Sentinel Vision
EVT-663
21 May 2020

2D Layerstack

Mangrove preservation in Kenya

Sentinel-2 MSI acquired on **01 May 2016** at 07:42:42 UTC
Sentinel-2 MSI acquired on **21 January 2020** at 07:32:21 UTC & **23 January 2020** at 07:22:09 UTC
Sentinel-2 MSI acquired on **06 March 2020** at 07:27:49 UTC
Sentinel-1 CSAR IW acquired on **21 March 2020** from 02:54:57 to 02:55:26 UTC
Sentinel-1 CSAR IW acquired on **07 April 2020** from 03:03:23 to 03:04:13 UTC

Author(s): Sentinel Vision team, VisioTerra, France - svp@visioterra.fr

Keyword(s): Coastal, mangrove forest, wetland, biodiversity, deforestation, fishing, salinity, water colour, Kenya

Fig. 1 - S1 (21.03.2020 & 07.04.2020) - The Kenian coast between Somalia at north-east and Tanzania at south-west. 2D view

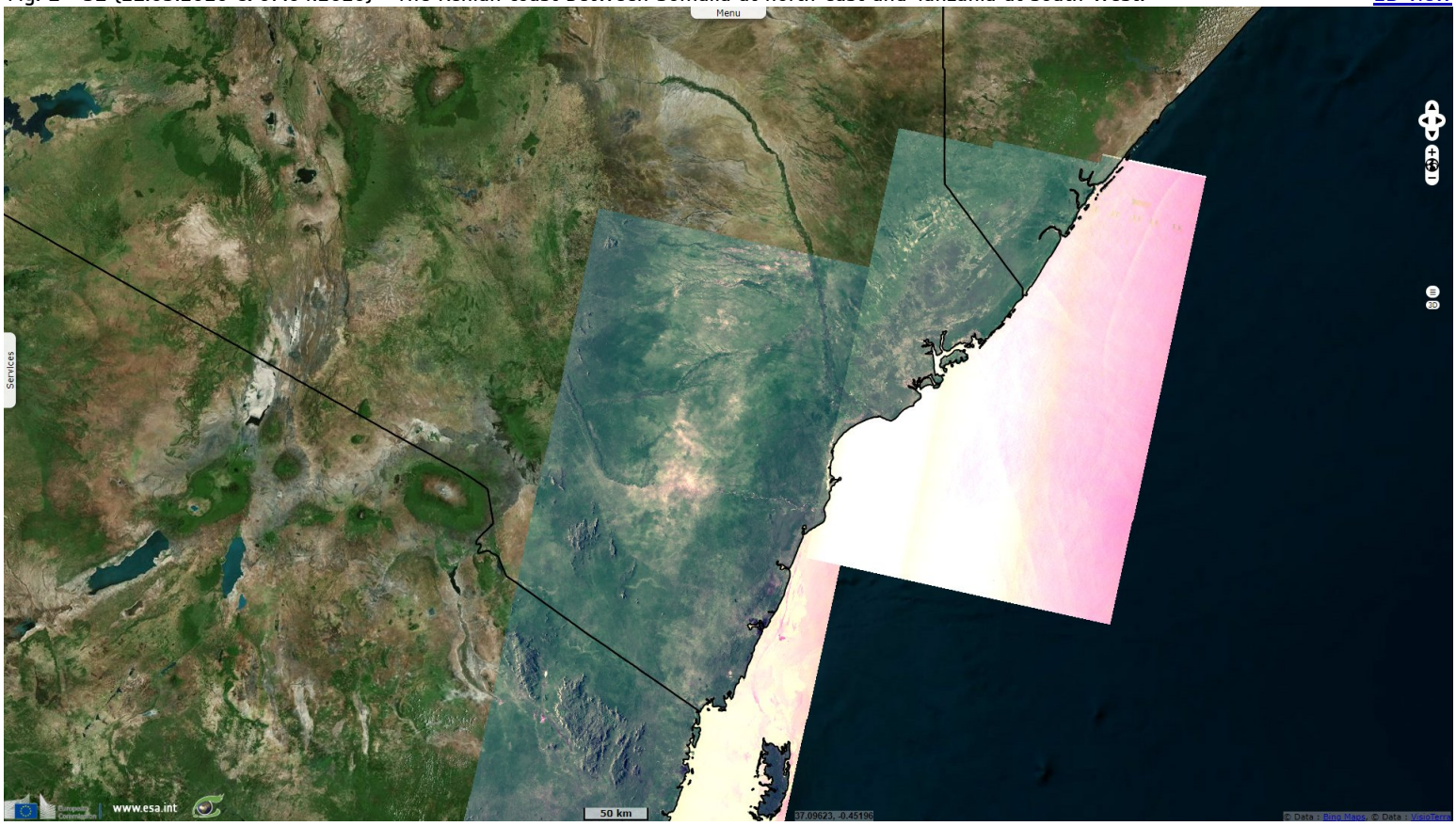
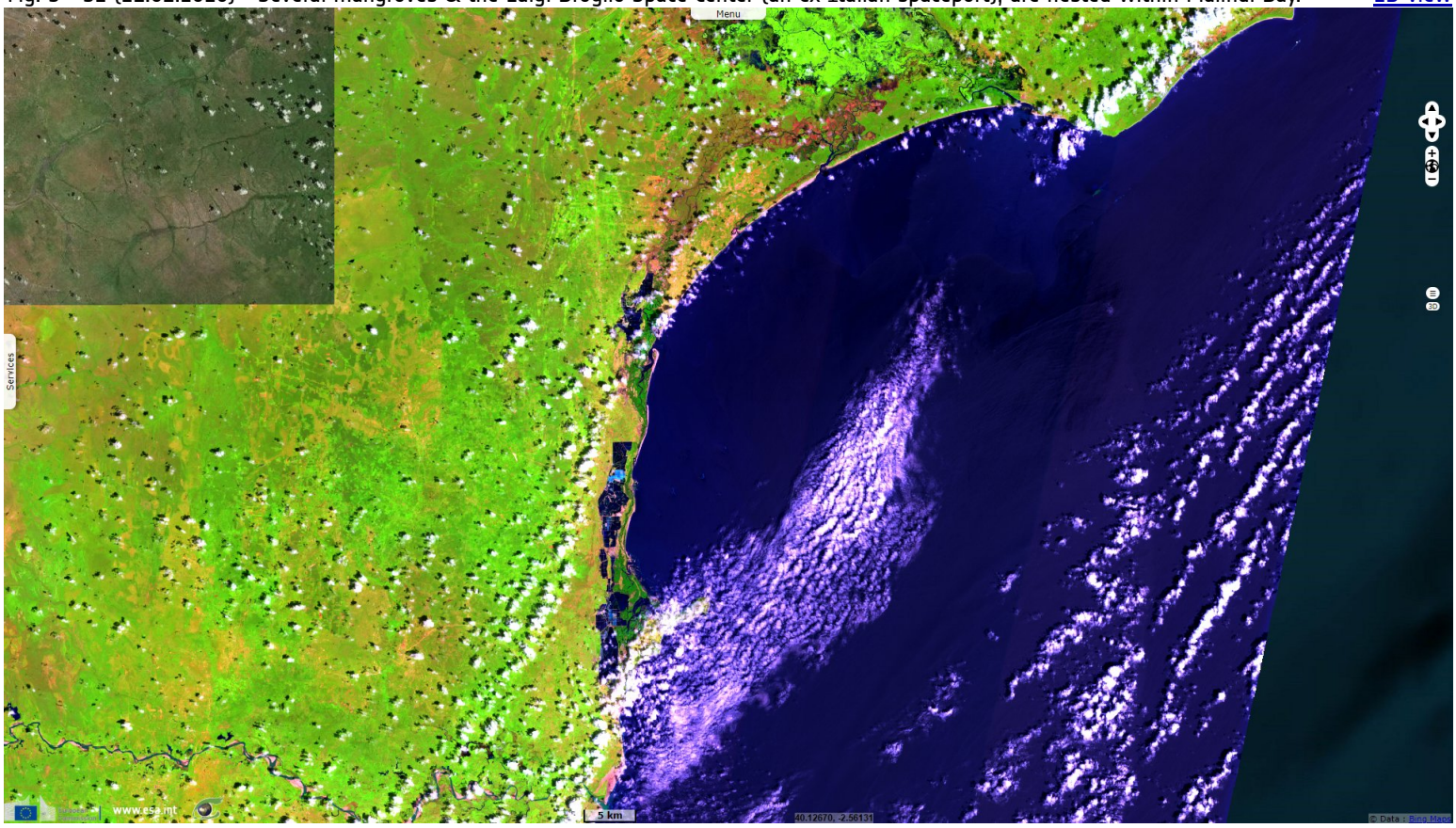


Fig. 2 - S1 (21.03.2020) - Large mangrove filled-coastline near the Somalian frontier. 3D view

In his master's thesis Factors controlling the distribution of Kenyan brachyuran mangrove crabs written in 2000, David Gillikin caracterised mangroves as follows: "*Mangroves are salt-tolerant trees and shrubs that usually grow in the intertidal zone throughout the tropics and sub-tropics. They are most often located along sheltered shores and can penetrate deep into the estuaries of rivers (Macnae, 1968). Mangroves trees have a very plastic form; the same species can grow as a short stunted bush in unfavorable conditions or as a full sized tree reaching heights of 40 meters, forming dense forests several kilometers thick under favorable conditions (Macnae, 1968).*"

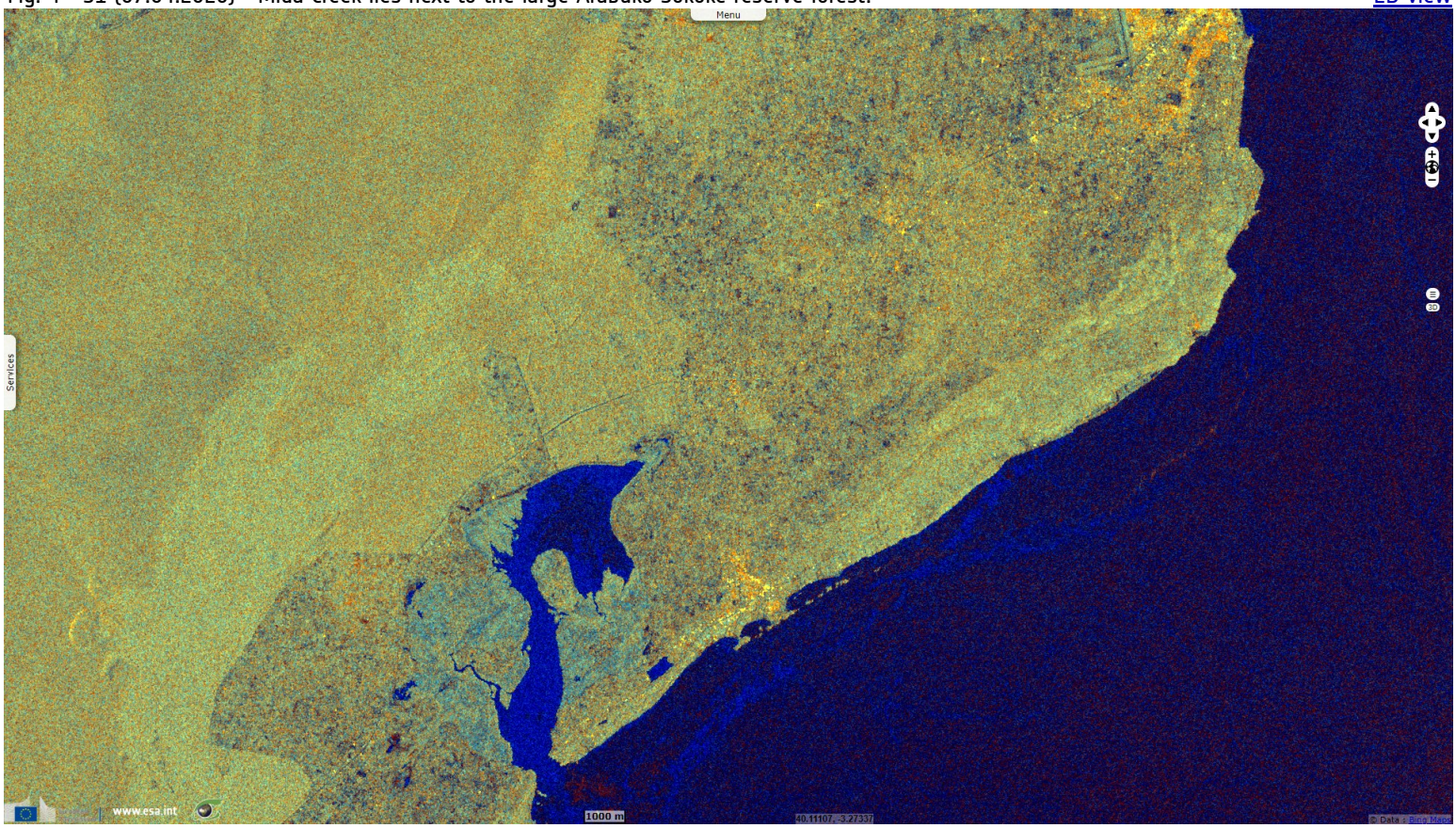
Fig. 3 - S2 (21.01.2020) - Several mangroves & the Luigi Broglio Space Center (an ex Italian spaceport), are nested within Malindi Bay. 2D view



Compared to neighbouring Somalia and Tanzania, Kenya has made important efforts to preserve and restore its mangroves. Tom Mwiraria highlights the importance of mangrove forest in an article published in the Kenyan Daily Nation newspaper on July, 26 2018: "*Mangrove trees act as a form of natural coastal defence by reducing soil erosion and the impact of ocean waves, and they also reduce the height of storm surges. They play an important role in reducing vulnerability to natural hazards and increasing resilience to climate change impacts. Mangrove soils are highly effective carbon sinks – reservoirs that have accumulated carbon-containing chemical compounds over a period of time.*" Mangroves store 50 times more carbon in their soils by surface area compared to tropical forests, and ten times more than temperate forests. This phenomenon makes the conservation of these coastal trees imperative in the bid to combat global warming and climate change.

Gazi Bay community planting mangrove seedlings for Mikoko Pamoja project - Source: Plan Vivo

Fig. 4 - S1 (07.04.2020) - Mida Creek lies next to the large Arabuko Sokoke reserve forest. 2D view

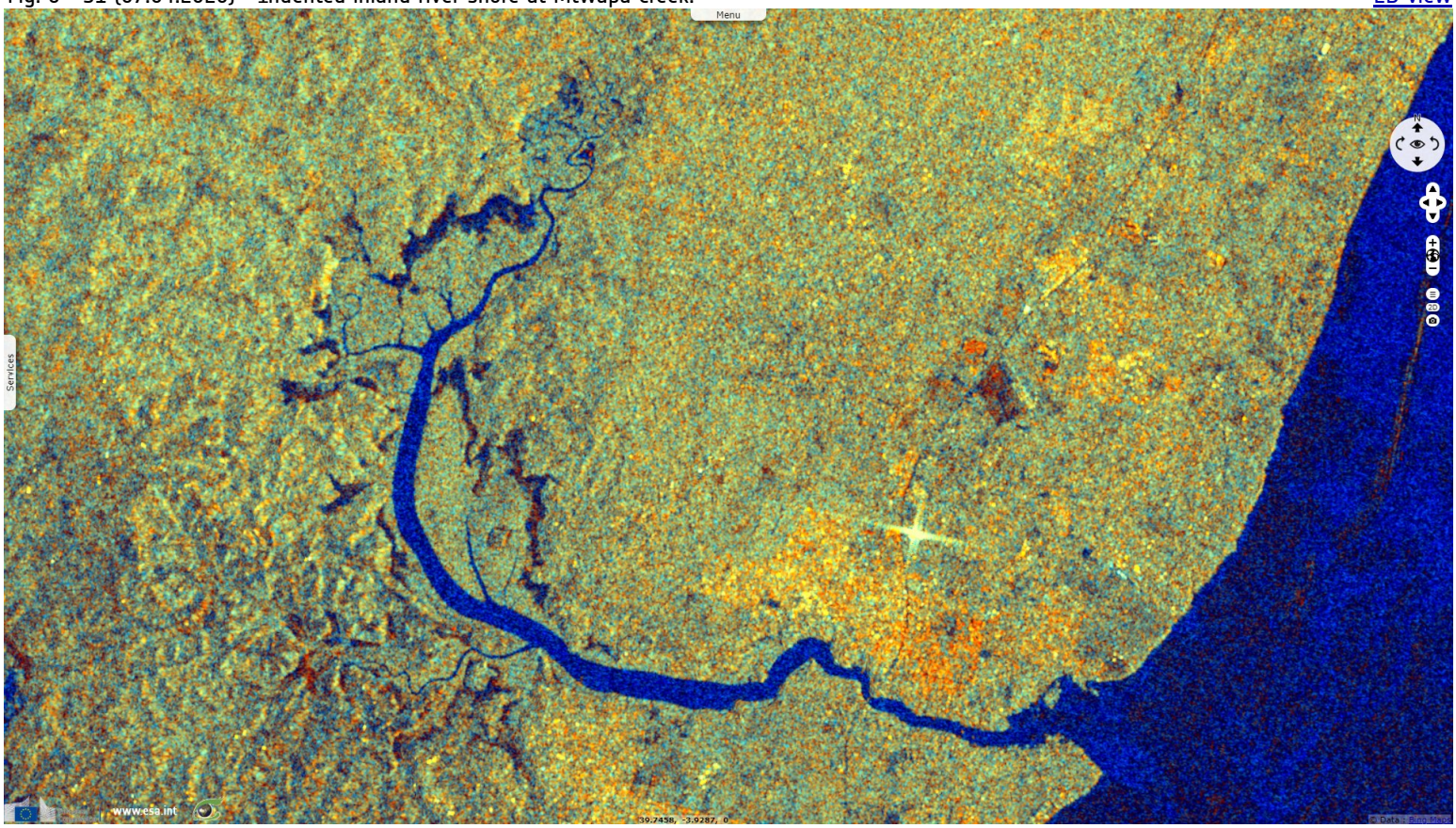


"*Sadly, mangroves are under threat, laments Casper van de Geer, the conservation and scientific adviser at Local Ocean Conservation: Watamu Turtle Watch. Mangrove forests are less than one per cent of all tropical forests worldwide, and less than 0.4 per cent of the total global forest estate, according to the UNESCO. Mangrove forests in Kenya cover about 61,271 hectares representing approximately three per cent of the natural forest cover or less than one per cent of the national land area. About 59 per cent of these forests occur in Lamu County, according to the government's National Mangrove Ecosystem Management Plan 2017-2027.*"

Fig. 5 - S1 (07.04.2020) - Mangrove forest in Kilifi Creek. 2D view

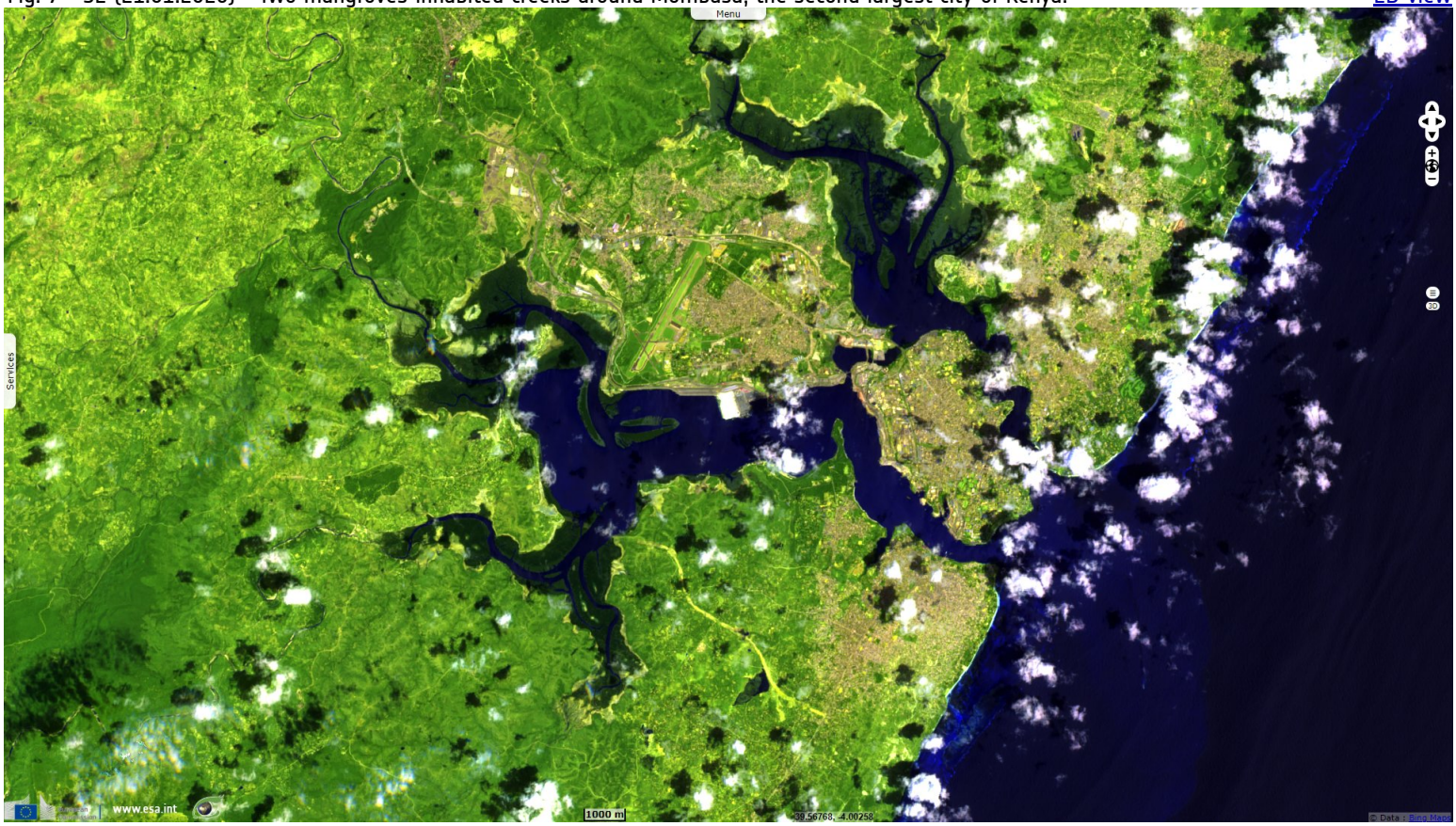
"*'Mangrove trees grow very slowly yet they are still being cut down in an unsustainable manner. Locals hack down mangroves for construction or for use as fuel. It takes decades for the trees to grow back,' says Casper van de Geer. De Geer adds: 'Fishermen digging up bait from the mangroves roots also pose a huge problem. The trees eventually wither from burrowing. During the dry spells, livestock keepers cut mangrove leaves to feed their animals. Leaves harvesting weakens and dries up mangrove trees.' The National Mangrove Ecosystem Management Plan (NMEP) identifies illegal harvesting, pollution (oil spills), overexploitation, coastal development and sedimentation as the major threats to mangroves in Lamu County.*"

Fig. 6 - S1 (07.04.2020) - Indented inland river shore at Mtwapa Creek. 2D view



"*Despite their widely recognized socioeconomic and ecological value, mangroves are among the world's most threatened vegetation types. More than a fifth of the world's mangroves have been lost over the past 30 years alone, and many surviving forests are degraded. Safeguarding them will require urgent interventions aimed at ensuring that their vital ecosystem services and non-market benefits are adequately incorporated in policy and development choices.*" added the Governance of Africa's Resources Programme

Fig. 7 - S2 (21.01.2020) - Two mangroves-inhabited creeks around Mombasa, the second largest city of Kenya. 2D view



The United Nations Environment Programme (UNEP) underscores Mikoko Pamoja, a successful project dedicated to this issue: "*A project on mangrove conservation and restoration in on the Kenyan coast is turning heads: It's the world's first conservation project to link mangrove forests to the global carbon market. They raises money by selling carbon credits to people and organizations eager to reduce their carbon footprint, through the Scottish charity ACES. This supports the planting and conservation of mangrove trees.*" "*International carbon markets can play a key role in reducing global greenhouse gas emissions in a cost effective manner, and the number of emissions trading systems around the world is increasing. This project, however, relies on voluntary contributions.*"

Fig. 8 - S2 (01.05.2016) - Gazi Bay, location of the Mikoko Pamoja project. 2D view

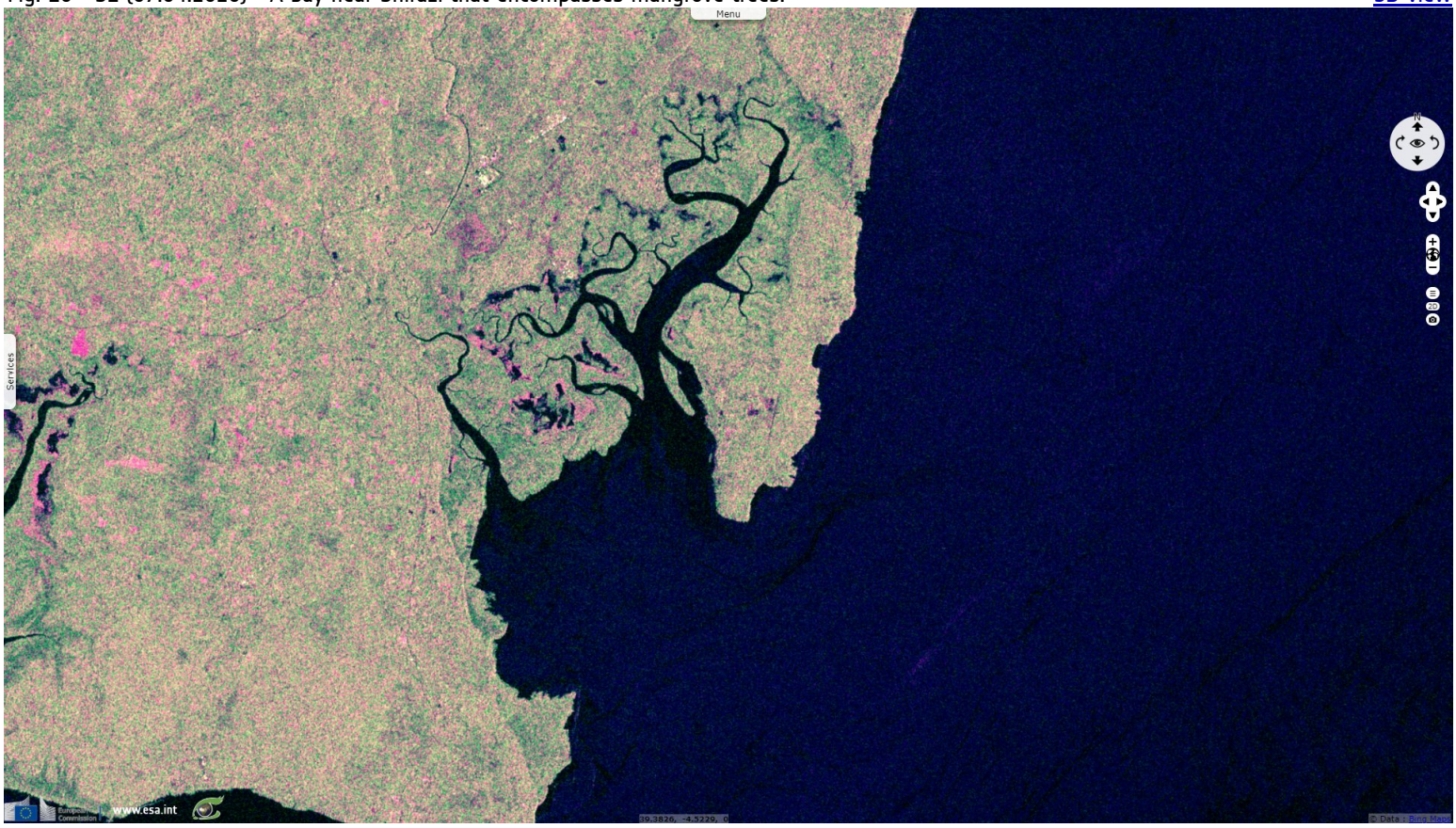
In their Mangrove Knowledge Hub, the Global Mangrove Alliance further develops on this initiative: "*Since its inception in 2014, Mikoko Pamoja Community Based Organisation has been able to ensure conservation of 117 ha of mangroves in the Gazi bay. In addition, the group, through the technical support from Kenya Marine and Fisheries Research Institute (KMFRI) and WWF-Kenya, has established new mangrove forests covering 10 ha. In return, the community has received a total of Ksh. 2.6 million shillings over the past two years, proceeds whose impact has breathed life into the two villages and put it back on a positive trajectory, rekindling hopes of a better tomorrow for future generations.*"

Fig. 9 - S2 (06.03.2020) - Gazi Bay, four years later in the project. 2D view

The United Nations Environment Programme (UNEP) underscores Mikoko Pamoja, a successful project dedicated to this issue: "*A project on mangrove conservation and restoration in on the Kenyan coast is turning heads: It's the world's first conservation project to link mangrove forests to the global carbon market. They raises money by selling carbon credits to people and organizations eager to reduce their carbon footprint, through the Scottish charity ACES. This supports the planting and conservation of mangrove trees.*" "*International carbon markets can play a key role in reducing global greenhouse gas emissions in a cost effective manner, and the number of emissions trading systems around the world is increasing. This project, however, relies on voluntary contributions.*"

In their Mangrove Knowledge Hub, the Global Mangrove Alliance further develops on this initiative: "*Since its inception in 2014, Mikoko Pamoja Community Based Organisation has been able to ensure conservation of 117 ha of mangroves in the Gazi bay. In addition, the group, through the technical support from Kenya Marine and Fisheries Research Institute (KMFRI) and WWF-Kenya, has established new mangrove forests covering 10 ha. In return, the community has received a total of Ksh. 2.6 million shillings over the past two years, proceeds whose impact has breathed life into the two villages and put it back on a positive trajectory, rekindling hopes of a better tomorrow for future generations.*"

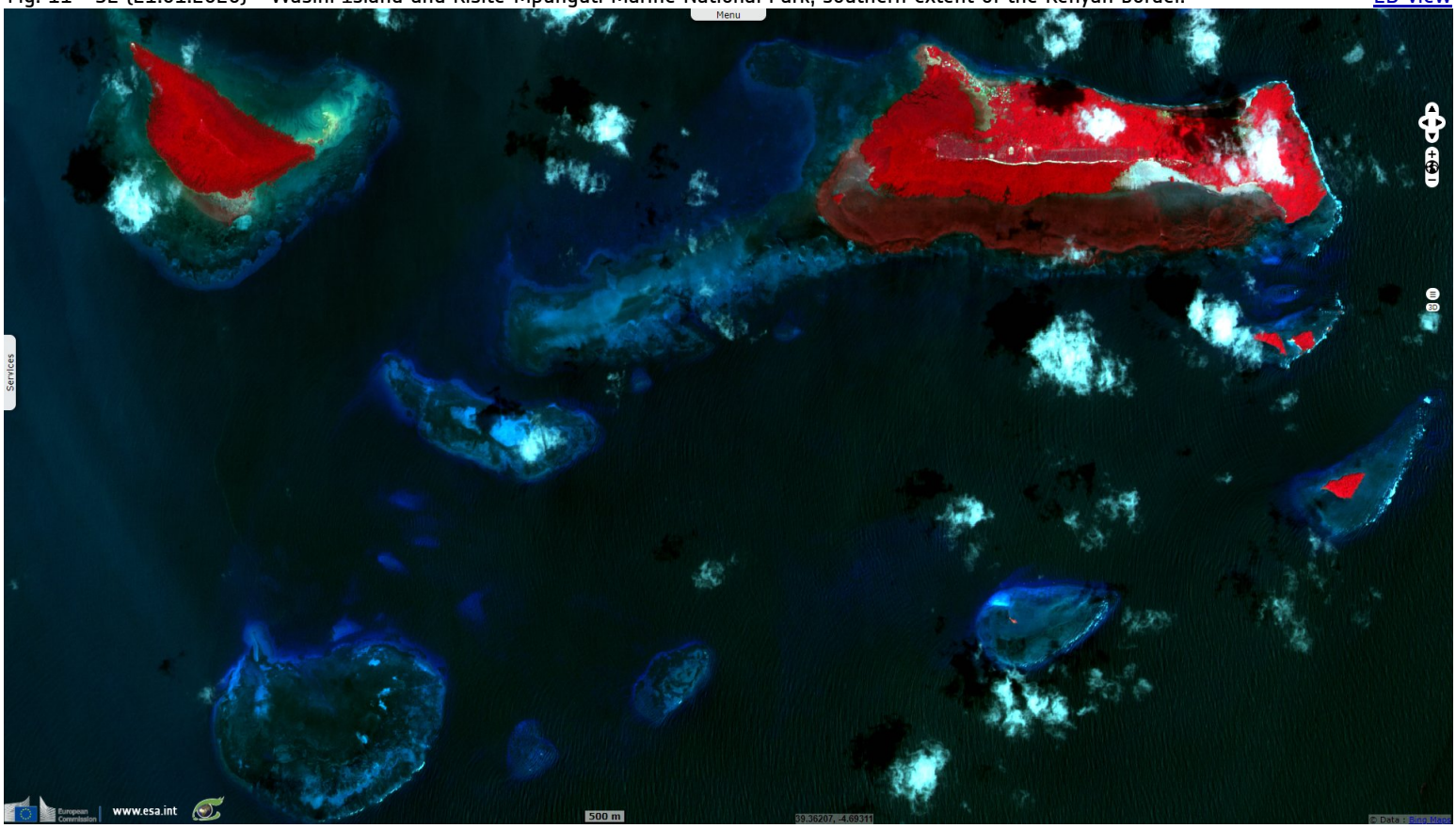
Fig. 10 - S1 (07.04.2020) - A bay near Shirazi that encompasses mangrove trees. 3D view



"*Gazi is a typical fishing community, living a subsistence lifestyle with limited agricultural activities to sustain them. There is a high poverty level according to the National Population Census of 2009 by the Kenya Bureau of statistics, which stems from a vicious cycle of low access to formal education. For a long time, wanton extraction of mangrove trees negatively impacted not only on their livelihoods but also the environment in Gazi Bay. The area remains the main target for illegal loggers of the mangrove trees because the poles formed from mangroves in this specific area are suitable for construction, as they are straight and more usable than other timber. They are also widely extracted for wood fuel.*"

"*For a community whose utilization of the mangroves is a trade handed down through several generations, their wake up call came when their livelihood was threatened due to destruction of the mangroves. It started off with marked reduction of fish caught. This was directly attributed to the excessive illegal logging, since mangrove forests are home to a large variety of fish, crab, shrimp, and mollusk species. The forests also serve as nurseries for many fish species, including coral reef fish. Diminishing timber products and other essential plant products that the community relied on, like medicines, accentuated their concern and need to protect the mangroves. The absence of the dense, sediment-trapping mangrove root systems destabilized the coastline and increased erosion, which was a direct threat to the community's health. And though many hadn't appreciated the mangroves' aesthetic value before, the steady loss of the thick greenery reminded the community that in a bid to survive, action had to be taken.*"

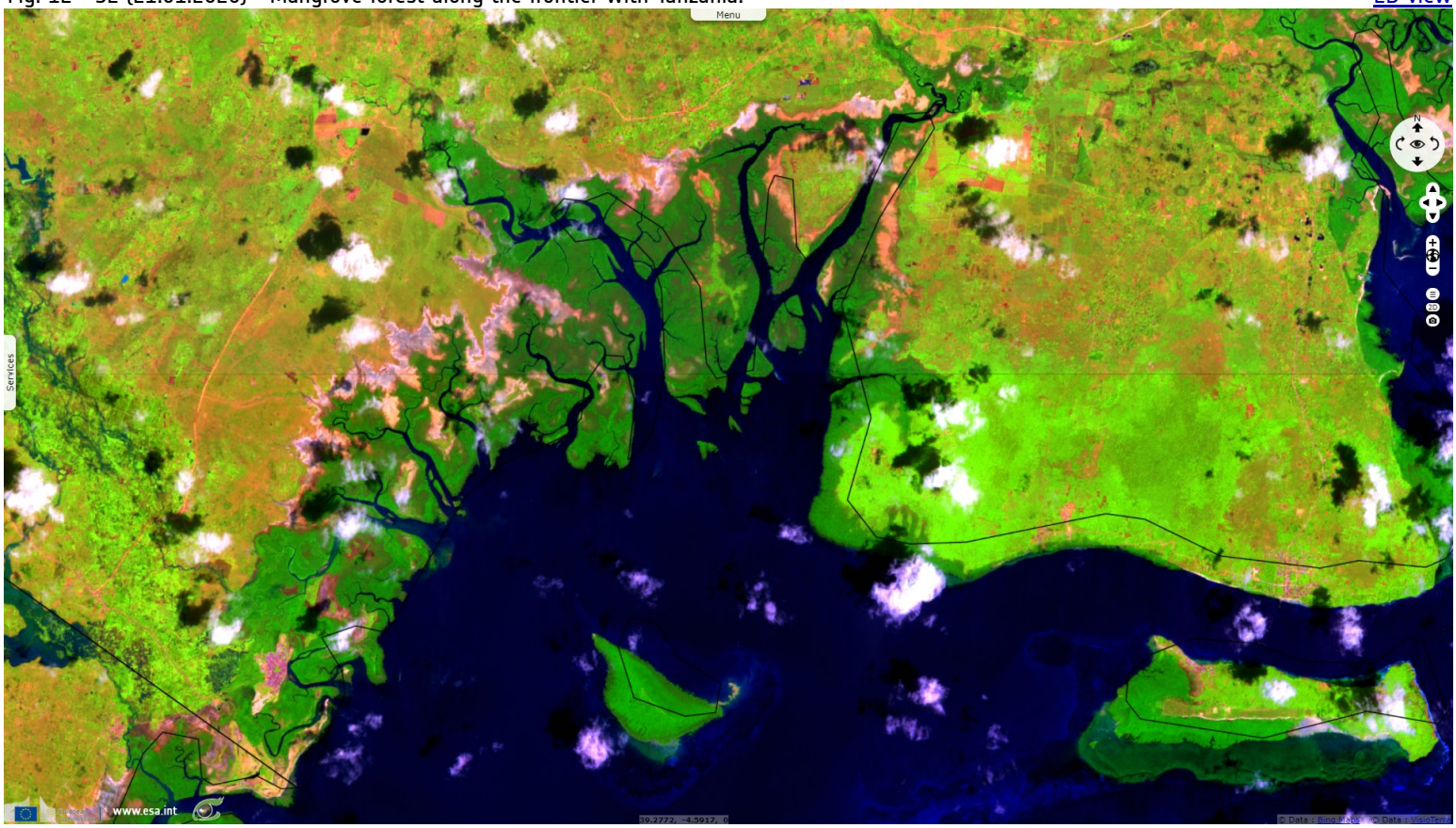
Fig. 11 - S2 (21.01.2020) - Wasini Island and Kisite-Mpunguti Marine National Park, southern extent of the Kenyan border. 2D view



"*The key to unlocking an intervention that would reverse the loss of mangroves and resuscitate the livelihoods of the Gazi Bay Community was the villagers' realization that the mangrove forest do not belong to the government and that they couldn't wait for someone else to save the mangroves. This important realization initiated the need for community involvement in the conservation of their mangroves, and the quest to improve their livelihoods through natural solutions. The key interventions included awareness-raising within the community of how cutting down of mangrove trees destroys fish nests and other marine life that in turn affects their livelihoods. Introduction of fast-growing terrestrial casuarina tree plantations as an alternative source of wood fuel and construction posts eased the pressure on the mangrove forests. One of the major milestones was the formation of the Community Forest Association (CFA) through which the community protected and established new mangrove forests for carbon trade with the technical assistance from KMFRI and WWF-Kenya.*"

Reforestation of Gazi Bay mangroves - Source: VLIZ-KMFRI

Fig. 12 - S2 (21.01.2020) - Mangrove forest along the frontier with Tanzania. 2D view



"*They are now reaping benefits through the annual income they earn that come directly to them. The community members have since been able to seek alternative sources of income, like Mama Hafsa Muhamed Zuga, who now runs a shop and sells confectionery. The interventions have brought tangible outcomes that according to Mama Hafsa have put the communities of Gazi and Makongeni village on an unprecedented growth path. 'Since we started conserving the mangroves and established new plantations, our husbands have been able to return home with bigger fish of different kinds for they now have a secure and habitable place to nest and enough food.*"

The UNEP also highlights other benefits: "*The payments for 'mangrove carbon' are also used to benefit the local community. 'We have provided fresh water to the community either by installing water points or by bringing piped water to people's houses,' says Ann Wanjiru, a local officer involved with the project. 'We have bought about 700 textbooks for local schools, and we have improved the infrastructure in the schools by renovating classrooms that were previously leaking.*"

More on European Commission space:						
More on ESA:	S-1 website	S-2 website	S-3 website			
More on Copernicus program:	Scihub portal	Cophub portal	Inthub portal	Colhub portal		
More on VisioTerra:	Sentinel Vision Portal	Envisat+ERS portal	Swarm+GOCE portal	CryoSat portal		

Funded by the EU and ESA EVT-663-SentinelVision powered by VisioTerra