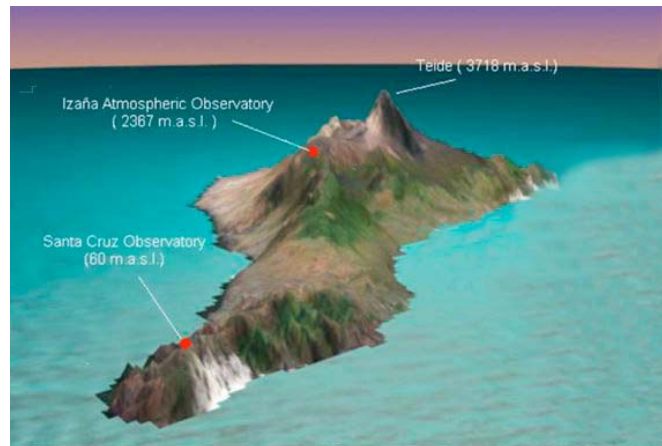


THE ATMOSPHERIC OBSERVATION IN TENERIFE ISLAND DURING THE LAST FOUR CENTURIES AND THE MOUNTAIN OBSERVATORY IN IZAÑA.

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THE GEOGRAPHICAL ENVIRONMENT

Tenerife is an island of volcanic origin, which can be traced to times towards the end of the Tertiary period. Emerging some seven million years ago, it is the largest of the seven islands of the Canary Archipelago. Located between the 28° and 29° N and 16° and 17° W, a little north of the Tropic of Cancer, it sits right in the middle of the other islands. Tenerife is just over 300 km away from the African continent and about 1200 km from the Iberian Peninsula. With a surface of 2034 km² and distinct triangular shape it is a mountainous island. The gigantic massif of Teide, sits above the circular formation of Las Cañadas. The Teide, with its 3718 m is the highest peak in all of Spain territories, and the third largest volcano on Earth.



SCIENTIFIC INTEREST 1600-1900

Trade-wind inversion was well known in the Canary Islands in ancient times. In 1592 the Italian engineer Torriani spoke of the dry warm air at the high mountains of Tenerife. The earliest antecedent of scientific works on Teide's Peak that we know of, dates back to the 17th century. In 1645 The Royal Society of London, requested the permission for two fellows of the Society to visit Tenerife to measure the “weight of the air” at the Peak. This was just two years since Torricelli had taken the first measurements with the barometer.

In June 1799 Alexander von Humboldt climbed up the Teide taking measurements of the air temperature and pressure, as well as collecting geological, flora and vegetation data. He was the first one in fixing the altitude of the sea cloud at around 1170 m., and explained the essential causes. Charles Darwin arrived to Tenerife with the “Beagle” expedition on 6th January 1832, although he was unable to disembark due to rumours of a cholera epidemic in his ship. In his book Darwin mentioned the diameter of dust particles and the importance of the Sahara's wind for this phenomenon. The first book specializing in the climate of the Canary Islands dates from 1823 and was written by the German geologist Leopold von Buch. In 1850 the astronomer Charles Piazzi Smith spent two months in a place named Altavista, near Teide's Peak, carrying out astronomical observations. He also provided fundamental and

original data concerning Teide's wind and climate. Ozone measurements were performed in Tenerife as early as 1862-1863 with the purpose of investigating an outbreak of yellow fever.

The change of direction from the usual Northeasterly winds in the coast of the island to an almost permanent SW wind observed in its high mountains called the attention of scientist from early times. It was probably well known to Edmund Halley when he published his "First Wind charts" in the "Transactions Philosophiques" in 1686. George Hadley made reference to Tenerife when he offered in 1735 an explanation for the Equatorial circulation. When William Ferrel published in 1856 his mathematical model of the atmospheric circulation (revised in 1860 and 1889) he made explicit mention of the winds observed in Tenerife.

Carl von Fristch, Vice-director of the Central Institute for Meteorology and Geodynamics (ZAMG) in Vienna spent a long period in Tenerife during 1864, observing and studying the trade winds and counter-trade winds regime. Julius von Hann director of ZAMG published studies based on observations of cloud and winds in Tenerife during 1884. In 1888 R. Abercromby published a report in the Review of the Royal Meteorological Society on "the electrical and meteorological observation on Tenerife's Peak". Based on the study "On the ultraviolet boundary of solar spectrum in accordance in the clichés obtained by Dr. Simony on Tenerife's Peak", A. Cornu published, in 1890, a report in the French review "Comptes Rendues". In 1900 K. Angstrom published in Upsala the results of the work done in Tenerife on "The intensity of solar radiation at several altitudes".

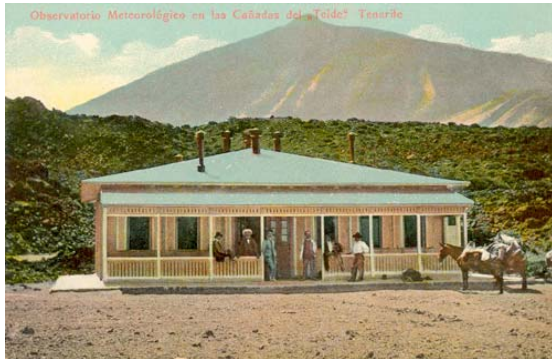
20TH CENTURY. THE FOUNDATION OF THE OBSERVATORY

With the development of upper air observation in the early 20th century the campaigns in Tenerife came into fashion among the aerological community. In 1904 Prince Albert of Monaco, in the company of the German Professor Hugo Hergesell, founder in 1892 and president of the International Commission for Scientific Aerostation (ICSA), carried out soundings around the island of Tenerife on board of the prince's yacht "Princesse Alice" using balloons to study the regime of trade-mark winds in the upper atmosphere. In the summer of 1906 Léon Teisserenc de Bort and Lawrence Rotch visited Tenerife with the ship "Otaria" launching 40 pilot and captive balloons from the peak on 8-10 August. They also made a number of observations and atmospheric soundings at the surrounding sea. The first simultaneous soundings in Tenerife were made on 28 July 1908, by Dr. Robert Wenger at the Orotava valley and Hergesell on board of the German warship "Victoria Luisa" In the same year Hildebrandt made wind studies right in the peak of the Teide.

Since then, international interest in establishing a permanent Observatory at Teide's Peak increased, and Teisserenc de Bort presented a proposal at the ICSA meeting of Milan in 1906. The observatory would be part of an ambitious project for an aerological network in the Northern Hemisphere. At this point it is important to bring to attention the close relation of professor Hergesell with Count Ferdinand von Zeppelin and the German aeronautical enterprises. An observatory in Tenerife, half way between Germany and its African territories, could have important strategic interest for wider objectives than scientific research.

In early 1909 a piece of land in Las Cañadas, 2200 m high in the slopes of the Teide, was hired under German initiative. Prof. Hergesell travelled to Tenerife in March signing the request to local authorities for building a scientific observatory. At the same time the German Navy had carried to Tenerife two large portable huts, lent by Kaiser Wilhem II to be installed at Las Cañadas. The Spanish government had been aware of these movements with increasing concern, which was quickly transmitted through diplomatic channels. Negotiations with the

German government were conducted during the following days. At the 6th ICSA conference in Monaco, just a few weeks later, Hergesell who had travelled to Monaco via Madrid announced that it was proposed to grant Spain the provisional use of the two huts “provided to the ICSA” by the emperor of Germany. The Spanish representative reported that Spain had committed to build a permanent meteorological observatory in the mountains of Tenerife. In the meantime German and Spanish scientists would operate the provisional observatory at Las Cañadas jointly. Such was the historical origin of the mountain observatory in Tenerife: in order to avoid a diplomatic conflict the Spanish government involved itself on a project, which it would have not undertaken for mere scientific purposes, at least at those early times.



One of the “Kaiser Huts” at the provisional observatory in Las Cañadas, with Teide’s Peak in the background

The observations in Las Cañadas started shortly after that. Wenger and Hergesell published the first studies in 1911. During the next years the provisional Observatory was visited by a considerable number of scientists, Germans mainly, such as Professor Lüdeling and Dr. Luyken, of the Königlich Meteorological Institute (Germany), Dr. Dember, professor at Dresde’s Physics Institute, Martin Uibe, W. Buchheim (Leonardville University, USA.) and others. They made observations on atmospheric electricity, magnetic declination, ultraviolet solar radiation, skylight polarization, ionization, optics etc. According to the quality of the results, it was emphasized that due to low dust and mist content “*Teide’s Peak was more suitable for physics and astrophysics research than the mountains of Switzerland or Italy*”

In the autumn of 1913 the Spanish Government began to build the definitive observatory in Izaña at 2367m above sea level, on top of a mountain plateau on the ridge which crosses the island. Inaugurated on the first day of 1916, it is located at 28° 18' N, 16° 29' W, 1000 Km from the nearest place in Europe and 400 Km. from Africa. Since its creation it has been always managed by the Spanish National Institute of Meteorology

Its early works were addressed to the study of high atmosphere through aerological observations, as well as conventional meteorological parameters. Visits of foreign scientists almost finished after the break of First World War. During the next decades the observatory only maintained some meteorological and aerological works, and radiation measurements. During the forties the Spanish meteorologist Inocencio Font published many works and articles on Izaña's climatology and meteorology, as well as some very interesting studies on high level winds, based on the soundings carried out at Izaña from 1916 to 1935. Some German scientists published similar works, notably von Ficker, Roschkott and Müller. The consequences of the Spanish Civil War and World War were felt at Izaña Observatory. The shortage of economic and material resources, as well as of specialized personal, caused the total absence of studies or special investigations. Only the meteorological observations were maintained and aerological sounding was interrupted in 1960, due to the change of location to the main city of the island, Santa Cruz de Tenerife.

Around 1958, foreign scientists once again began to arrive to Izaña, on the occasion of a solar eclipse. Several astronomers and astrophysicists used out Observatory to carry out studies on atmosphere transparency and to test the suitability for astronomical observations. In October, 1968, the Meteorological Institute of Mainz University, headed by Dr. Christian Junge, was temporally at the Observatory to test new instruments to detect and measure atmospheric pollution and which would be used on board the “Meteor”, a German oceanographic and meteorological ship, which would make an expedition in 1969. In the summers of 1973 and 1974, a sounding series was carried out at the Observatory to study microturbulences in the atmosphere, in view of the great importance that disturbance has to astrophysical sky observations. During the next years other studies were made on the transport of aerosols in the Atlantic Ocean and on the chemical components of the atmosphere. Following his 1979 campaign for the observation of halocarbons Dr. R. A. Rasmussen, from the Oregon Graduate Center for Study and Research (USA) wrote in a letter to Dr. Zalote, scientific responsible of the Observatory that “*the data we are obtaining at Izaña are some of the best in the world.*”

Institutions of Germany were mainly responsible for the renewed interest on Izaña. From 1981, Drs R. Schmitt and Balchtrusch, commissioned by Deutscher Wetterdienst carried out studies on the capability of Izaña as a BAPMoN (Background Atmospheric Pollution Monitoring Network) station, representative of the free troposphere in the southern part of the North Hemisphere. In 1984, 75 years after the 1909 agreement, the governments of Germany and Spain signed another one by which the observatory became a station of the WMO BAPMoN programme under joint co-operation. In 1989 BAPMoN and GO₃OS (Global Ozone Observing System) merged in the current GAW programme (Global Atmospheric Watch) of which Izaña is one of the principal stations.

21TH CENTURY. THE FUTURE OF THE OBSERVATORY

During the last years Izaña has increased at a spectacular rate the quantity and quality of atmospheric observations and the observatory is involved in a considerable number of programmes and experiments such as those of NDSC (Network for Detection of Stratospheric Change) with measures of radiation, Ozone and many other atmospheric components. In 2004 the Observatory will assume the functions of main centre for the ozone calibration of the European Brewer spectrophotometers network. Izaña has also a bright future in the role of validating and calibrating satellite sensors. Collaboration with the European Space Agency on this subject is currently ongoing.



This is the happy end of the very ancient attraction of Tenerife and its mountains for scientists and the result of some historical events during the first years of 20th century closely related to the initial development of modern meteorology.

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