2024

IAF EARTH OBSERVATIONS COMMITTEE (EOC)

Introduction

Earth Observations has entered an era of high importance on international political and social agendas due to the twin threats of global climate change and biodiversity reduction. These developments have also demonstrated significant business value across a wide variety of commercially important applications, attracting new business from both established industries and entrepreneurial firms throughout the value chain. The rapid advancements in technologies, business models, and science are accelerating the value Earth Observations provide to society, especially as threats and impacts increase, offering actionable information for societal decisions. The global satellite community is growing rapidly, driven by the rising demand for Earth observation services, and pursuing Machine Learning (ML) and Artificial Intelligence (AI) to analyze massive amounts of data collected by EO missions, revealing insights through geospatial analytics that are crucial for resource management, urban planning, and more. The EO community is also growing beyond government agencies, with commercial companies and public-private partnership arrangements.

Summary

According to the World Economic Forum, Earth observation (EO) technologies, utilizing data from satellites, aircraft, and ground-based sensors, have the **potential to generate a cumulative economic value** of $3.8 trillion between 2023 and 2030. Key industries—agriculture, energy, government services, finance, mining, and supply chains—will generate 94% of this value by enhancing productivity, optimizing processes, and supporting sustainable practices. EO also has the potential to reduce global CO2 emissions by over 2 billion tons annually. To capitalize on this opportunity, increased collaboration and awareness are needed across the EO value chain, particularly as we approach critical global sustainability targets by 2030.

The IAF Earth Observations Committee (EOC) plays a key role in organizing, curating, and coordinating EO-related activities at the IAF, particularly through the Earth Observations Symposium during the IAC, which covers all aspects of Earth Observations from Science, applications, mission development to ground data-processing systems.

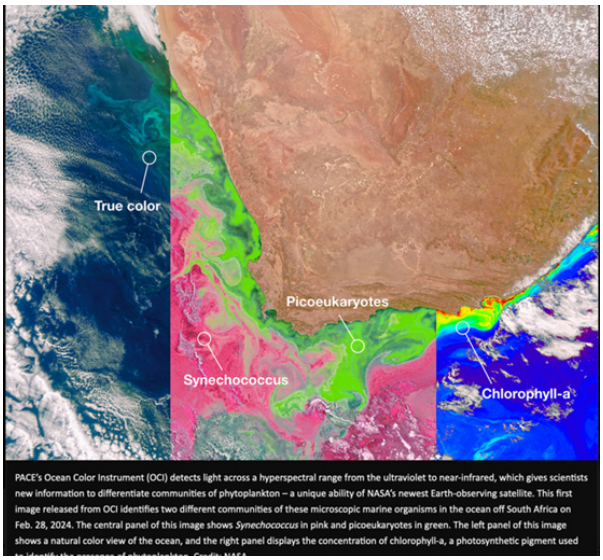
Latest Developments and Highlights

In 2024, Earth observation missions have seen several significant developments, reflecting advancements in technology, international collaboration, and the growing importance of monitoring Earth's environment. Here are some of the key developments:

- **EarthCARE** (Earth Cloud, Aerosol, and Radiation Explorer): a collaboration between ESA and JAXA, launched in May 2024. The mission aims to improve understanding of the role that clouds and aerosols play in reflecting solar radiation back into space and trapping infrared radiation emitted from Earth's surface. This mission has garnered attention for its potential to provide insights into climate modelling and the Earth's radiation balance, which are critical for predicting climate change.
- **INSAT-3DS** was launched on 17 February 2024 off atop a Geosynchronous Satellite Launch Vehicle (GSLV). This ISRO meteorological satellite, is equipped with advanced payloads such as an Imager and a Sounder, and aims to enhance weather forecasting, disaster warning, and climate monitoring services in India. The Imager captures high-resolution images of the Earth's surface, aiding in cloud motion tracking, fog detection, and monitoring of land and ocean temperatures. The Sounder provides atmospheric profiles, including temperature, humidity, and ozone levels, essential for accurate weather prediction. INSAT-3DS plays a crucial role in improving the accuracy and reliability of meteorological services, supporting India's

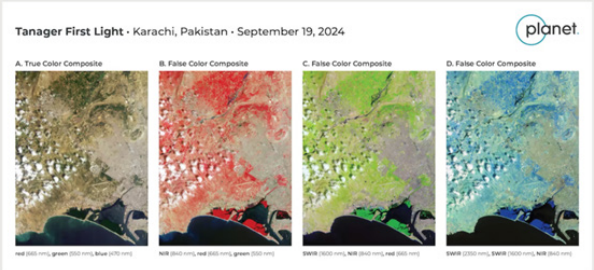
disaster management efforts, and contributing to climate research by offering real-time data on various atmospheric parameters.

- **PACE** (Plankton, Aerosol, Cloud, ocean Ecosystem) mission is a NASA satellite mission designed to advance our understanding of Earth's ocean and atmosphere. PACE aims to provide unprecedented insight into the health of our oceans, the composition of our atmosphere, and how they interact. The satellite is equipped with a state-of-the-art hyperspectral radiometer, which can measure the colour of the ocean in more detail than previous missions. In addition to ocean colour, PACE also monitors aerosols and clouds, which play a crucial role in Earth's energy balance. PACE improves climate models, supports fisheries management, and enhances our understanding of how human activities impact the planet.



PACE's Ocean Color Instrument (OCI) detects light across a hyperspectral range from the ultraviolet to near-infrared, which gives scientists new information to differentiate communities of phytoplankton – a unique ability of NASA's newest Earth-observing satellite. This first image released from OCI identifies two different communities of these microscopic marine organisms in the ocean off South Africa on Feb. 28, 2024. The central panel of this image shows *Synechococcus* in pink and picoeukaryotes in green. The left panel of this image shows a natural color view of the ocean, and the right panel displays the concentration of chlorophyll-a, a photosynthetic pigment used

- **GHOSt,** GHOSt-4 and 5 were launched, on SpaceX's Falcon 9 rocket, from Vandenberg Space Force Base in California.
- **MethaneSAT** was successfully launched in March 2024. MethaneSAT is an American-New Zealand space mission launched in 2024. It is an Earth observation satellite that will monitor and study global methane emissions to combat climate change.
- **Sentinel-2C**, launched in September 2024, the third Copernicus Sentinel-2 satellite was successfully launched on a Vega rocket from Kourou, French Guiana.
- Space Assets advanced the US National Oceanic and Atmospheric Administration's (NOAA) mission to understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources. On June 25th, 2024, NOAA launched its **Geostationary Operational Environmental Satellite (GOES)-19 satellit**e, the fourth and final GOES satellite of this series. Following a successful on-orbit checkout of its instruments and systems, NOAA plans to put GOES-19 into operational service, replacing GOES-16, as GOES EAST. NOAA's next-generation geostationary satellite GeoXO had 2 contracts awarded by NASA on behalf of NOAA including the spacecraft bus and lightning mapper (LMX) by Lockheed Martin Corp. The JPSS-4 launch contract was awarded to Space Exploration Technologies Corporation (SpaceX) and is scheduled to launch in 2027. NOAA continues its Commercial Data Program for numerical weather prediction models and will acquire 3,000 near-real-time global navigation satellite system radio occultation (GNSS-RO) data profiles per day from Space Sciences and Engineering LLC (PlanetiQ) and Spire Global Subsidiary, Inc.
- **IRIDE Constellation:** Italy's IRIDE project, funded under the National Recovery and Resilience Plan, will feature a hybrid constellation of different satellites equipped with dedicated EO sensors, supporting national and European geospatial needs.
- **Maxar's Global Basemap:** Maxar unveiled an updated version of its global basemap, offering 30-centimeter resolution imagery, significantly improving upon previous versions.
- **CNES-ISA:** The CNES-ISA **VENµS** (Vegetation and Environment Monitoring on a New Micro-Satellite) mission, a joint project between the French space agency CNES and the Israel Space Agency (ISA), officially ended its mission after seven years in orbit.
- **Kinéis:** Launched the first 5 satellites of a planned constellation of 25 satellites dedicated to the Internet of Things (IoT). The mission of Kinéis' Space IoT is to connect and locate any object, anywhere on the Earth's surface, guaranteeing data transmission in near-real time, at low bit rates, with minimal energy consumption.
- **Tanager-1 (Carbon Plume Mapper):** Launched Tanager-1 on 16 Sep 2024, the first of a series of satellites being developed and deployed through a unique public-private partnership powered by philanthropy that brings together diverse technical, scientific, engineering and policy expertise to accomplish bold emission reduction objectives. The coalition, led by the nonprofit Carbon Mapper, includes JPL, Planet Labs, RMI and Arizona State University alongside philanthropic supporters.



Tanager First Light images of Karachi, Pakistan, taken on September 19th, 2024. Each of these images is composed of 3 of the over 400 bands that Tanager collects with each capture. From left to right: (A) A visible-wavelength image using 470 nm for Blue, 550 nm for Green, and 665 nm for Red. (B) A near-infrared false-color image using 550 nm for Blue, 665 nm for Green, and 840 nm for Red. (C) A shortwave infrared false-color image using 665 nm for Blue, 840 nm for Green, and 1600 nm for Red. (D) A second shortwave infrared image using 840 nm for Blue, 1600 nm for Green, and 2350 nm for Red. (Photo by Planet Labs, PBC)

Future Outlook

- **NASA-ISRO Synthetic Aperture Radar** (NISAR) Mission Preparation: The NISAR mission, a joint project between NASA and ISRO, has been a focal point of Earth observation discussions. Scheduled for launch in 2024, this mission is designed to provide detailed observations of land and ice dynamics, crucial for understanding climate change, natural hazards, and ecosystem disturbances. Technology Developments: In the past year, significant progress has been made in developing radar systems and satellite components, with anticipation building for its launch.

- **Copernicus CO2 Monitoring Mission** (CO_2M). Development Phase: The CO_2M mission, part of the European Union's Copernicus program, has been under development, with a focus on monitoring anthropogenic CO_2 emissions. This mission will be the first dedicated to tracking CO_2 emissions on a global scale, aimed at supporting international efforts to reduce greenhouse gas emissions. International Collaboration: The mission has seen significant international interest, as it is expected to play a crucial role in global climate agreements and policymaking.

Committee activities

The IAF Earth Observation Committee (EOC) has planned a robust series of sessions for IAC 2024 in Milan, Italy, with eight sessions to accommodate the growing interest. The committee will continue to support GEOSS in formulating and executing Plenary programs, Special Sessions and Global Networking Forums. The EOC continues to foster collaborations with the Group on Earth Observation (GEO) and the IAC Young Professionals Program (YPP) coordinating and developing opportunities for mutually beneficial activities and events to provide further engagement and foster growth in the next generations that is key for continued and sustained growth of the EO community.

For IAC 2025, the EOC will focus on climate change challenges, technological advancements, and the commercial EO sector.

The EOC has been actively involved in supporting follow-up to GLOC 2023. The EOC is also placing focus on AI and Machine Learning - the integration of AI and machine learning in processing EO data has become more prevalent, enabling faster and more accurate analysis of satellite imagery for various applications, including environmental monitoring and disaster management.