

Name of research institute or organization:

**MeteoSchweiz, Zürich**

Project description:

### **The weather in 2004**

The weather in 2004 was rather uneventful compared to the extreme situations that occurred in 2003. After the unusually hot and beautiful summer 2003, many people were disappointed with summer 2004, although the long-range average shows that at least in the lowlands the summer temperatures 2004 were again warmer than usual.

Compared to the mean values for 1961-1990, the temperatures in the lowlands on the northern side of the Alps as well as in the high mountainous areas were approx. 1° too warm in 2004 (see table below). The duration of sunshine in the region of Bern corresponded to the expected values while the amount of sunshine in the region of Jungfrauoch was slightly below average. Precipitation fell in the lowlands on the northern side of the Alps and in the Bernese Highlands in approximately the usual amounts.

Comparisons of three parameters with the long-range mean 1961-1990 at the stations Jungfrauoch and Bern. For temperature the deviation from the long-range mean is shown. Duration of sunshine and precipitation are expressed relative to the average amounts. Because precipitation is not measured at Jungfrauoch, values from Kleine Scheidegg have been used.

	Jungfrauoch	Bern
Mean temperature	+1.2° C	+0.9° C
Duration of sunshine	92%	99%
Precipitation	98%	98%

### **Dynamic start of the year**

The year began stormy and wet with pronounced west wind weather in mid January. In the peaks of the Alps remarkably high wind speeds were registered. For example on January 13, 2004, a wind speed of more than 200 km per hour was measured at Jungfrauoch, and in many places in the lowlands on the northern side of the Alps stormy wind speeds were observed. But compared to the gale-force storms Lothar, Wilma, or Vivian, the wind speeds registered were under the record marks. In addition to high wind speeds, there was a considerable amount of precipitation. 1.5 to 2 meters of snow fell in the higher regions, causing temporary danger of avalanches. Large amounts of snow also fell toward the end of January, but this time down into the lowlands north of the Alps as well.

February began with mild weather, especially in the mountains. Masses of subtropical air produced sunny and spring-like weather, and several stations reported near record values for the month of February. Jungfrauoch measured temperatures during this phase that otherwise occur on the long-range average only during the month of June. This sunny and warm weather lasted the entire first week of February. Shortly thereafter several streams of cold air from the north caused changeable weather with little precipitation. Protected as it is by the Bernese alps, Wallis received only 10-20% of its usual amount of precipitation. At the end of February another stream of cold air caused the weather to turn very cold. On February 24, Jungfrauoch measured -27.0°, the coldest temperature measured in 2004.

### **Changeable spring**

The month of March had an unusually warm period in the middle of the month. Temperatures typical of early summer were measured especially in parts of the mountains and in the Föhn areas in the northern slopes of the Alps. These temperatures almost reached record values for the month of March. This warm weather period was flanked by two cold phases at the beginning and at the end of the month. Winter broke through especially hard again between March 20-26. In higher regions of eastern Switzerland and in the northern slopes of the Alps it snowed intensively, leaving up to one meter of snow in some cases.

No extreme weather conditions occurred in April. The weather was typical of April – capriciously showing many different faces during the course of the month. The month began with springtime temperatures of over 20° in the lowlands, falling back into late winter in the second week. The first heavy thunderstorms of 2004 appeared at the end of April. They moved from the Napf area to the Zürcher Oberland.

Winter made a last appearance at the beginning of May. Local snow depths of more than one meter were measured, and once again the danger of avalanches increased accordingly. Isolated avalanches thrust their way down into the valleys. As a result of the winter weather, May had temperatures cooler than the long-term mean in the mountains as well as in the lowlands. Mid-month – on Ascension Day – the temperatures in the lowlands were between 25° and 28°, and locally even warmer. The long Pentecost weekend began with beautiful weather and pleasant temperatures. After Pentecost Sunday the weather changed, and the end of the month was varied and rather cool for the time of year.

### **“The summer after the record summer”**

After the extraordinarily hot and sunny “summer of the century” in 2003, the expectations for summer 2004 were high. And accordingly the disappointment was great for many people when it became obvious that there would be no repeat performance of summer 2003. But on the whole, the summer balance (June-August) was not as bad as was claimed here and there. The temperatures were 1 to 1,5 degrees higher on the average than the summer mean from 1961-1990. Sunshine and precipitation were also in the normal range. What was missing in summer 2004 were the long periods of fair weather. As soon as summer weather started to settle in, a new weather front with moisture and cooler temperatures would move in.

The meteorological summer began in June with a low pressure system that came out of the NW over the Alps and moved toward the Balkans, producing extremely heavy precipitation in some areas. Some stations for example in the Berner Oberland and central Switzerland recorded amounts of precipitation between June 1-3 that equaled the amounts normally measured during the entire month. There was even considerable local damage. The ensuing weather was dominated by wet and cool Atlantic air masses. Protected by the Alps, southern Switzerland received little precipitation. In fact, Sottoceneri (southern Tessin) registered the driest month of June since measurements began in 1864.

Several massive hailstorms crossed the northern side of the Alps on July 8 and caused enormous damage. Swiss hail insurance received over 6800 claims from agriculture for a total sum of more than 30 million Swiss francs. There was also enormous damage to buildings and vehicles. During the rest of July the weather was more settled with climatic conditions that corresponded to the long-term mean.

A subtropical high pressure system finally brought in real summer weather in the first few days of August. The average temperature during the first ten days of August was 3 to 5 degrees above the long-term mean. On August 2 it reached 34,8° in Sion, the record high in Switzerland for the year. On August 4 the highest temperature at Jungfrauoch was recorded: +9,6° C. Afterwards the high pressure area flattened out, but still sent warm and increasingly moist masses of air into Switzerland until the middle of the month. This led to local heavy thunderstorms with some damage. In addition two tornadoes of the categories F1 and F2 were sighted in canton Freiburg. Tornadoes are rare in Switzerland, but they are nevertheless possible during unstable weather conditions and have even been photographed.

### **Several near-record temperatures in autumn**

After the changeable weather at the end of August, September began with the build-up of a high pressure system that is typical of summer. In the lowlands on the northern side of the Alps, the temperatures in many places went up again to levels above 25°, and in the mountainous regions the weather was very sunny with pleasant temperatures. Looking back in the past, we see that similarly pronounced late-summer periods occur only about once every ten years. Late autumn weather returned in the second half of September after several streams of cold polar air moved in. The snowline sank down to 1300 meters.

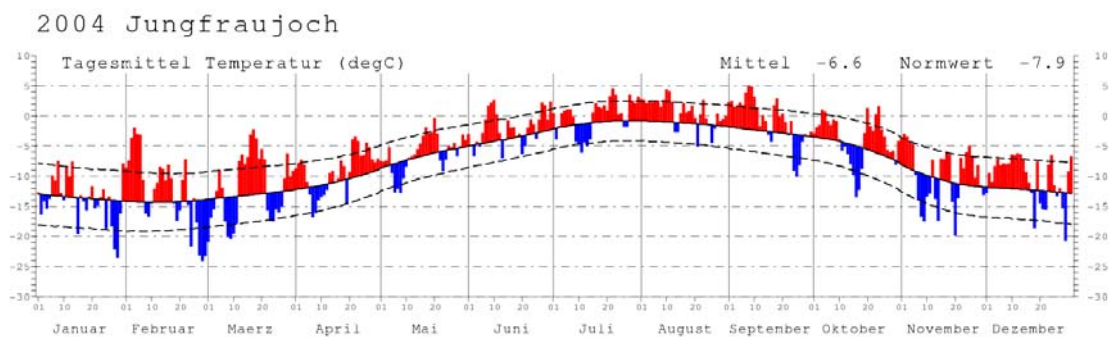
At the beginning of October, and especially on October 5, exceptionally high temperatures were registered. Many weather stations reported nearly reaching all-time record high temperatures. Adelboden (1320 meters a.s.l.) measured 23.2°, for example, compared to the absolute record of 24.1° in 1966. Another important feature of this year's weather in October was the frequency of heavy thunderstorms around the middle of the month. Afterward the month ended as changeably as is typical of April. Thus with the exception of a few valleys, the amounts of precipitation were high on both sides of the Alps.

Extremely high temperatures were measured at high altitudes again at the beginning of November. The November records were broken at several stations. Temperatures ranging between 17° and 20° were registered in the middle altitudes (1000-1500 meters a.s.l.). These are temperatures that could be expected in late summer rather than early winter. After this unusually warm weather, three consecutive streams of cold air brought in a period of early winter weather. Snow fell for the first time in the lowlands in winter 2004/2005. The end of the month November was also marked by several storms over entire Switzerland.

Until mid-December a high pressure system produced fair and warm weather in the mountains, while the midlands experienced miserable weather under a layer of stubborn fog. Heavy snowfall set in after the middle of the month, bringing the long desired snow to the mountainous areas and partly into the lowlands. The Christmas holidays on the other hand were almost spring-like.

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The daily mean temperature in 2004 measured at the weather station Jungfrauojoch as compared to the long-term mean from 1961-1990 (solid line) and to the long-term mean of the fluctuation range (dashed line; standard variation).

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