. Motion carried on voice vote.

c. Huizenga with discuss the alternative dates with Chief

d. Douglas proposed giving Huizenga authority to change the approved alternatives dates to June 19 and 20 if June 21 clashes with Father's Day. Motion approved on consensus.

8. REPORTS

No reports

9. ADJOURNMENT

a. Huizenga adjourned the meeting at 7:15 pm.

b. The next meeting is Jan. 26, 2026.

FMAC Budget 2026			
Item	Prooposal		Adjustment
Public Education Events	210		200
Public Education Materials	200		0
NFPA ASIP Training	195		195
Firefighter Appreciation Day	630		400
Team Rubicon Appreciation Dinner	1250		0
Fire Warning signs	2100		0*
Chipper Day Yard Signs	228		0
FMAC T-shits	90		0
Fire Migitation Operaitons - Catamount	20000		5500
Fire Migitation Operaitons - Cottage			5305
	24903		11600
* fund through community fundraising			

LOOKING FORWARD

January 2026

Below is a schedule of events the Fire Mitigation Advisory Committee is planning for the coming year to make our Town safer and educate our community. If insurance costs, mitigation efforts and safety for our homes are of concern to you, please join us for any or all the following events.

We're all in this together!

<table>
<tr><th>Special Events and Programs</th><th>Fire Mitigation Advisory Committee Meetings</th></tr>
<tr><td>April 11 – Fire Resistant Horticulture in partnership with Colorado State University</td><td>Last Monday of Every Month

6PM at Town Hall or on MS Teams</td></tr>
<tr><td>May 30 – Home Ignition Zone - Best Practices Course– Full day course with Tom Welle, in partnership with Historic Green Mountain Falls Foundation</td><td rowspan="10">January 26
February 23
March 30
April 27
May 18 *
June 29
July 27
August 24
September 28
October 26
December 7 *

* Change from first Monday of the month due to holiday</td></tr>
<tr><td>June 06– Firefighter Appreciation Day</td></tr>
<tr><td>June 20 – Neighbor Helping Neighbor Fire Mitigation Workday</td></tr>
<tr><td>June 13-14 Chipper Days</td></tr>
<tr><td>July 10-18 Team Rubicon Fire Mitigation</td></tr>
<tr><td>July 25 – Bronc Days – Stop by our booth!</td></tr>
<tr><td>August 1 – Neighbor Helping Neighbor Fire Mitigation Workday</td></tr>
<tr><td>August 15-16 Chipper Days</td></tr>
<tr><td>September 28 – Getting GMF Firewise</td></tr>
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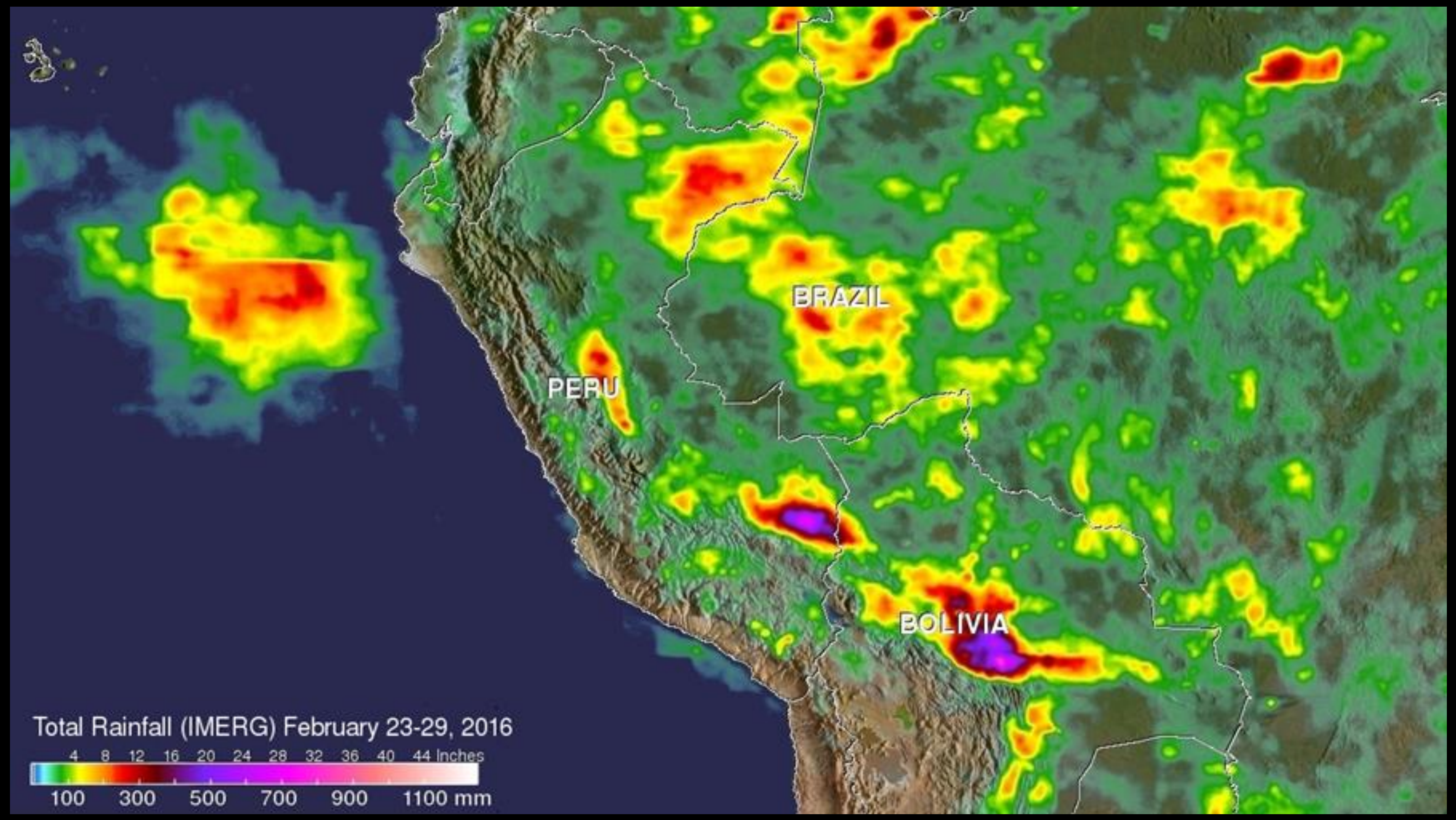
NASA | NSPIRES

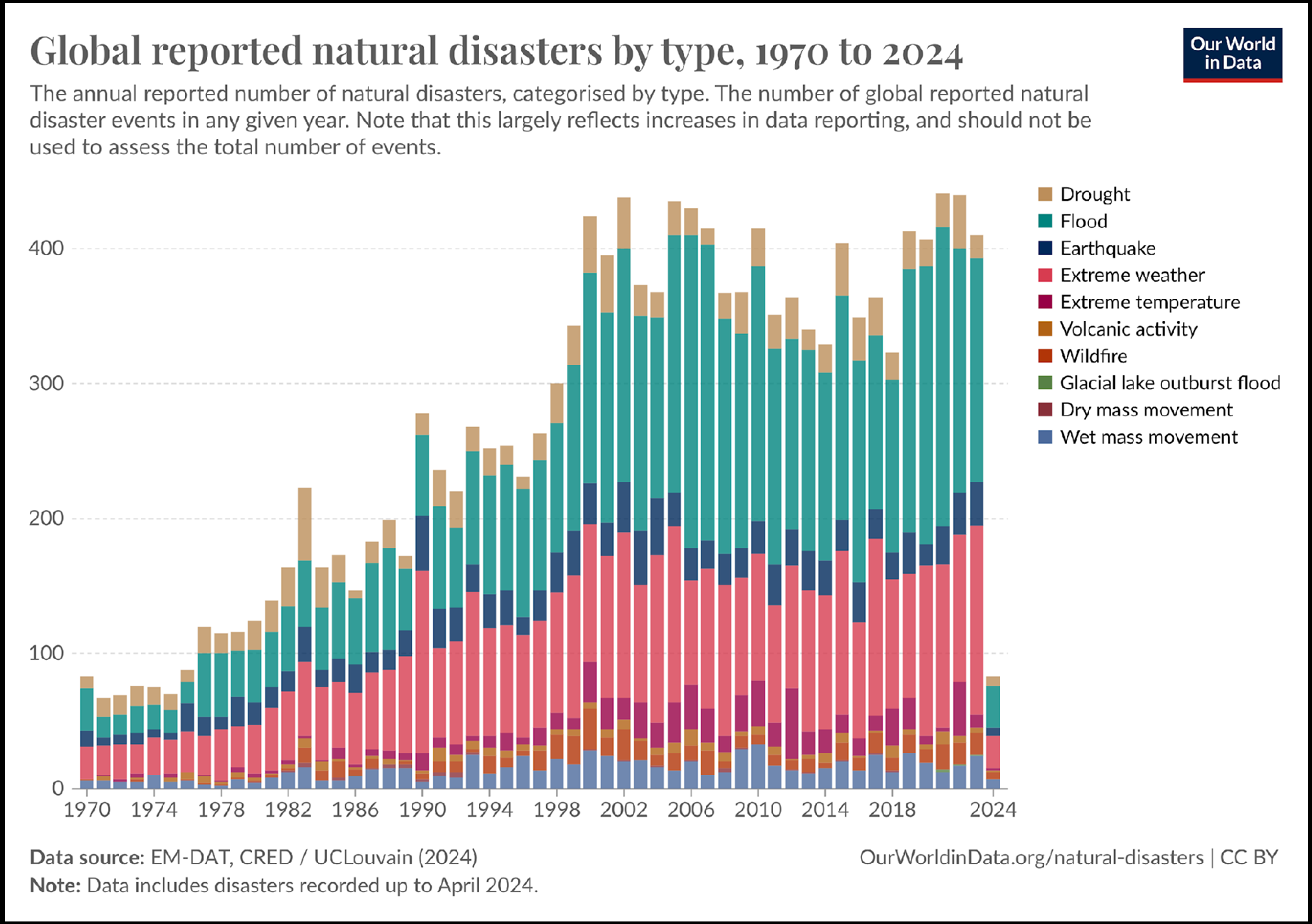
FloodSense: AI-Agent-Driven Real-Time Flood Intelligence

& Environmental Intelligence



The Flood Challenge

- Floods are the #1 U.S. disaster → >$150 B/yr and rising
- Latency gap: 30-min IMERG → multi-day LEO
- Delayed evacuations, fragmented coordination
- Hurricane Ian 2022: 500+ km^2 inland flooding missed for hours for example
- Need: sub-10-minute continuity + real-time risk triage

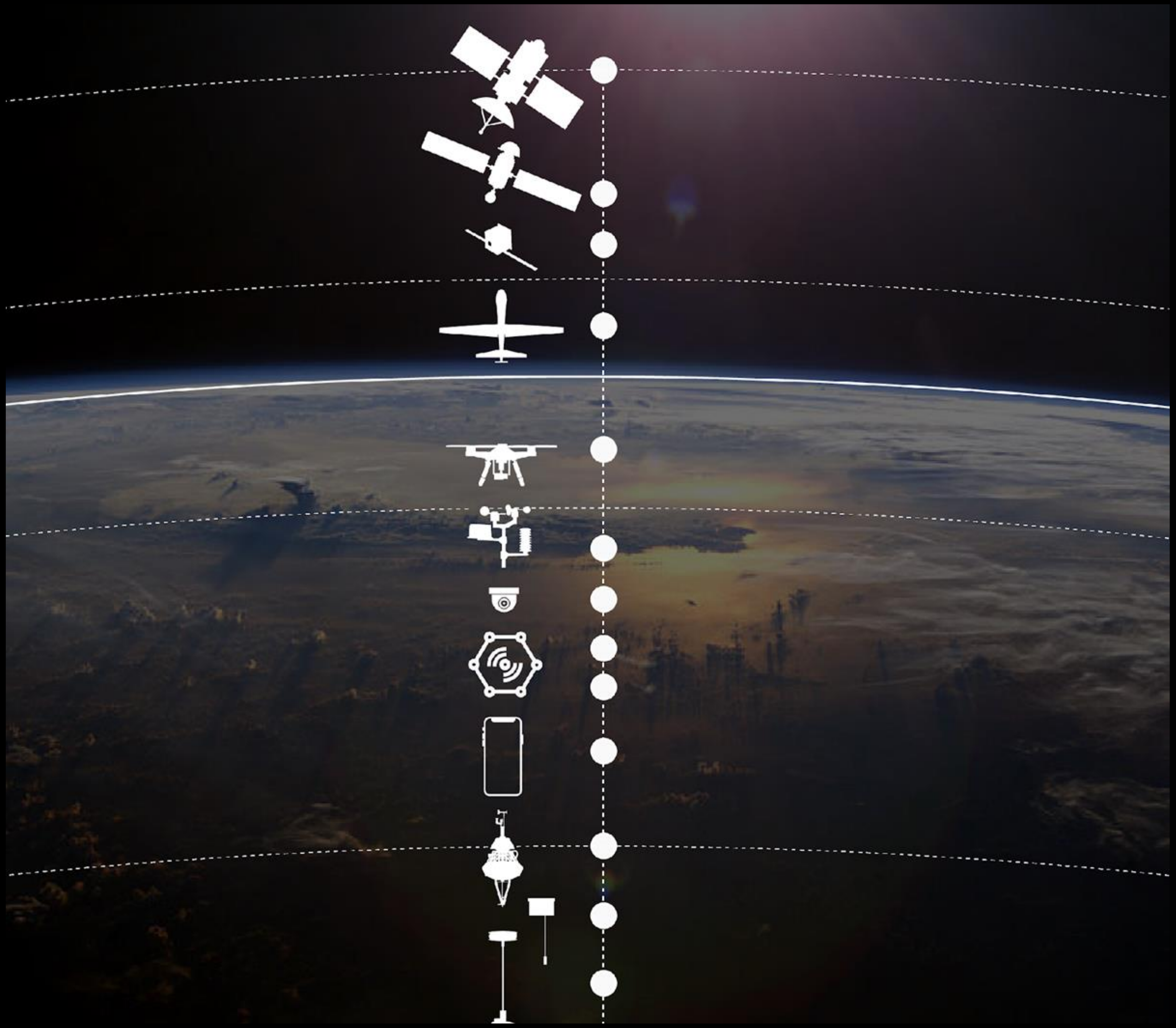


FloodSense: Leona-Powered Real-Time Flood Intelligence

- Guardian Space AI-agent platform (Leona central coordinator)
- Fuses NASA + global GEO sensors via Guardian Pro architecture
- 5-minute CONUS | 10–15-minute global maps (A world first)
- Co-designed with Fire Department+ Colorado Mountain Ranch Community
- Delivers explainable alerts before, during, and after an event

Multi-Orbit & Agnostic Data Fusion Architecture

- Direct-broadcast GOES-R (pre-public) → 5-min CONUS full-disk
- Meteosat SEVIRI / Himawari AHI → 10–15-min global
- IMERG Early/Late v07 (0.1°, Kalman-MORPHed, bias <5 %)
- NISAR L-band SAR + SWOT Ka/R altimetry quarterly calibration
- Leona orchestrates CT-Net fusion + RDE across Guardian Pro hubs



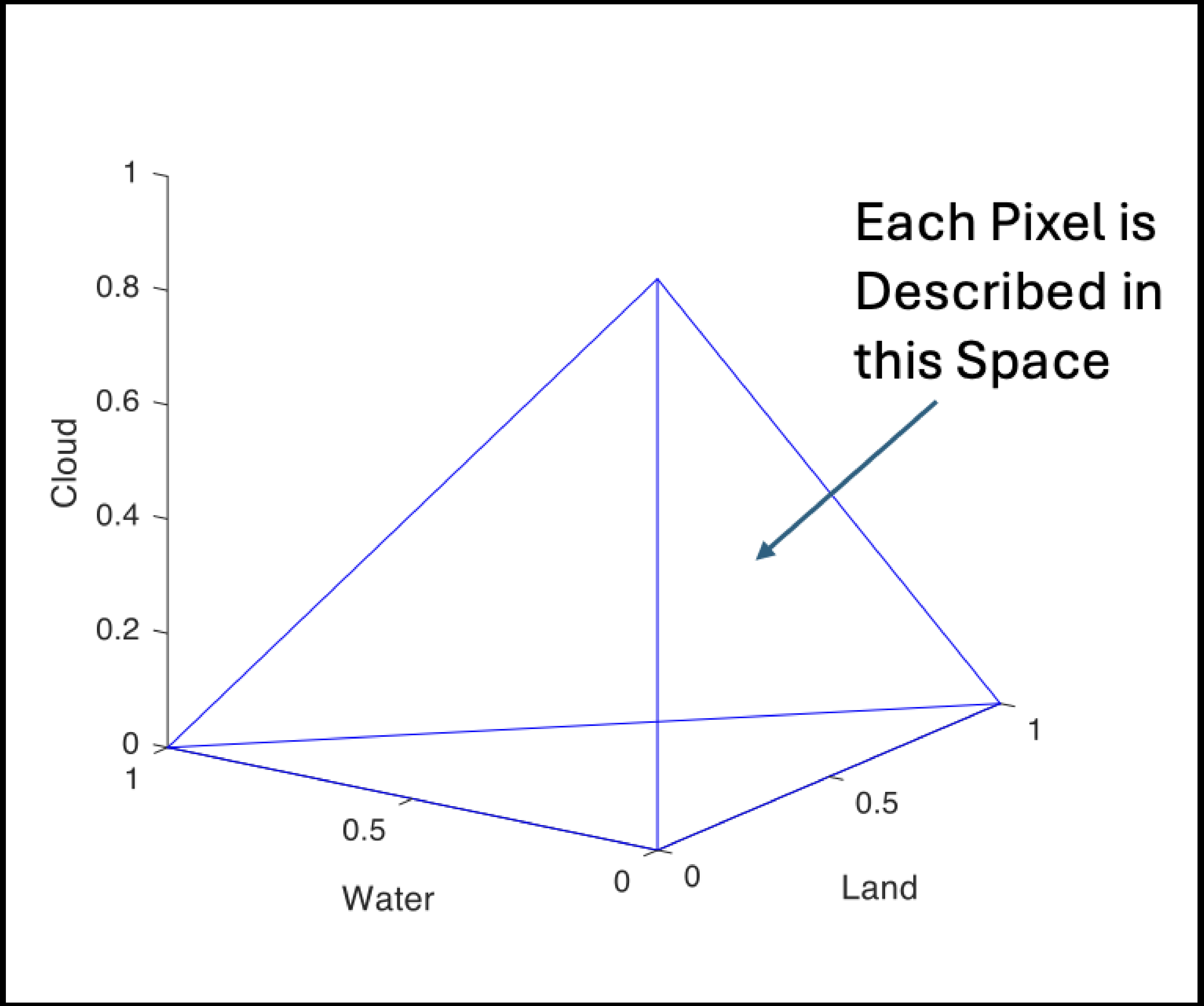
Spectral Modeling – 6-Band Anomaly Detection

- GOES-R ABI Ch. 2–7 (0.47–2.25 µm vis-SWIR, 0.5–2 km)
- Weekly per-pixel BRDF via Ross-Li kernel (k_0 + k_1f_geo + k_2f_vol)
- Anomaly = $\Delta\rho\lambda > 2\sigma$ vs. most-recent clear-sky + 10 m HLS mask
- Cloud handling: split-window BT diff >1 K + Mahalanobis D > 3
- Water flag: NIR/SWIR reflectance <0.05

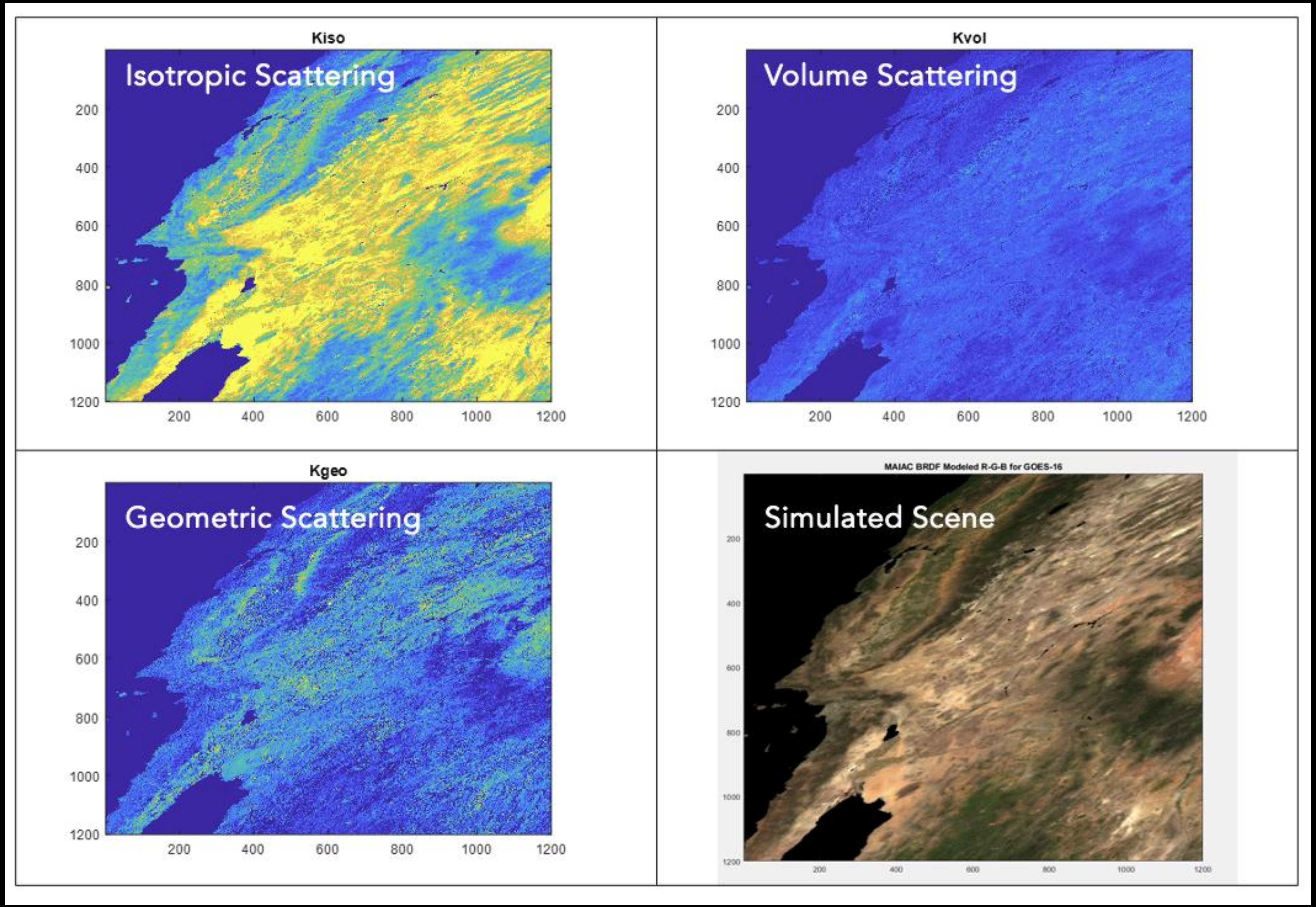
Mixed Pixel Model

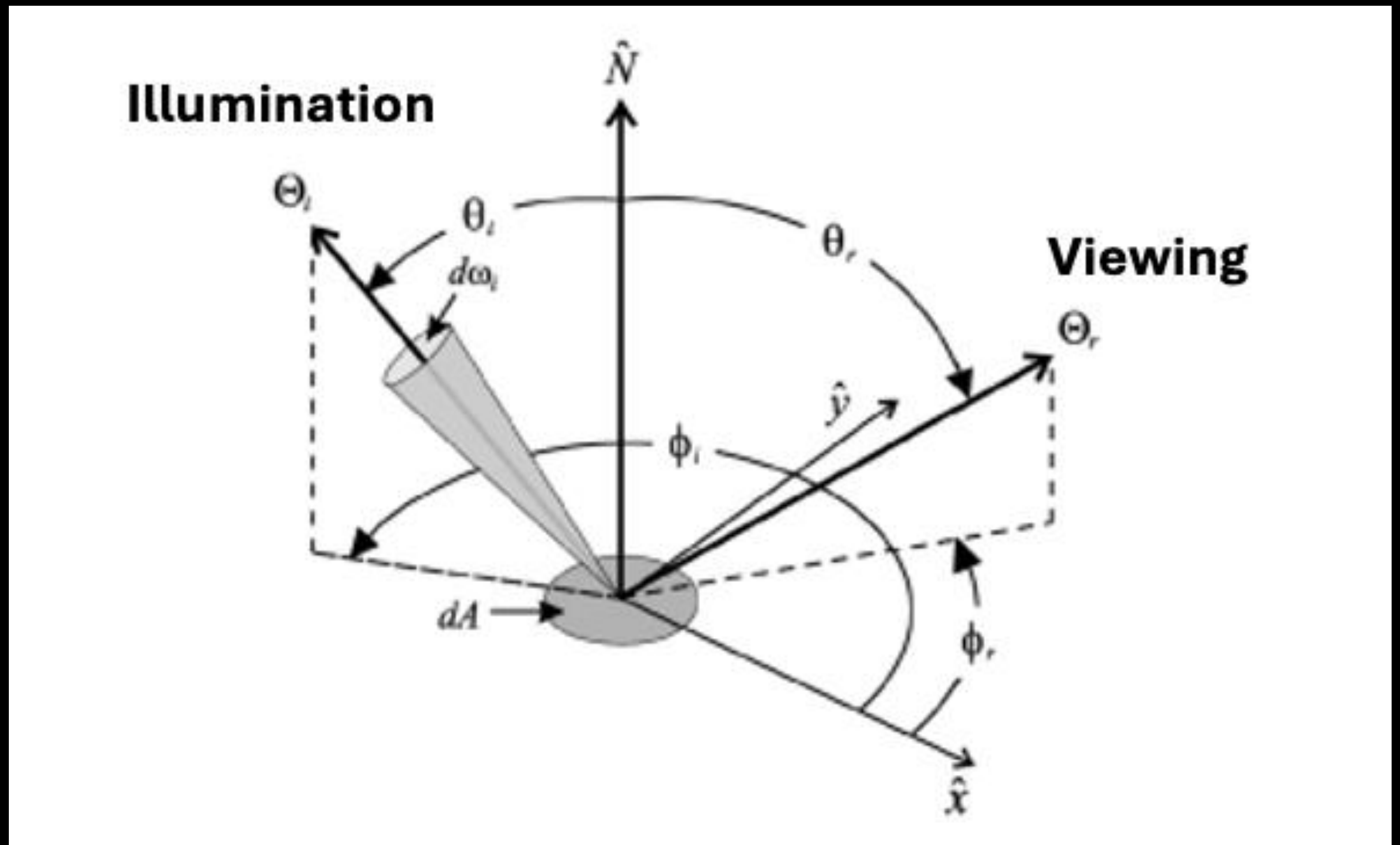
- Retrieval of (Land, Water, Cloud) fraction best fits the reflectance the bands 0.47, 0.64, 0.86, 1.37, 1.6, 2.2 micorns

- Constrained to be within physically realistic volume (left)



Bidirectional Reflectance Model



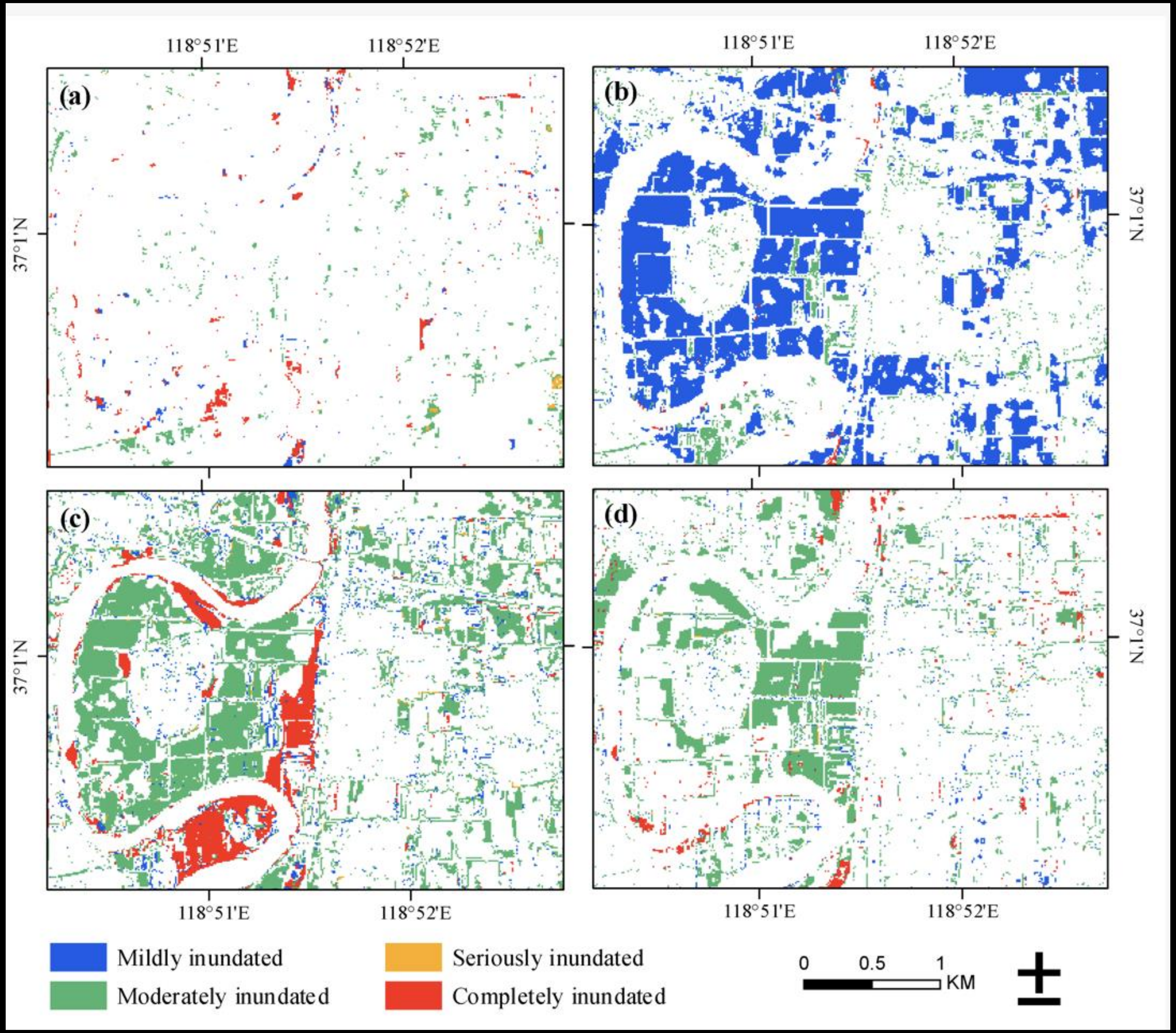


- Ross-Li model uses three scattering kernel functions (“Iso”, “Vol”, “Geo”) to model angular dependence on illumination and viewing.

- MAIAC coefficients weight each kernel function to predict pixel

Agentic AI Change detection for Flooding

- Continuous retrieval of water coverage from GEO
- Bidirectional reflectance model
  - **Land surfaces from NASA MAIAC (Multi-Angle Implementation of Atmospheric Correction**
  - **Lambertian Water**
  - **Lambertian Cloud**
- Multispectral fitting retrieves mix of Land, Water, Cloud
- Cloud-Free land-water mosaic
- Most recent, least cloudy pixel
- Pixel age



Hurricane Ian, Florida 2023

- Category 4 → 1 landfall Sept. 28–29 near Cayo Costa, FL
- 500+ km^2 inland flooding (red extents)
- Detected <5 minutes via GEO anomalies + IMERG >200 mm accumulation
- 92 % recall vs. USGS gauges
- 3× faster than NOAA FEP (1-hr latency)
- RDE triaged high-risk bridges first

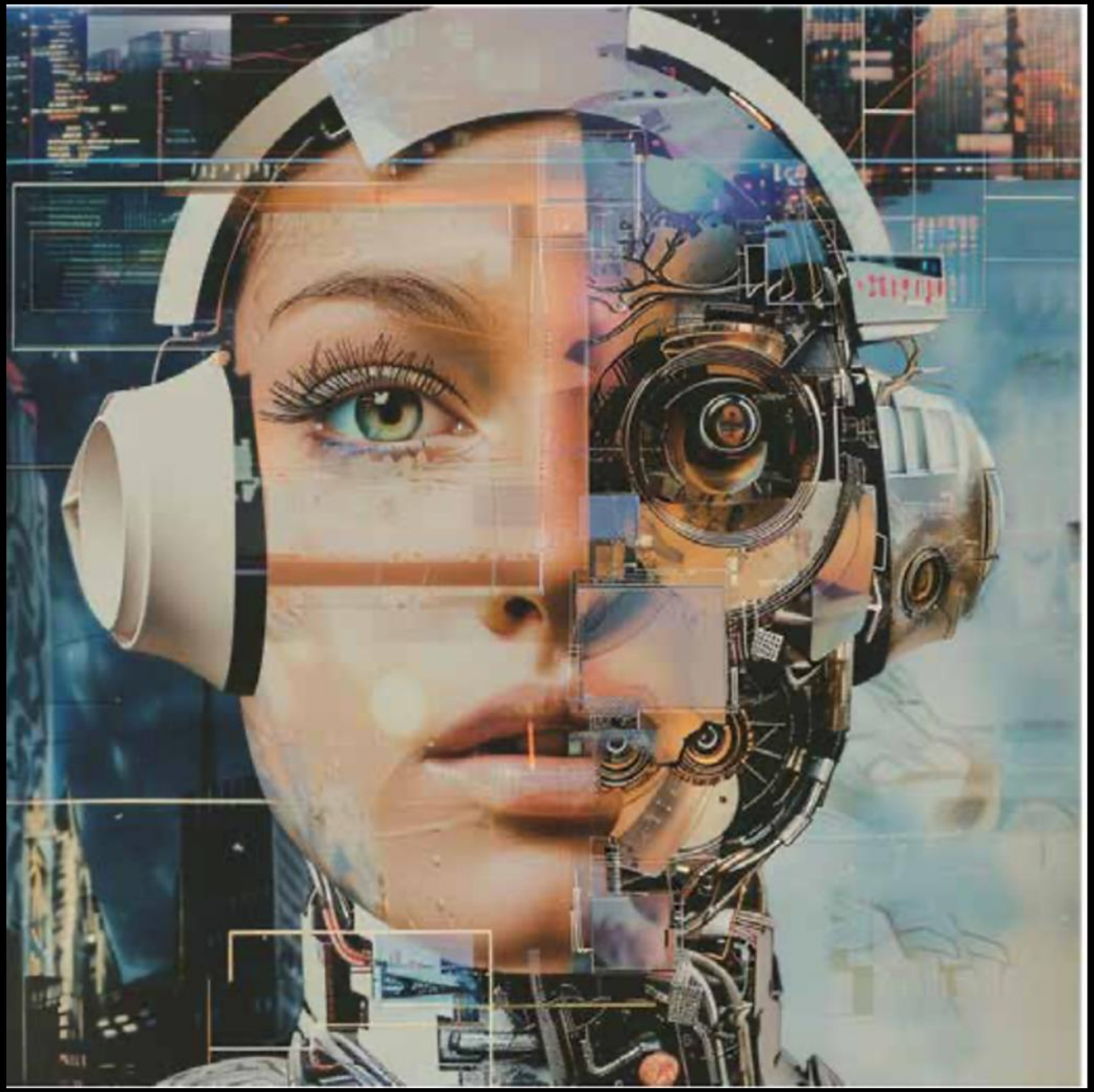
Figure 1. Flooding (red) from Hurricane Ian, September 28-29, 2023.

Community Partnership

- Colorado Mountain Ranch Community and Fire Department (co-design + field testing)

Why Fund FloodSense?

- First Leona-powered 5-minute operational flood maps
- Proven on Ian and many other examples, fully risk-mitigated, $1 M → 3-year roadmap
- Co-designed with Colorado Mountain Ranch FD
- Sustainable via Guardian Pro / EVENT360 revenue + open science
- Directly advances NASA Earth Action–Disasters



FloodSense: Multi-Orbit AI Fusion for Real-Time Flood Intelligence

Abstract

FloodSense is an AI-orchestrated, co-designed platform that integrates real-time NASA Earth observation (EO) data streams from IMERG for precipitation, NISAR for backscatter, SWOT for altimetry, and GOES-R ABI for multispectral persistence—extended globally via MSG and Himawari—to produce flood-extent polygons and rainfall-accumulation grids at 5-minute cadences over CONUS and 10-15 minutes worldwide. Co-developed with a federal end-user and post-event partner, it resolves temporal gaps in hydrologic monitoring by synergizing GEO high-frequency revisits (5-min direct broadcasts) with LEO precision (cm-level) and IMERG cloud-penetrating estimates, powered by explainable CT-Net and RDE. Innovations include BRDF modeling for 6 vis-SWIR anomaly detection and Leona-orchestrated Bayesian risk diffusion for pixel-provenance alerts. The 3-year $1M plan: Year 1 ($200K) prototypes fusion with Ian validation; Year 2 ($300K) integrates LEO/post-event pilots; Year 3 ($500K) scales to Hazus/IPAWS with open release. FloodSense advances Earth Action–Disasters: ≥30% faster FEMA responses (averting $5-10B liabilities), ≥85% F1 accuracy vs. USGS/NOAA, 50+ analysts trained, FAIR DAAC archiving for global resilience.

Overview and Objectives

U.S. flooding exceeds $150B annual damages, driven by climate extremes, but systems like NOAA FEP (1-hr latency) and USGS LEO maps (multi-day) lack sub-hourly continuity for dynamic propagation. Flood-Sense builds a multi-orbit pipeline ingesting GEO ABI/MSG/Himawari imagery (0.5-2 km, 6 bands: 0.47, 0.64, 0.86, 1.37, 1.60, 2.25 μm), calibrating with NISAR L-band SAR (VV/VH <-15 dB water) and SWOT altimetry (120 km swath, 1 cm accuracy), forced by IMERG v07 (0.1°, 30-min Kalman-MORPHed). Out-puts: probabilistic rasters (0-1 flood prob, ensemble uncertainty) and GeoJSON vectors, streamed < 2-min to dashboards. Objectives:

1. Develop 5/10-min ingestion-alert pipeline with modular fallbacks (e.g., IMERG-only at 75% fidelity).
2. Co-design thresholds/interfaces (e.g., heatmapped gradients) via bi-monthly sprints, validated on Hurri-cane Ian (Sept. 28-29, 2022; 500+ km^2 inland flooding near Cayo Costa, FL).
3. Achieve ≥85% F1 extent detection, >0.80 IoU boundaries, < 10 m RMSE vs. in-situ (USGS/NWS gauges, n>500 pilots).
4. Transition to federal ops while releasing open artifacts (Dockerized CT-Net, Apache 2.0; >1 TB datasets) for GEO derivatives.

Background and Relevance to NASA INNOVATE

Floods are NASA's top Earth Action–Disasters focus for societal applications, yet data silos persist: IMERG v07 offers gauge-calibrated precip (bias < 5% land) at 30-min but no inundation; NISAR/SWOT enable vegetation/cloud-penetrating discrimination (L/S-band SAR, Ka/R altimetry) at 12-21 day revisits; GOES-R ABI scans CONUS 5-min with Ch. 13 BT cloud-masking but needs fusion for attribution. FloodSense aligns INNOVATE via co-design (end-user thresholds, e.g., >50 mm/6 hr +20% anomaly = Tier-1 alert), NASA synergy (HLS Landsat-Sentinel masks), rapid prototyping (Y1 demo), sustainability (commercial post-event > $500K/yr revenue), open science (ISO 19115 metadata, ≥3 yr LP DAAC/GES DISC archives). Enables IPAWS geo-fencing for 20-50% loss reductions, scaling to UN Sendai risk targets.

Innovation and Major Advance

Outpacing LEO-focused (Copernicus 24-72 hr SAR) and GEO-limited (EUMETSAT 15-min vetted) systems, FloodSense pioneers GEO-LEO-IMERG fusion under RDE—graph-based risk equilibration propagating probabilities across assets (diffusion kernels balance alert variance). Gains: 5-min CONUS via GOES-E/W HRIT/EMWIN (<1-min ingest); 10-15-min global MSG/Himawari. Spectral: Weekly per-pixel BRDF (Ross-Li kernel $f_r = k_0 + k_1 f_{geo} + k_2 f_{vol}$ fitted from clear-sky) for anomalies $\Delta\rho_\lambda = \rho_{obs} - \rho_{BRDF} > 2\sigma_\lambda$ (σ MERRA-2; water NIR/SWIR <0.05). CT-Net: ConvLSTM-3D CNN on [T=6, C=8 (6 spec + IMERG + SRTM)] tensors; gated recurrence $h_t = \tanh(W_{xh}x_t + W_{hh}h_{t-1} + b_h) \odot \sigma(...)$; loss $L = 0.7(1 - 2\ \mathrm{L}\ y\hat{y}/(\mathrm{L}\ y + \mathrm{L}\ \hat{y})) + 0.3\mathrm{BCE}$. Explainability: SHAP (>70% precip attribution); Grad-CAM++ (hotspots >0.5 drivers). RDE: Leona + flood agent GNN $R_v = (1 - \beta)R_v + \beta\ \mathrm{L}\ A_{uv}P_u(flood|data)$, $\beta = 0.6$, OSM infrastructure graphs. Ian: 92% recall on 300 km^2 extents (Fig. 1), 3x FEP speed.

Scientific and Technical Approach

FloodSense runs Kubernetes-serverless on AWS/GCP (Lambda ingest, SageMaker inference; <1 TB S3 storage), handling >10 GB/hr on A100 GPUs (10^5 CycleGAN-augmented samples for clouds).

Spectral Modeling: 7-day rolling clear-sky composites (ABI Ch. 2-7; MSG/Himawari/GOES), BRDF-normalized for zenith/azimuth metadata. Cloud mask: split-window (Ch. 14/16 BT diff >1 K), optical (Ch. 2 ref <0.2); flags persistent deviations vs. most-recent clear-sky/HLS (10 m quarterly) mask. Threshold: Mahalanobis $D = (\Delta\rho - \mu)^T \Sigma^{-1} (\Delta\rho - \mu) > 3$ (Σ MERRA-2 cov).

Rainfall Assimilation: IMERG Early/Late v07 as 3D grids (mm/hr Kalman-smoothed); trapezoidal accumulation $A_t = A_{t-1} + \Delta t/2(r_t + r_{t-1})$, $\alpha = 0.8$ morphing. Proxy: SCS-CN $Q = (P - 0.2S)^2/(P + 0.8S)$ ($S = 1000/CN - 10$, NLCD CN); >50 mm/6 hr boosts probs +40%, GMI/DPR cloud-agnostic.

LEO Integration: Quarterly NISAR L2 σ° (dB geocoded), SWOT L2 η: water fraction $w = (\sigma_{VH} -$

$\mu_{land})/(\mu_{water} - \mu_{land}) > 0.5$; kriging $\hat{\eta}(x) = L\ \lambda_i \eta_i$ (spherical variogram, 5 km range). Refinement: LS $\Delta e = (X^T X)^{-1} X^T (h_{SW\ OT} - h_{GEO})$ for <10 m RMSE. Contexts: MERRA-2 ϑ <0.3 m^3/m^3 antecedent dry; ECCO coastal surges.

CT-Net Fusion: 4-layer ConvLSTM (3×3×3 kernel, 16-64 filters, 0.2 dropout) + U-Net; aug: temporal warp/spectral jitter ±5%. Pass: LSTM over T=6 to 1×1 fusion; sigmoid probs + MC dropout unc (50 passes, std <0.1). Train: AdamW (lr=1e-4, wd=1e-5), early stop val Dice >0.85; CV on 20 events (Ian/Ida). RDE: GraphSAGE on 10^4-node graphs (elev/vuln features, <1 km edges); aggregate message-passing for triage (high-R bridges 2x priority). Explain: Integrated Gradients (precip 45%, SWIR 30%, DEM slope 15%); LIME pixel-trust.

Delivery & Validation: GeoTIFF/GeoJSON streams <10 s to dashboards; FAIR ISO APIs. Retrospective: Ian F1=0.92 (Fig. 1 red vs. USGS). Prospective: Gulf pilots (n=20 events, IoU>0.80). Risk

Figure 1: Ian inland extents (red) from GEO anomalies + IMERG, detected <5 min post-landfall

Implementation Plan and Schedule

Year	Budget	Key Milestones	Deliverables/Metrics
1	200,000	BRDF/CT-Net prototype build; 4 co-design sprints; Ian retrospective validation. M1: Data ingest (Q1); M2: 5-min U.S. demo (Q4).	Prototype API; interim accuracy report (F1 ≥80%); Gulf Coast pilot dataset.
2	300,000	NISAR/SWOT LEO integration; post-event damage pilots; 10 real-time events. M3: Calibration fusion (Q2); M4: Uncertainty ensemble (Q4).	Validated regional maps (F1 ≥85%); Ian-scale damage report.
3	500,000	National API rollout; Hazus/IPAWS transition; user workshops. M5: Open-source release (Q2); M6: Adoption evaluation (Q4).	Operational platform; 50+ trainees; DAAC archive (>90% uptime).

End-User Co-Design and Engagement

Bi-monthly Agile sprints (user stories, e.g., “As analyst, need heatmaps for evac priority”); federal partner provides workflows/ground-truth (SAR gauges); state pilots (TX/FL) feedback. Post-event validates extents (e.g., >1 m building inundation). Annual Labs: Hands-on NASA EO/AI for 50+ analysts; pre/post surveys >70% proficiency.

Sustainability and Transition Strategy

Institutional: Hazus/IPAWS perpetual embed. Technical: Docker CT-Net cloud, $200K/yr subs. Commercial: Insurer post-event > $500K revenue. Scientific: Apache 2.0; ≥3 yr DAAC/NetCDF; GDACS workshops.

Management Structure and Roles

Co-leads: Tech/NASA liaison (30% effort). Advisor: EO validation (10%). Engineer: Models (40%). Partners: Requirements (5%), damage (10%). Bi-weekly reviews; risk register. Budget: 60% personnel, 15% indirect, 10% subawards/cloud/equipment, 5% travel.

References

Huffman et al. (2023) J. Hydrometeor.; Rosen et al. (2022) IEEE TGRS; Biancamaria et al. (2020) Water Resour. Res.; Goodman et al. (2019) Bull.

December 18, 2025

Nima Pahlevan, Ph.D.
Program Manager & Scientist
Earth Science Division | Science Missions Directorate
Mary W. Jackson NASA Headquarters
Mail Code 3Y37
300 E Street SW, Washington, DC 20546

Dear Dr. Pahlevan,

I am writing on behalf of the town of Green Mountain Falls, Colorado, where I serve as the Town Manager. Situated in Ute Pass, a steep valley in the Rocky Mountain foothills, our town confronts some of the state's most severe flood risks on a regular basis. Our region is highly prone to flash flooding due to steep terrain, rapid elevation changes, intense localized thunderstorms, and post-wildfire burn scars that create hydrophobic soils, accelerating runoff and triggering debris flows and mudslides. Green Mountain Falls expresses strong interest in the FloodSense product and urges expanded access to its real-time flood data, integrated with tools like Guardian Pro and Guardian Apps, to enhance our emergency response capabilities.

Our town faces profound challenges in managing flood threats. The Ute Pass region is among Colorado's most flash-flood-prone regions, where slow-moving thunderstorms produce heavy rainfall that funnels rapidly down canyons and steep slopes onto alluvial fans and low-lying areas below, often creating "walls of water" with minimal warning. Post-wildfire burn scars—such as those from the Waldo Canyon fires — exacerbate these risks by repelling water, leading to heightened flooding, debris flows, and mudslides even from moderate rain. The flash floods following the Waldo Canyon fire caused substantial damage to property and risk to residents in Green Mountain Falls, —stretching our resources with demanding evacuations, road closures and other emergency operations. Traditional monitoring often lacks the hyper-local, real-time data needed, leading to delayed responses, increased risks to responders and residents, and amplified damage.

Access to the FloodSense product could transform our flood preparedness and response. By delivering real-time water level monitoring, predictive analytics, and precise hyper-local alerts—potentially fused from advanced sources like satellite Earth observation data—FloodSense directly addresses the rapid-onset nature of flash floods in our community, including high-risk burn scar areas. This capability would enable us to anticipate threats in vulnerable canyons, issue proactive evacuations, deploy resources efficiently, and conduct safer rescues, ultimately saving lives and reducing economic and community impacts.

Integrating this with Guardian Pro and Guardian Apps would further empower emergency responders. Guardian Pro offers advanced real-time monitoring and property-level insights, while the mobile Guardian Apps provide field personnel with on-the-go access to live data, alerts, and coordination tools. These platforms would improve situational awareness in challenging terrain with limited visibility or connectivity, enhance inter-agency collaboration, and optimize operations during dynamic events. The benefits include faster impact containment, reduced personnel strain, and greater resilience for residents facing intensifying storms in a changing climate.

Moreover, our town is keenly interested in collaborating on the ongoing development and refinement of FloodSense. As on-the-ground experts in Colorado's unique flood environments, we are eager to provide valuable ground truth data—such as direct observations of water levels, flood extents, debris flows, and event timelines from our response activities—for calibration and validation purposes. This partnership would help improve the product's accuracy in complex terrains like burn scars and steep foothills, ensuring it better serves first responders and communities nationwide.

In summary, providing our department with access to FloodSense and the supporting Guardian Pro and Apps—along with opportunities for collaborative development—would equip us with critical technology to address the distinctive flood challenges in Colorado's mountains. We encourage your support in extending these resources to fire departments across the state, fostering safer, more resilient communities.

Should you require any additional information or wish to discuss collaboration opportunities further, please do not hesitate to contact me at (719) 684-9414 or manager@gmfco.us.

Sincerely,

Caleb Patterson
Town Manager
Green Mountain Falls