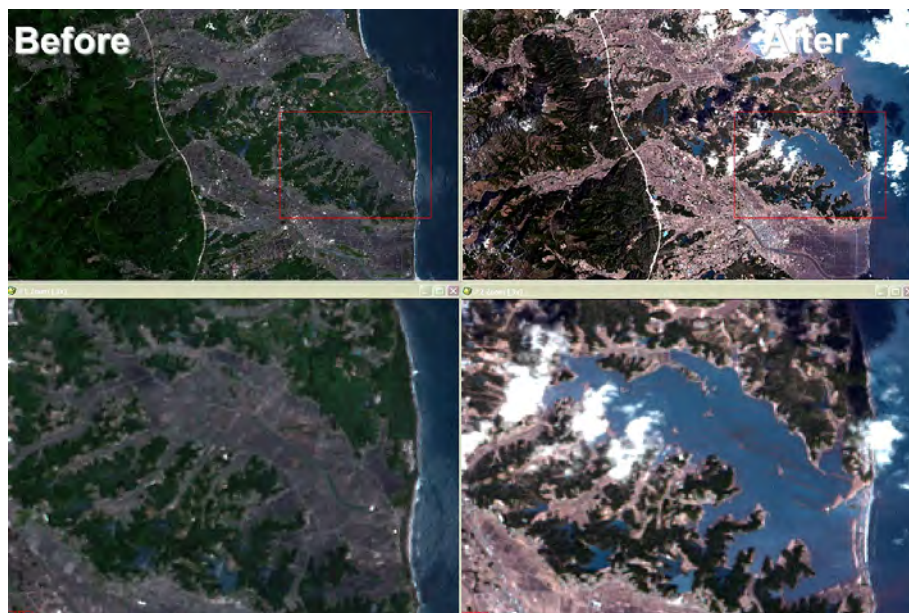


Space Assets to Mitigate Crisis in the Atlantic

The Atlantic International Research Centre (AIR Centre), as an international organization to provide technological and scientific solutions to solve urgent needs in the Atlantic region, is highly interested in the space applications to prevent and mitigate crisis affecting the Atlantic. The Earth Observation from the space has shown in the last years to be a very efficient tool to response to complex emergencies in the ocean.

A very valuable data for disaster monitoring are the satellite images of the affected area, the following examples are just a real demonstration of this: **Tsunami in Japan 2011**: the satellite images were delivered just few hours after the tsunami, providing unique data on the highways and railways available to bring relief to the victims, the critical situation of the Fukushima nuclear power station was also detected form the very first image:

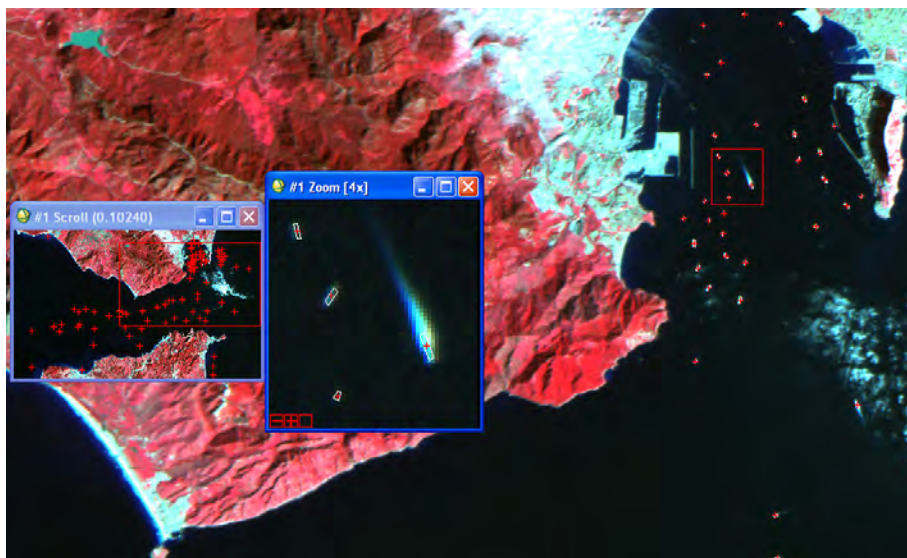




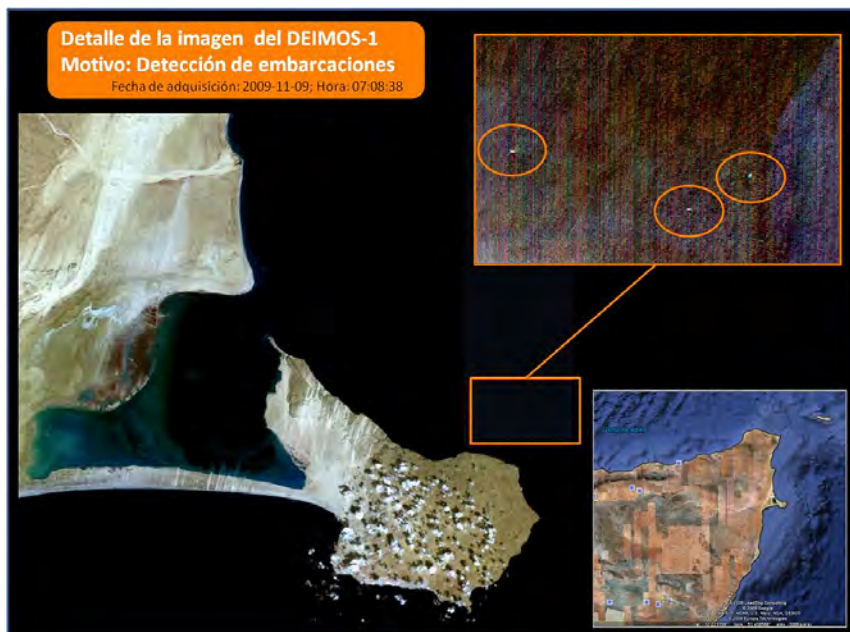
Katrina Flooding in New Orleans: the satellite images of New Orleans were the best way to estimate the size of the disaster and the magnitude of the crisis, at the same time a cartography of all the flooded areas was performed in a few hours to drive the emergency teams to the most affected areas.



Control of Illegal Vessel Traffic: the combination of optical or SAR images with AIS data is a very powerful tool to monitor illegal vessel traffic (illegal immigration, narcotraffic,...), this is an example of traffic monitoring with those tools on Gibraltar area:



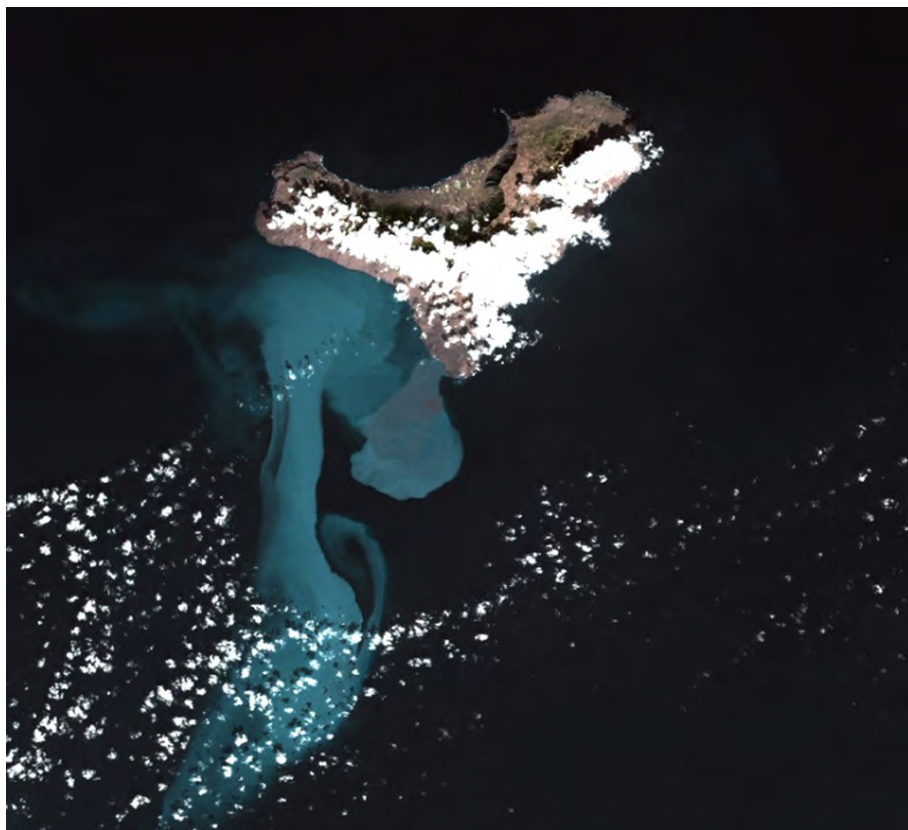
Piracy Control: international piracy is a critical problem in the Indic Ocean, but it is also affecting the Atlantic, mainly in the African coast like Cameroon. The use of satellite imagery to detect its modus operandi, to identify the coast port of operation and the ways the pirates use to get in and out of the coast are extensively analysed by optical and radar satellites, as in the following examples:



Violation of national sovereign limits: the satellite allows an immediate analysis of possible violations of sovereign limits, or detect suspicious operations in international waters; this is an example of China activities in the South China Sea where a complete base was setup on a reef in a few months:



Volcanic eruption in El Hierro (Canary Island): the satellite is the unique observation system on the Atlantic that is able to provide synoptic measurements due to its very large field of view. This is an example of a single satellite image that provides the full size of the effect of a volcanic eruption underwater very close to El Hierro island in the Canaries.



Atlantic Constellation of the AIR Centre

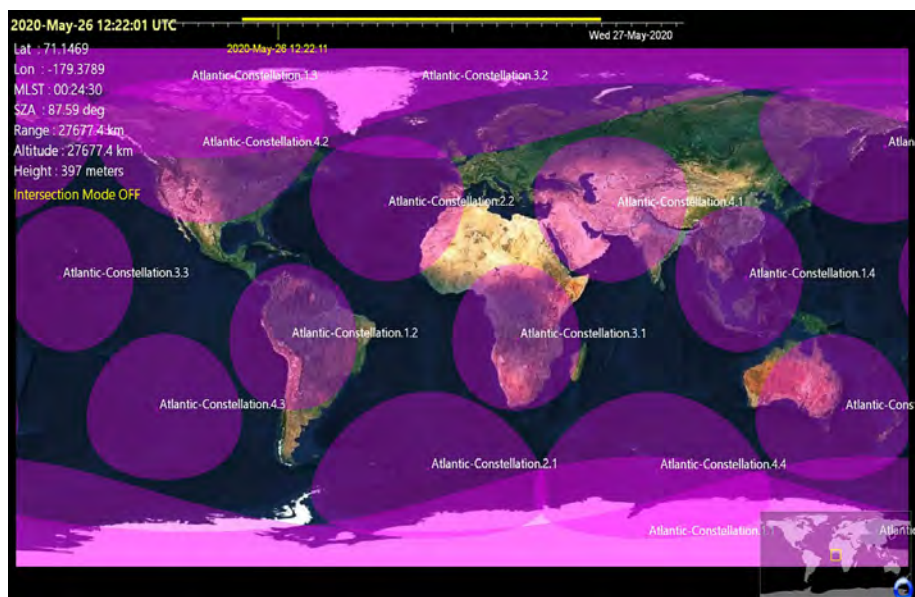
All above are examples of the use of satellites for emergencies on the ocean. There is a large number of very sophisticated satellite systems that can provide unvaluable services for crisis in the Atlantic. However, for some applications (e.g. tsunami detection, illegal fisheries,...) we need a system with a very frequent revisit, for this reason at the AIR Centre we have started an international collaborative project to deploy a constellation of small satellites (the **Atlantic Constellation**) to provide valuable data with an unprecedented revisit time and latency.

Taking into account the priority of needs we have selected the following payload instruments as baseline for the constellation:

- An AIS (or VDES) decoder for vessel monitoring, covering a conical field of view under the satellite, limited by the minimum elevation of the satellite from see surface that is set to 5°
- A Multispectral optical high resolution camera in visible, NIR and TIR bands with a geometric resolution better than 5 m, a swath of 20 km

- A Hyperspectral optical medium resolution camera with a geometric resolution better than 50 m a swath of 100 km
- A GNSS/R sensor able to track all GNSS constellations (GPS, Galileo, GLONASS and Beidou) reflected on the sea surface with angles up to 35°-40°
- An IoT 5G transponder (preferably under the new 5G standard) for communications

The constellation includes 16 satellites, 4 satellites per plane in 4 orbital planes.



This Atlantic Constellation will be able to provide very frequent imagery, with revisit time of 3 hours and latency of less than one hour, plus continuous data of vessel traffic with AIS coverage with gaps of only 15 minutes.

Conclusions

Earth Observation Satellite systems are of paramount importance to predict or mitigate emergencies in the Atlantic. They have been used for crisis like tsunamis, volcanic eruptions, flooding, etc. In addition, they are also a critical tool for response to crisis like piracy, illegal vessel traffic, illegal fisheries, ocean pollution or violation of sovereignty.

In order to improve the capacity of response to those emergencies, the AIR Centre has started the development of a constellation of small satellites (the **Atlantic Constellation**) in international collaboration to provide optical images, vessel traffic data and 5G communications along the Atlantic with unprecedented frequency.