

Name of research institute or organization:

**Federal Office of Meteorology and Climatology MeteoSwiss**

Title of project:

The weather in 2015

Report by:

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### **Report for the International Foundation HFSJG**

Again a new high: with a surplus of 1.29°C compared with the normal value 1981-2010 the annual temperature 2015 reached a new record level. Together with the former record temperature surpluses of 1.25°C in 2014 and 1.21°C in 2011, three years in quick succession have yielded practically identical record temperatures. In addition, the year 2015 produced the second-warmest winter south of the Alps and in the Engadine and – overall in Switzerland - the second-hottest summer as well as the third-warmest November since observations started in 1864. Finally, the months of November and December brought a record lack of precipitation south of the Alps.

As can be seen in table 1 below, the temperature 2015 was well above the norm value 1981–2010 (reference period), with a higher deviation in the high Alpine regions than in the lowland regions north of the Alps.

Precipitation totals reached 90 percent of the normal value in the Jungfrau region and were well below of the normal values in the lowland regions north of the Alps.

*Table 1. Annual values 2015 referring to the parameters temperature and precipitation as well as the deviations from the reference period 1981–2010 for the stations Jungfraujoch and Berne. As precipitation is not measured on Jungfraujoch the values pertaining to the Kleine Scheidegg are used here.*

|                     | <i>Jungfraujoch</i> | <i>Berne</i> |
|---------------------|---------------------|--------------|
| Average temperature | -5.7 °C             | 9.9 °C       |
| Deviation           | +1.5 °C             | +1.1 °C      |
| Precipitation       | 1463 mm             | 768 mm       |
| Deviation           | 90 %                | 73 %         |

### **Extremely mild start to the year**

In the first half of January the weather in Switzerland was characterized above all by mild westerly and south-westerly currents. On 10 January it turned extremely mild with daily mean temperatures between 6°C and more than 14°C above the normal value 1981–2010. Central Switzerland experienced the mildest winter day since observations started. In Lucerne the daily mean temperature reached 15.1°C – a value never before recorded in any of the winter months (December to February) in the measurement series starting in 1871. The daily maximum rose to 19.3°C. Only in the winter of 1992/93 has there been a comparable daily maximum (19.5°C). South of the Alps daily maxima reached between 20°C to approximately 23°C. However, record winter temperatures are above 24°C in these parts.

### Wintery from mid-January onwards

In the second half of January north-westerly and northerly currents brought the winter back to Switzerland. On both sides of the Alps snow fell even at low altitudes. February presented itself wintery with – in many parts – under-average temperatures with snowfall down to low altitudes on both sides of the Alps. Especially south of the Alps, snowfall was substantial. In mid-February 16 cm of fresh snow fell in Locarno-Monti within two days. In Airolo (1100 m a.s.l.) and San Bernardino (1640 m a.s.l.) snowfall amounted to 63 cm, in Bosco-Gurin (1500 m a.s.l.) as much as 96 cm. One week later a cold air front from north-west covered almost the whole of Switzerland in fresh snow. In low altitude areas north of the Alps amounts remained under 10 cm. South of the Alps 10 to 20 cm of fresh snow were recorded even at low altitudes while at higher altitudes over half a metre was measured regionally.

### Extremely mild winter conditions south of the Alps and in the Engadine

Despite a cold February the winter was overall too mild in Switzerland with a surplus of 0.7°C compared with normal values 1981–2010. Extremely mild winter conditions prevailed south of the Alps and in the Engadine. The weather stations of Lugano, Locarno-Monti and Samedan registered the second-warmest winter since observations started. South of the Alps surplus temperatures varied between 1.5 and 1.8°C. In Samedan the winter temperature was even 2.4°C above the normal value 1981-2010 and in other parts of the Engadine, 1.0 to 1.4°C above the normal value. In high exposed areas of the Alps, however, winter temperatures remained slightly under the normal value.

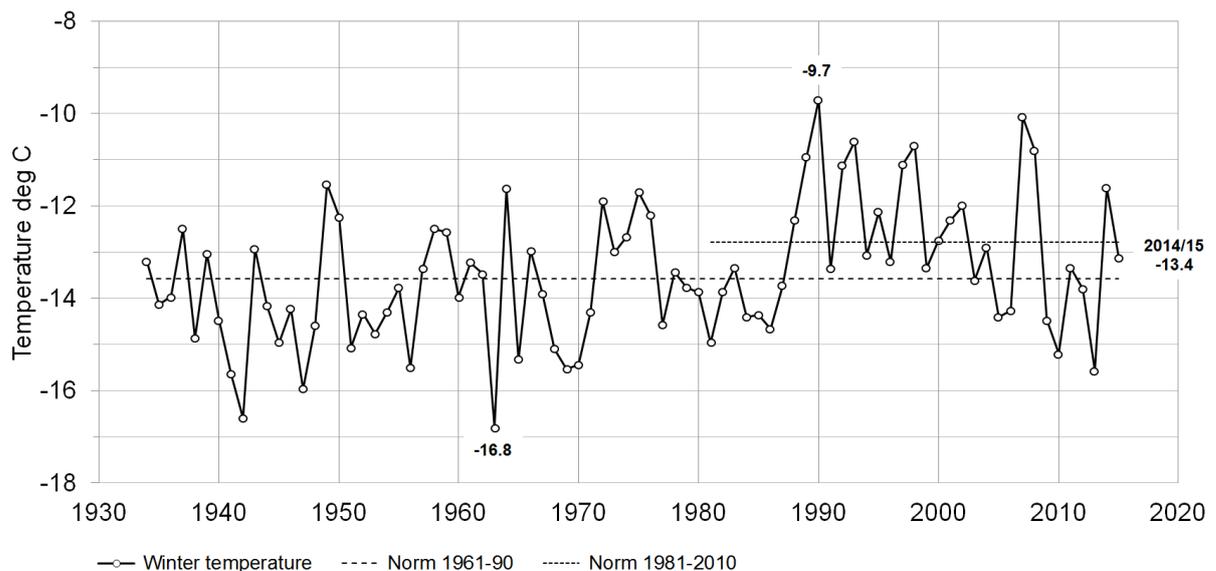


Figure 1. Winter temperatures (DJF) from 1933/34 to 2014/15 at the Jungfrauoch (3580 m a.s.l.; homogeneous data).

### A sunny onset of spring

After a few grey and wet days at the beginning of the month, March came up with fabulous high-pressure weather until mid-month. From 6 to 13 March the whole of Switzerland registered - to a large extent - between 80 and 100% of the daily sunshine maximum duration. At high altitudes daily mean temperatures in many parts reached a surplus of between 4 and 7°C above the normal value 1981-2010 while on the Jungfrauoch there was a surplus as high as 5 to 9°C. In low altitudes of the northern Plateau daily maxima rose to between 14 and 17°C. In the lower areas south of the Alps a strong northerly Föhn brought temperatures above the 20°C mark on 11 March.

### **Fair weather for the solar eclipse**

From 18 to 20 March a high-pressure zone established itself from England to Russia - just in time for the partial solar eclipse on 20 March which could be observed in many parts of Switzerland under perfect weather conditions. Areas south of the Alps were at a disadvantage since they were affected by a solid cloud cover that was transported by an upper low-pressure zone from south-western France precisely on 20 March.

March ended in a late-wintery mood with snowfall down to 600 m and stormy conditions on both sides of the Alps. With a strong northerly Föhn on 27 March wind gusts reached over 90 km/h south of the Alps. On 31 March storm Niklas brought high winds to the Plateau, which peaked at over 100 km/h and - in high exposed areas - 160 km/h.

### **Sunny and mild in the middle of spring**

In April quiet, sunny and mild spring weather prevailed in Switzerland. The consistently warm, high-pressure conditions with practically no precipitation temporarily caused acute danger of forest fires in the Grisons and south of the Alps.

### **End of spring with record precipitation**

The transition to mainly low pressure conditions marked the beginning of a period with intense precipitation as April departed and May arrived. Within six days all of Switzerland received a medium of around 100 mm of rain. The largest totals were measured in the Lower Valais, in the Vaud Alps and in the adjoining Bernese Oberland. At higher altitudes precipitation totals amounted to 200 mm and more. Most of the precipitation fell within three days. Some individual weather stations with precipitation series dating back over 100 years registered their second-highest three-day totals since observations started. Especially in the western part of Switzerland the high precipitation volume resulted in flooding and damage caused by torrents as streams burst their banks.

At several meteorological stations with long measurement series further strong precipitation at mid-month resulted in a May registering the highest precipitation total since observations started – above all in the western Alps and in the Bernese Oberland. A number of stations with long measurement series recorded the second- or third-wettest May in their history.

### **Extremely hot summer**

The Swiss summer 2015 will rank as the second-warmest in the 152-year-old history of meteorological observation. In Switzerland the overall mean temperature surplus amounted to 2.4°C compared with the normal value 1981–2010. This resulted in the summer 2015 ranking above all previous record summers with a difference of over 1°C, the only exception being the legendary, hot summer 2003. Concerning the overall mean, the latter was around 1°C hotter than the summer of 2015.

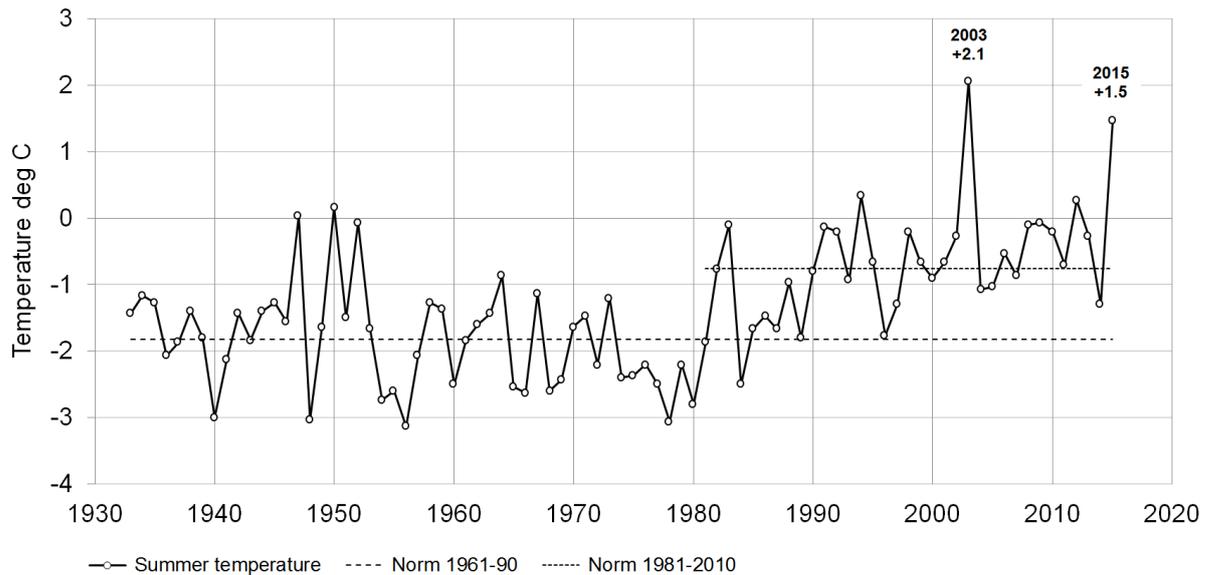


Figure 2. Summer temperatures (JJA) from 1933 to 2015 at the Jungfrauoch (3580 m asl; homogeneous data).

In most regions the temperature surplus in summer amounted to between 2.0 and 2.5°C above the normal value 1981–2010. South of the Alps surplus values were between 1.6 and 2.3°C. Already at the onset of summer the heat announced itself. With a surplus of 1.8°C in relation to the normal value 1981–2010 the fourth-warmest June was recorded since observations started in 1864. South of the Alps, in the Engadine, in the Valais and in Western Switzerland the month of July was in many parts the hottest month since the beginning of observations. In the remaining areas July counted among the three hottest months in the annals spanning 152 years. July temperatures were 3 to 4°C above the normal value 1981–2010. And, to round it all off, the summer 2015 registered the fourth-warmest August since observations started. Averaged over the whole of Switzerland the August temperature rose to 1.8°C above the normal value 1981–2010.

### Heat waves near record-breaking point

From 1 to 7 July 2015 Switzerland experienced a week with one of the most extreme heat waves since observations started over 150 years ago. The mean daily maximum temperature was as high as 33 to over 36°C in low altitudes north of the Alps. At the Geneva weather station 36.3°C was measured, an almost identical value to the 36.7°C that was registered during the record-breaking week in summer 2003. At other meteorological stations only the summers of 2003, 1952 and 1947 had presented even higher values.

The week with extreme heat came to its conclusion on 7 July when Geneva registered 39.7°C, the highest temperature ever observed north of the Alps. This value is almost 1°C higher than the previous record of 38.9°C dating from 28 July 1921, which was also registered in Geneva.

South of the Alps the period with extreme heat unfolded from mid-July onwards. The hottest week lasted from 17 to 23 July. At Locarno-Monti the mean daily maximum temperature reached 34.7°C. Again, temperatures were practically identical with those measured during the record week of August 2003, which amounted to 35.0°C. The highest temperature south of the Alps was registered on 22 July: 36.8°C at the Locarno-Monti station. This is the third-highest value in the Locarno-Monti measurement series which dates back to 1935.

### **A lot of summer sunshine regionally**

Thanks mostly to the very sunny month of July, some regions north of the Alps experienced the second-sunniest summer in the homogenous measurement series available since 1961, namely at the meteorological stations of Neuchâtel, Lucerne, Altdorf, Zurich-Fluntern, St. Gall und Säntis. Berne registered the third-sunniest, Basel and Geneva the fourth-sunniest summer.

### **Autumn begins with cool weather**

In both autumn months September and October cool northerly and north-westerly currents as well as cold north-easterly winds (“Bise”) had an impact on temperatures. In September the overall mean temperature was 0.8°C below the normal value 1981-210, in October 0.6°C. With the arrival of humid and cold air there was some snowfall in the mountains.

### **Extreme warmth and plenty of sunshine at the end of autumn**

Due to a persistent high pressure zone with the arrival of warm air from south-westerly and westerly directions, Switzerland registered the third-warmest November since observations started in 1864. The overall November mean temperature rose to 2.7°C above the normal value 1981–2010. Already in the year before, November had been extremely mild with a temperature surplus of 3.1°C. Looking further back, the record November 1994 was similar in terms of mild weather with 3.3°C above the normal value.

At a number of weather stations, especially at higher altitudes, new November records were observed in terms of daily maximum temperatures. On the Great St Bernard Pass (2470 m a.s.l.) the daily maximum on 12 November was extremely high in relation to the 152-year-old measurement series. The thermometer climbed to 11.9°C - more than 2°C above the former November record of 9.7°C dating from 11.11.1977.

Not only the high temperatures but also plenty of sunshine characterized the first three November weeks. In Lucerne, Altdorf and Lugano it was the sunniest November in the homogenous measurement series available since 1959, at other weather stations the second or third-sunniest November.

### **Persistent lack of precipitation**

Already in summer precipitation was generally below average. In autumn the scarcity of precipitation continued. Only September brought above-average precipitation to some major areas, namely in the westernmost region of the country, in Ticino and in Grisons. October precipitation totals were largely below average and the first three weeks in November were practically without any precipitation in the whole of Switzerland. Taking into account all three autumn months, precipitation totals reached only 50 to 70 percent of the normal value 1981–2010 on the eastern Plateau. In the remaining areas 70 to 90 percent was observed. Only in parts of Grisons did precipitation totals amount to 100 percent of the normal value.

South of the Alps a record drought was experienced in the period from November to December. Lugano and Locarno-Monti registered only 0.8 mm of precipitation: normally a total of 200 to 250 mm should be expected. They were the lowest November-to-December totals in the relevant series spanning well over 100 years.

### **And as in the previous year . . . waiting for winter to come**

The extreme warmth of November continued into December. Averaged over the whole of Switzerland, December produced a record surplus of 3.2°C. The former record was held by the year 1868 with a 3.0°C surplus. The persistent high pressure weather with extremely mild temperatures and with hardly any precipitation resulted in a substantial overall lack of snow in early winter. Due to the stationary high pressure zone certain regions in the German part of Switzerland and in Grisons registered the sunniest December in the homogenous measurement series available since 1959.

### Annual balance

In most areas of Switzerland annual temperatures in 2015 were 1.0 to 1.4°C above normal values 1981–2010. Averaged over the whole of Switzerland, the result was a surplus of 1.29°C, narrowly beating the former record value of a 1.25°C surplus registered in the previous year 2014.

North of the Alps annual precipitation reached only 60 to 85 percent of the normal value 1981–2010. In parts of the Alps precipitation totaled from 80 to around 100 percent of the normal value while south of the Alps 70 to 95 percent of normal precipitation amounts were recorded.

In many parts the sunshine duration was registered at between 110 and 120 percent of the normal value 1981–2010. On the Plateau and in north-western Switzerland values of even 125 percent of the normal value were observed. Some meteorological stations registered the third-sunniest year in their homogenous measurement series, namely the stations at Neuchâtel, Berne, Zurich und St. Gall. Homogenous sunshine duration measurement series date back as far as 1959. It is only the Zurich station that can provide homogenized series which date as far back as 1884 when observations started.

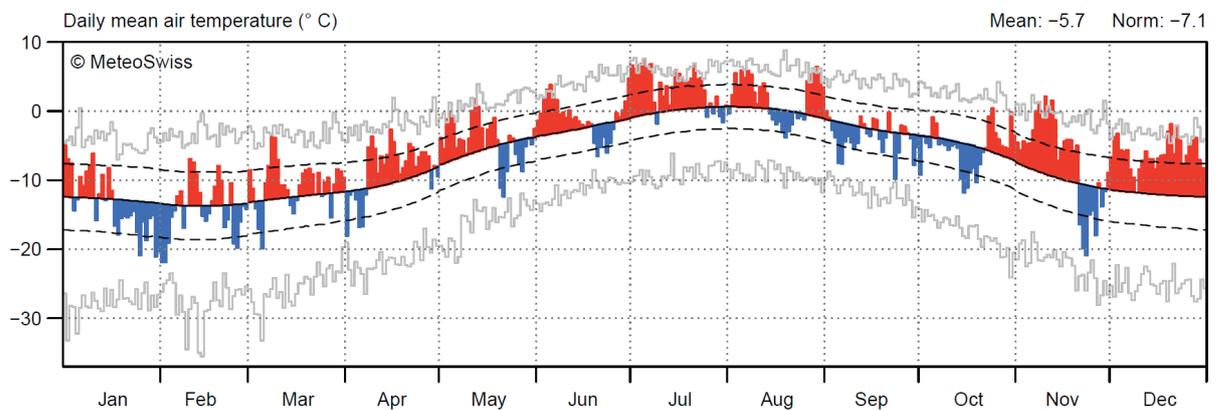


Figure 3. Development of the 24-hour mean temperatures 2015 at the Jungfrauoch (3580 m asl), in relation to the long-term mean value 1981–2010 (solid line) and the long-term mean fluctuation (dashed line, standard deviation). The two grey curves show the highest and the lowest 24-hour mean temperatures since observations started.

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