Introducing the EarthDaily Constellation,
a scientific-grade Earth observation mission with daily revisit time

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EarthDaily Agro

• **EarthDaily Analytics (EDA)** is a vertically-integrated software and analytics space company developing world-first technologies in data services, satellite processing, ML and actionable insights. Its subsidiary **EarthDaily Agro** (formerly Geosys) has over 35 years of experience in satellite and weather data agricultural analysis delivering services and expertise in over 50 countries.

• **EarthDaily Agro mission** is to help professionals in agriculture and natural resources management make better decisions using information and geographic technologies, and the latest results in agronomic research.

• **Customer portfolio** spans all major sectors, such as crop insurance, agriculture lending, commodities, precision agriculture, food and feed processing, and crop consulting, as well as to governments and international organizations.

![EarthDaily Agro office's locations](image)
The EarthDaily Constellation

Mission timeline

Mission Kick-Off
2021

2021

2022 - 2023

Building Satellites with
Loft Orbital Airbus and ABB
2022 - 2023

2024

Launch of 10 satellites
2024

2024

Full Operations Capability
end 2024
(except for TIR, FOC+6 months)
# The EarthDaily Constellation

**Space segment details**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of satellites</td>
<td>10 (9 + 1 in-orbit spare)</td>
</tr>
<tr>
<td>Launch period</td>
<td>Q1-Q2 2024</td>
</tr>
<tr>
<td>Spacecraft</td>
<td>Arrow bus from Airbus</td>
</tr>
<tr>
<td>Design life</td>
<td>10 years</td>
</tr>
<tr>
<td>Orbit</td>
<td>Sun-synchronous, <strong>10:30 AM local time passover</strong></td>
</tr>
<tr>
<td>Orbit control</td>
<td>Precisely maintained for consistent viewing over mission life</td>
</tr>
<tr>
<td>Revisit</td>
<td>1-day, daily coverage of ~100% of Earth’s landmass</td>
</tr>
<tr>
<td></td>
<td>&lt;12h latency available</td>
</tr>
<tr>
<td>Spacecraft mass</td>
<td>200Kg (total)</td>
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<tr>
<td></td>
<td>74Kg (payload)</td>
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<tr>
<td>Swath</td>
<td>240 km</td>
</tr>
<tr>
<td>Altitude</td>
<td>~630 km</td>
</tr>
<tr>
<td>Viewing angle</td>
<td>Nadir (always)</td>
</tr>
<tr>
<td>Delivery method</td>
<td>Cloud distribution, API-first approach</td>
</tr>
</tbody>
</table>
The EarthDaily Constellation

Characteristics of the 22 bands

- **Core Vegetation**
  - Monitor vegetation status (vigor, phenology, diseases), yield potential and productivity of crops, detect the changes

- **Advanced vegetation**
  - Monitor events such as flowering and diseases detection. Improved biophysical variables monitoring.

- **Soil Content**

- **Atmosphere**
  - Enhance data quality and usability by correcting atmosphere effects, water vapor, aerosol, cloud haze. Ensuring actionable and measurable insights.

- **Water**
  - Monitor plants water stress and availability of water resources. Help manage irrigations strategies when combined with weather information.

**EarthDaily Constellation**

EarthDaily Constellation will be deployed in early 2024 and will utilize 22 Spectral bands curated for agribusiness.

- 5m GSD
- 3.5m product sampling
- Worldwide Coverage
- Daily Frequency
- Cloud Mask

- S - Sentinel
- L - Landsat
- 🌍 - EarthDaily
The EarthDaily Constellation

Characteristics of the 22 bands

<table>
<thead>
<tr>
<th>Band name</th>
<th>Center (nm)</th>
<th>Bandwidth (nm)</th>
<th>GSD (m)</th>
<th>Absolute calibration</th>
<th>Sat to Sat calibration</th>
<th>Geolocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal</td>
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<tr>
<td>Blue</td>
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<tr>
<td>Aqua</td>
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<tr>
<td>Green</td>
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<tr>
<td>Yellow</td>
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<tr>
<td>Red</td>
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<tr>
<td>Red Edge 1</td>
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<tr>
<td>Red Edge 2</td>
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<tr>
<td>Red Edge 3</td>
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<tr>
<td>Near Infrared</td>
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<tr>
<td>Water vapor 1</td>
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<tr>
<td>Water vapor 2</td>
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<tr>
<td>SWIR 1</td>
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<tr>
<td>Cirrus</td>
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<td>SWIR 2</td>
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<tr>
<td>Methane 1</td>
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<tr>
<td>Methane 2</td>
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<td>Wildfire</td>
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<td>LWIR TIR 4</td>
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</tr>
</tbody>
</table>

- Detailed data not available publicly yet
- Radiometric error <5%
- Geolocation error <6m
- NDA required for further discussions

- Atmospheric correction (aerosol scattering), ocean color, water quality & organic content
- Sensitive to vegetation sensing, carotenoid, browning and soil background, atmospheric correction (aerosol scattering)
- Plant pigments & health, ocean color, water quality & organic content
- Plant health, green peak, sensitive to total chlorophyll in vegetation.
- Plant health, early detection of disease, drought, and lack of fertilization
- Plant vigor (chlorophyll absorption), plant stress, leaf area, nutrients content
- Position of red edge (chlorophyll content), consolidation of atmospheric corrections / Fluorescence baseline
- Position of red edge (chlorophyll content), atmospheric correction, retrieval of aerosol load
- Position of red edge (chlorophyll content), Leaf Area Index (LAI), edge of the NIR plateau
- NIR plateau, sensitive to total chlorophyll, biomass, LAI and protein, water vapor absorption reference, retrieval of aerosol load and type.
- Atmospheric correction and cloud detection, plant stress, moisture
- Atmospheric correction
- Atmospheric correction, vegetated water content
- Cirrus detection and properties for cloud masking
- Soil moisture, Snow / Ice
- Methane detection and characterization
- Methane detection and characterization, Plant water stress
- Radiative fire power, wildfire detection and characterization
- Surface temperature
- Soil quality (carbon), soil moisture
- Plant health, crop water use & water management
- Mineral composition & volcanoes
- Snow characterization
- Urban heat
EarthDaily Simulated dataset

Dataset to be representative of future EDC data
→ Used actual observations from available sensors
→ Data fusion and spatio-temporal resampling to fit EDC specs
→ Cloud masking to reflect realistic coverage over time

<table>
<thead>
<tr>
<th>Spectral Bands</th>
<th>Sentinel-2 (SRE)</th>
<th>Venus (SRE)</th>
<th>Landsat8</th>
<th>MODIS</th>
<th>ED equivalent</th>
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</thead>
<tbody>
<tr>
<td>Blue</td>
<td>B02 (10m)</td>
<td>B03 (5m)</td>
<td>B2 (30m)</td>
<td>x</td>
<td>B02</td>
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<tr>
<td>Green</td>
<td>B03 (10m)</td>
<td>B04 (5m)</td>
<td>B3 (30m)</td>
<td>x</td>
<td>B04</td>
</tr>
<tr>
<td>Yellow</td>
<td>x</td>
<td>B05 (5m)</td>
<td>x</td>
<td>x</td>
<td>B05</td>
</tr>
<tr>
<td>Red</td>
<td>B04 (10m)</td>
<td>B07 (5m)</td>
<td>B4 (30m)</td>
<td>x</td>
<td>B06</td>
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<tr>
<td>Red Edge 1</td>
<td>B05 (20m)</td>
<td>B08 (5m)</td>
<td>x</td>
<td>x</td>
<td>B07</td>
</tr>
<tr>
<td>Red Edge 2</td>
<td>B06 (20m)</td>
<td>B09 (5m)</td>
<td>x</td>
<td>x</td>
<td>B08</td>
</tr>
<tr>
<td>Red Edge 3</td>
<td>B07 (20m)</td>
<td>B10 (5m)</td>
<td>x</td>
<td>x</td>
<td>B09</td>
</tr>
<tr>
<td>NIR</td>
<td>B08 (10m)</td>
<td>B11 (5m)</td>
<td>B5 (30m)</td>
<td>x</td>
<td>B10</td>
</tr>
<tr>
<td>SWIR</td>
<td>B11 (20m)</td>
<td>x</td>
<td>B6 (30m)</td>
<td>x</td>
<td>B15</td>
</tr>
<tr>
<td>TIR</td>
<td>x</td>
<td>x</td>
<td>B10 (30m)</td>
<td>MOD11A1 (1km)</td>
<td>B22 (120m)</td>
</tr>
</tbody>
</table>
EarthDaily Simulated dataset

Bands available:
- Blue - 5m
- Green - 5m
- Yellow - 10m
- Red - 5m
- Red Edge 1 - 10m
- Red Edge 2 - 10m
- Red Edge 3 - 10m
- NIR - 5m
- SWIR - 95m

Land Surface Temperature - 120m

Time & Region:
September 3rd 2018 to August 31st 2020
Toulouse, SUDOUE CalVal area – France

Access to demo data will be available:
Internet connection, Python environment to access Azure blobstorage + given credentials
Results on irrigation events detection from TIR

Study site

Methodology

Ts-VI Triangle method (Goward et al., 1985) → parametrization proposed by Jiang and Islam (1999) with fractional vegetation cover (Fr) as proposed by Tang et al. (2010).

→ Fr is estimated from NDVI using the formula proposed by Carlson and Ripley (1997). Weather data from ERA5 Land.

\[ Fr = \frac{NDVI - NDVI_{\text{min}}}{NDVI_{\text{max}} - NDVI_{\text{min}}} \]

Figure from Jiang and Islam (1999), Allies (2018)

Figure from Tang et al. (2010)
Results on irrigation events detection from TIR

Study site

Methodology

Evolution of the evaporative fraction on the SUDOUE Venus site
Results on irrigation events detection from TIR

Monitoring EF over season for 2 plots

→ Abrupt increases can be detected
→ Spatial correlation within fields, potentially associated to pivot for irrigated corn field
Data & Analytics distribution

Data and services access for end-users through

EarthPlatform

Data as a Service

Platform as a Service

Earth Analytics

Analytics as a Service

Build Your Own Analytics

Access to scientists based on short proposal submission / hackathon event & through collaborative funded projects
Thank You

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Anne DUBOIS - R&D partners and funded projects Lead
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