

LIGHT AIR OZONE

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: Haupt

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Translated from German
by Philip Smith

Haupt Publishers

AROSA AROUND 1930

Guesthouses and hotels in Arosa Juggahalde during the health resort's golden age.



AROSA 2018

With the former Sanatorium *Florentinum*
(bottom left), today the Mountain Lodge Hotel.



FOREWORD

I congratulate the Swiss government for the unparalleled success of the Arosa observatory. Its measurements and scientific research have been groundbreaking for the atmospheric science community. Ability to carry out high-quality measurements is the backbone of monitoring the state of our atmosphere. Human impact on the atmosphere can be best studied by using long-term records, like those of Arosa.

In addition to ozone measurements, Switzerland has played a pioneering role in atmospheric radiation measurements including the UV-end of the atmospheric spectrum. This has also allowed studies on long-term changes and variations of atmospheric radiative balance, which are essential to understanding our climate and weather patterns. Radiative balance and the impact of changes in greenhouse gases are central to future climate scenarios. They are also essential for modelling weather forecasts and various processes such as cloud formation and rain.

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Humankind has made several important steps to protect planet Earth from harmful changes caused by human activities. Acidification caused forest damage and acidification of lakes in Europe a few decades ago. The emissions of sulfur and nitric compounds have been successfully limited by international agreements. Another success story has been the signature of the Montreal protocol in 1987 to reduce the emission of ozone depleting gases. Slow recovery of the ozone layer is already underway.

In 2015 UN Member countries signed the Paris Agreement with the goal to limit global warming to between 1.5° and 2.0°C. Both the economic and technical means to reach those targets exist. Climate change causes snow, ice and glaciers to melt and it affects rainfall patterns, tropical storms and the wellbeing of human beings and nature. We should build upon the success of the Montreal Protocol to ensure a bright future for the coming generations.

Prof. Petteri Taalas, Secretary-General
World Meteorological Organization

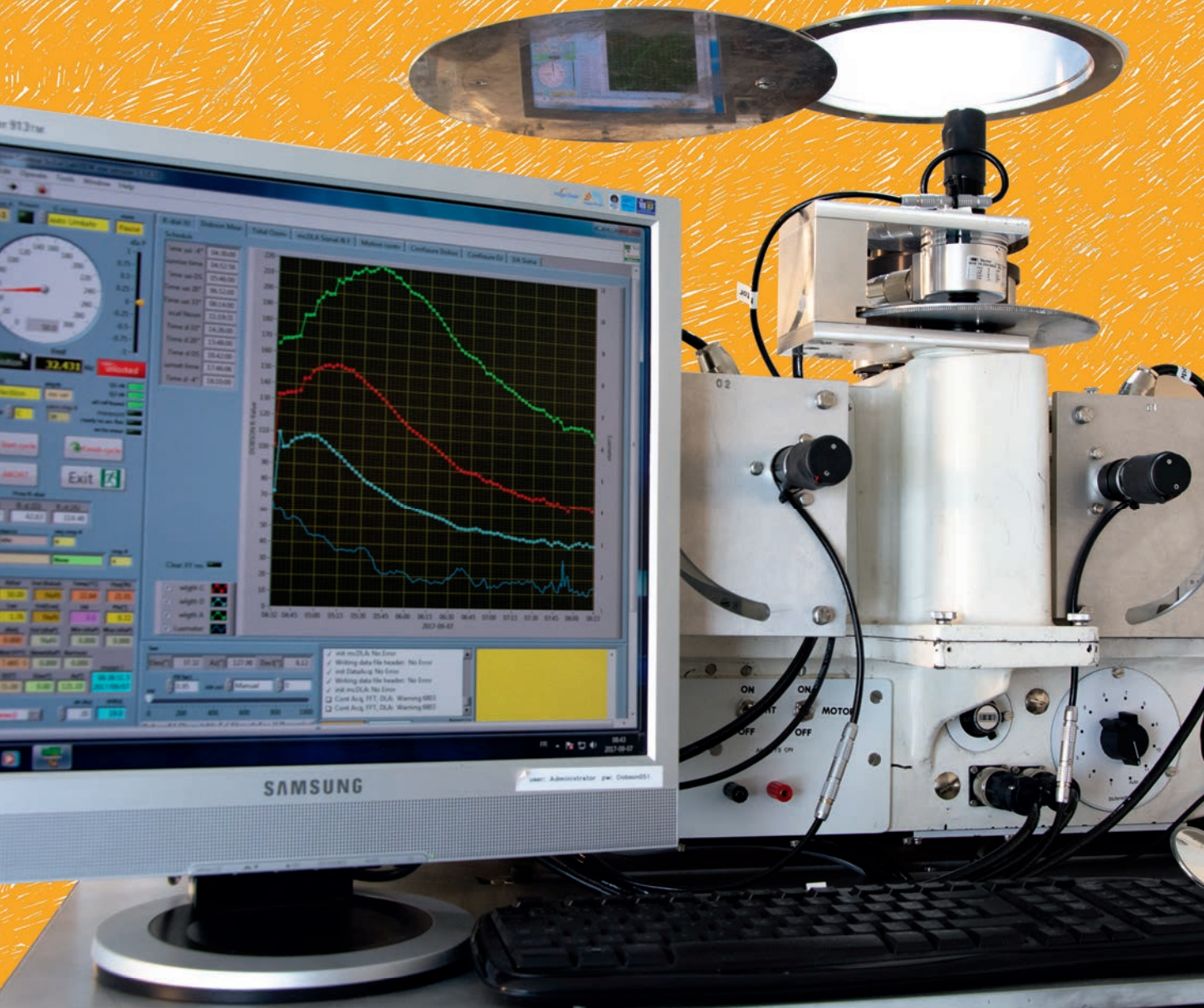
PETTERI TAALAS

Secretary-General of WMO



OZONE MEASUREMENTS IN AROSA

The intensity of UV light is measured with a Dobson spectrophotometer and used to calculate the atmospheric ozone amount.





FOREWORD

From the 1990s until our retirement, we were responsible for carrying out the important ozone measurements in Arosa for the Federal Office of Meteorology and Climatology MeteoSwiss and we worked as ozone researchers at the Swiss Federal Institute of Technology in Zurich (ETH Zurich). We worked together a great deal during those years. About three years ago the opportunity arose to delve into the history of the Light Climatic Observatory (LCO) founded in 1921.

In so doing we came across innumerable documents chronicling the long history of Swiss ozone measurements in Arosa, which had until that time been neither studied nor appraised. A good example is the extensive correspondence of the founder of the LCO F.W. Paul Götz (1891-1954). Thirty-five binders detailed his contacts with all important ozone researchers working at the time. Other documents were found in the annual reports of the Arosa Resort and Tourism Association and the *Kulturarchiv* (town archive) Arosa Schanfigg.

They take us back to the days when there were no antibiotics to cure tuberculosis, so patients went to recover in the many sanatoriums in the mountain resorts of Davos and Arosa. Medical curiosity therefore played its role in the founding of the Observatory. The focus was on examining the climate and the radiation in Arosa. Paul Götz, considered it essential to include observation of the stratospheric ozone layer.

In recent years, we have collected and interpreted countless documents about the exciting history of the world's longest series of ozone measurement records. It is thanks to the unflagging commitment of some forceful personalities that measurements have continued in Arosa to this day. The author of this book, Martin Läubli, has described our scientific research in a lively and accessible style, while Rachel von Dach's original design invites the non-specialist to read on. The book reveals the importance of reliable long-term measurements in describing man-made ozone depletion and in verifying the success of the "treatment" initiated by the Montreal Protocol.

Johannes Staehelin and Pierre Viatte

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TRAVELLING INTO CLEAN AIR

LANGWIES RAIL VIADUCT

Engineering feat on the line between
Chur and Arosa, opened in 1914.





FROM FARMING VILLAGE TO HEALTH RESORT

A sudden whistle just after departure. It puts us in mind of a scene from old films, a long blast as the train slowly draws out of the station, picking up speed while the travellers wave goodbye to those on the platform. It is not quite that evocative on this Saturday in May. The time is 1.08 pm and the train compartments have few occupants.

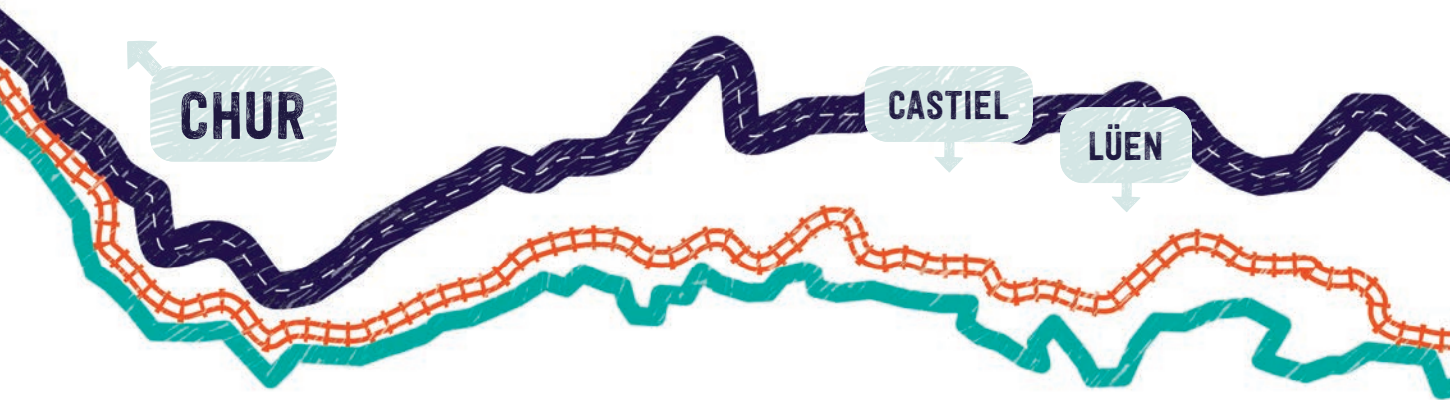
The Rhaetian Railway's red train leaves Chur station right on time. The journey begins with a short drive through the town. Elderly gentlemen greet the engine driver. People know each other. But just one stop later, the train moves into the lush green landscape of early summer, the narrow Schanfigg valley. It follows River Plessur, swollen with meltwater. The slopes are steep and covered in dense forest. After ten minutes the train reaches the first tunnel and then the first galleries cut into the rock. The riverbed is already well below, cut deep into the valley. Slate rocks rise, and then it is pitch-black again. The railway line follows the contours of the valley, sometimes it takes a direct route through the cliffs. To the left are protective rockfall nets, to the right high fir trees block the view into the depths below.

But what was it like, hundreds of years ago when the river meandered through a primeval forest, washing rugged rocks? What on earth caused people to move into this inhospitable terrain? Was it the search for new land to raise livestock and plant vegetables? Or was it just a sense of adventure?

We're running into yet another tunnel. Is it really wide enough for the train? From a distance it looks so tiny, set in the cliff face that soars to the sky. There is also an idyllic waterfall. Mother Nature offers the traveller the perfect spectacle en route to Arosa.

The train moves quickly with a soft rattle. Sloping ridges, oddly shaped rocks. There is still snow on the mountain peaks. At Lüen-Castiel, the train stops in front of an overgrown herb garden. Another half an hour and the valley opens. The first Alps appear. St. Peter, Molinis, Peist. The villages at the halts are far above or nestled far below near the river.

DAVOS' OFFSPRING



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The Schanfigg is first mentioned in records as “Scanavico” in 765. This refers to the outer part of the valley from today’s town boundary of Chur to Frauentobel, between the modern villages of Peist and Langwies. Places such as Lülen, Castiel or Calfreisen on the right of the valley – the “sunny side” – appear in documents as early as the 11th and 12th centuries. Today, the whole valley up to the sources of River Plessur in Arosa is classified as Schanfigg.

It was the Walser people who in the 12th and 13th centuries pushed deep into the inner valley during the Alpine migration period. They came from the Walser colony in Davos and travelled over the 2,300-metre-high Strela Pass. Around 1300 they moved into the Fondei and Sapün side valleys. They settled in Medergen, Langwies, and finally in the 14th century they occupied the valley ending in Arosa. They were mountain farmers and shepherds who bred livestock.

We do not know for certain why these people, originally from the Valais, set out in all directions. Was it due to overpopulation? Natural disasters, the plague or simply a sense of adventure? Whatever the reason, the mild climate at that time meant they could grow crops even at high altitudes. In addition, the feudal lords in the Alps granted various rights and freedoms to their subjects who were willing to withstand hardships to populate inhospitable land. In this way they consolidated their claims to power, promoted the growth of the population and brought new areas under cultivation, thus achieving control of the Alpine passes. The Chur cathedral chapter and the St. Luzi Monastery discovered an additional source of income in the valley: free tenants bred cattle throughout the year on behalf of the Church and subsequently sold them in the markets of the South.

Plessur

Road

Railway line

Pass



ST. PETER

PEIST

MOLINIS

STRELAPASS

LANGWIES

For centuries, the Strela and Duranna passes leading to Davos and Prättigau gave access to this deserted valley. The roadway over the Strela Pass was also the shortest route between Chur and the country around Davos. The first census in 1850 showed this was still the case. The population of Langwies was 358, of Peist 237 and only 56 people lived in Arosa. At that time, Arosa was politically part of the municipality of Davos.

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LITZIRÜTI

WEISSHORN

AROSA

Early guesthouses

These were once all farming villages, some until the middle of the 19th century. The mountain village of Arosa gradually became a health resort towards the end of the century, but it took a long time. On 1 April 1851, Arosa separated from Davos, becoming a municipality in its own right. But the expected development as an independent community did not happen straight away. In 1880 the population was at the level it had been before separation from Davos. Fifty-four inhabitants.

It was thanks amongst others to Luzius Hold and his family that despite the difficulties of reaching Arosa, it did not lose contact with the “outside world”. The director of the grammar school in Chur – the *Kantonsschule* – gave the community advice in the middle of the 19th century, when it was weighing political separation from Davos. The Hold family had owned a holiday home in Arosa since 1847. In the summer this was a place where prominent Swiss and Germans from the worlds of politics and science came together.

Word gradually spread that the mountain village was suitable as a health resort – in particular for patients with lung disease and consumption. As a result, more guesthouses opened in the 1880s. They had names like *Brunhold*, *Kurhaus Arosa*, *Waldhaus Arosa*, *Seehof* and *Rothorn*. In 1884, the owners founded the Arosa Resort Association. Marie Herwig built the first sanatorium, *Berghilf*, in 1888, which was open the whole year round to take in the sick and convalescent.

Three years later, the road from Chur to Arosa was completed. Now the Federal stagecoach reached Arosa. In 1891, the Swiss Meteorological Institute (nowadays MeteoSwiss) began measuring temperature, pressure, humidity, hours of sunshine and other metrics at Villa Frisia. According to the 1888 census, 88 people lived in Arosa; by the end of the century the population had already risen to 1,071.

“The mountains flanking the valley are crenelated, so they form ridges that provide a backdrop and at every moment the scenery changes. On the sharp bends you often worry the horses will bump their heads, you ready yourself to leap from the coach, but the coachman, a Thurgau man who wears the typical shepherd’s silver earring, a man who rose to the rank of corporal in the army, calms all our fears with his composure and assured manner.”

Friedrich Ernst, a traveller from Dresden, reporting around 1900, from Ueli Haldimann: Arosa

AROSA'S MOUNTAIN CLIMATE

"Sunshine and fresh air have outstanding healing qualities".



AROSER FREMDENBLATT



Nr. 18.

IV. Jahrgang.

19. Dezember 1914

Der hochalpine Kurort Arosa ist offen,

die Gasthöfe, Heilanstalten und Pensionen führen ohne jeden Preisaufschlag ihren gewöhnlichen Betrieb weiter. Eine grosse Zahl von Kurgästen aller Nationen befindet sich zur Zeit in Arosa. Weitab von den Kriegsschauplätzen, auf dem neutralen Boden der Schweiz gelegen, ist der hochalpine Luftkurort Arosa, dank seines unübertrefflichen Klimas, seiner ruhigen Lage und seiner landschaftlichen Schönheiten besonders geeignet.

zum Aufenthalt von Gesunden, von Kranken und Rekonvaleszenten.

Mitten in ausgedehnten Nadelwaldungen, in 1800—1900 m Höhe und an Hochgebirgsseen gelegen, vereinigt Arosa in seiner frischen, staubfreien Alpenluft, seiner geringen Luftfeuchtigkeit, seiner völligen Windstille und Nebelfreiheit die besten natürlichen Heilfaktoren. Im Gegensatz zu den klimatischen Verhältnissen vieler Kurorte des Tieflandes, der Meeresküste und von Orten selbst des Hochgebirges, die in einem Tale aufgebaut sind, besitzt

Arosa das Abhangklima.

Dieses zeichnet sich durch mildere und besonders im Winter wärmere Temperaturen aus, als das Talklima. Arosa liegt an einem nach Süden abfallenden Abhang und ist aus diesen Grunde in viel stärkerem Masse der Wirkung der Sonne ausgesetzt, als andere zum Teil sehr hoch gelegene Kurorte. Wegen seiner aussergewöhnlichen Höhenlage und der damit verbundenen beträchtlichen Luftverdünnung ist die Sonnenstrahlung in Arosa bei weitem viel stärker als in allen klimatischen Stationen des Mittelgebirges und des Tieflandes. Daher ist das Abhangklima des Hochgebirges im Winter viel wärmer als das Talklima. So ist beispielsweise die von der Sonne durch Strahlung gesendete Wärme in dem hochalpin gelegenen Arosa im Winter mehr als dreimal so gross, die therapeutisch hochwichtige ultraviolette Strahlung viel intensiver als im Tieflande. Die Sonnenkuren und Luftkuren von Arosa sind von hervorragender Heilwirkung.

Die elektrische Bahn Chur-Arosa ist eröffnet!

In dieser neuesten elektrischen Hochgebirgsbahn der Schweiz hat der hochalpine Luftkurort Arosa eine der ausgezeichnetsten Bahnverbindungen erhalten. Die Fahrt durch das wildromantische Plessur-Tal mit den grossartigen Eisebauten der Bahnstrecke ist hervorragend schön. Billige dreitägige Sonntagskarten für Wintersporttreibende. — Fahrzeit Chur-Arosa 1 1/4 Stunden.

Reiseverkehr nach Arosa.

Zwischen dem Auslande und der Schweiz bestehen in allen Richtungen gute Schnellzugsverbindungen. An der schweizerischen Grenze sind Reisepässe vorzuweisen. Sonst bestellt in Folge des Krieges keinerlei Beeinträchtigung im Reiseverkehr und im Aufenthalt in der Schweiz. Verwundeten oder rekonvaleszenten Heeresangehörigen gewähren die Gasthöfe Preisermässigung. Alle Anfragen richtet man an das

Offizielle Verkehrsbureau Arosa.

A strenuous journey

Even after the Schanfigg Road had been built, the trip to from Chur to Arosa could take up to six hours. The journey remained an adventure. Carts, carriages and sleds transported food, mail and guests to Arosa, as well as building materials for the fast-growing health resort.

The train stops in Langwies. Here it changes to the other side of the valley and drives over a major engineering feat dating back to the pioneering construction of the railway to the south. The line crosses the deep Langwies Ravine over a 284-metre viaduct mounted on 42-metre pillars. Since no suitable building blocks were available locally, engineers decided to build a concrete bridge using the plentiful gravel and sand. At the beginning of the 20th century it was the world's largest reinforced concrete bridge. The railway line running 26 kilometres from Chur to Arosa is an astounding feat of engineering and construction. Although the height difference was 1,154 metres, the railway engineers laid the track in the landscape in such a way that they did not need a rack-and-pinion locomotive. Construction work began in the summer of 1912, and the Chur-Arosa line was officially opened on 11 December 1914.

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The idea of a train had first been raised in 1902, because travelling to Arosa – despite work to upgrade the road – was still very difficult and cars in the canton of Grisons were not allowed to drive on the roads. In fact, up until 1927 several different routes were proposed, and there was even talk of building a cable car from Chur to Arosa. This major project started to take shape when the Chur-Arosa Railway Company was established in 1911.

The new railway line saved tourism in Arosa. Resort and holiday guests were now able to travel in comfort to the sports and health resort throughout the year, even for a short visit lasting a few days. Travelling time from Chur was just over an hour. The resort had by now become a destination for winter holidays. Resort Director Felix Moeschlin believed the future lay in sports tourism. Rather than a health resort for those with consumption, it should try to attract summer tourists and those keen on winter sports. He was in office from 1915 to 1920 and promoted various sporting facilities in line with his ideas. For example, the bobsleigh run to Litzirüti was extended. German war internees built the first ski jump in Arosa. The expansion paid off. The number of overnight stays rose from 247,000 in 1920/21 to 536,000 in 1930/31. Then times became more turbulent. There was a growing threat of war and the economy slumped. Arosa's golden age was over.

Private sanatoriums were converted into hotels, but they struggled to survive until there was an improvement in the economy. Between 1930 and 1941 the population dipped below the level of 1920, shrinking from 3,466 to 1,980 inhabitants. Yet to this day, the high mountain resort lives from the holiday and sports business. Today, Arosa notches up almost a million overnight stays per year.

YEAR	POPULATION
1888	88
1900	1,071
1930	3,466
1980	3,508
1990	3,241
2000	3,551
2016	3,219

Imposing valley basin

The train crosses the viaduct. As the traveller catches a first glimpse of the deep valley cut by the River Plessur, it is hard to imagine that engineers and construction workers built this railway over a hundred years ago. The train enters a dark forest. As the great German poet Christian Morgenstern, author of “Songs from the Gallows”, once wrote in a letter in 1901 about his first stay in Arosa, “The landscape is just magnificent, forests as if of stone, imposing mountain peaks, magnificent basins, crystal clear air.” Morgenstern visited Arosa several times because he suffered from lung disease.

**“Fragrance flows from the meadows.
Darkness spills from the wood.
From deep within secret gullies
Babbles the sparkling brook.”**

Christian Morgenstern on Schanfigg, second stanza of the poem “Welch ein Schweigen” (“Such silence”), reprinted in the *Aroser Fremdenblatt*, February 1912

On this day in May the streams are gorged with the meltwater that spills down the slopes. The train goes past the hamlet of Litzirüti, pushing on in great loops up the mountain. It is now in the valley basin, very close to the River Plessur that meanders

AROSA LANDSCAPE

The sports and health resort in the early 1970s.

