Ricardo Conde
Portuguese Space Agency (PT-Space)

Digital Planet and a New Space Data policy – A contribution for better understanding the space and oceans interactions

The Challenge of open data

Without additional mitigation efforts, "warming by the end of the 21st century will lead to high to very high risk of severe, widespread, and irreversible impacts globally" (Intergovernmental Panel on Climate Change, 2014).

The message is clear: without additional mitigation efforts at the international level to address the causes of the climate change, we can expect several consequences like loss of lives, ecosystem degradation, extinction of plant and animal species, economic losses, social disruption…

Addressing climate change requires precise, continuous monitoring of a multitude of variables related to the atmosphere, land, oceans, and atmosphere interactions, sustained over long periods of time.

The Space Age started in the 1950s (1957) and since then, around 470 Earth Observation (EO) Satellites were launched. 180 of them were government owned and more than 35 nations have been involved in the operation of EO Satellites.

But today, with so many variables to be collected, so precisely and over such long periods, there are still gaps in our ability to adequately monitor climate change despite the development of new sensors with new capabilities in the new satellite generation.

Satellites play an important role in collecting data about climate. They represent a unique advantage point and ability to provide continuous global coverage and can be matched by *in situ* observation systems. These advantages are particularly relevant in remote or sparsely populated areas like oceans and over the Artic and the Antarctic.

But today, besides the increasing number of satellites and the disruptive environment of the so-called New Space, with mega constellations and diversity of new sensors (AIS, RF sensing, Optical and Sar images, narrow and broad band communication systems), the outcome of data available is still a barrier to develop earth observation applications and computing models, basically because this represents a market and the investments of the companies should have the return of their investments and therefore the data available is restricted or expensive and this represents a big limitation to the development of EO applications.

Let us think for a moment about the navigation data made available since de 1990's by the Global Position System (GPS). In the very beginning, the simple idea to open this data sparked several concerns about the security aspects, and open data were considered a threat for national security.

But trade-off mechanisms were implemented to live simultaneously with the high precision position data and the so-called latter commercial position precision, and we well know the results in terms of the development of applications and the global impact in all sectors of our society. Today, crucial services running over the globe are based in the navigation data made available by their data policy.

This is the path that EO data and the respective data policy should take.

Currently there are few EO satellites that provide a real open EO data. A good example is the Copernicus Program with their Generation of Sentinel Satellites.

But these satellites are limited in terms of resolution (time and space) and there are some applications that require more resolution, like fire monitoring, tracking vessels, precision agriculture, ports monitoring, etc.

The concept of public availability of the data is quite simple: the governments (taxpayers) pay the upstream (Satellite, Ground stations and Operations) and the data is made available open and free to public institutions and research institutions. This is the concept of Copernicus.

But why is there reluctance in seeking a higher resolution (time and space) for the next generation of European Copernicus Satellites? National security in the main reason invocated. But this is not completely true.

There are several companies that invested in this high-resolution imagery market and they represent a strong lobby for continuing to provide this high-resolution data to the market.

The fact is that the national security cannot be an excuse to go forward for the high-resolution data for Copernicus also because there are mechanisms that can be put in place to address these concerns, particularly the same concept that was implemented for the Galileo program, the public regulated services (PRS): the mechanism that monitors the institutions that have access to the high precision Galileo navigation signals.

Regarding the EO Data, no EO company is currently known to be profitable in the private data market. Behind these markets there are always governments or governmental agencies that assure part of their business, buying large amounts of data to implement their national data policies, for example distributing this data to R&D institutions.

This is one of the big challenges of this decade and particularly when this EO data will be needed in massive quantities to face the problems of climate change to be used to feed new computing models to better understand and therefore to predict the interactions between oceans, atmosphere, space, and climate.

Promoting access to data, defining, and implementing Government data policies and, at the end, imposing the changes needed, are the roles of the Space Agencies. Agencies for space play an important role regarding data policies:

- They should act as the hubs to access to this data.
- They should promote the upstream, fostering the development of the downstream applications.
- The agencies should implement public data policies that lead to costs reduction regarding access to data.

We need to look forward to democratizing the access to data (satellite data in particular).

Imagine, using your mobile phone, that you ask: What is the quality of the air today in my city and what will be the quality of the air in the next two hours? And a simple question, what is the health of our country today?

These two simple questions could only have an answer if we have a permanent source of data without boundaries! This is the dream: to have open data with quality.

The reality and the needs will impose these policies for sure. It will be needed one initiative and the rest will follow.

The Portuguese Space Agency is looking forward to fostering new data policies and it is committed to address two great challenges, thus contributing to the development of the EO downstream applications: fostering the development and launch of a satellite constellation, together and in partnership with other Atlantic Nations with the perspective to get high resolution data; developing an EO multiplatform data to foster the development of downstream applications.

These are the two commitments of the Portuguese Space Agency to tackle the access to EO data to envisage the creation of a National EO Ecosystem based in a new public data policy.

Alberto Cohen
Argentinian Navy

Military forces and systems are generally perceived as readily available assets in most sorts of complex crises.

Even more so, if a crisis situation starts to develop in the maritime environment. There are no "free roaming" elements rapidly available for a fast response, and state actors respond with what's mostly at their hands, their Navies.

But, at the same time, the past few decades have seen a constant development of commercial systems aimed to increase the safety at sea that range from GPS to satellite communications or AIS. These systems aren't directly related to military forces, even if they're available to them. Satellite observation from space has grown into a fully mature instrument for sea control, and the access to satellite imagery in different ranges of the spectrum is nowadays available to the general public (at a given price, of course).

While several western navies have nearly unlimited access to the byproducts of their own nation's space programs, South American and African countries have to depend on much more limited national satellite resources, or pay the costs associated to a commercial service.

In the response to a crisis at sea, three capabilities become critical:

- Detection and tracking, in order to properly assert the situation.
- Communications, in order to control and coordinate the response.
- Presence and resilience, in order to act and sustain the activity on scene.

Maritime Domain Awareness frames these capabilities and provides the base for better resolution of a crisis by providing a better understanding of its origins and context and allowing a more suitable response.

The first two aforementioned capabilities are heavily dependent on technology, and, in most situations will demand interaction and cooperation between units from different countries but also between civilian and military / coast guard vessels. The former relies heavily on combined training, which has become the norm rather than the exception, and is assisted by standard procedures based on similar doctrine, and so it becomes "relatively" simple, even in complex situations. The rapid deployment and coordination of the international effort after the loss of the submarine ARA "SAN JUAN" off the coast of Argentina in November 2017 has proved so.

On the other hand, the interaction between civilian ships and crews and military/ coast guard systems can be tricky at times, due to the different nature of their goals and interests and to a potential "cultural gap". Fortunately, in most cases these potential rough edges have been smoothed over the years thanks to the regular interaction within the frame of the national SAR systems, which have been providing support for years in situations where life at sea has been in danger.

SAR systems are used to provide rapid response and continued assistance in situations of diverse degree of risk for life at sea and are potentially good enablers for international cooperation due to the humanitarian nature of their mission, which rends them uncontroversial.

A potential key to crisis prevention and solution at sea could be the strengthening of international links mirroring the already established cooperative status of the national SAR systems, and the use of those structures (mostly operated by military / coast guard forces) as a common path for further trust building and as an access path to bring together other key stakeholders in any crisis exceeding the specific SAR framework.

A key area where cooperation is both fully in place and indispensable is Antarctica. The volume of traffic and the number of tourists in the area are increasing at an exponential rate, and the response capabilities available tend to be limited, if not sparse due to the constraining environmental conditions and the distances involved. With no local population, the risk of a humanitarian crisis is practically negligible but, on the other hand, the risk of a SAR crisis becoming potentially disastrous isn't. Nations that operate Antarctic stations and vessels have established cooperation channels that help minimize such a risk and have, so far, prevented massive losses of life when incidents did happen.

But, if nobody would openly argue the need of cooperation when it comes to the preservation of life at sea, other areas produce much more competitive situations. The exploitation of sea-based natural resources is probably the most critical one in the South American coasts and, at the edge of the EEZs, it's evolving into a quagmire where hundreds of fishing vessels spend months fishing at the verge of controlled areas resupplying and refueling from readily available "mother ships" and transfer their cargo to reefer ships that, in due term, will carry it across the globe without any possible control. IUU fishing is ripe in those regions and the limited capabilities of the coastal nations are unable to confront with packs of up to 300/400 fishing vessels at the peak of the seasons.

International cooperation around this subject is as necessary as for SAR purposes, but quite less achievable, due to the conflicting nature of the interest involved and the number of non-national actors who also are part of the equation. The absence of regulatory frames such as prescribed in the articles 63, 64 and 116 to 119 of UNCLOS precludes the ability of the affected nations to preserve the existing resources and to manage them in a sustainable fashion. This ongoing situation doesn't seem to present a short-term solution and is sustained by the notorious power unbalances between the flag states involved and the coastal nations.

Crises at sea, then, comprise the full spectrum of international attitudes: from total cooperation when it comes to SAR and the protection of human life at sea, to a conflictive lack of dialogue when resource exploitation is involved. It is up to all involved nation states to create cooperation avenues and consensus in order to search for mutually beneficial solutions in the long term.

Technology has the potential to become a huge enabler towards this goal, by providing transparency and accountability, but it's the political leaders who'll eventually determine the future conditions in which these issues will be solved.