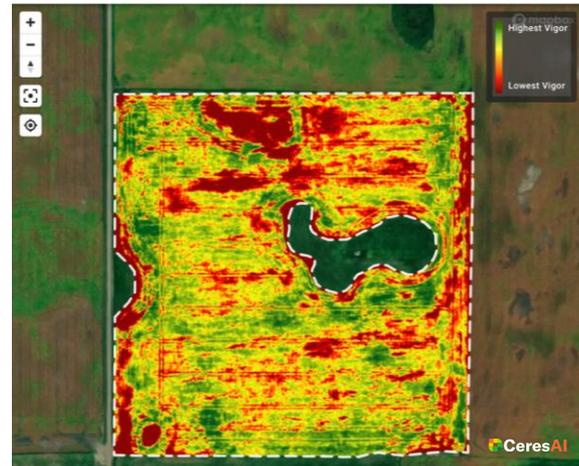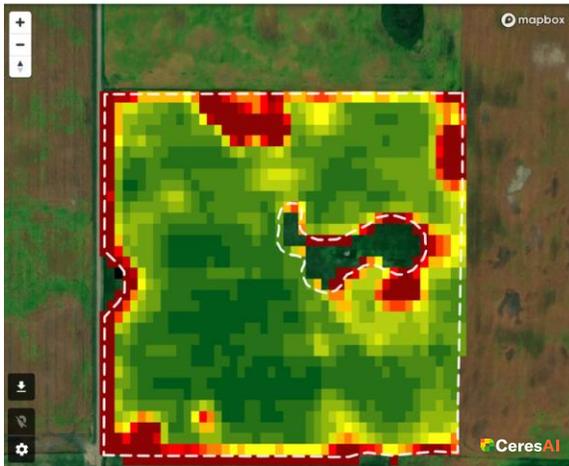# REMOTE SENSING IMAGERY EVALUATION GUIDE

OPTIMIZING COST, RESOLUTION, AND RELIABILITY FOR AGRICULTURAL INTELLIGENCE

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Soy fields in the US Midwest region, captured in satellite imagery on the left and high-resolution aerial imagery on the right

Imagery sources differ in resolution, revisit frequency, spectral capability, and weather reliability. **CeresAI evaluates aerial and satellite imagery for each product, selecting the source that delivers the most accurate and timely insight.** Although our technology originated in high-resolution fixed-wing aerial imaging, we now incorporate satellite data where it provides additional coverage, frequency, or historical depth. Our AI models unify and standardize these varied inputs, enabling consistent, high-quality analytics regardless of where the pixels originate, ensuring clear and dependable outputs across products.

Before diving into each imagery source, **it's worth addressing two misconceptions** we frequently hear in customer conversations and across the industry:

MISCONCEPTION #1
"AERIAL IMAGERY IS ALWAYS MORE EXPENSIVE THAN SATELLITE."

This one surprises a lot of people. High-resolution satellite imagery sounds cheaper, but satellite tasking often requires buying large, predefined minimum-area tiles. Customers end up paying for far more acreage than they actually need. CeresAI's aerial network does the opposite: we collect only the acres of interest, routed efficiently, which typically makes aerial the more economical option for high-resolution needs.

MISCONCEPTION #2
"ISN'T THERE A SATELLITE PROVIDER THAT HAS FREE DAILY HIGH-RESOLUTION IMAGERY?"

While open-data satellites like Sentinel-2 and Landsat are valuable for field and regional monitoring, their spatial and temporal resolution constrain the amount of fine-scale detail they can capture. Commercial high-resolution satellites are available, but they are not free, do not provide daily coverage, and typically involve large minimum-area purchase requirements.
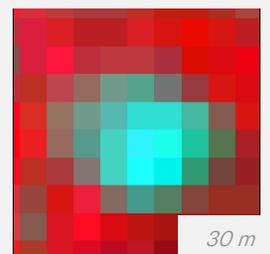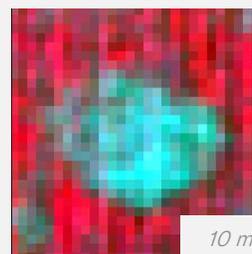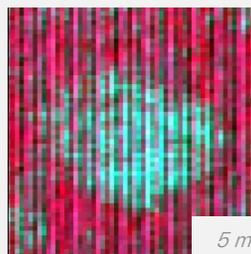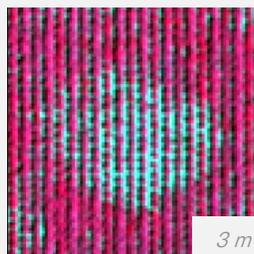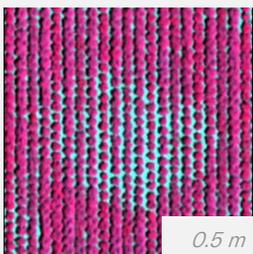
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QUICK GUIDE: WHEN TO USE WHAT

Before diving into the deeper technical details, here's a simple way to understand which imagery source fits which need:

→ **HIGH-RESOLUTION (<1m):** Aerial or High-Res Satellite

Best for detailed plant-level diagnostics such as irrigation issues, fine structural variability, or any insight requiring super clear spatial fidelity.

→ **MEDIUM-HIGH RESOLUTION (3–5m):** Daily Constellations

Useful when frequent monitoring is important and cloud gaps need to be minimized. Great for tracking general field patterns across time.

→ **MEDIUM RESOLUTION (10m):** Sentinel-2

Well-suited for field-level monitoring of broader crop patterns, seasonal changes, and trend analysis.
Reliable spectral quality with consistent global coverage.

→ **LOW RESOLUTION (30m):** Landsat

Ideal for regional or watershed-level trends, long-term historical analysis, and large-area environmental assessments.

→ **SAR (varied resolutions):** All-Weather Complement

Penetrates clouds, haze, and smoke to provide structure and moisture-related signals. Cannot produce optical vegetation indices, so it is best used as a complementary source.

| 0.5 m | 3 m | 5 m | 10 m | 30 m |

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PLATFORM COMPARISON TABLE

This guide provides an overview of the main imagery modalities used in agriculture, outlining their strengths and limitations to help explain why different sources are suited to different types of insights.

PLATFORM TYPE	SENSOR TYPE	RESOLUTION TIER	TYPICAL ACTUAL RESOLUTION	COST	WEATHER RISK	SPATIAL DETAIL / USEFULNESS
CeresAI Aerial	Optical + Thermal	High Res	<1m	$	Low - Medium	**Very High** – fine structures visible; thermal included
Satellite	Optical	High Res	<1m	$$-$$$	Medium	**High** – slightly lower edge clarity; no thermal
Satellite	Optical	High-Medium Res	3-5m	$$	Medium	**Fair** – medium-scale variation visible
Satellite	Optical	Medium Res	10m	Open-data	High	**Moderate** – good for large-scale field patterns; insufficient for detailed analysis
Satellite	Optical	Low Res	30m	Open-data	High	**Low** – reliable for regional trends but too coarse for field-level detail
Satellite	SAR	High Res	<1m	$$$$	None	**High** – excellent structural visibility; no optical content
Satellite	SAR	Low Res	5 - 20m	Open-data	None	**Fair** – useful for moisture/structure patterns at coarse scale

NOTE: 'Spatial Detail / Usefulness' describes the imagery's ability to resolve field-scale features relevant to agricultural monitoring. It does not compare radiometric or spectral calibration performance across platforms.

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1.   COST DYNAMICS & PLATFORM COMPARISON

Cost correlates strongly with spatial resolution and with the complexity of acquisition.

CeresAI AERIAL (EFFICIENT SCALABILITY)

CeresAI performs thousands of flights annually, enabling <1 m spatial fidelity and optional thermal layers. Flights are routed efficiently, minimizing cost per acre and avoiding minimum-area tile purchases.

This enables precise, targeted coverage; you only acquire the acres you need.

Resolution: 0.5m
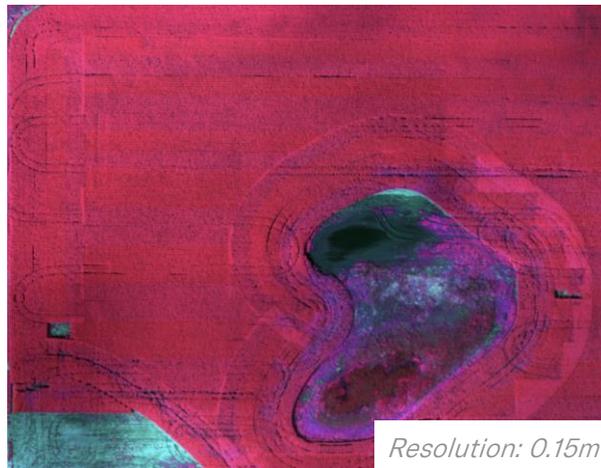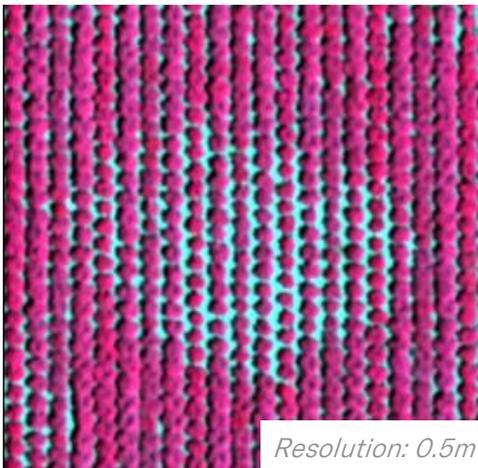
Resolution: 0.15m

OPTICAL SATELLITE HIGH RES (HIGH TASKING COMPLEXITY)

Tasked high-resolution satellites offer strong spatial detail but typically require purchasing large minimum-area tiles, which can result in paying for more coverage than needed. Image quality varies by provider and collection conditions, and viewing angle or atmosphere can affect edge sharpness. These sources are powerful tools but can be less efficient for small or distributed acreage.
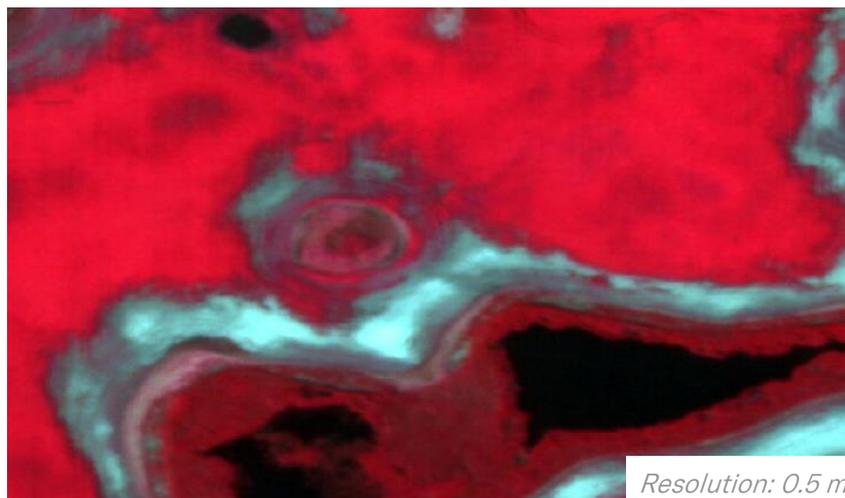
Resolution: 0.5 m

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OPTICAL SATELLITE MEDIUM-HIGH RES (DAILY REVISITS)

Daily optical constellations, such as PlanetScope, provide true daily global coverage at 3–5 m resolution. The high revisit frequency helps reduce weather-related gaps, though spatial fidelity and fine-feature detection are more limited than high-resolution aerial or satellite sources. Minimum-area acquisition requirements are also common and can result in purchasing imagery that extends beyond the fields of interest.

Resolution: 3 m

OPEN-DATA OPTICAL SOURCES (10–30 m)

Medium (10 m) and Low (30 m) resolution optical satellite imagery (e.g., Sentinel-2, Landsat) are publicly available but lack the spatial resolution for detailed asset monitoring. While there is no acquisition fee for these pixels, substantial processing and analytics are still required to turn them into actionable insights.


Resolution: 10 m

Resolution: 30 m

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SAR SATELLITE (ALL RESOLUTIONS)

While SAR delivers consistent visibility regardless of weather or lighting conditions, it measures surface structure, moisture, and texture, not the reflected light needed to calculate vegetation metrics. Optical imagery captures light in specific spectral bands, which is essential for generating agronomic indices such as NDVI, chlorophyll estimation, canopy vigor, and other multispectral or thermal-based crop-health indicators. High-resolution SAR is also the most expensive imagery type on this list due to the technical complexity of acquisition, limited commercial supply, and the specialized processing required to extract usable information.

Resolution: 3 m
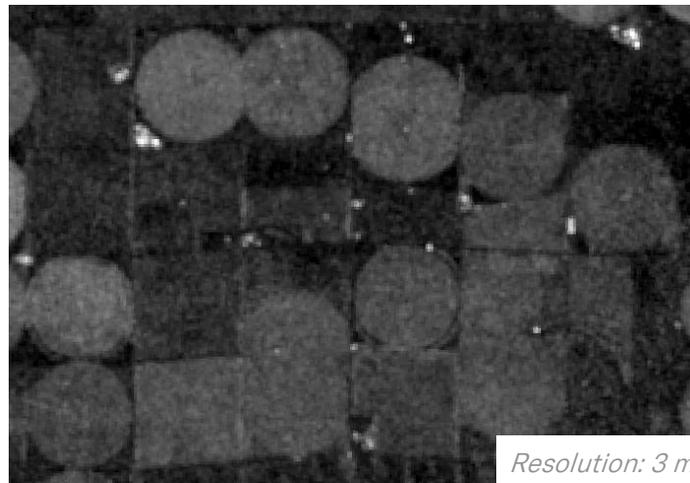
2.   WEATHER IMPACTS: RELIABILITY OF DATA

Acquiring data at the right time is as critical as the quality of the data.

→ **AERIAL IMAGERY**
(More Flexible Windows)

Aerial collection is also weather-dependent, but flights can often operate beneath high cloud ceilings or capitalize on short clear windows, offering more flexibility when timing is critical.

→ **TASKED OPTICAL SATELLITES**
(High Weather Risk)

On-demand high-resolution satellite tasking requires clear skies and good illumination. Clouds, haze, or poor viewing conditions can easily cause missed opportunities during narrow monitoring windows.

→ **DAILY OPTICAL SATELLITES**
(Lower Weather Risk)

Daily optical satellites like PlanetScope increase the likelihood of obtaining a cloud-free image near important dates, even if spatial detail is more limited.

→ **FIXED-ORBIT OPTICAL SATELLITES**
(Medium Weather Risk)

Systems like Sentinel-2 and Landsat capture imagery on fixed schedules. While cadence is reliable, they cannot avoid clouds, and persistent weather can lead to multi-week gaps in usable imagery.

→ **SAR** (No Cloud Risk)

SAR operates independently of sunlight and can penetrate clouds, smoke, and haze, though the data captured differs from optical satellite imagery because of this.

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3. RESOLUTION & ACCURACY: THE DETAIL GAP

Ground Sample Distance (GSD) describes the size of each pixel on the ground. It directly affects what you can see and how accurately features can be measured.

FEATURE DETECTION

1m resolution offers 100x the detail of 10m resolution.

→ **HIGH RES** (<1 m)   Required to see sprinkler rings, subtle nozzle issues, and individual tree-level health.

→ **HIGH-MEDIUM RES** (3-5 m)   Captures broader within-field patterns but not fine localized issues.

→ **MEDIUM RES** (10 m)   Suitable for field-level trend analysis; limited for diagnostic detail.

ACREAGE ACCURACY

Higher-resolution imagery generally enables more precise delineation of field boundaries because smaller pixel sizes capture edge detail more clearly. Medium-resolution sources, with larger pixels, tend to introduce more smoothing and approximation, especially in irregularly shaped fields or complex landscapes.

WHAT THIS MEANS FOR YOU

Choosing between aerial, satellite, and other imagery sources should not be a guessing game.

At CeresAI, we evaluate the available options for each product, taking into account resolution, revisit frequency, weather reliability, and the type of insight needed. We select the source that provides the right balance of accuracy and timely delivery, so you can focus on decisions rather than managing data logistics.

MEET THE AUTHOR

Mitch Goulette (Product Manager, CeresAI)

Product Manager with 8+ years of experience applying geospatial and remote censing technologies to improve agricultural analytics and strengthen crop insurance workflows.