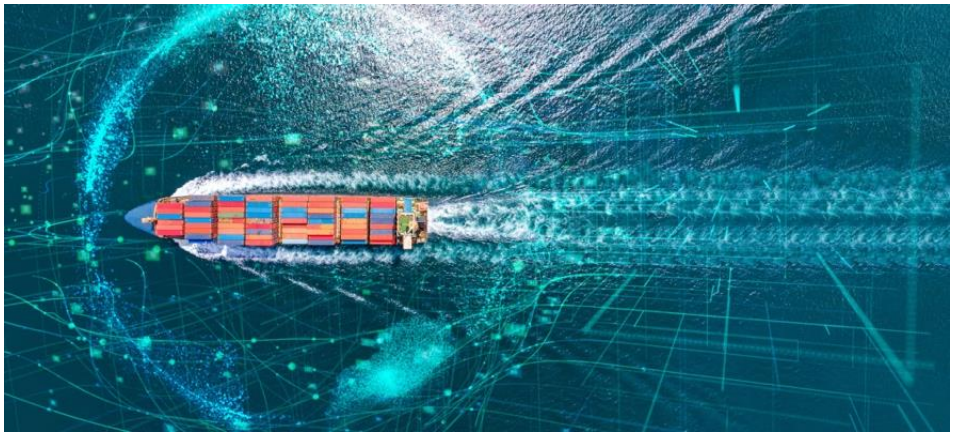
Earth Observation for the Maritime Sector: Use Cases and Commercial Opportunities

Introduction to the maritime sector

The maritime sector plays a pivotal role in the global economy, **serving as a lifeline for international trade,** transportation, energy production, and as vital source of food**.** Shipping remains the most cost-effective and efficient mode of transporting goods across long distances. Roughly 90% of global trade by volume is carried out through maritime routes, making ports and shipping lanes essential components of the global supply chain. The fisheries and aquaculture sector also plays a vital role in **providing food for millions of people worldwide**, especially in coastal regions and developing countries, where seafood often constitutes a primary source of animal protein. Moreover, the maritime industry provides employment opportunities for millions of people worldwide.

However, the industry is under increasing pressures to **reduce its environmental impact**. Issues such as air and water pollution, greenhouse gas emissions, and oil spills pose significant challenges. Stricter regulations and demands for cleaner, more sustainable practices are driving the industry to adopt greener technologies and practices. Growing global food demand which to some extent can clash with the sustainability and preservation of our seas is also resulting in increasing pressure for efficiency and digitalisation within the industry. Moreover, **geopolitical issues surrounding illegal maritime migration, border security, smuggling and piracy** are fast becoming a high priority for many governments. As a result of these challenges, Earth Observation-based services are becoming more and more accepted and adopted within the industry thanks to their ability to address the sustainability and efficiency requirements of the sector.



Source for picture: https://business.esa.int/news/one-sea-association-and-esa-partner-to-support-uptake-autonomous-shipping-maritime-sector

The sector in numbers

95%

of global trade by volume is transported and delivered by the shipping industry

11 billion tons

Cargo transported annually

50,000

Merchant vessels in operations globally

Source for numbers: https://www.chilternmaritime.com/why-is-the-maritime-industry-so-important/

Zoom in on Europe

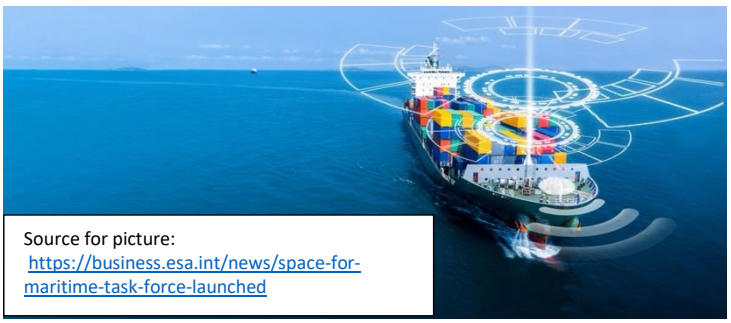
Europe is home to some of the world's busiest and most significant seaports, including Rotterdam, Antwerp, Hamburg, and Marseille. These ports serve as crucial gateways for international trade. Moreover, Europe is the home of many major shipping companies that operate globally. Greek, Danish, and Norwegian shipping companies, in particular, play a significant role in the international shipping market. Stakeholders across the European maritime landscape include several **maritime authorities** who are looking for new and more efficient ways to fulfil their mandates, an **R&I ecosystem** where exciting innovations are being developed for application in challenging environments, **service providers** who are delivering value to the market with cutting-edge technologies for **end users** such as port authorities, national governments, shipping companies, fisheries, and construction companies.

Various authorities and public agencies such as the **International Maritime Organization (IMO)**, the **European Maritime Safety Agency (EMSA)**, the **Directorate-General for Maritime Affairs and Fisheries (DG MARE)**, the **European Fisheries Control Agency (EFCA)** and several national agencies such as the UK's **Maritime and Coastguard Agency** are all concerned with guiding how the maritime sector is managed. These entities drive many initiatives and regulations such as the **International Convention for the Safety of Life at Sea (SOLAS),** the **European Union Maritime Security Strategy (EUMSS)**, and the **Common Fisheries Policy (CFP).** Numerous industry associations also play a vital role in **representing the voice of the industry at political/international levels**. They routinely promote and advance the common interests of businesses and promote the proliferation of common industry standards.

Europe has many entities involved in highly sophisticated Research & Innovation in the maritime sector. Numerous institutions and universities across the continent are looking into issues that face the maritime sector, such as the **optimisation of port operations, wave energy, dark vessel monitoring, autonomous shipping, and harmful algal blooms (HABs).**

Critical challenges facing the maritime sector

Illegal maritime migration in Europe is at its highest level since 2016. In 2022, the number of irregular border crossings into Europe from via the Central Mediterranean route rose to over 100,000 and the number of crossings at the English Channel rose to over 70,000, accounting for a 51% and 37% increase on the previous year respectively.[1] **Maritime safety incidents are also on the rise.** A large part of these increases can be attributable to a post-pandemic increase in seaborne trade. Machine damage or failure has been the main driver of this surge in safety incidents, growing by 24% in 2021 and 13% in 2022. It is also possible that an improved attitude of incident reporting drove these numbers up.[2] Digitalisation (AI, machine learning, cloud connectivity) is enabling real-time processing of data, leading to actionable insights and more reliable decision-making for the maritime security/safety stakeholders. **However, adequate training, awareness, and accountability among the workforce are still crucial** in minimising human errors and ensuring safe usage of digital systems.[Error! Bookmark not defined.]



Source for picture: https://business.esa.int/news/space-for-maritime-task-force-launched

Demand for sustainable seafood is also a strong and growing trend from consumers. The number of Marine Stewardship Council (MSC) certified fisheries and supply chain organisations are continually increasing year on year, with 550 fisheries in 2023, up from 539 the previous year. The MSC is the international not for profit responsible for the world's most widely used

[1] https://www.frontex.europa.eu/media-centre/news/news-release/eu-s-external-borders-in-2022-number-of-irregular-border-crossings-highest-since-2016-YsAZ29

[2] https://www.dnv.com/expert-story/maritime-impact/What-are-the-latest-maritime-safety-trends-and-how-are-safety-regulations-evolving.html

sustainable seafood ecolabel.[3] At European level, maritime transport represents **3 to 4% of the EU's total CO_2 emissions, or over 124 million tonnes of CO_2 in 2021.** There is increasing pressure for the sector to reduce its emissions, hence the forthcoming introduction of the maritime sector to the **EU Emissions Trading System**[4].

How space adds value for the maritime sector

Space technologies play a crucial role in enhancing various aspects of the maritime sector. The integration of satellite-based technologies and space-derived data has significantly improved the efficiency, safety, and sustainability of maritime activities. Earth Observation (EO) data can help monitor **weather patterns, sea conditions, and environmental changes**. This data is invaluable for maritime operators in making informed decisions about routes, avoiding storms, and ensuring the safety of vessels. Satellites also help monitor and manage fisheries by **tracking vessel movements, identifying illegal fishing activities, monitoring maritime pollution such as oil spills or CO2 emissions,** and **assessing the health of marine ecosystems.**

Given the huge focus on maritime security, EO is proving invaluable by providing continuous surveillance of maritime areas. Satellite imagery assists in **monitoring shipping routes, detecting suspicious activities, and preventing illegal activities such as piracy, illegal fishing and smuggling**. Space technologies also enable connectivity for autonomous and remotely operated ships. Satellite communication ensures continuous data exchange, navigation updates, and remote control capabilities for smart shipping applications. For this application in particular, EO better enables the acquisition of essential information such as sea and weather conditions, and when in colder regions, enables safe navigation around sea ice. Offshore renewable energy project developers and investors can use EO to **identify the most suitable areas for the exploitation** of renewable energy sources, plan their development and monitor their integrity/status.

EO-enabled marine surveying and mapping of the seabed and coastal areas is important to **determining prospective infrastructure sites**. It also helps construction companies in continuously monitoring the progress achieved on construction sites and in reporting on this progress to their clients (e.g., infrastructure owners / operators). Maritime insurers, investors and asset managers all rely on **evaluating the levels of risk exposure**, using probabilistic approaches of the events, exploiting historical data, and performing climate reanalyses over several years. Again, EO can aid in all of this.

It should be noted that **Global Navigation Satellite Systems (GNSS)** are extremely useful to the maritime sector by providing accurate and reliable positioning information for maritime vessels, improving navigation and reducing the risk of accidents.

Some space related initiatives in Europe

A major foreseen trend in the industry is the proliferation of **Maritime Autonomous Surface Ships (MASS).** There is currently a lot of regulatory work is being developed at IMO level on this topic[5]. The non-mandatory MASS code is expected by 2024 and based on the application of the non-mandatory MASS Code at an initial stage, the mandatory MASS Code is expected to enter into force on 1st of January 2028. **EMSA is currently in the process of developing a risk-based assessment tool (RBAT)[6] for the evaluation of new Maritime Autonomous Surface Ships** (MASS) projects. It is expected to be

[3] https://www.msc.org/about-the-msc/reports-and-brochures/annual-report-2023-summary

[4] https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

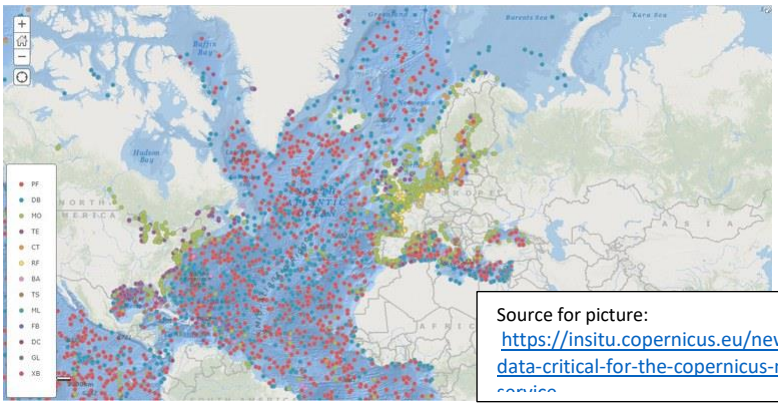
[5] https://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx

[6] https://www.emsa.europa.eu/mass.html

finalised in 2023 and results will be shared with relevant stakeholders. The regulatory and technical impact of MASS technology in the shipping industry is expected to be transformative with EO and GNSS both considered important data sources for this initiative.

An important development in the sector is the incorporation of the shipping industry's emissions into the **EU Emissions Trading System**[7] in 2024. This will open opportunities for EO companies **to aid in the monitoring, reporting and verification of emissions** coming from the shipping industry.

The **Copernicus Marine Service (CMEMS)**[8] is one of the six services provided by the European Union's Copernicus program, which is the EU's Earth Observation and Monitoring program. CMEMS focuses specifically on providing reliable and up-to-date information about the state of the global and regional marine environment. It is designed to serve a wide range of users, including public authorities, researchers, industries, and the general public.



Source for picture: https://insitu.copernicus.eu/news/in-situ-data-critical-for-the-copernicus-marine-service

The **European Marine Observation and Data Network (EMODnet)**[9] is a network of organisations working together to provide access to marine data, data products, and services in Europe. EMODnet aims to improve the availability and accessibility of high-quality marine data across various thematic areas, fostering a better understanding of the European seas and oceans. The initiative was launched by the European Commission as part of the European Marine and Maritime Research Strategy.

The **European Maritime Spatial Planning (MSP)**[10] platform has several projects, initiatives, and a community of practice (CoP) that are aiming to drive forward the use of EO in maritime spatial planning.

[7] https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-shipping-sector_en

[8] https://marine.copernicus.eu/

[9] https://emodnet.ec.europa.eu/en

[10] https://maritime-spatial-planning.ec.europa.eu/