

# ClearSky

## Product Guide



**Aspia  
Space**

# ClearSky Product Guide



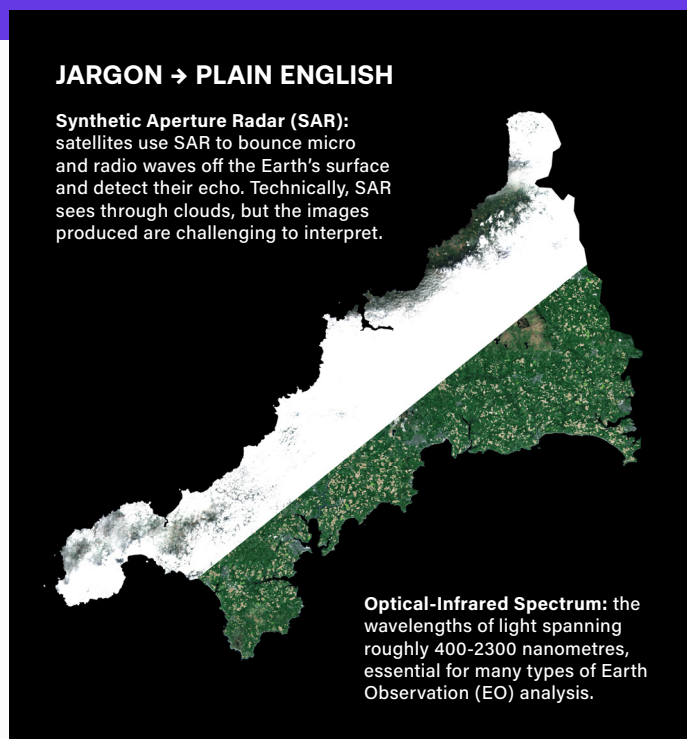
Aspia Space  
Cloud-free  
Earth observation.  
AI + human eye.

## What is ClearSky?

ClearSky is an AI algorithm that gives you invaluable unobscured Earth Observation data intelligence in near time. It's like looking at the world as though there were no clouds at all.

### JARGON → PLAIN ENGLISH

**Synthetic Aperture Radar (SAR):** satellites use SAR to bounce micro and radio waves off the Earth's surface and detect their echo. Technically, SAR sees through clouds, but the images produced are challenging to interpret.



**Optical-Infrared Spectrum:** the wavelengths of light spanning roughly 400-2300 nanometres, essential for many types of Earth Observation (EO) analysis.

ClearSky cuts through the cloud in this RGB composite image of Cornwall, UK.

When cloud, smoke or pollution obscures a satellite's view of the ground, intelligence from Earth observation images is lost. ClearSky solves this problem using a unique combination of deep learning and Synthetic Aperture Radar (SAR) to predict imaging across the full optical-infrared spectrum. Even when there's 100% cloud cover.

## How does ClearSky work?

ClearSky translates SAR data into cloud-free multispectral optical-infrared images.

Each pixel in a ClearSky image is an AI prediction, mimicking traditional 'direct view' optical and infrared images. Because it's delivered in a standard raster format, ClearSky results can be handled, analysed and interpreted in the same way as regular EO imagery.

Our current offering is based on ESA Sentinel imagery. ClearSky predicts Sentinel-2 imagery, giving you:

- ▶ 10-20m resolution
- ▶ Global land coverage
- ▶ Bottom-of-atmosphere reflectance values
- ▶ 10 spectral bands: Blue, Green, Red, Red Edge 1—4, Near-IR, SWIR 1, SWIR 2

ClearSky predicts Sentinel-2 equivalent imagery using Sentinel-1 C-band SAR. Depending on geographic location (particularly latitude), Sentinel-1 acquires a new image every 3-12 days. For every Sentinel-1 SAR acquisition, we can produce a ClearSky prediction of what Sentinel-2 would see at optical-infrared wavelengths. The result is a reliable sequence of cloud-free optical and infrared imagery.

SWIR 2

SWIR 1

Red Edge 4

NIR

Red Edge 3

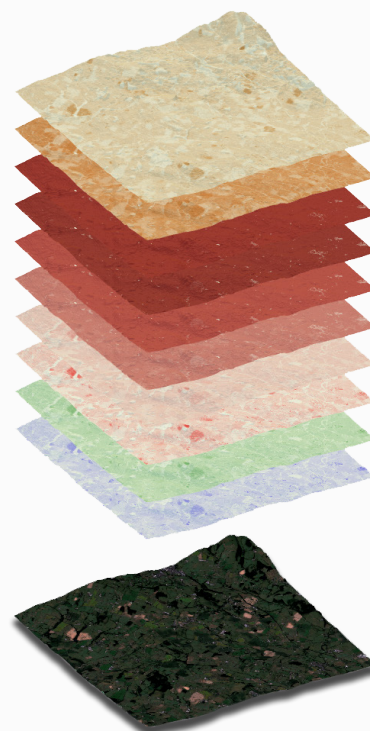
Red Edge 2

Red Edge 1

Red

Green

Blue

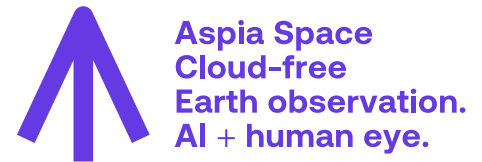


RGB

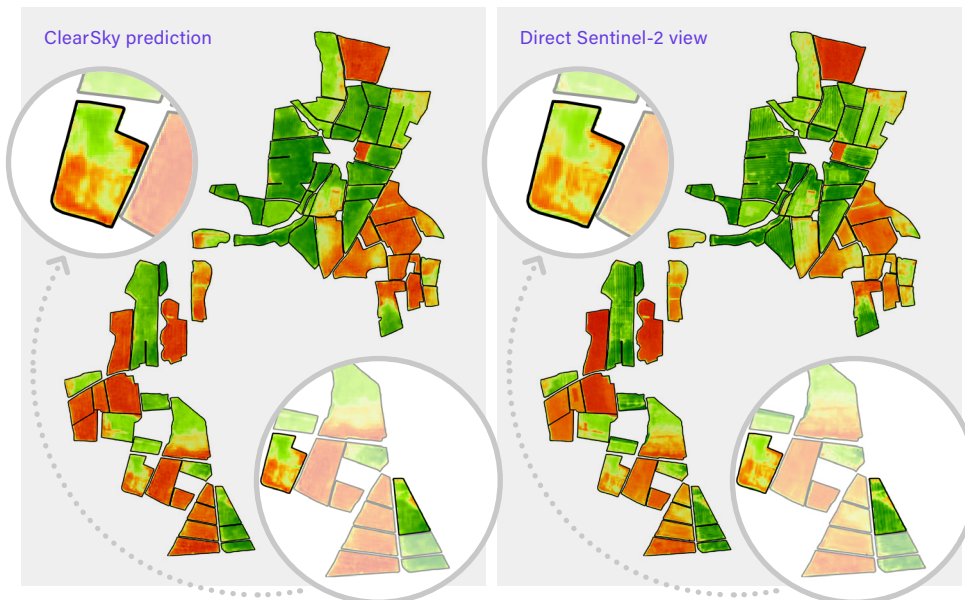
Exploded view with all 10 spectral bands.



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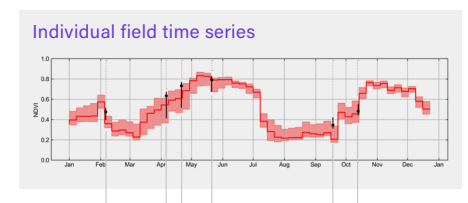
## ClearSky In Action



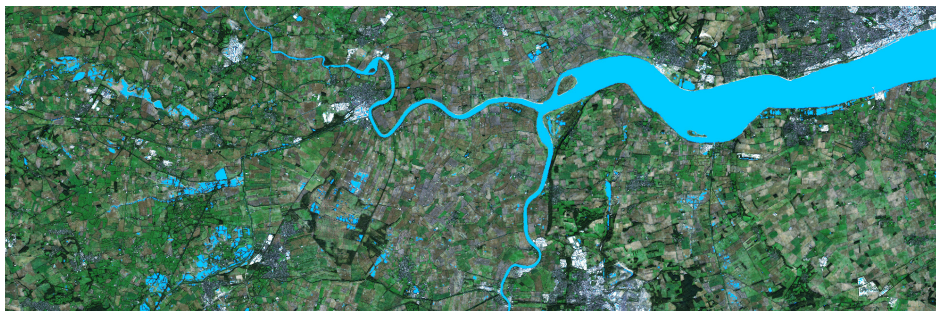
Mapping NDVI variations on a field-by-field basis, and their evolution with time

### Tracking Normalised Difference Vegetation Index (NDVI) at 10m level

The Normalised Difference Vegetation Index (NDVI) is a well-established remote sensing index sensitive to the density of photosynthesising vegetation. It can easily be calculated from ClearSky imagery using the Red and Near-IR channels in the standard way:  $NDVI = (Near-IR - Red) / (Near-IR + Red)$ . Since ClearSky provides cloud-free imagery, we can track the evolution of NDVI at the 10m level in single fields at high time resolution.



Cloud free Sentinel-2 view



Flooding in Northern England, November 2019

### Flood mapping through the Normalised Difference Water Index (NDWI)

The Normalised Difference Water Index (NDWI) compares the reflectance in the short-wave infrared band to the green band to detect surface water. So NDWI can easily be calculated from ClearSky imagery to map, and track, flooding events.

## How accurate is ClearSky?

We validate ClearSky by comparing the algorithm's prediction to actual cloud-free views on a pixel-by-pixel, band-by-band basis.

This way we can quantify the accuracy over billions of pixels and recommend, if necessary, statistically robust confidence intervals for any ClearSky pixel right across the optical-infrared spectrum. The average accuracy per pixel is currently 12%.

The more ClearSky collects image data, the greater its performance. Over time, its accuracy keeps increasing. Aspia Space updates ClearSky every six months to ensure predictions are the best they can be.

## Benefits

- **Regularity:** Receive cloud-free optical-infrared multispectral imagery at the same cadence as Sentinel-1
- **Reliability:** Get consistent, clean images with no intermittency. Introduce the time-domain to your image analysis
- **Flexibility:** ClearSky produces information-rich multispectral imagery to be used in myriad ways
- **Multi-scale:** Analyse individual fields or entire continents, on scales of 10 metres to 1000s of kilometres