Sentinel Vision
EVT-119
12 October 2017

2D Layerstack

Call at port in the Canaries for Spanish national day

Sentinel-2 MSI acquired on **18 December 2015** at 11:58:45 UTC
Sentinel-2 MSI acquired on **31 December 2015** at 12:03:59 UTC
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Sentinel-1 CSAR IW acquired on **01 June 2017** at 19:12:37 UTC

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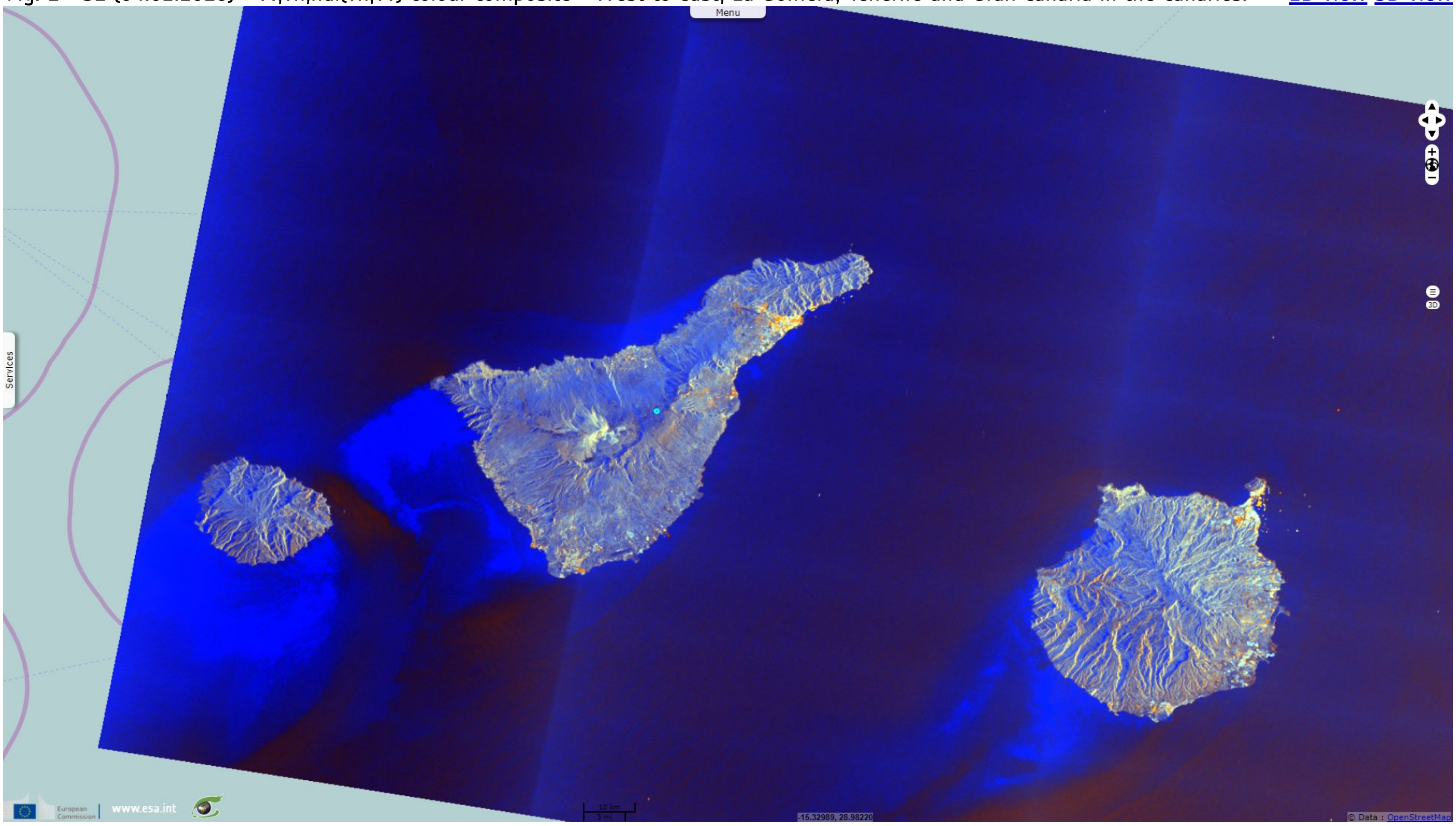
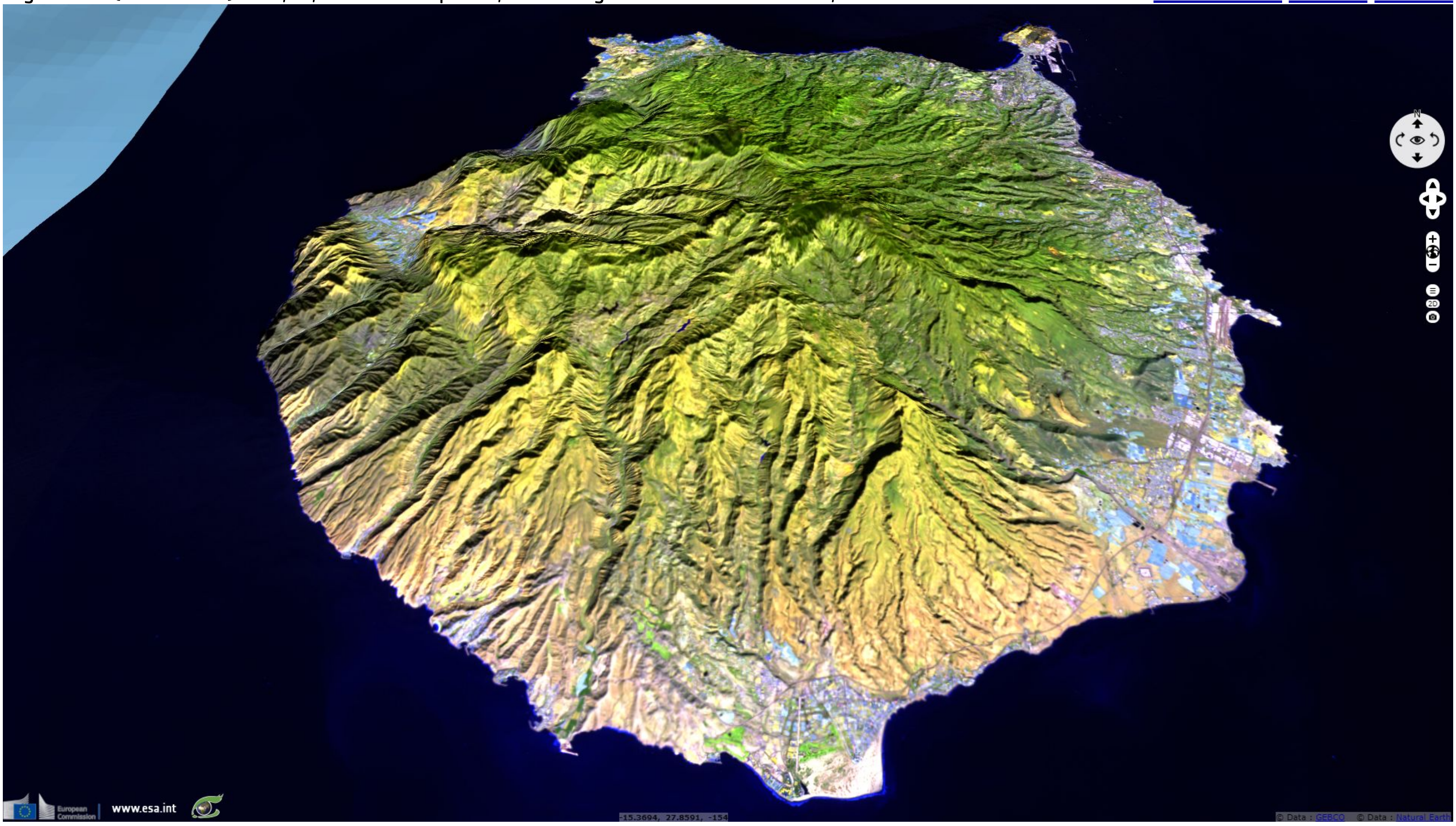
Fig. 1 - S1 (04.02.2016) - vv,vh,ndi(vh,vv) colour composite - West to east, La Gomera, Tenerife and Gran Canaria in the Canaries. 2D view 3D view



Around year 1000, long after mankind reached the Americas, the viking navigator Leif Erikson sailed from Greenland to Canada (that he called Vinland). There, he set two colonies that lasted until the early XVth century. In 1492, Genoan navigator Christopher Colombus (Cristoforo Colombo) was mandated by Spain to find the western road to Asia. Colombus Day commemorates his first landing on the American continent, rediscovered at this occasion and the meeting of indigeneous inhabitants. This day is observed in Spain, Italy, most of USA, several countries in the Americas under various names.

After he left Spain, Colombus called at port in the Canary Islands, a Spain possession off Morocco. He restocked provisions and made repairs in Gran Canaria, then departed from La Gomera, crossing the Atlantic ocean pushed by the then-unknown trade winds. It is why Canaries were chosen in this story to honour Fiesta Nacional de España.

Fig. 2 - S2 (18.12.2015) - 12,11,2 colour composite, relief magnified 2x - Gran Canaria, where Colombus restocked. 3D animation 3D view 2D view



As other archipelagoes of Macaronesia, Canary islands are thought to be the product of hotspots. The Lanzarote Lanzarote Geoparc describes the geologic context of the Canary Archipelago:
The Canary Islands are located in the African tectonic plate on a passive continental margin, in an intraplate geodynamic context and developed on a lithosphere of Jurassic age (150-180 Ma) (Hayes and Rabinowitz, 1975; Verhoef et al. , 1991; Roest et al., 1992). The islands' basement consists of oceanic crust (Uchupi et al., 1981, Dañobeitia, 1980, Banda et al., 1981). These are large independent volcanic buildings whose emerged part constitutes the top of a stack of submarine materials, which can reach more than 4-5 km in height.
The Canary Islands formed in a first phase by a stacking of submarine volcanic materials at the end of the Cretaceous and the beginning of the Tertiary (Robertson and Stillman, 1979; Watkins and Hoppe, 1979) followed by a phase of subaerial materials about 20-30 Ma (1998), which are mainly formed by effusive eruptive mechanisms, although many volcanic buildings have been the product of the explosive and hydromagmatic volcanism (Abdel-Monem et al., 1971, Coello et al., 1992; Cantagrel et al..

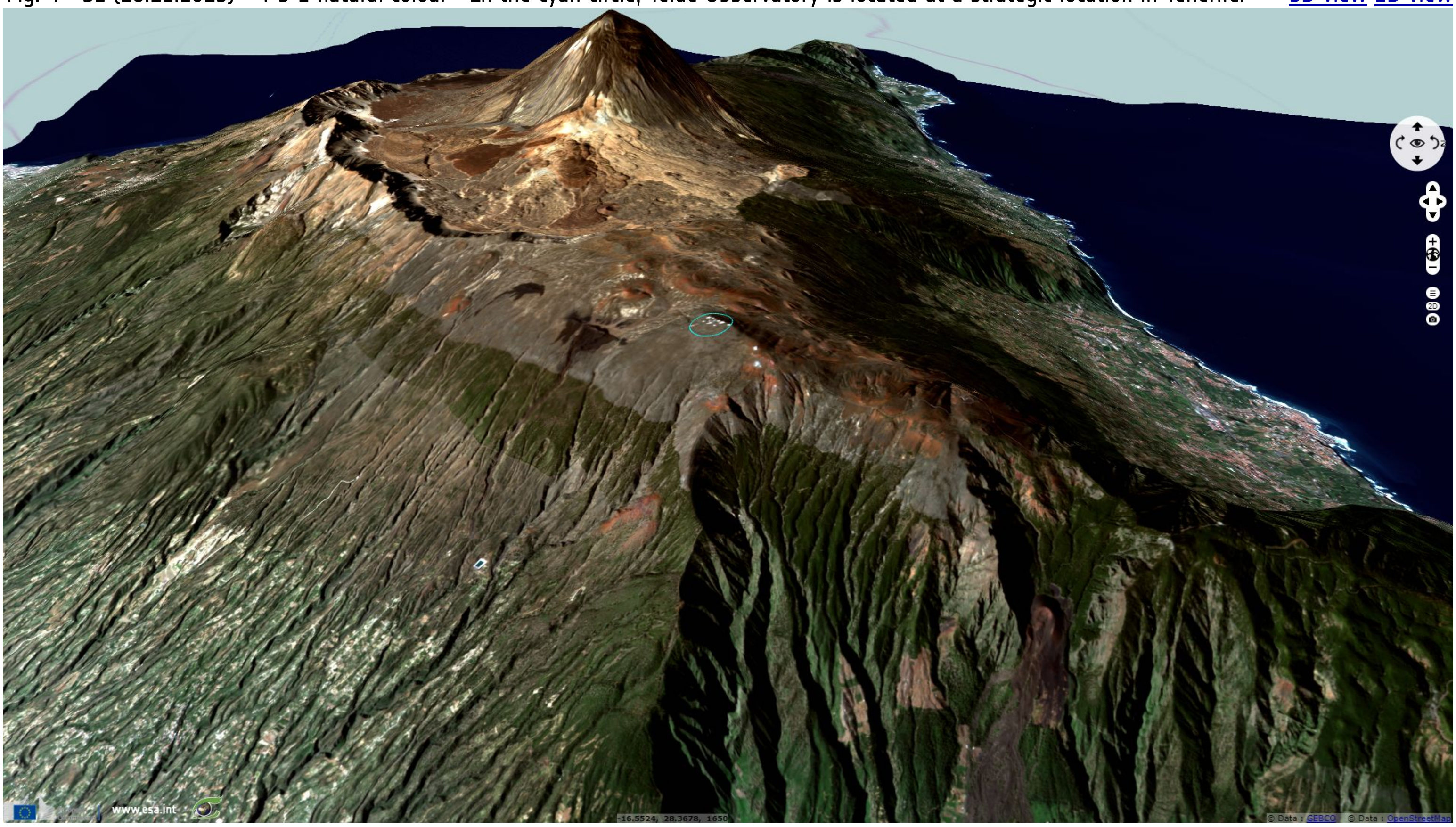
Regarding Gran Canaria island, The Smithsonian Institution's Global Volcanism Program describes its volcanic setting : "*The largely Miocene-to-Pliocene island of Gran Canaria in the middle of the Canary archipelago has been strongly eroded into steep-walled radial gorges called barrancos. Three major volcanic structures form the circular 60-km-wide island, which has been modified by caldera collapse, gravitational edifice failure, and extensive erosion.* "

Fig. 3 - S2 (18.12.2015) - 11-8-2 colour composite - Tenerife and La Gomera islands. 3D animation 3D view 2D view

Tenerife and La Gomera each host a UNESCO World Heritage site, respectively Teide National Park and Garajonay National Park. UNESCO described the first, writing: "*Situated on the island of Tenerife, Teide National Park features the Teide-Pico Viejo stratovolcano that, at 3,718 m, is the highest peak on Spanish soil. Rising 7,500 m above the ocean floor, it is regarded as the world's third-tallest volcanic structure and stands in a spectacular environment. The visual impact of the site is all the greater due to atmospheric conditions that create constantly changing textures and tones in the landscape and a 'sea of clouds' that forms a visually impressive backdrop to the mountain. Teide is of global importance in providing evidence of the geological processes that underpin the evolution of oceanic islands.*"

Regarding the unusual shape of Mount Teide, Smithsonian Institution provides the following explanation: "*The origin of the caldera has been variably considered to be due to collapse following multiple major explosive eruptions or as a result of a massive landslide (in a manner similar to the earlier formation of the massive La Orotava and Guimar valleys), or a combination of the two processes.*"

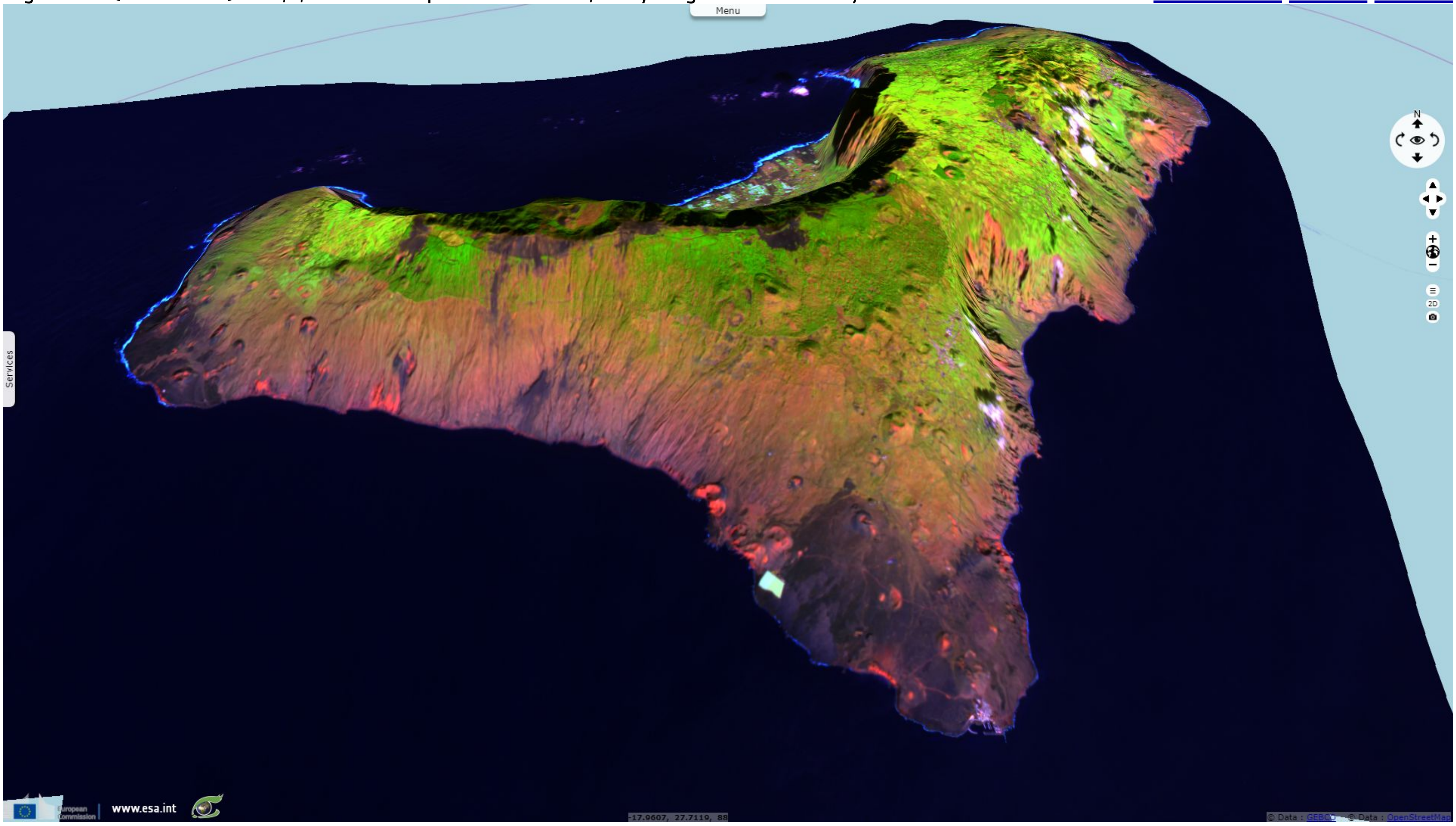
Fig. 4 - S2 (18.12.2015) - 4-3-2 natural colour - In the cyan circle, Teide Observatory is located at a strategic location in Tenerife. 3D view 2D view



While they are located at a subtropical latitude, these volcanic islands benefit from a strong oceanic influence. Northeasterly Trade winds prevail at these latitudes, orographic precipitations thus happens mostly on the north-east slopes of the volcanoes. This explains why vegetation is more prevalent on one side of these islands than on the other. Located in the rain shadow of Mount Teide, Teide Observatory benefits from a dry climate, its altitude decreases the effects of atmosphere while its low latitude (for a European land) is a beneficial factor for some optical instruments.

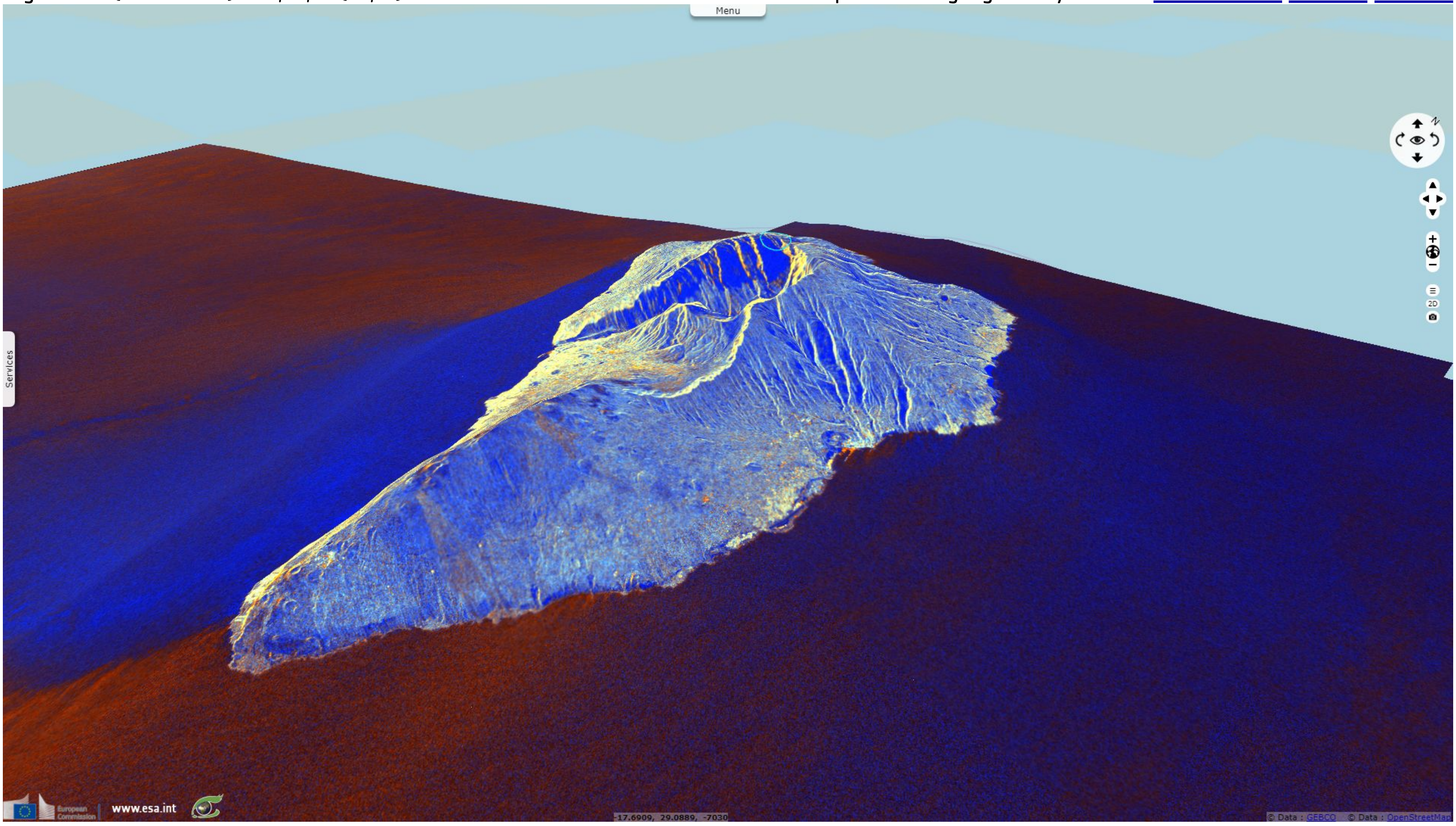
Instituto de Astrofísica de Canarias wrote about Teide observatory: "*Astrophysics in the Canaries began (in the early 1960s) at this Observatory. It is situated 2.390 metres above sea level in Izaña. [...] The first telescope for studying zodiacal light, light dispersed by interplanetary material, entered service here in 1964. Its geographical location (between the eastern and western solar observatories), together with the clarity and excellent quality of the sky, mean that the Observatorio del Teide is ideally suited for studying the sun. For this reason it is home to Europe's finest solar telescopes.*". Among other instruments, it encompasses ESA's Optical Ground Station.

Fig. 5 - S2 (31.12.2015) - 11,8,2 colour composite - El Hierro, the youngest of the Canary islands. 3D animation 3D view 2D view



Smithsonian Institution describes the island writing: "*The triangular island of Hierro is the SW-most and least studied of the Canary Islands. The massive shield volcano is truncated by a large NW-facing escarpment formed as a result of gravitational collapse of El Golfo volcano about 130,000 years ago. The steep-sided scarp towers above a low lava platform bordering 12-km-wide El Golfo Bay, and three other large submarine landslide deposits occur to the SW and SE. Three prominent rifts oriented NW, NE, and south at 120 degree angles form prominent topographic ridges.*" Its inhabitants make use of Hierro topography to generate energy, it became one of the first energy-self-sustainable islands using hydroelectricity and solar panels while storing intermittent excess of wind energy via pump storage.

Fig. 6 - S1 (01.06.2017) - vv,vh,ndi(vh,vv) - La Palma island massive caldera and multiple vents highlighted by S1. 3D animation 3D view 2D view

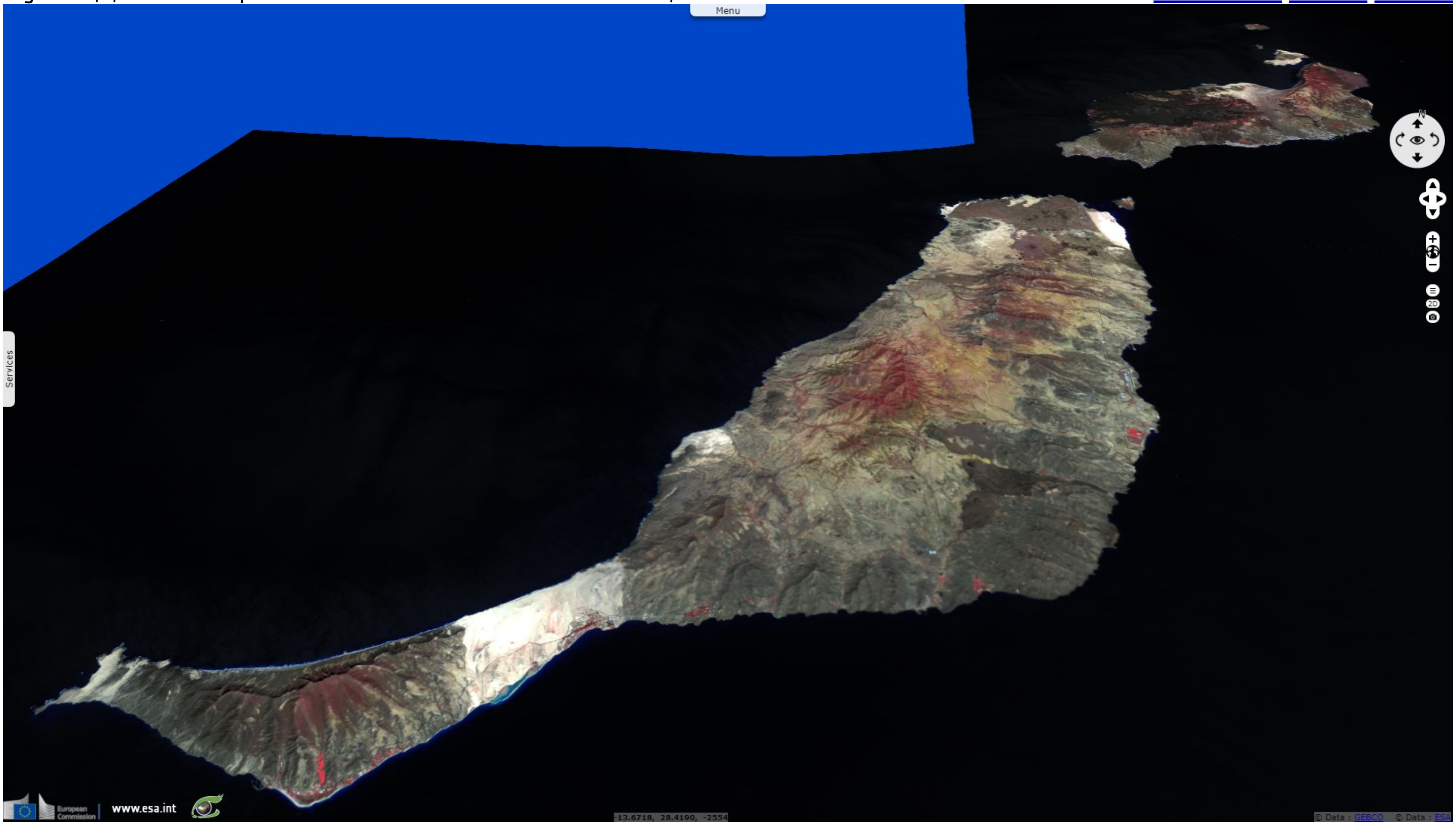


La Palma is described by Smithsonian Institution: "*The 47-km-long wedge-shaped island of La Palma, the NW-most of the Canary Islands, is composed of two large volcanic centers. The older northern one is cut by the massive steep-walled Caldera Taburiente, one of several massive collapse scarps produced by edifice failure to the SW. The younger Cumbre Vieja, the southern volcano, is one of the most active in the Canaries. The elongated volcano dates back to about 125,000 years ago and is oriented N-S. Eruptions during the past 7000 years have originated from the abundant cinder cones and craters along the axis of Cumbre Vieja, producing fissure-fed lava flows that descend steeply to the sea. Historical eruptions at La Palma, recorded since the 15th century, have produced mild explosive activity and lava flows that damaged populated areas. The southern tip of the island is mantled by a broad lava field produced during the 1677-1678 eruption. Lava flows also reached the sea in 1585, 1646, 1712, 1949, and 1971.*"

Fig. 7 - S2 (31.12.2015) - 4-3-2 natural colour - Roque de los Muchachos Observatory sits at the top of La Palma's highest volcano. 3D view 2D view

Roque de los Muchachos Observatory is now a prime observatory of European Northern Observatory. Instituto de Astrofísica de Canarias wrote about Gran Telescopio CANARIAS, one of its most advanced instruments: "*The Gran Telescopio CANARIAS (GTC) is a 10,4 metres primary mirror reflecting telescope. It is designed to incorporate the most up-to-date technology and it is one of the most advanced telescopes in the world and the largest of the optical-infrared.*"

Fig. 8 - 8,4,3 colour composite - Fuerteventura and Lanzarote islands, east of the Canaries. [3D animation] [3D view] [2D view]



Being volcanic islands, Canary islands are highly subject to orographic precipitations and erosion. Youngest islands rise from the seafloor while older ones collapse or are slowly abraded. Because of this, older islands such as the Fuerteventura and Lanzarote islands are less rugged and receive less precipitations. While younger islands have a humid subtropical climate, Fuerteventura and Lanzarote are more arid and less vegetated.

Fig. 9 - S2 (2017.03.09) - 4-3-2 natural colour - Zoom on Lanzarote island, Mars on Earth. [3D animation] [3D view] [2D view]

Lanzarote Geopark website describes its unique features: "*Lanzarote and the Chinijo Archipelago is a geopark of oceanic volcanic islands in which, in addition to having a geological heritage of international relevance, with great value and good conservation, it is possible to observe the interaction, over more than 15 Ma, between the volcanic and erosive and sedimentary processes, both in continental and marine environments. In October 1993 an area of the UNESCO World Geopark of Lanzarote and the Chinijo Archipelago had already been declared a Biosphere Reserve by UNESCO. In this geopark, almost 70 sites of geological interest (LIG) have been inventoried, between terrestrial and marine, with high uniqueness and representativeness, 13 of them with international relevance.*

Lanzarote has been built with materials almost exclusively basaltic, grouped in three stages of volcanic construction, one submarine and two sub-areas. During the first phase, of Oligocene age, the basement of the island is constructed, constituted by submarine volcanic materials, rocks of *plutónico and sedimentary type. During the Myo-Pliocene and Pleistocene-Holocene there are two stages of subaerial volcanic activity separated by a period of eruptive calm of at least 2.5 Ma, during which the old Mio-Pliocene volcanic structures were subjected to a continuous erosion that shaped their forms originals."*

Lanzarote Geopark is used by ESA to train astronauts. ESA comments the Pangea mission: "*The session in Lanzarote is devoted to field geology in a 'planetary analogue', meaning a setting with terrain very similar to that found on Mars.*"

Landscape at Geoparque Lanzarote in the Canary Islands that is part of the second session of ESA's Pangaea training course for astronauts.

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