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Should proactive oil spill monitoring from satellite be the new normal?

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Abstract

In recent decades industrial activity in the marine environment has dramatically increased. Dense offshore infrastructure combined with an increase in shipping activity creates a complex blend of potential oil pollution and environmental risk. Globally, it is estimated that between 1 and 3 million tonnes of oil enters the marine environment per year (EEA, 2007, p. 232), of which 24% is from marine transport (18% from operational ship discharges and 6% from accidental spills) and 3% from offshore extraction (Carpenter, 2018), although a new estimation from the Oil in the Sea IV is forthcoming (Q1 2022). Whilst most major oil spills are geographically limited, pollution incidents have significant and far-reaching environmental, societal, and business impacts.

Despite an improved understanding of oil spill risk, many pollution incidents are often misidentified/misrepresented, unobserved or, in some cases unnoticed until the failure is catastrophic. Currently the majority of remote visual inspection activities, performed by aircraft or short-term satellite-based programs, are reserved for emergency response and/or post incident assessment. However, regular proactive satellite monitoring, available at a relatively low cost, can greatly enhance oil spill preparedness by increasing knowledge on the presence, characteristics, and behaviour of oil pollution in marine and coastal environments. Examples of such programs, such as NESDIS, EMSA and NOFO, can claim direct influence on the decrease of marine pollution events, especially those not related to accidental spills but day to day operations, due to early detection, quicker qualification, and subsequent incident response.

Rapidly expanding satellite constellations now provide regular, high frequency observations on a global basis, enabling proactive monitoring capabilities to be exploited in the vicinity of almost all offshore infrastructure and high-density shipping areas, within a more acceptable cost model to end users (Figure 1). As such, some regions can be covered by acquisitions on a sub daily basis by the same satellite constellations, removing the significant overheads involved in planning a multi-operator acquisition plan. This enables greater visibility

of the interaction between offshore assets, coastal facilities, local vessel activity and the natural marine environment and enables early alerts of oil spill events to strengthen situational awareness and mitigate offshore pollution risk.

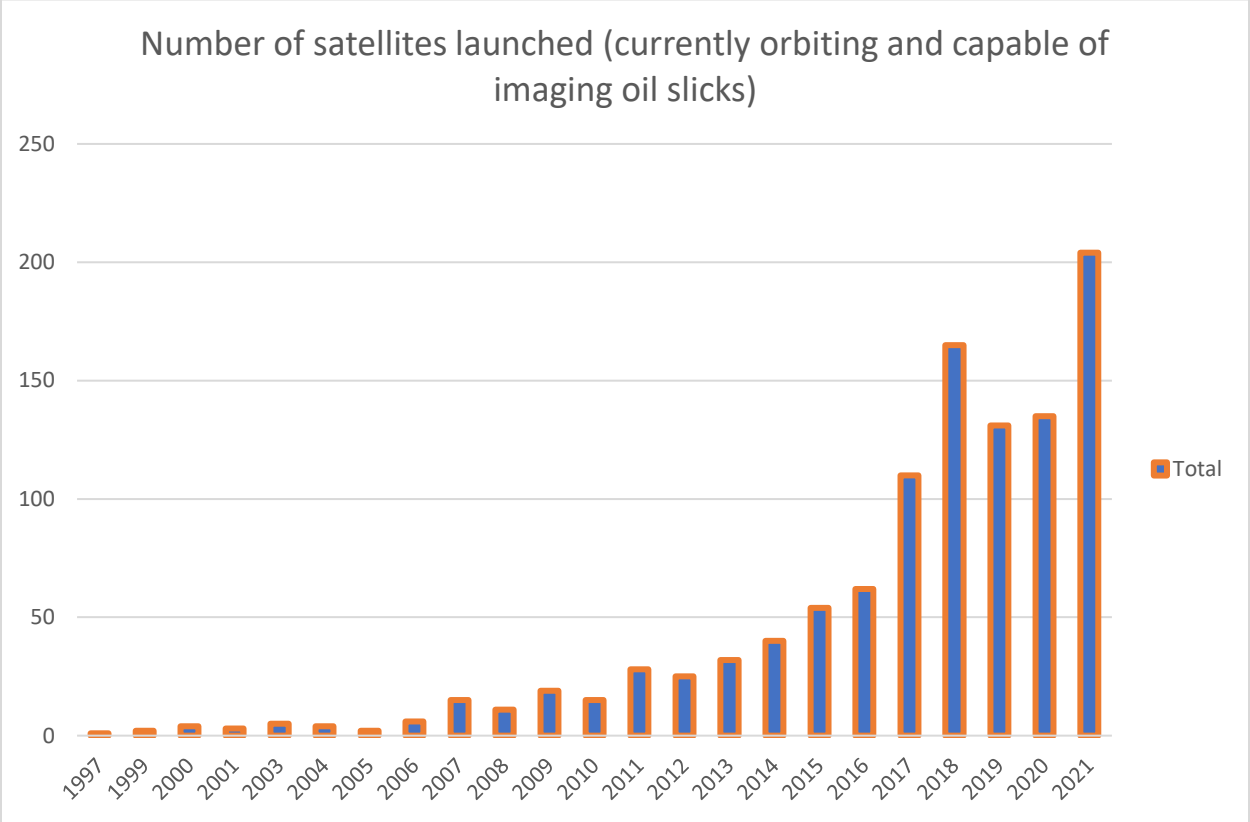

Figure 1 – Current satellites in orbit that show sensors capable of imaging oil slicks (source: UCS Satellite Database (jan.2022) http://www.ucsusa.org/satellite_database)

Expert processing, interpretation and analysis is critical in converting this step-change in imaging capabilities into intelligence capable of providing early detection and qualification of sea surface slicks that would have previously gone either unreported or undetected. Subject matter expertise combined with developments in machine learning have enabled further scalable understanding on the presence, characteristics, and behaviour of oil pollution in marine and coastal environments.

This study illustrates several significant spill events observed by CGG's SeaScope proactive oil spill monitoring system in the last 12 months to highlight why satellite data should be incorporated into standard workflows for oil spill preparedness. SeaScope, developed with support from the European Space Agency's business applications, offers invaluable situational awareness to key stakeholders with regards to the presence of oil slicks in an area. By routinely

ingesting, processing, and interpreting multi-mission satellite imagery at pace, SeaScope maximises value from this often-underused data source, translating high-frequency satellite data into an actionable stream of intelligence to mitigate offshore pollution risk.

In one such example, CGG's SeaScope service monitored a long-term oil pollution event located in a region of legacy oil production and close to one of the world's densest shipping lanes in South-East Asia. Analysing the back catalogue of available satellite imagery over the region, CGG identified that the spill was first imaged on 24th December 2019 and was ongoing for 20 months. Oil slicks of >140 km in length were persistently observed over the period (Figure 2), originating from a single release point on the seabed at a depth of approximately 100 m (328 ft) and spatially correlated with a decommissioned oil well. The observed slicks spanned 275 km into the waters of multiple countries home to a range of important marine and coastal ecosystems, including mangroves and coral reefs. Upon review of the historical satellite data, it is clear that with a proactive monitoring programme CGG would have flagged the spill almost 2 years before its eventual observation, identified its origin and alerted key stakeholders to its presence.

This, and further selected case studies, illustrate that proactive satellite monitoring is applicable to a range of maritime industries, including active hydrocarbon production, ageing and decommissioned infrastructure and abundant vessel activity. When activated as part of tiered oil spill preparedness and response, proactive satellite monitoring can inform the decisions of multiple teams, including operations, environmental, crisis, legal, and corporate, enabling early response to the detection of oil spills and minimising the associated environmental, societal, and economic impacts.

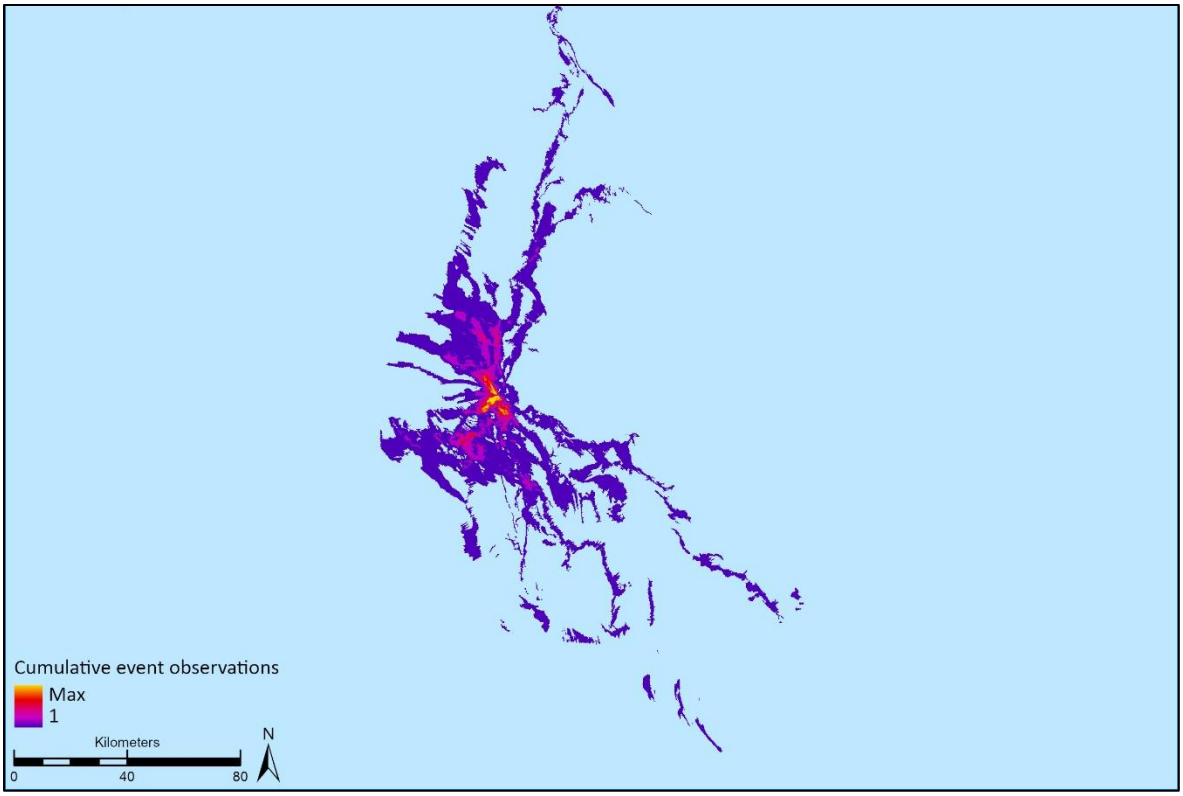

Figure 2 – Expanse of oil observed on sea surface over 20 months – South East Asia (2019-2021)