

Name of research institute or organization:

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**MeteoSchweiz, Zürich**

Title of project:

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Project leader and team

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Project description:

### **The unusual weather conditions in 2003**

Switzerland experienced an extremely hot summer in 2003. But it was an extraordinary year in many respects, the most notable being the tendency to drastic weather changes.

#### **Winter began in February**

The start of the New Year 2003 was unusual on several accounts. In Geneva the springtime weather that began in December 2002 continued on during the first few days of January. The warm weather caused the leaf buds on the chestnut trees to appear in December, which was an absolute record since weather observations began in 1808 and also a clear sign of unusual weather developments generally. After these first overly warm January days, the weather during the following weeks was hardly winter-like. In the lowlands the first blanket of snow didn't arrive until the last few days of January.

A dramatic change in the weather conditions occurred in February. Short and intensive snowfall covered parts of the lowlands with 20 to 30 cm of snow. This kind of snowfall had hardly occurred since 1987. A stable winter high pressure system kept the temperatures low, making February the coldest since 1986. The high pressure also meant lots of sunshine, and in the higher regions north of the Alps and in Graubünden, February 2003 was among the four sunniest during the last 100 years of weather measurements.

Surprisingly, the warm weather returned in March. Subtropical air masses pushed temperatures up several times to levels that are typical for May. The accompanying lack of precipitation that began in February was the start of a precarious period of dryness that would reach its climax in the extremely hot months from June to August.

#### **The persistent warm winter phase**

The warm month of March marked the end of winter that was among a series of warm winters that suddenly began in 1987/88. This recent and rapid change in temperature has a great meteorological significance because it strongly affected the increase in the average winter temperature since the beginning of meteorological measurements. Between the first year of official Swiss climate observations in 1864 and the year 2001, the temperature trend in winter north of the Alps shows an increase of +1.5 °C per 100 years, and south of the Alps an increase of +1.0 °C per 100 years.

#### **Prominent weather changes**

Through a massive shift in air masses at the beginning of April, the weather changed abruptly from early summer back to winter again. Artic air flowed into the midlands and sank the temperature in many places down to -3 to -5 °C, and isolated to -8 °C,

very unlike temperatures for April. In some areas the ground was covered with a layer of 20 to 15 cm of snow.

Toward the end of April the sequence of abrupt weather changes continued with summer temperatures (25 °C and higher) measured locally on both sides of the Alps. The first few days of May were very summer-like, and the foehn winds aggravated the situation to cause temperatures near or slightly over 30 °C. This rapid change from deep winter to intense summer conditions is typical for continental areas that are long distances away from the ocean. Switzerland, however, is usually influenced by the proximity of the Atlantic and its moderating effect on the climate.

### **Extreme summer heat**

This moderating influence of the Atlantic had almost no effect on the extreme heat wave during the summer. A high pressure system stayed almost permanently over the Azores and held the cooling precipitation far to the north. The duration of the heat wave for the entire month of June was more unusual and extremer than the high temperatures themselves, but nevertheless the month's average temperature reached an incredible 2 to 3 degrees above the previous high records. In some regions June 2003 brought the highest temperatures measured ever since 1864, but after a comparatively moderate July, August was hot enough to beat the June records. On August 11, 2003, in Grono in Misox (Graubünden), it reached a scorching 41.5 °C, clearly exceeding the old record of 39.0 °C in Basel in 1952.

The average summer temperatures in 2003 were 4.0 to 5.5 °C higher than normal summer temperatures. It was 2.5 °C hotter than the highest temperatures measured since measurements have been recorded. The occurrence of a heat wave such as the one in 2003 therefore has an extremely low statistical probability.

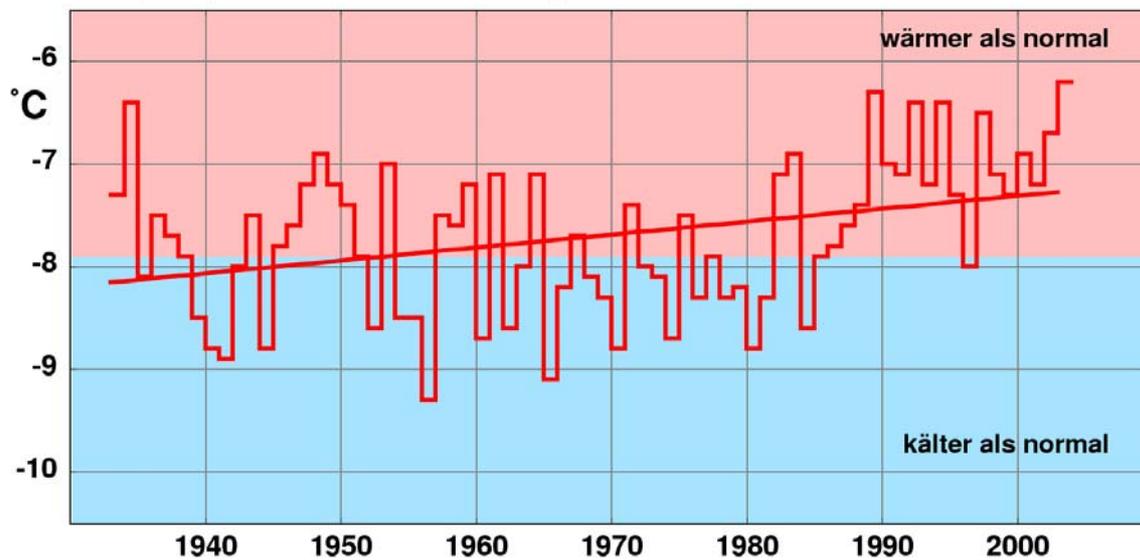
### **Massive turn in the weather in October**

During the last half of September isolated temperatures of 30 °C were measured in northern Switzerland, followed by an abrupt change to winter weather in October. Repeated streams of polar air moving into the northern side of the Alps led to snowfall down into the lowlands during the second half of the month. In some areas this was the first time in three decades that it had snowed enough to cover the ground in October. Barely a month after the last day of high summer temperatures it froze in the midlands (i.e. temperatures below 0 °C were registered during the day). This rapid change was once again characteristic of continental climate behavior, which is uncommon to Switzerland.

November was milder, and December, although mild and very sunny, had pronounced temperature fluctuations, thus ending an extremely warm year. In some places it was the warmest, in other places the second or third warmest year since 1864. 2003 was also very sunny and accordingly had low amounts of precipitation.

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