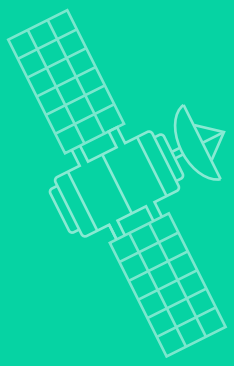
orbify



SATELLITE-BASED

SOLUTIONS FOR CLIMATE AND SUSTAINABILITY

INSIGHTS

An Independent Review

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TERRAWATCH SPACE

Algal blooms in Finland - modified Copernicus Sentinel data (2023), ESA, CC BY-SA 3.0 IGO

Introduction

Earth Observation for Climate and Sustainability Monitoring

Climate change is no longer an expected phenomenon that is forecasted for the future, but rather it is the current reality, with its effects being felt almost everywhere on the planet. This year saw record wildfires in Canada[1], global temperature records being continuously broken[2] and Antarctic sea ice levels reach record low levels[3]. And, more importantly, we are seeing increasing proof[4] that climate change is the reason behind most or all of these events.

From a commercial market standpoint, there is a lot at stake: crop failure risks are high[5], infrastructure risks are out of date[6], carbon markets are on the rise[7], and climate policies are being implemented - for reporting climate-related risks[8], nature and biodiversity related risks[9], supply chain risks[10] and so on.

Earth observation (EO) is arguably one of the most critical technologies for climate - for understanding how the climate is changing, by monitoring the atmosphere, the land and the oceans (summarized as the Essential Climate Variables), for supporting our adaptation to the changing climate by forecasting the weather and modeling climate risks and for facilitating the climate mitigation process by measuring greenhouse emission levels globally and enabling the transition towards renewable energy sources.

EO technologies have several applications for climate and sustainability monitoring, from scientific, commercial and policy perspectives. While the applications of EO span across different sectors, this white paper takes a closer look at the use cases of EO that generally focus on climate-related activities.

1 https://www.axios.com/2023/09/29/canadas-hellish-wildfire-season-defies-the-calendar
2 https://climate.copernicus.eu/copernicus-october-2023-exceptional-temperature-anomalies-2023-virtually-certain-be-warmest-year
3 https://www.theguardian.com/world/2023/sep/26/antarctic-sea-ice-shrinks-to-lowest-annual-maximum-level-on-record-data-shows
4 https://www.worldweatherattribution.org/extreme-heat-in-north-america-europe-and-china-in-july-2023-made-much-more-likely-by-climate-change/
5 https://www.axios.com/2023/07/05/crop-failure-climate-models
6 https://www.scientificamerican.com/article/were-building-things-based-on-a-climate-we-no-longer-live-in/
7 https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important
8 https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en 9 https://tnfd.global/
10 https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en

The following figure lists some of the key use cases of EO classified into three market verticals: Climate, Environment and Compliance.

Climate

This category of use cases pertains to the monitoring of climate-related activities and consist of three main use cases:

Greenhouse Gas Emissions Monitoring includes the use of data from satellites to monitor, quantify and report greenhouse gas emissions such as carbon dioxide and methane on global, national, regional and asset levels, to be used for reporting, mitigation and trading.

Carbon Markets include the use of EO for determining the quantity of carbon stored in forests, soil and other natural resources to be used for carbon accounting projects, specifically in measurement, verification and reporting systems.

Climate Risks include the use of satellite data combined with other sources of data to forecast risks due to extreme weather phenomena such as floods, droughts, wildfires, heatwaves, sea-level rise and the like.

Environmental Impact Assessment

This category includes use cases that are related to the continuous monitoring of the environment for sustainable development.

Air & Water Quality pertains to the use of EO for forecasting levels of air quality on national, regional and city level, as well as integrating data from satellites to monitor water quality across different types of water bodies.

Forest Monitoring includes the use of data from satellites to continuously monitor the level of deforestation globally, while also being able to classify the species of trees, measure forest canopy levels and contribute to forest inventories.

Land Use relates to the use of satellite imagery to track changes to the natural landscape due to human activities such as forest degradation, and increase in croplands.

Compliance

This category relates to the use of EO for designing, monitoring and implementation of climate-related policies, and consists of three major applications.

Biodiversity Impacts pertain to the use of satellite imagery to identify and classify the biodiversity in and around specific assets and the need for reporting the biodiversity impacts related to EU Biodiversity Strategy 2030[11].

Deforestation Regulation (such as the European Union Regulation on Deforestation-free Products[12]) relates to the use of EO technologies to support the monitoring and reporting of deforestation-related activities for products imported into the EU.

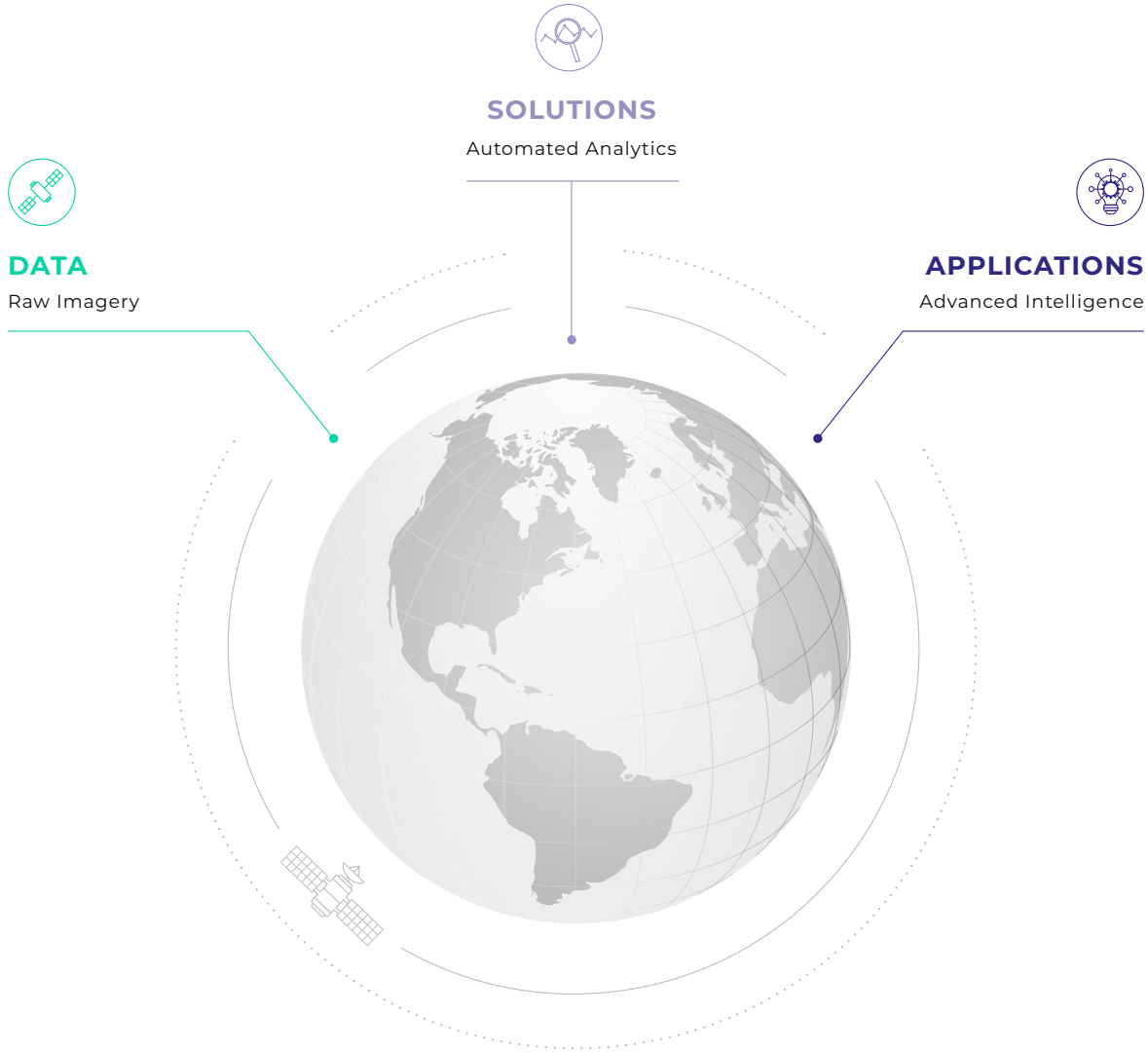
Sustainability Reporting (such as the Corporate Sustainability Reporting Directive[13]) includes the use of satellite data for tracking and reporting the social and environmental risks of large businesses, as defined by the regulation.

11 https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en
12 https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en
13 https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en

Market Landscape

Segmenting Earth Observation Products

The process of using EO for the aforementioned applications can vary depending on the use case, the type of the user, the level of accuracy needed, the available budget among other factors. In general, the commercial landscape of EO for climate and sustainability monitoring can be classified into three major segments: Data, Solutions and Applications.



Data

This segment of EO products relate to the use of data, i.e. raw satellite imagery, acquired directly from satellites. In this case, the assumption is that the user is equipped with skills and tools necessary to process the data and convert it into an actionable insight, with in-house resources. Skills might include the availability of talent with knowledge of remote sensing and geospatial domains. Tools might include EO platforms, which are typically cloud-based, that allow accessing and processing various types of EO data curated from several sources, as required.

The ongoing advancements in space technologies such as reduction in costs of launching spacecrafts, miniaturization of satellites and the evolution of cloud computing has meant that over 1,000 EO satellites have been launched, as of 2022. These include both satellites built, launched and operated by the public sector, as in, space agencies and governmental organizations, as well as those owned by the private sector.

Data offered by companies in the private sector usually differs and varies compared to that offered by the public sector missions. In general, imagery collected by satellites launched by commercial companies tend to provide data of higher spatial resolution (the detail of the pixels in an image), higher temporal resolution (the frequency of image collection over an area) and lower latency (the delay between image collection and image delivery).

Some of the most prominent satellites include the Sentinel-1 and Sentinel-2, part of the Copernicus programme, led and implemented by the European Commission and the European Space Agency, as well as the Landsat series of the missions, led by the National Aeronautics and Space Administration in the United States.

Some notable examples of companies in the private sector in this segment include Planet, Maxar, Airbus, Satellogic and Spire among several others. The past decade has seen the evolution of the so-called NewSpace era, which has led to the creation of EO companies from around the world focused on launching satellites with selected sensors (optical, thermal infrared, synthetic aperture radar, radio instruments etc.) in order to collect satellite data that are relevant for specific applications. Each sensor may have specific characteristics and properties, leading to its use for selected applications - for example, thermal infrared sensors are useful for monitoring wildfires, while synthetic aperture radar instruments can be useful for disaster management applications.

THINGS TO CONSIDER

TYPE OF SENSOR

Each provider may offer data collected by one or more sensors (optical, thermal infrared, synthetic aperture radar, radio instruments etc.), focused on specific applications

SPATIAL RESOLUTION

From lower resolution imagery (100 m) up to very high resolution imagery (30 cm)

TEMPORAL RESOLUTION

From monthly frequency to sub-daily frequency, over the same location

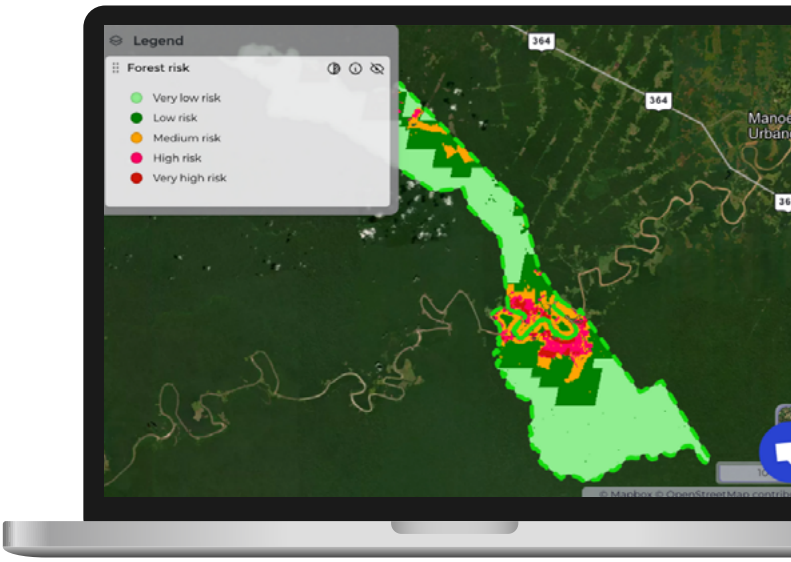
PRICING

From imagery on-demand price per per square kilometer to customized subscription packages

Solutions

This segment of EO products include solutions that use satellite data to provide automated analytics to the users. These products are aimed at automating the analysis of satellite imagery leveraging artificial intelligence and machine learning models to streamline the measurement and assessment of natural assets, providing environmental insights within a few clicks. In general, Solutions tend to be horizontal platforms, providing automated analytics focused on some specific use cases. However, products within the Solutions segment do not tend to specialize in solving one particular problem within a selected market, but rather offer a broad range of analytics applicable within a specific domain. Some products may be focused on a domain such as climate, sustainability, financial services etc., while others may be sector-focused such as agriculture, forestry, insurance etc.

Some examples of Solutions include Orbify, SkyFi, Climate Engine, Geosite and Kermap among several others. The past few years have seen the rise of growth of Solutions in the EO market, primarily due to the explosion in the acquisition of satellite data, from both public and privately funded missions. Given that the vast majority of users of EO typically want to have directly available analytics derived from satellite data, the Solutions segment is seeing rapid growth.



A Snapshot from the Orbify Platform for forest monitoring (Credit: Orbify)

Thanks to the advancements in cloud computing, data fusion and artificial intelligence, solutions such as Orbify are able to analyze and process satellite imagery at a scale not seen before. Not only do these products allow users without expertise in EO to directly receive actionable insights, they also facilitate the easy integration of EO-derived insights into customizable templates for reporting purposes. This is vital for the Compliance use cases discussed in the previous section, especially related to the integration of EO insights for regulation and policy monitoring purposes, as well as further analysis and integration of these insights into business workflows.

THINGS TO CONSIDER

DOMAIN OF INTEREST

Each product within the Solutions segment might specialize in a specific domain, offering automated analytics applicable to that particular area

ADAPTABILITY

While some customers might be satisfied with the default output templates provided by the the Solutions, others may require a degree of flexibility and customizability in order to get the full value out of the platform

PLATFORM READINESS

The time required to get started with the product is critical, which is related to the level of automation of the platform, as some of them might be more automation-ready than others

PRICING

Any platform that provides upfront pricing for required analytics (similar to an enterprise software tool) might be recommended, especially as users of Solutions tend to not have expertise in EO

Applications

This segment of products pertains to the use of EO for advanced intelligence, specific to various domains. Products within this category offer capabilities to solve a vertical-specific problem as opposed to offering products for solving problems across industries and use cases. This is made possible by the integration of various sources of data and the development of proprietary algorithms to process them leading to provision of deeper insights needed by users in sectors such as agriculture, insurance, mining, real-estate, energy etc.

EO-based products within this category tend to fulfill sophisticated user needs within the markets and offer more than just analytics, but predictive insights. More often than not, companies and products found within this category tend to associate more with the respective verticals, more so than with EO. As such, these companies are more likely to be labeled as agtech, insurtech, proptech etc. rather than EO companies.

Examples of Applications include products that provide insights related to crop yield forecasting (Gro Intelligence), parametric insurance for disaster claims (Descartes Underwriting), climate risks derived from proprietary climate models (Jupiter Intelligence) among several others.

THINGS TO CONSIDER

PROBLEM STATEMENT

Every provider within this segment is focused on solving specific problems and hence, it is relevant to pick the one with the right expertise and credentials

VALUE ADD FROM EO

Leveraging satellite data is one of many ways to solve a specific problem, hence understanding the actual value of leveraging EO is useful in order to differentiate between products that use EO and products that do not

METHODOLOGY

Given the criticality of the results derived from EO products in this segment, peer-reviewed publications is one approach to validating the methodology

SCALABILITY

Given that users may have needs that can scale globally, it is useful to verify whether the product can be scaled in all necessary locations, before being deployed

Strategic Fit

How to Choose an Earth Observation Product for Climate and Sustainability Insights?

While all the three segments of EO-based products have unique aspects, it might be confusing as a user to decide which one of the three categories are relevant, depending on the specific needs. Understanding the difference between the segments becomes critical especially as organizations aim for strategic fit of EO within their processes and look towards adopting and integrating EO-based products within their workflows.

The following table provides a high-level summary of the differences between the three segments of EO products, aimed at providing an overall understanding to identify which EO type of EO product might be the best fit for the needs.

EO PRODUCT CHARACTERISTICS	DATA	SOLUTIONS	APPLICATIONS
Requires In-House EO Expertise	✓	✗	✗
Cost of Overall Adoption	$$$	$	$$
Automated, Ready-to-Use Analytics	✗	✓	✓
Level of Customizability	●●●	●●○	●○○
Actionable, In-Depth Intelligence	✗	✓	✓

Data vs Solutions vs Applications

One of the most typical ways to identify strategic fit of products is through the use of techniques such as the 'jobs-to-be-done' framework, which can provide directions on implementing the right workflow, with the right tools. The five following factors together could potentially facilitate the users of EO to determine which segment of EO products would be the most relevant for their needs and most suitable within their organizations.

IN-HOUSE EO EXPERTISE

Organizations that already have or plan to have in-house teams with knowledge of EO have the right skills to choose to go with Data products. However, for those organizations that do not have any internal expertise of EO, Solutions and Applications are a better fit, since the conversion of raw satellite data into actionable insights needs a combination of remote sensing, data science and cloud computing skills. If organizations do not possess all of these capabilities, it would be both time-consuming and expensive to build them internally.

COST OF ADOPTION

Whether organizations have a budget allocated for EO could have an impact on the choice of the kind of EO product to be adopted. If there is sufficient budget for acquisition of data (from both public and private sources) as well as for the acquisition of human and computing resources for internal processing of the data, the Data segment might be a good fit. Otherwise, the Solutions and Applications are a better fit, given they are more likely to be less expensive compared to the process involved in acquiring and processing data in-house.

AUTOMATED ANALYTICS

The choice of whether ready-to-use analytics is required or not, can have an impact on the type of relevant EO product. The Data option does not come with ready-to-use analytics as the processing of data potentially using artificial intelligence models might need to be done in-house. However, the other two options can provide analytics that can be directly integrated into the internal organizational workflows.

IN-DEPTH INTELLIGENCE

The final factor focuses on whether there is a need for sophisticated insights, which relates to whether accurate, domain specific intelligence is needed for the job to be done. While some uses of EO do not require continuous, real-time updates, such as periodical environmental reports, other use cases such as crop yield forecasting or insurance models need an ongoing monitoring system. This is usually possible through products in the Applications category, typically vertical-specific products within agtech, insurtech, proptech etc., which can directly enable organizations to build such ongoing monitoring capabilities. Products from the typically horizontal Solutions category usually tend to be a better fit for broad, high-level insights from EO. The Data category is not considered a strategic fit, in this case, as even though organizations can derive in-depth insights from raw imagery, it might be cost efficient to leverage an existing product from the market.

CUSTOMIZABILITY

Some use cases, specifically those within the ‘Compliance’ category discussed previously, might require some readymade templates that facilitate the reporting process of metrics leveraging EO data. Some platforms such as Orbify, an example from the Solutions segment, can enable organizations to easily build dashboards to support the reporting mandated by regulation (e.g. EUDR, CSRD etc.).

In general, the choice of an EO product is not a straightforward process, as it requires several tradeoffs analyses, feasibility studies and commercial viability assessments. However, a combination of the aforementioned factors can support any organization interested in leveraging EO for getting a job done. Whether it is a product from the Data, Solutions or Applications category, the value of EO lies in its ability to continuously monitor and objectively report the changes happening in the planet - irrespective of whether they are natural assets, or human activities.

Orbify is a geospatial data platform for evaluating, monitoring, & marketing natural assets, providing ready-to-use remote sensing data analysis using cutting-edge ML models that deliver ease, precision, and speed.

The platform delivers instant, actionable insights by providing a comprehensive dashboard of remote sensing data analysis. The diverse range of environmental indicators offered by Orbify, includes everything from land use analysis to natural hazards assessment, and even biodiversity tracking.

Organizations from different markets such as nature-based solution developers, sustainable development teams, as well as insurance companies, use Orbify.

LEARN MORE ABOUT ORBIFY

TERRAWATCH SPACE

TerraWatch Space is a strategic advisory and communication firm exclusively focused on the Earth observation sector, working with public and private organizations globally on strategic, commercial, marketing policy-related and due diligence assignments.

Founded by Aravind Ravichandran, a recognized expert and communicator in the Earth observation (EO) and wider space industry, TerraWatch has experience delivering go-to-market and positioning studies, commercial strategy and due diligence assignments for startups, large enterprises, space agencies and investors.

Aravind is also the author of the popular TerraWatch Space newsletter providing analysis and insights on the EO sector.

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