



Is Satellite Data Right for Your Needs?

HUMANITARIAN GUIDE

A practical guide to help the humanitarian decision maker determine if and how to work with satellite data and tools.

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Introduction

Who this guide is for and what value it serves

Have you ever thought about the possible use cases for satellite data? Have you wanted to incorporate satellite data and tools into your programming but didn't know where to start? Is it challenging to keep up with the latest trends in satellite data and Earth science and what's applicable to the humanitarian context?

This guide is designed to help the **humanitarian decision-maker** (e.g., Information Management Officers, Technology Advisors, Program Managers, and others) determine if and how to work with satellite data and tools. This guide is an entry point for any humanitarian decision-maker who is ready to improve their outcomes using satellite data. With an increasing evidence base and level of need, humanitarian decision-makers cannot afford to ignore opportunities where satellite data and tools can make a greater impact.

Do you need to allocate scarce resources and make strategic choices that shape humanitarian programs? Do you have experts on your team or partners that can navigate the technical details?

While you may not be a technical expert, you recognize the importance of data and emerging technologies in improving efficiency, scalability, and outcomes. This resource will be most beneficial for decision-makers who have a basic understanding of geospatial concepts (e.g., ability to interpret map outputs) and who have access to subject matter experts who can help them answer technical questions related to their specific use case. Don't have access to the right kinds of experts? Activate our community through the NASA Lifelines Earth Science Review Board where you can submit questions to a panel tailored for your needs and get unbiased recommendations. Even if you are not working with satellite data (yet), this guide hopes to inspire your next steps and a strategy to operationalize these immense resources.

By providing a structured framework of key questions and case studies demonstrating real-world applications, this guide provides a repeatable method and community examples to make informed choices. Questions to consider range from evaluating the benefits and risks of satellite data to understanding ethical considerations, cost implications, and capacity requirements. Beyond technical guidance, this resource also helps organizations assess the expertise needed to work with geospatial data, manage expectations about data accuracy and limitations, and ensure that satellite-driven insights align with humanitarian principles. Finally, it offers practical recommendations, training resources, and strategies for effectively communicating findings to stakeholders. Using the knowledge in this guide, decision-makers can unlock more value from satellite data, making their work more effective, data-driven, and impactful.

Community Profile

HUMANITARIAN DECISION-MAKER



Goals:

- Improve humanitarian outcomes through resource allocation decisions that ensure effective use of technology – while securing more funding for program implementation.
- Identify interventions that are evidence-based, scalable, and efficient to meet urgent needs while building long-term resilience.
- Avoid unnecessary risk in their investments, ensuring that any use of new technologies or approaches are justified and meet actual needs.
- Align with global trends in data-informed crisis response.

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What satellite data and tools are relevant for Humanitarians?

There are many different kinds of satellites imaging different parts of the world at different cadences and swath sizes and resolutions. While one satellite might be designed for detecting heat islands and temperature extremes, another satellite might be better suited for monitoring smallholder farms. Some satellites are designed to monitor the same places around the world at consistent revisit rates, others are tasked to capture on-demand locations as needs arise.

The range of satellite data includes optical and hyperspectral imagery, synthetic aperture radar (SAR), LiDAR, thermal imagery, weather and climate data - all useful for various humanitarian needs from flood monitoring to planning evacuation routes to air quality assessments to infrastructure damage assessments - to name a few. There are also a few different ways to access satellite data, depending on how you want to use it (e.g., directly from providers and in various formats, from third party platforms hosting many satellite data providers, open data programs, etc).

In addition to a wide range of satellites and data types, there are also many derived models, datasets, services, and tools that are relevant for humanitarian applications. Many times, these are the best place to start, especially if your team has limited internal capacity or time to work directly with satellite data.



Explore Caribou Space's Beyond Borders report to learn more about different types of satellite data, applications and tools in the humanitarian context. 

Suitability Assessment Framework for Satellite Data

By systematically navigating questions related to evaluation, scoping, analysis, and communication, humanitarian organizations can better determine when satellite data is fit for purpose, identify appropriate data sources and tools, address ethical considerations, manage expectations, and ensure responsible use.

Throughout the framework, you'll be encouraged to consider privacy and ethical implications, accuracy and uncertainty in the data, data accessibility, analytical capacity, costs, and partner availability, and much more. The framework emphasizes transparency, community engagement, and rigorous evaluation of impact to ensure humanitarian principles—humanity, impartiality, neutrality, and independence—remain central to decisions informed by satellite imagery.

A few important notes:

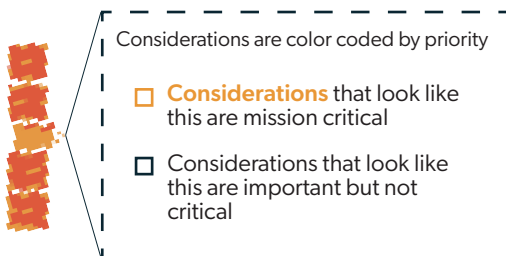
- **This is the beginning of a living framework that will evolve as more case studies are added and more decision-makers operationalize this resource.** As others apply the framework to their own work, we will update the questions and considerations and pressure test this resource in other domains.
- **Given the broad range of humanitarian applications for the framework, consider this a guide and not a set of explicit instructions** - everything might not apply to your case study in the same way our first two case studies have tackled these questions. Please consider them both a reference in how to interpret the framework.

- **Questions are not always linear, and you may need to revisit questions you previously answered as your data collection, analysis, and implementation unfolds.** For example, your requirements might evolve as situations change (e.g., shifting area of interest, changing population of need, etc.). Or perhaps you aren't able to task and collect imagery as you expected and need to adjust plans, or your team's bandwidth shifts. Be sure to document decisions along the way to streamline the process later.
- **Engage your team and partners – and affected communities where possible – throughout the process.** They can inform your evaluation, approach, and how to communicate and share results.
- **Consider the broader effects technology adoption can have across your programs and partners.** As you'll see in the framework, the process of identifying, implementing and evaluating a new data source is multifaceted. Maximize the efficiency of this process by creatively adding to existing internal knowledge, leveraging partnerships, and reaching out to others who may have experiences you can learn from. While this framework helps you assess satellite data for specific uses, taking a broader view is critical to unlock the full potential and value of a technology that applies to so many problems. Many of the questions answered here will hopefully serve you in considering other technologies.

Is Satellite Data Right for Me?

Questions

What decisions could Satellite data support?



Considerations

- **Define** clearly the decision-making process (emergency response, resource allocation, planning), including when decision(s) are made and by whom.
- **Identify** the hazard(s) involved as different types of satellite data and tools are designed for specific hazards (e.g., wildfire detection or water detection).
- **Note** if there is a specific trigger or threshold that results in decision-making or if these are ongoing and/or routine decisions. Always consider your end user(s) and how they want data to be shared.
- **Understand** what other data and tools are involved in the decision-making process and where satellite data and tools could/should complement existing workflows.
- **Research** case studies using satellite data and tools documented by organizations like [UNOSAT](#), [UN OCHA's Humanitarian Data Exchange](#), [NASA's Applied Remote Sensing Training \(ARSET\)](#), [ReliefWeb](#), and [GeoEvidence Explorer](#).
- **Review** the data and tools used across these case studies in case there are resources you can use - either as turnkey solutions or part of your approach. These will be good to share with your technical experts so you don't duplicate previous efforts and can take advantage of existing resources.
- Consider tapping humanitarian GIS networks or communities (e.g., GISCorps, Missing Maps, NASA Lifelines Earth Science Review Board) for precedents and advice.

Are there any precedents for this use case? Are there relevant resources we could use?

What are the ethics and risk considerations of introducing the use of satellite data?

- **Consider** the ethical and risk considerations at each stage of your work from design through implementation and follow-up. How might adding a layer of satellite data intersect with these? How might it introduce new risks? Consider aspects like the potential that imagery is misused by other parties, that it is misinterpreted, that it exposes information on vulnerable populations (e.g. their location) to malicious actors, and more. More example questions to consider in our appendix resource labeled the ethics and risk audit.
- Is additional local data needed? Is this data openly available? Are data owners willing to share the data? Is a data sharing agreement needed, and do you have relationships in place to broker that access? Are there sensitivities in sharing local data?
- Refer to established ethical guidelines (e.g., [Humanitarian Data Exchange's \(HDX\) Data Responsibility Framework](#), [Berkeley Protocol on Digital Open Source Investigations](#), [International Committee of the Red Cross \(ICRC\) guidelines for digital humanitarian action](#)).
- More example questions can be found in the appendix under the Ethics and Risk Audit section.

What data could support these decisions? What are “must have” requirements for the data for these use cases? Is commercial imagery or tasking needed? What are our alternatives?

- **Identify** with technical advisors the key data characteristics needed like spatial resolution, frequency of revisit, latency, geographic coverage, and accuracy needed to support these decisions.
- Note which are “must have” vs “nice to have”.
- Consider what ancillary datasets you’ll be using along with satellite data and derived tools and where remote coverage complements existing assets. This may also inform your satellite data requirements (e.g., covering areas where you have other data, time periods of data collection, etc).
- Evaluate the need for commercial data vs. publicly available imagery based on required resolution and latency.

What’s Our Approach?

Questions

Do any existing solutions meet our requirements? If not, what gaps exist regarding data access and analysis to support our use case?

Considerations

- Evaluate any turnkey solutions (ie. ready-made, pre-existing). There are a few catalogues of satellite data-driven applications, including [Space for Development](#) and the [NASA Lifelines Gallery](#).
- Consider if any ground truthing or validation has been done. Does this include your area of interest or similar geographies? If this validation hasn’t been done, consider including this in your in-country work.
- **Explore** ways to involve affected community voices.

- Clearly identify gaps where existing solutions don't meet your specifications and explore any analysis required (e.g., custom image processing, analysis pipelines).

What types of skills and expertise are needed? Based on our internal capacity and bandwidth, can our teams take on this work? What kinds of partnerships do we need?

- **Identify** essential expertise needed: GIS analysts, remote sensing specialists, data scientists, field validators.
- If expertise does not exist in-house, consider partnerships with experienced providers, especially in your application area (e.g., Earth observation companies, academic institutions, volunteer mapping communities like [Humanitarian OpenStreetMap \(HOT\)](#) or [GISCorps](#)).
- Communities of experts like [NASA Lifelines](#), [H2H Network](#) and [START Network](#) are also good options for technical services and support.

What data, tools, standards and techniques are already adopted and trusted by humanitarians? What is my team familiar with? How can we know we've covered everything?

- **Liaise** with your team to assess what they have experience with and bandwidth to take on themselves and if/where they want to partner.
- Consider using widely adopted tools (e.g., Google Earth Engine, HDX platform, OpenStreetMap (OSM), UNOSAT standards, ESRI ArcGIS and standards (e.g., Common Operational Datasets, HXL standards, Cloud Optimized Geotiffs, REST APIs) that are most likely used by your partners.
- Consider leveraging technical, community-driven shared learning platforms (e.g., Women in Geospatial or AID Arena) or efforts like NASA Lifelines' Earth Science Review Board to provide up-to-date, tailored technical advice for your needs.

Which data is open and accessible for us and our partners? Who needs access to the data? Any sensitivities on who gets access or when?

- Check with your team that they've made the most of free and open data and tools (considering their capacity, bandwidth, and your program needs).
- Consider sources of openly available imagery and derived datasets (e.g., NASA, ESA, HDX data repositories, Google Earth Engine catalog / GEE community catalog, open data programs from commercial providers, OSM).
- **Ensure** your team has a sustainable data management plan, with access, security, updating, and more included (easier with open data sources).

What will this approach cost (in people time, time spent, data purchases, travel, etc)? Is it worth the investment? Are there free/more affordable alternatives?

- **Scope** resources needed and estimate a budget with the technical team. Consider a few scenarios including a "good enough" analysis and the ideal scenario.
- Explore cost-saving options (open data programs, cloud credits from Amazon/Microsoft, imagery donations through partnerships). Consider trade-offs of various options (e.g., data is free but takes more time/skills to prepare).

- Take a “value for money” approach to evidence the contributions of satellite data/tools to the impact achieved; there are great examples in the **VALUABLES** consortium’s work and, more recently, **CONVEI**.

How much time do you need to gather data? For analysis?

- **Clearly** specify data collection timelines and how they align with your decision-making timelines.

What are your needs for analysis like cloud computing, internet bandwidth, team time, other expertise, and in-country partners?

- **Clarify** what infrastructure you currently have access to and what you’d need to procure for analysis (compute, cloud resources, GIS licenses) and potential logistical barriers (internet connectivity, field validation). Consider whether this is compatible with your required timelines for decision-making.

Sharing and Communicating Results

Questions

How accurate are the data, analysis, and findings? What is our confidence in this data?

Considerations

- **Adopt** and document a methodology for assessing the accuracy of the satellite data (e.g., ground-truthing, historical validation, peer-reviewed models).
- **Communicate** uncertainty levels and confidence intervals in analysis to decision-makers.
- **Identify** known biases (coverage gaps, classification errors, sensor limitations), assess how they impact the data, and proactively disclose them. Explain how these factored into your confidence assessment.

How should we communicate about risks and uncertainty and how to apply data?

- Define known risks and uncertainties in simple language, avoiding technical jargon when communicating to non-technical audiences.
- **Recommend** clear decision guidance (what kinds of actions to take/not take based on data).

Are there elements of our approach that should be shared? (e.g., lessons learned, data, tools)

- Document your methodology, tools, data processing techniques openly (e.g., blog post, brief reports, forums like HDX).
- Share data openly where possible, following responsible data sharing principles and protecting sensitive data.

What was the impact of our decision-making using this data/analysis?

- ❑ **Establish** clear impact measurement criteria (e.g., lives saved, faster response, improved resource allocation).
- ❑ **Conduct** post-action reviews to capture lessons learned and integrate these into future protocols and training.

In retrospect, would we use satellite data again? What do we want to do differently next time?

- ❑ Plan ongoing feedback loops with end-users to improve continuous application of satellite imagery.
- ❑ Invest in time for teams to iterate on approaches.



Appendix: Ethics and Risk Considerations

This is not an exhaustive list but hopefully will guide your thinking as you consider your specific use case and context. We recommend consulting the more in-depth resources like Signal Code, the Berkeley Protocol, the Locus Charter, and others when reviewing with your team.

Mission Purpose & Transparency

Is the primary purpose of the satellite or EO data mission humanitarian, climate, or development-oriented?

Is the mission clearly not dual-use for military or intelligence purposes?

Are the satellite operators, data providers, and funding sources publicly disclosed?

Are usage restrictions clearly stated and understandable to non-technical users?

Data Access & Equity

Is the data freely available or priced affordably for non-commercial humanitarian use?

Are interfaces or tools accessible to users in low-bandwidth or low-resource environments?

Are local languages, regional formats, or relevant cultural contexts considered?

Can local actors request tailored products or coverage based on their needs?

Are the benefits of the data reaching vulnerable or marginalized communities?

Consent, Privacy & Data Governance

Was community input solicited or respected before data collection or use?

Is there a mechanism for communities to opt-out or control their data visibility?

Are measures in place to avoid identification of individuals or groups?

Does the platform follow humanitarian data protection standards?

Is there a way for communities to challenge or appeal data misuse?

Technical Integrity & Bias Mitigation

Are core algorithms open source or reviewable?

Can local experts verify or reproduce results?

Are assessments in place to check for bias in the data or outputs?

Have known data gaps been acknowledged and addressed?

Accountability & Partnerships

Are local actors involved in co-designing or interpreting the data?

Are private-sector partners held to community-centered standards?

Is there a documented log of data decisions?

Are impact assessments or after-action reports publicly shared?

Is there a neutral oversight body or community advisory council?

Is there a way to monitor ethical compliance over time?