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Research in Graubünden

100 years of ozone measurements

The Arosa and Davos data series

The ozone measuring instruments on the measurement platform at PMOD/WRC. Photo: Fabrizio Vignali, PMOD/WRC.

While climate research today focuses primarily on the warming of the Earth's atmosphere, a scientific data series is being maintained in the Swiss Alps whose relevance has grown over many decades. The ozone measurements from Arosa, now continued in Davos, form the world's longest continuous record of its kind. Today, they serve as a key dataset for monitoring the atmospheric ozone layer and its role as a protective shield against the harmful effects of solar UV radiation.

The measurements began in 1926 at the Lichtklimatisches Observatorium (LKO) in Arosa, initiated by the physicist Paul Götz. At the time, his interest was less climatological than medical. Researchers studied the effects of the high-altitude climate on tuberculosis patients and sought to understand how UV radiation is regulated by the ozone content in the stratosphere. The records that emerged from this work later became the most important basis for research into the ozone hole. Without the continuous data from the Graubünden Alps, scientists in the 1980s would have lacked the reference needed to determine the extent of the changes caused by ozone-depleting substances, which were used between 1950 and 1990 as propellants in spray cans, refrigerators and many other applications.

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For more than 90 years, the LKO was the center of this research. To secure measurements over the long term at a high technical level and to make use of synergies with modern radiation research, the measurement series officially moved to Davos in 2021. The Physikalisch-Meteorologisches Observatorium Davos (PMOD/WRC), which has operated the World Radiation Center on behalf of the World Meteorological Organization for more than 50 years, took on this additional task on behalf of the Federal Office of Meteorology and Climatology MeteoSwiss. To ensure the continuity of the measurement series, parallel measurements were carried out at both locations over several years. This allowed the scientists to ensure that the "Arosa-Davos series" could be continued seamlessly and homogeneously.

In climate research, continuity is crucial for distinguishing long-term changes from natural variability. Even today, some of the measurements are still carried out using historical Dobson spectrophotometers. These instruments determine the ozone content of the atmosphere by measuring how strongly the Sun's ultraviolet radiation is attenuated. They are essential for the long-term comparability of the data series and are supplemented by more modern Brewer spectrometers, which work according to the same principle. Global political action, as set out in the Montreal Protocol, has been shown to have measurable effects on the ozone layer. Current calculations indicate that the ozone layer could return to its original state by around the middle of this century. In Davos, daily monitoring continues in order to precisely document the development of the atmosphere's protective shield. PMOD/WRC will celebrate the 100th anniversary of the Arosa-Davos ozone measurements on 25 July 2026 from 6.45 p.m. with a public anniversary event in Davos.

Julian Gröbner

Julian Gröbner. Image: PMOD/WRC.

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