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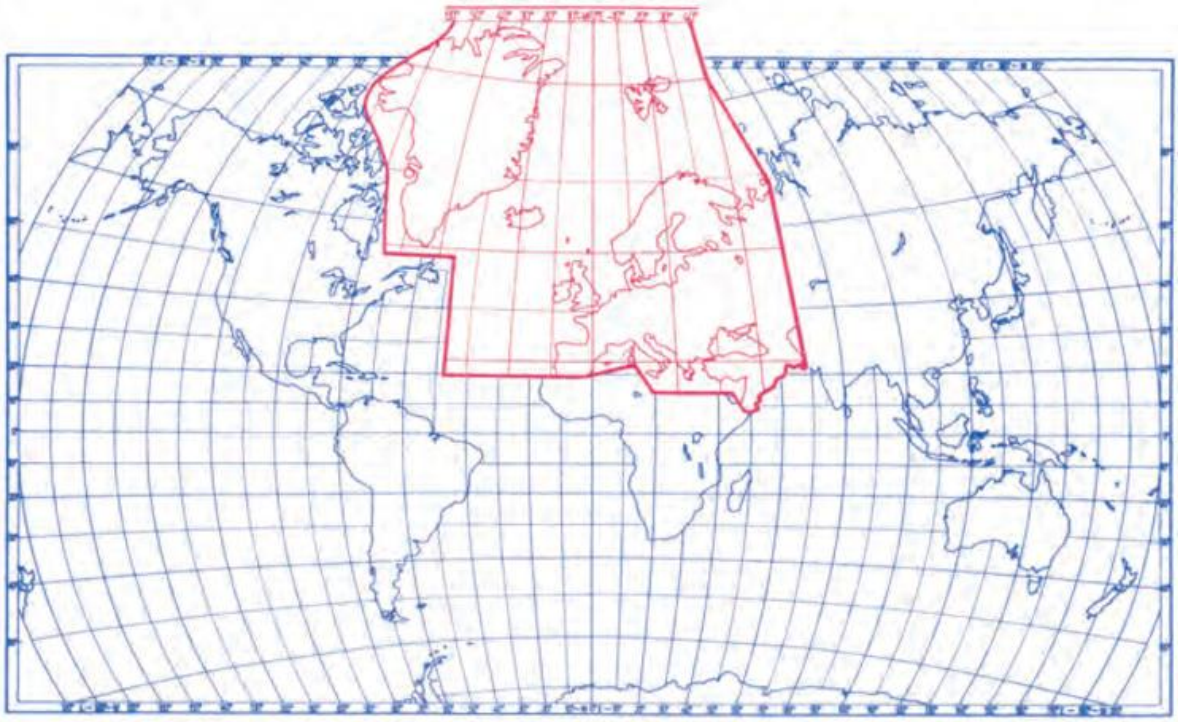
Deutscher Wetterdienst

Annual Bulletin on the Climate in WMO Region VI

- Europe and Middle East -

2006



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The Bulletin is a summary of contributions
from the following National Meteorological and Hydrological Services
and was co-ordinated by the Deutscher Wetterdienst, Germany

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Foreword

The year 2006 was a very exciting year for both climatologists and readers of record books. In various countries and places it was the warmest year or at least one of the warmest, even in very long time series. To give only a few examples: it was the warmest year in the 348-year Central England temperature series and also in De Bilt in the Netherlands, where measurements began in 1706. This already implies that 2006 was an outstanding year, actually having been the warmest for at least 300 years in more than one location.

However, there were some more remarkable features in 2006 concerning our Region. Over large parts of Europe, the year 2006 started very cold with wintry conditions, but this was more than balanced out by most of the following months, especially July and the last four months of the year, which were extremely warm, particularly in central and northern Europe. These months or seasons were, of course, also record-breaking: with one record following the other.

The northernmost parts of our Region were already very mild at the beginning of the year. On Svalbard it was more than 12 °C warmer than normal in January and again in April 2006, and more than 5 °C on the annual average. This was even more than in the years 2004 and 2005, which were already very mild. Nowadays we classify these events as extreme. But, when we look at future climate projections, it could well be possible that in about 100 years such events will no longer be considered as extreme, but normal. The Arctic parts of our Region are expected to be those where climate changes will be largest and fastest, and if we look back on our climate monitoring results, we find strong signs that the recent climate change is already apparent and continuing steadily.

Records of this year did not only concern temperature. Some months, seasons or other longer periods were extremely sunny and dry over large areas; others were extremely wet and dull. Both, extended droughts and flooding can be found during 2006 in various parts of our Region, which caused considerable damage. Luckily, we did not have so many severe storms as in other years.

However, 2006 saw another record which is the most pleasant: the high number of countries participating in this 13th issue of the Annual Bulletin. 44 out of 49 countries sent their contributions in time to our editors Dr. Peter Bissolli and Peer Hechler of DWD (Deutscher Wetterdienst) who once again took over the task of compiling all these very informative contributions into a concise summary comprising the most important anomalies and highlights of this record-breaking year. I would like to express all my warmest thanks to all contributors, reviewers and editors for their excellent work and co-operation concerning this Bulletin issue, also to the authors of the special reports, which are included again as in the previous years. With this issue appearing already in summer 2007, we have further reduced the delay between the reporting year and the distribution of the Bulletin.

I wish you pleasant reading of this interesting documentation.

Daniel Keuerleber-Burk
President of WMO Regional Association VI

Outstanding Events and Anomalies

Temperature

- Very warm year with record anomalies in many places in the Region, particularly in the Arctic area
- Especially July and autumn were record breakingly warm in many countries, especially in Central Europe and parts of northern Europe.
- December extremely mild especially in northeast Europe

Precipitation

- Long dry periods (up to 35 consecutive days without rain), especially in some parts of the east
- Wettest spring in parts of Switzerland for more than 140 years
- Flooding of Danube and Elbe rivers in April
- Driest summer ever recorded in southern and western Finland
- Wettest August in some places in Central Europe

Sunshine

- Extremely sunny July, but extremely dull February and August in Central Europe

Wind

- Severe storms in France on the Atlantic coasts on October 3-4 and on December 8 with gusts up to 150 km/h
- Severe storms over northern Central Europe on October 30 – November 1 and on December 30-31 with gusts up to 156 km/h

Annual Survey

Temperature

2006 was again a warm year nearly all over the Region (Fig. 0.1). The highest anomalies (deviations from the 1961-1990 long-term mean) were recorded on Svalbard, reaching outstanding +5 °C and exceeding even the record values of 2005. This is in line with a recent strongly decreasing trend of Arctic Sea Ice extent which has been reported by, among others, the National Snow and Sea Ice Data Center (USA). In most of northern, western and central Europe, but also in parts of the Middle East, the anomalies were between +1 and +2 °C. In eastern and southeastern parts of the Region and over large areas of the North Atlantic, the anomalies were also mainly positive, but less than +1 °C. Only a few locations in the southeast of the Region (e.g. in Romania, Greece, Turkey, Armenia) recorded slightly negative or zero anomalies.

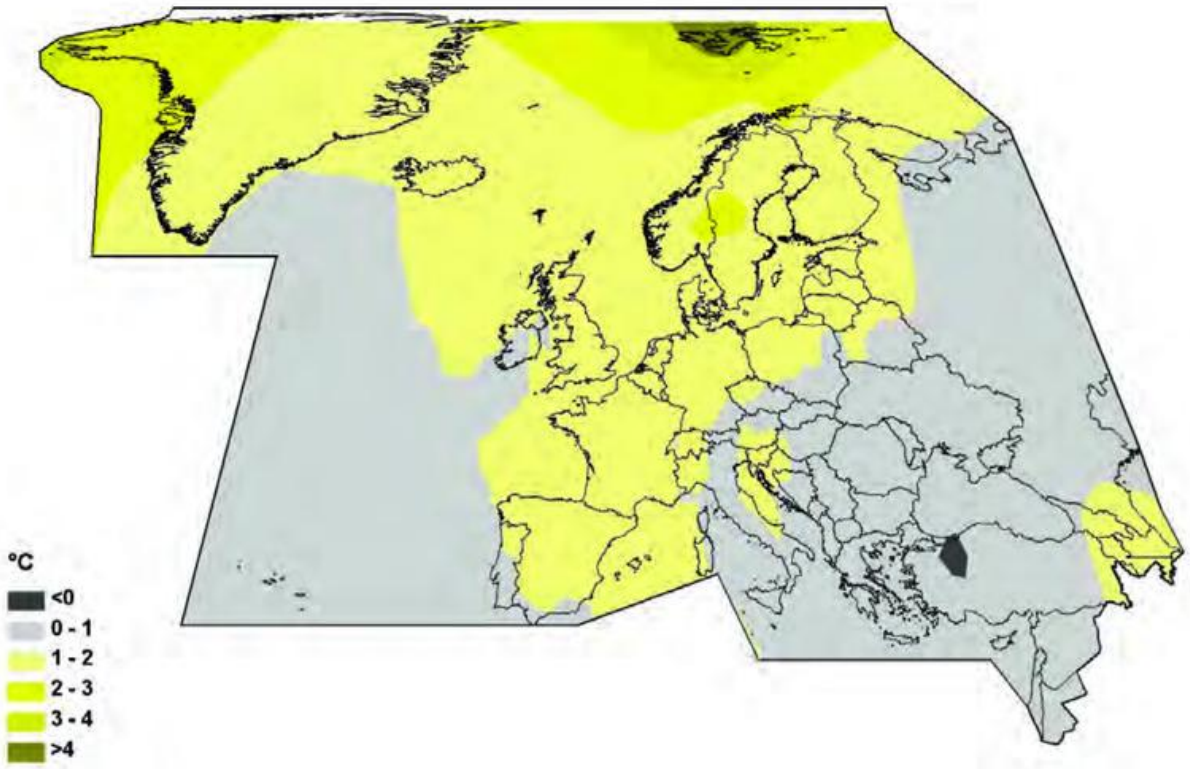


Fig. 0.1: *Mean annual temperature anomalies in 2006 (reference period 1961-1990) in WMO Region VI (interpolation of CLIMAT data).*
Source: Deutscher Wetterdienst

Although 2006 was warm on average, especially Central Europe and its adjacent regions had a very cold start of the year until March. In contrast, July and the last four months of the year were outstandingly warm, in many cases the warmest period ever recorded. In the Czech Republic, for example, the average air temperature of the period September-December 2006 was the highest since 1974. Typical examples of this special annual cycle are Poland (Fig. 0.2), Hungary (Fig. 0.3), Belarus (Fig. 0.4) and the Ukraine (Fig. 0.5). In the Middle East, it was just the other way around: here, it was warm from February onwards during most of the year, whereas the end of the year (November and December) was quite cold.

Many temperature records were beaten this year at many stations in some of the months, seasons or even over the whole year. 2006 was the warmest year within the 348-year Central England temperature time series, and record annual average temperatures were also observed

Fig. 0.2: *Monthly mean temperature anomalies in Poland in 2006 (average of 20 stations, reference period 1971-2000).*
Source: Institute of Meteorology and Water Management, Poland

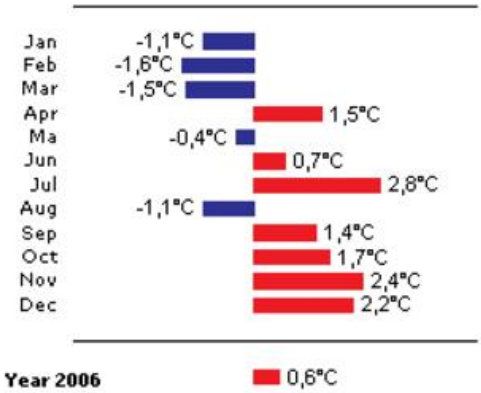


Fig. 0.3: *Monthly mean temperature anomalies in Hungary (country average) in 2006 (reference period 1961-1990).*
Source: Hungarian Meteorological Service

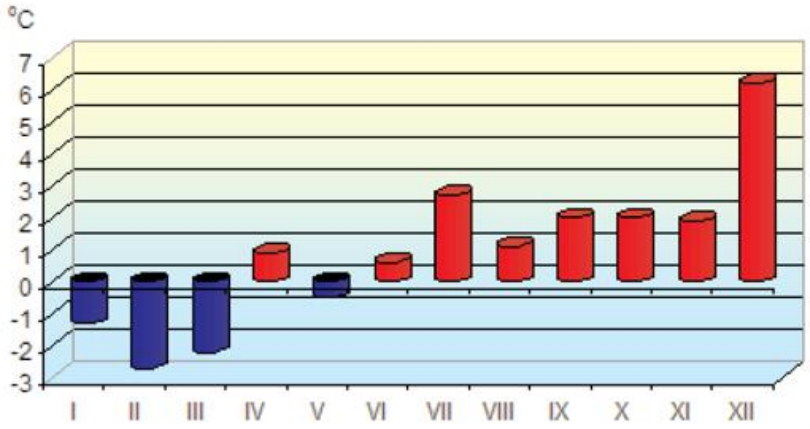


Fig. 0.4: *Monthly mean temperature anomalies in Belarus in 2006 (reference period 1961-1990).*
Source: State Committee for Hydrometeorology of the Republic of Belarus

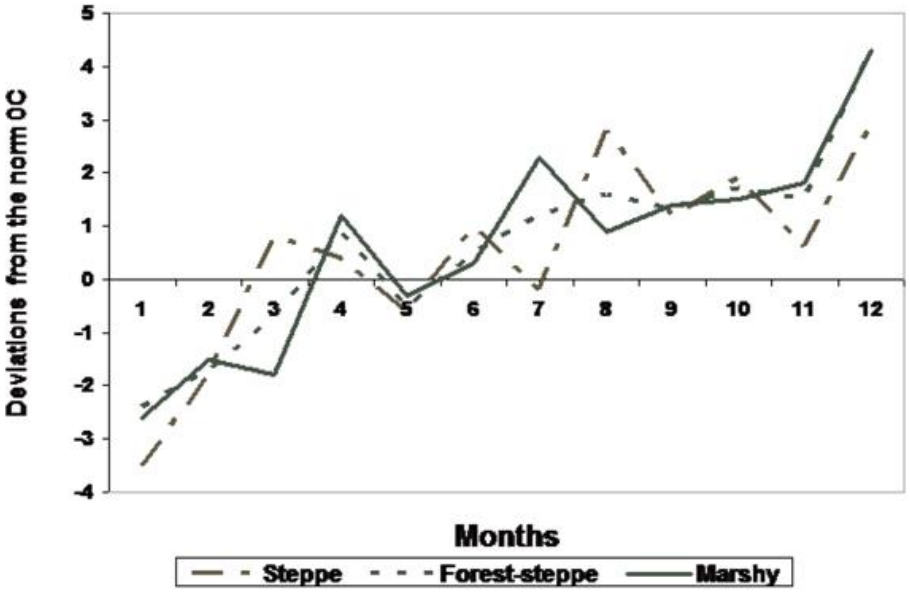


Fig. 0.5: *Monthly mean temperature anomalies for three different regions in the Ukraine in 2006 (reference period 1961-1990).*
Source: Ukrainian Hydrometeorology Centre

for most areas of the United Kingdom and for some stations in Ireland. In particular, the annual average minimum of the Central England temperature was the highest on record (Fig. 0.6), while the maximum temperature was only the 5th warmest.

For Norway as a whole, 2006 was the warmest year (anomaly +1.8 °C) ever recorded, together with 1934 and 1990 (Fig. 0.7); especially for western Norway it was by far the warmest year. Since 2002, the Norwegian annual mean temperature has been considerably above normal

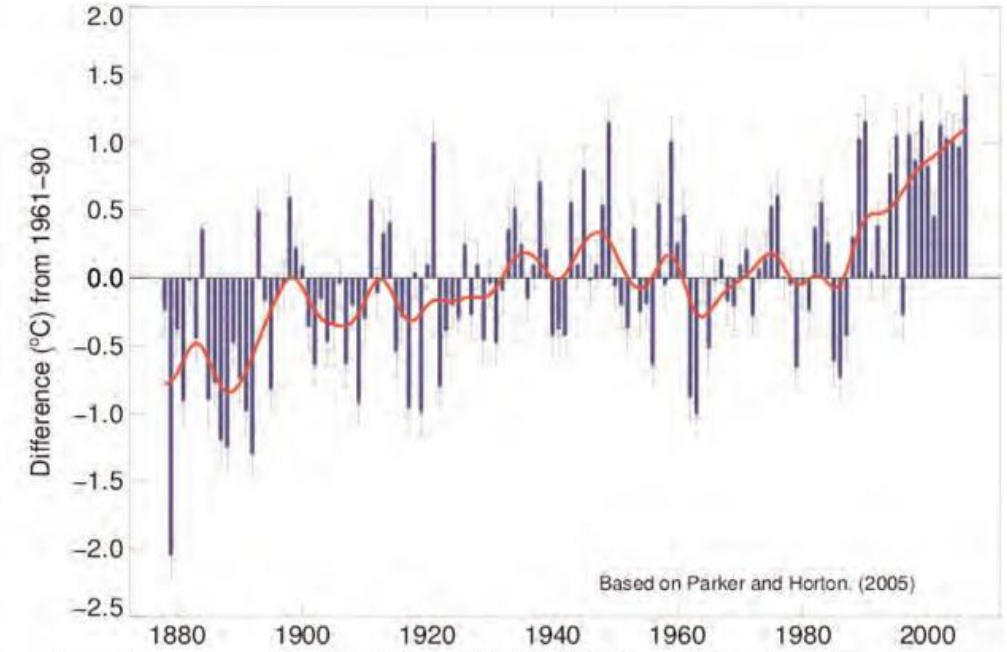


Fig. 0.6: *Annually-averaged daily minimum 1878-2006 Central England temperature anomalies (reference period 1961-1990, blue bars) with 2 standard-error range (grey bars) and smoothed values (21-point binomial filter, red line).*
Source: Met Office, United Kingdom

and has increased steadily. In Sweden, 2006 was the 6th warmest year (since 1860). Nevertheless, the average temperature in Sweden for the whole period from 1991 to 2005 was 0.9 °C warmer than normal, partly more than 1 °C (Fig. 0.8).

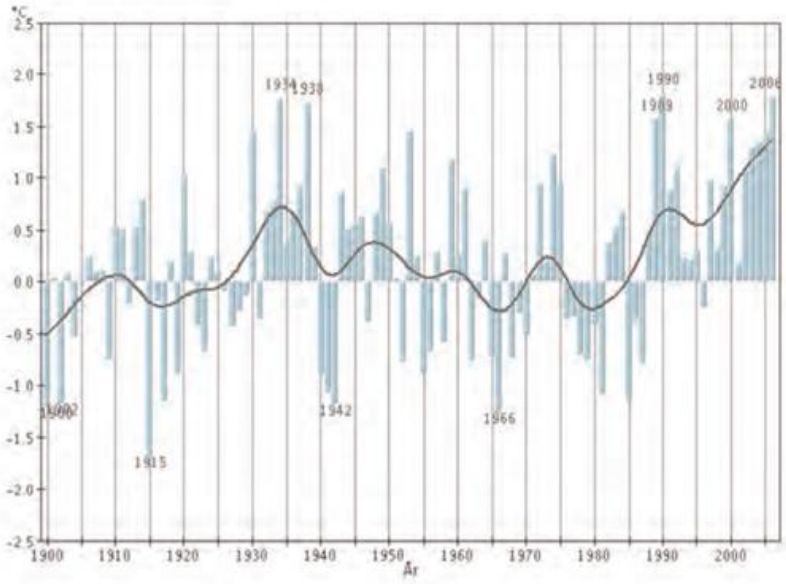


Fig. 0.7: *Annual mean temperature anomalies in Norway (1900-2006, reference period 1961-1990) with smoothed values.*
Source: Norwegian Meteorological Institute

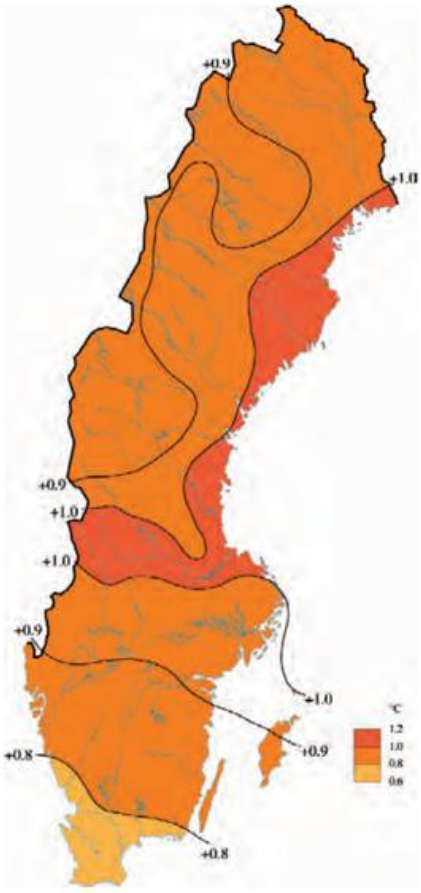


Fig. 0.8: *Difference of the mean annual temperature in Sweden (1991-2005 minus 1961-1990)*
Source: Swedish Meteorological and Hydrological Institute

The annual mean temperature for Denmark on the whole was also a new record: it amounted to 9.4 °C, which was +1.7 °C above normal and 0.1 °C higher than the previous record in 1990 (Fig. 0.9). With 2006, 17 of the last 19 years in Denmark were warmer than normal, thus continuing the sharply rising warming trend of recent decades. In Tórshavn on the Faroe Islands, 2006 was with 7.5 °C the third warmest year since 1873 after 2003 and 1933. Nine of the months in 2006 were warmer than normal on the Faroe Islands, with only the spring months having been colder. On Greenland it was also very warm in 2006, but it was not the warmest year on record: 2003 was warmer in Nuuk, 2002 and 2005 were warmer in Danmarkshavn.

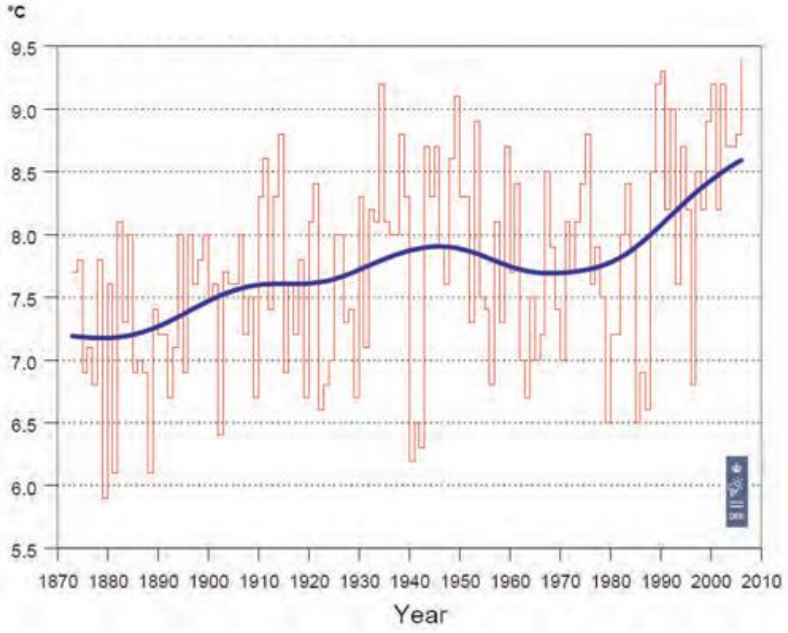


Fig. 0.9: *Annual mean temperatures in Denmark (1873-2006) with Gauss-filtered values (bold line). Source: Danish Meteorological Institute*

In Germany, the areal mean value was 9.5 °C in 2006 (anomaly +1.3 °C); it was the 5th highest since 1901. The number of summer days (Tmax >= 25 °C) was mostly twice or three times as high as compared to the normal, while the number of frost days was around the long-term average. In Switzerland, 2006 was the 5th warmest year, too (since 1864, Fig. 0.10). Luxembourg (airport) reported 44 summer days (normal: 28.5) and 12 hot days (Tmax >= 30 °C, normal: 4).

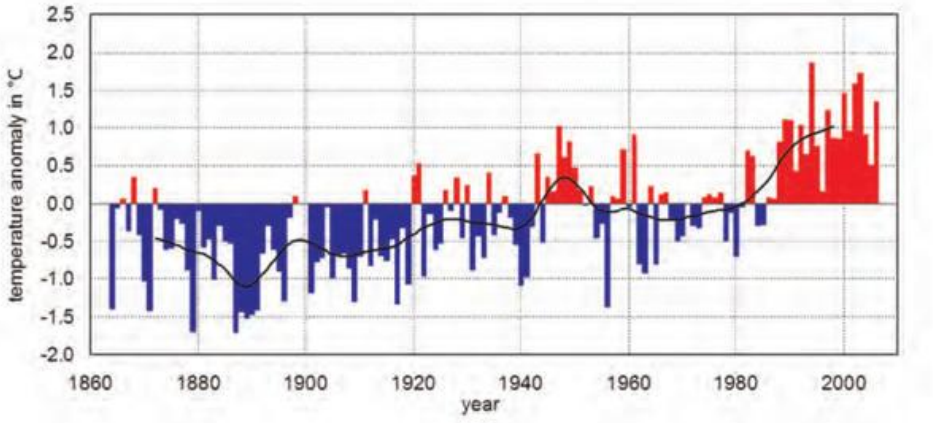


Fig. 0.10: *Annual mean temperatures in Switzerland (1864-2006) and smoothed values. Source: MeteoSwiss*

In Brussels-Uccle, Belgium, the annual mean temperature reached 11.4 °C (normal: 9.8 °C), exceeding the former record of 11.3 °C of 1989. De Bilt in the Netherlands had 11.2 °C on average, thus also recording the warmest year since the start of measurements in 1706 (Fig. 0.11). France recorded 2006 as the 3rd warmest year since 1950 after 2003 and 1994; it was 1.1 °C warmer than the 1971-2000 average. Slovenia observed partly quite high anomalies, too (> +1.5 °C for some minimum and maximum temperatures, Fig. 0.12), so 2006 was the 5th warmest year since 1951, for example, in Ljubljana and at the coast.

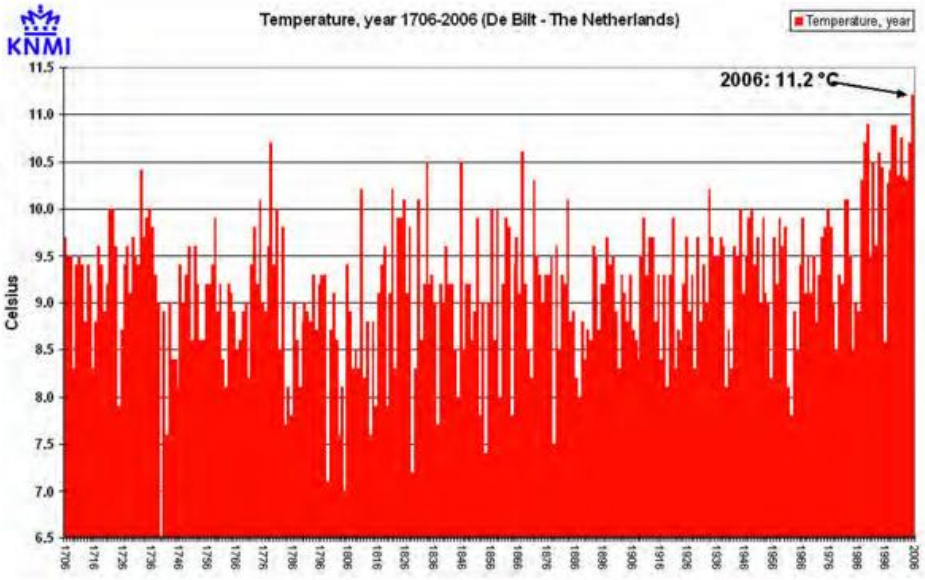


Fig. 0.11: *Annual mean temperatures in De Bilt (Netherlands) 1706-2006.*
Source: Royal Netherlands Meteorological Institute

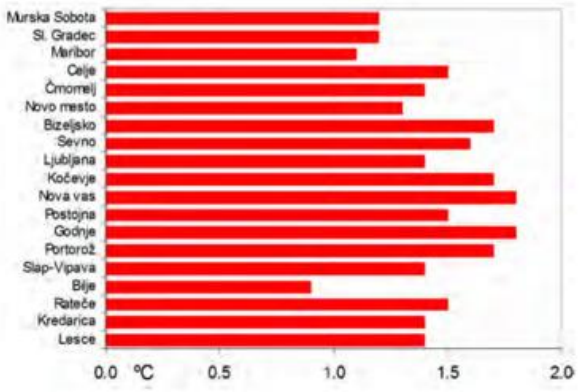


Fig. 0.12: *Maximum air temperature anomalies 2006 (reference period 1961-1990) at some stations in Slovenia.*
Source: Environmental Agency of the Republic of Slovenia

2006 was also one of the warmest years in the south. In Portugal, it was the 5th warmest year since 1931. For Peninsular Spain and the Balearic Islands, it was the warmest year since 1980 (Fig. 0.13), with particularly warm temperatures in the eastern half. The mean trend of this time series is 0.37 °C / 10 years.

In some places in the southeast of the Region, 2006 was also among the 10 warmest years of the time series although the anomalies were only a few tenths degree of a centigrade. In Zagreb Gric (Croatia), 2006 was the 7th warmest year since 1862, in Armenia the 7th warmest since 1929. It was also one of the warmest years in Malta; though still 0.5 °C colder than in 2001 which was the warmest year. The same applies to the sea temperature around Malta.

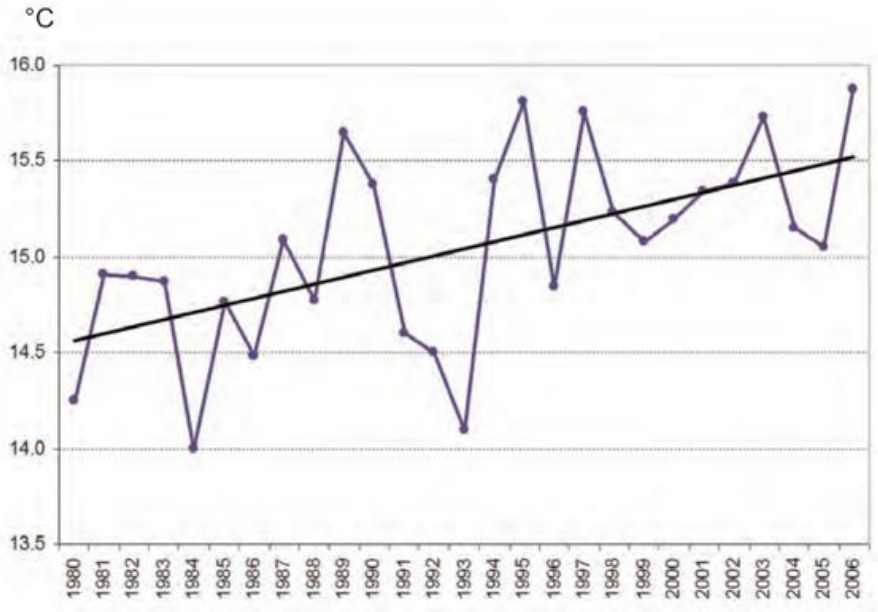


Fig. 0.13: *Areal annual mean temperatures for Peninsular Spain and the Balearic Islands and trend line.*
Source: National Institute of Meteorology, Spain

Daily maximum temperatures above 40 °C were reached in some places in the south at several occasions. Jordan recorded 45 °C as the highest annual value on 4 days in 2006 (May 25, June 6, August 18 and September 29).

Precipitation

Annual precipitation amounts in 2006 were around normal (80-125% of the 1961-1990 normal) in most parts of the Region. Higher-than-normal amounts occurred notably in northern Greenland, Svalbard, and in parts of Iceland, Norway (western Finnmark) and Sweden, whereas in other places it only occurred locally (Fig. 0.14). In Sweden, 2006 was the 6th wettest year on record for the country as a whole. The year was relatively dry on the Norwegian west coast, in the Baltic countries, in and near the western Mediterranean, on the southern slopes of the Pyrenees and the Alps, in Cyprus, in some areas near the Black Sea and the Caspian Sea, in parts of Lebanon (especially in the autumn and winter months), Israel and Jordan. In the high mountains of Lebanon, consequently only 66% of the normal annual snowfall was recorded in 2006.

Estonia recorded in 2006 30-35 consecutive dry days in the vegetation period; only 2002 was drier during the last 50 years. In particular, large parts in the north of the country received less than 70% of the normal annual precipitation. In Latvia, 2006 was the 7th driest of the last 83 years, causing low water levels in rivers. The Gauja River near the city of Sigulda had the lowest water level measured since 1940 during the period July-October (Fig. 0.15). In the south, especially in the Po Valley in Italy, too, a low annual amount of precipitation caused extensive drought conditions in that area with reduced water availability for drinking, agriculture and thermoelectric power stations. On the other hand, flooding events occurred in Romania from March to August. In particular the flooding of the Danube from April to June partly affected many adjacent countries, especially in April.

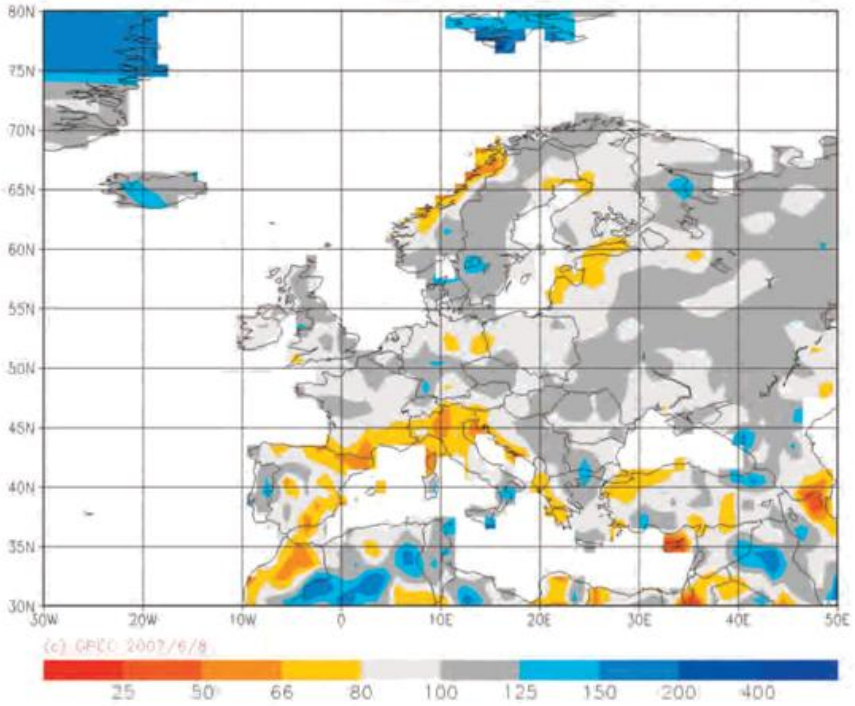


Fig. 0.14: *2006 annual precipitation amounts in WMO Region VI in per cent of the 1961-1990 normal. Source: Global Precipitation Climatology Centre (GPCC), Germany*

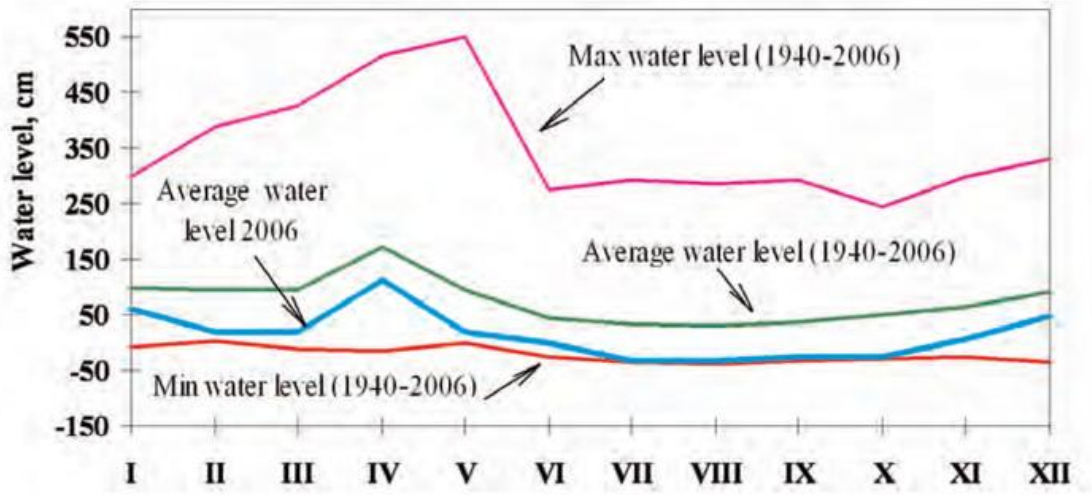


Fig. 0.15: *Water level anomalies in the Gauja River near the city of Sigulda, Latvia. Source: Latvian Environment, Geology and Meteorology Agency*

The monthly distribution of the annual precipitation was quite unusual in some countries. In Ireland, January and February were very dry, especially in the east of the country, whereas widespread heavy rainfalls during the last three months of the year led to flooding in places in midland and western areas. Albania, which has normally the wettest months in winter, received monthly records in March and, in part, higher amounts in the summer months as compared to the winter months (Fig. 0.16). Some parts of Israel had a period of 35 consecutive days without rain from November 16 to December 20 which in the north of the country was by far the longest dry period in the winter season from November to March since 1928/29 (Fig. 0.17).

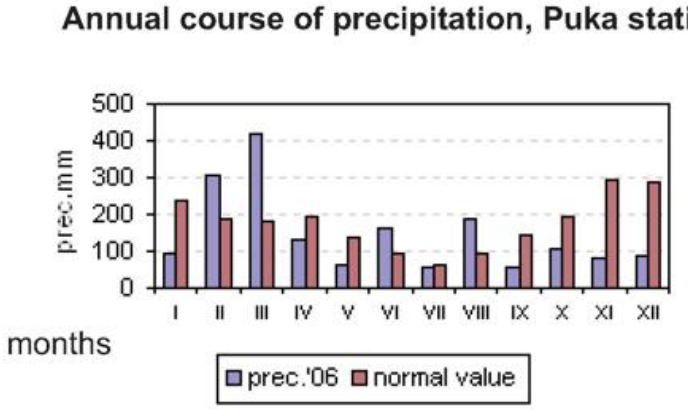


Fig. 0.16: *Annual course of precipitation in 2006 and 1961-1990 average at Puka (northeast Albania). Source: Hydrometeorological Institute Albania*

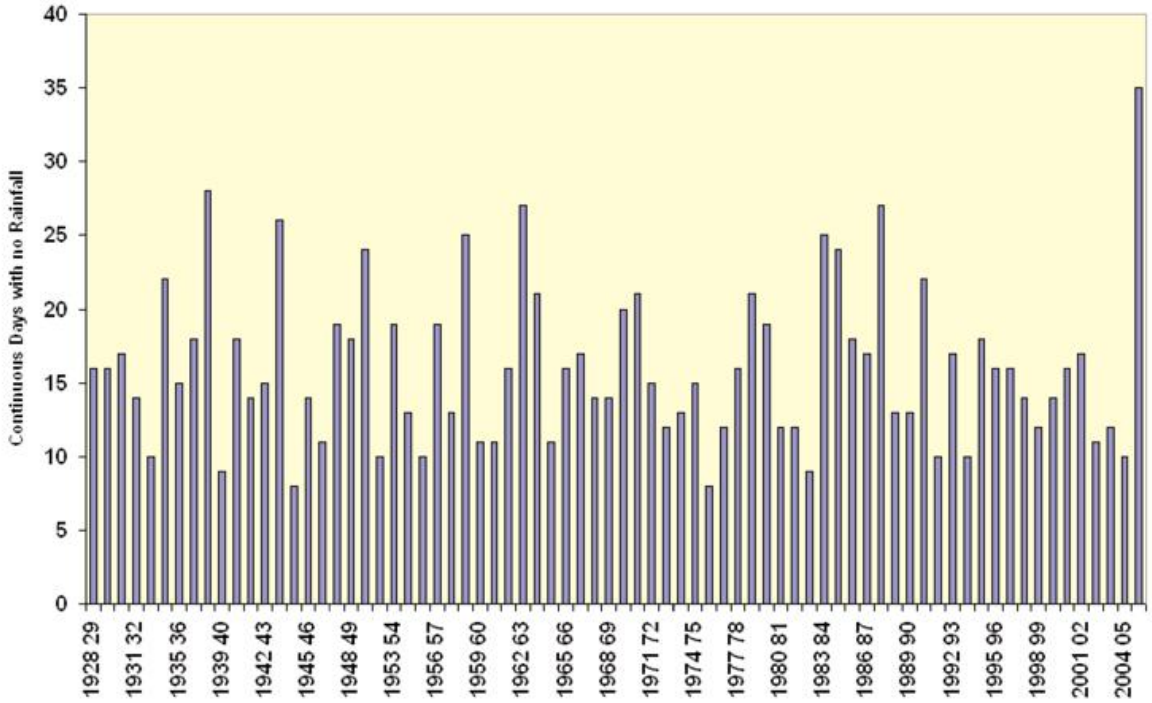


Fig. 0.17: *Longest period without rainfall in Kefar Giladi (northern Galilee in northern Israel) in the winter season November – March 1928/29-2005/06. Source: Israel Meteorological Service*

Sunshine duration

2006 was a sunny year as compared to the normal in many parts of the Region. In some places, it was the sunniest or one of the sunniest within many years.

In the north, 1494 hours of sunshine were recorded in Reykjavik (Iceland), which is 118% of the normal. This excess mainly occurred in spring. In the south of Iceland, it was the sunniest spring since 1924. In contrast, the sunshine total in Akureyri in northern Iceland was slightly below normal.

The sunshine duration was also unusually long in Estonia: since 1955, only the year 2002 was sunnier in Tartu.

In Ireland, annual sunshine totals were around 10% above normal all over the country. April, June and July were particularly sunny months relative to the normal and only March was duller than normal at all stations. Shannon Airport had its sunniest year since 1968, while at Dublin Airport it was the sunniest year since 1959. 1770 hours at Rosslare was the highest annual total within the country. In the United Kingdom, Aberdeen Airport smashed their December sunshine record, with around 90 hours of sunshine being recorded, which is just over double their December average.

In Denmark, 1703 sunshine hours were recorded in 2006 for the country as a whole which is 114% of the normal. July was record breakingly sunny with 321 sunshine hours. In Tórshavn on the Faroe Islands, the sunshine duration in 2006 set a new record with 1064 hours (127% of the normal) throughout the whole year. Germany had an areal mean sunshine total of 1771 hours (116% of the normal) in 2006; it was the 3rd sunniest year since 1951 after 2003 and 1959.

The year 2006 was also very sunny in the Netherlands with a total of 1782 sunshine hours (115% of the normal) particularly in July, whereas February and August were very dull. The coastal station Valkenburg recorded 340 sunshine hours in July; such a monthly total had never been reached there before. Belgium (Uccle) also had a remarkable deficit of sunshine in February (30 hours, normal: 73 hours) and August (94 hours, normal: 188 hours), whereas many sunshine hours (309, normal: 195) were recorded in July. Thus, this was the dullest February and August in Belgium since 1887 and the third sunniest July after 1959 and 1911 (Fig. 0.18). A similar distribution was observed in Luxembourg, although records were not broken. In France, only the southern half and the west of the country received more sunshine than normal.

Austria had an excess in annual sunshine of 15-30% as compared to the normal all over the country, and in Slovenia the normal was also exceeded nearly everywhere, in Celje even by up to 19%. In Hungary, too, most of the year was sunnier than normal, especially the warm months July, September and October.

In the south of the Region, Malta recorded a daily average of 8 hours and 18 minutes of sunshine in 2006, which corresponds to an annual total of 3029.5 hours and was slightly more than the average in the past 78 years.

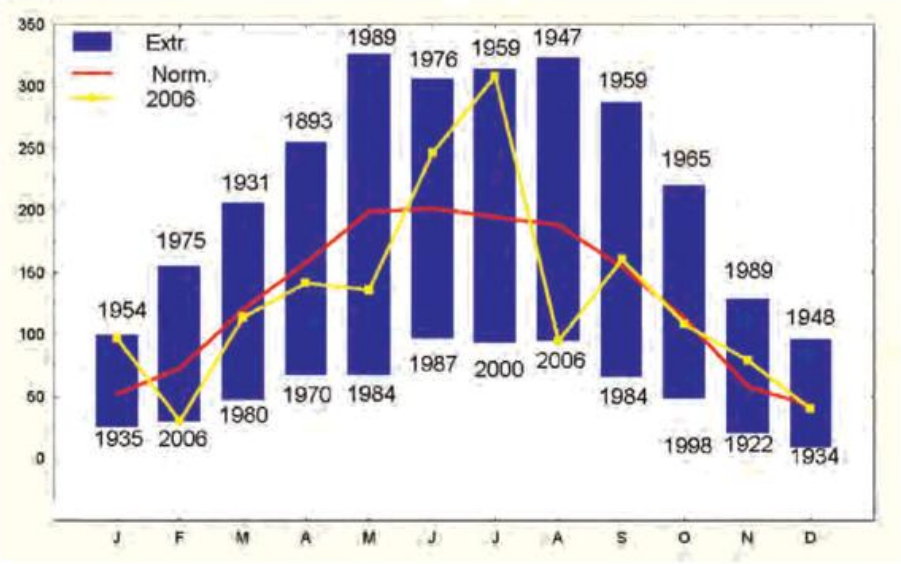


Fig. 0.18: *Annual course of sunshine duration (in hours) in Uccle (Belgium) in 2006 and averages of the normal period 1961-1990, showing the sunniest and dullest years since 1887 (bars). Source: Royal Meteorological Institute Belgium*

Wind

Norway recorded only one strong storm on January 11, causing significant wave heights above 13 metres and damage in the Lofoten area. Within the Norwegian sea area, the highest wind speed on oil platforms in 2006 was measured in the Haltenbank area on January 31 with 110 km/h and also wave heights above 13 metres.

In Germany, strong thunderstorms were recorded on July 5-6. Gusts up to 110 km/h were measured at Lake Constance, and in western parts of the country the wind was strong enough to overthrow trees. In some places, the semi-final soccer match of the World Championship could not be shown at public viewing sites due to thunderstorms and flooding. Apart from this event and a few other thunderstorms and tornadoes in July and August, strong winds in Germany were mainly restricted to the last third of the year. The ex-hurricanes Helene and Isaac caused stormy gusts in October, just like a low pressure system over southern Sweden in the same month. Two severe storms with gusts up to 156 km/h were recorded over the coastal areas of Germany, one on October 30 – November 1 and another at the end of the year on December 30-31. The former one caused the highest flooding at the coast of East Friesland for more than 100 years, but thanks to the fortified dykes no severe damage occurred. However, this storm caused severe high water situations in Denmark in the Øresund, the straits, the sea south of the island Sjaelland and in the Baltic Sea. High waves were also observed in the northern North Sea on October 31.

On October 3-4, a severe storm touched France. It had developed from a low pressure system over the Golf of Gascony. Gusts were particularly high in the region of Aquitaine (150 km/h on the southern Atlantic coast and 130 km/h up-country). The storm then moved to the northeast of France causing severe flooding in the region of Alsace and Lorraine. Another storm in France occurred on December 8 with gusts up to 140 km/h, particularly on the Atlantic coasts and in the northwest. Luxembourg (airport), too, recorded the strongest storm late in the year on December 8, but only with gusts up to 93 km/h.

In Hungary, two heavy storms were recorded in summer, one on July 22, the other on August 20 (the Hungarian National Day), the latter with gusts up to 120 km/h.

The south of the Region was hit by waterspouts that reached the sea surface in the coastal area near Castelldefells in Catalonia (Spain). On May 3, a strong storm caused the rivers in southeast Spain to overflow. Later, on September 21, the remnants of hurricane Gordon interacted with a deep Atlantic low, causing strong winds and severe damage particularly in Galicia (northwest Spain).

The highest wind gust in Malta was 83 km/h on February 1.

In Greece, a winter storm with gusts up to more than 100 km/h passed the northern and central Aegean Sea and then moved westwards the Ionic Islands on January 24. It was accompanied by heavy snowfall which caused damage to the electric power network. This storm also affected the European part of Turkey, causing there a short blackout. Another storm with more than 90 km/h occurred in Greece on February 26 over the Attica region (around Athens). Trees fell down. Five severe storms with damage to plants, mostly trees, were recorded in Turkey in March and April, and three more in November and December. Strong winds also occurred occasionally in various areas of Cyprus, particularly in January, February, March and October. Tornados were recorded on February 7 in the south-eastern coastal area of Cyprus, associated with heavy rainfall, hail, floods and damage to houses and crops, and again on October 31 in the southern coastal area.

In Israel, a tornado hit in western Galilee (north Israel, Fig. 0.19) on April 4. In the Lebanon, south-westerly winds up to about 110 km/h were measured in spring, easterlies up to about 100 km/h in autumn. Syria, too, was affected by strong gusts up to 109 km/h caused by many

low pressure systems during 2006. In Armenia, a hailstorm with heavy rain in the north-east of the country on May 9 resulted in mudflow causing damage to livestock. Strong winds were also observed in November in this country with gusts up to 145 km/h on November 4.

Three tropical storms entered the Region over the Atlantic in 2006: Alberto (June 18), hurricane Gordon (September 20) and hurricane Helene (September 25). Two more hurricanes (Florence in September and Isaac in October) were classified as extratropical depressions before entering the Region.

Fig. 0.19: *Tornado in western Galilee (northern Israel) on 4 April 2006.*
Source: Israel Meteorological Service, Photo taken by N. Mercer, Tuval, Israel

Seasonal Survey

Temperature

The year 2006 was characterised by a change from a cold winter over most of continental Europe to a warm summer and autumn.

Winter 2005/06 was cold over most of the continental areas of the Region, in many places the anomalies were < -1 °C, locally < -2 °C; this was outstanding (percentiles <2%, see seasonal maps), especially in northern Poland and around the Black Sea. Over the Mediterranean the temperature was around normal. On the contrary, nearly the whole Atlantic area, most of Scandinavia, the United Kingdom and Ireland, parts of the Iberian Peninsula as well as the countries in the very southeast of the Region, e.g. Armenia, were warmer than normal.

The highest anomalies were observed in Svalbard, exceeding partly +9 °C. All the Svalbard stations recorded the warmest winter since measurements started. In Iceland, too, this winter was very mild: in Reykjavik and Akureyri, it was the 4th warmest since the inception of continuous measurements. Only 36 days of full snow cover were recorded in Reykjavik (normal 55).

Spring 2006 was cold over parts of northern, eastern central and north-eastern Europe with anomalies mostly not more than 1 °C colder than normal, only occasionally the deviation from normal was < -1 °C. The majority of the rest of the Region was warm that spring, with the highest positive anomalies occurring in Svalbard again, reaching up to more than +6 °C. The abnormally warm Atlantic flow continued.

The mean spring maximum temperature anomalies on the Italian islands Sardinia and Sicily partly exceeded twice their standard deviations (Fig. 0.20).

Summer 2006 was warm nearly everywhere in the Region. The anomalies were mostly above +1 °C, in some places in northern, western and central Europe and in the southeast of the Region also > +2 °C and very exceptional (percentiles >98%). Negative anomalies occurred only at a few locations, e.g. in Greenland.

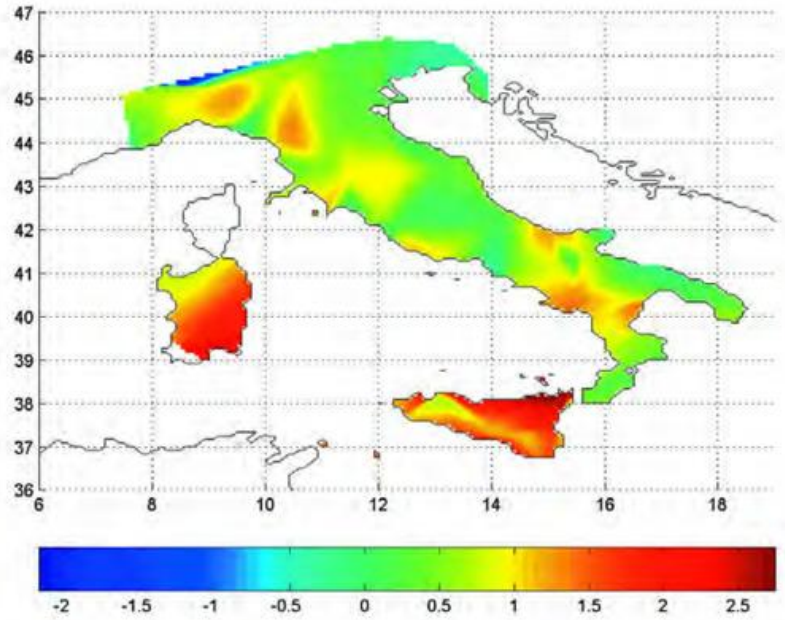


Fig. 0.20: *Seasonal mean of maximum temperature anomalies (reference period 1961-1990) in spring 2006 in Italy, divided by their standard deviations.*
Source: National Centre of Meteorology and Aeronautical Climatology, Italy

The seasonal mean temperature at Svalbard Lufthavn was 6.3 °C; together with 1922 this was the warmest summer since 1912.

Finland counted 59 summer days (Tmax >= 25 °C) and hot days (Tmax >= 30 °C) were recorded in each of the three summer months. Especially the latter phenomenon is quite unusual in Finland and happens only every 10th year on average.

In Sweden, new records for mean summer temperature were observed at some stations in the southernmost part, e.g.in Lund, as compared to more than 140 years of observations. Summer 2006 was the 4th warmest summer in Norway since 1900 and the 5th warmest in Latvia for the past 83 years. With 17.2 °C (anomaly +1.9 °C) it was also the 5th warmest summer in the Central England temperature record. In the Netherlands, it was the 3rd warmest summer since 1901.

In the south, too, this summer was one of the warmest, being for example the 5th warmest in Portugal since 1931. The average minimum temperature reached even its 2nd highest value.

In Armenia, this summer was the hottest for 70 years (anomaly +2.7 °C, Fig. 0.21). Syria was also considerably warmer than normally due to the extending Indian Monsoon effects with heat waves that, from time to time, result in temperatures of 3-5 °C above normal for short periods of time.

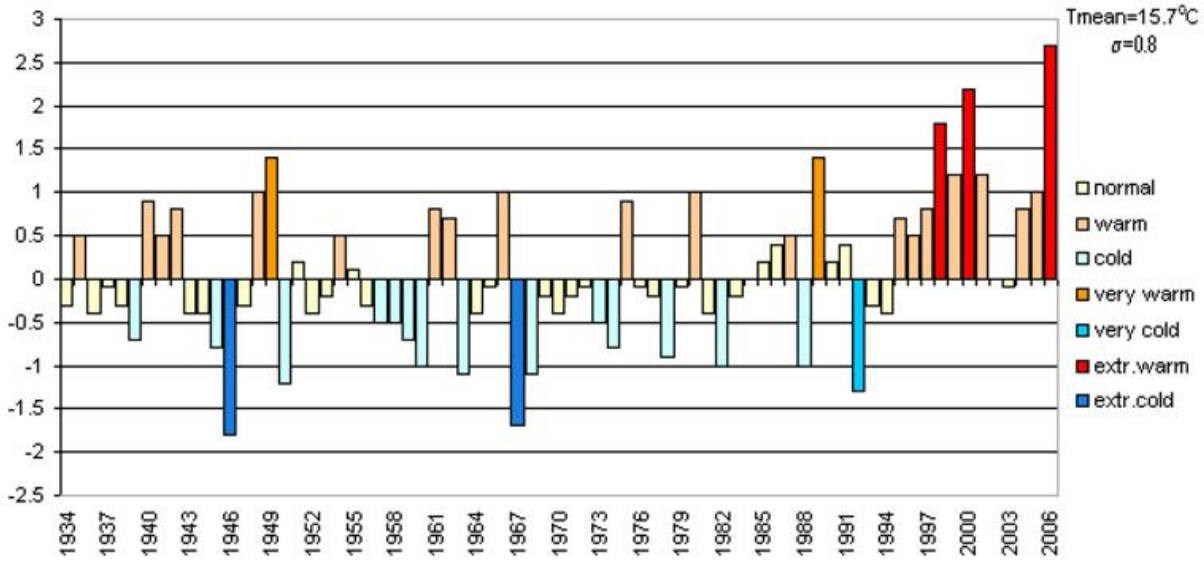


Fig. 0.21: *Summer temperature anomalies (°C, reference period 1961-1990) in Armenia. Source: Armstatehydromet, Armenia*

Autumn 2006 was also warm in allmost all parts of the Region. Mostly, the anomalies were above +1 °C, in large parts of Europe already above +2 °C, and in Central Europe even above +3 °C at many stations. Negative anomalies were restricted to very few places, e.g. in northern Russia and near the eastern Mediterranean.

In several European countries, autumn 2006 was record breaking in temperature. It was the warmest autumn in the Central England temperature record dating back to 1659. The seasonal mean was 12.6 °C (anomaly +2.3 °C). Sea surface temperatures in coastal waters in the United Kingdom were also warmer than in any previous autumn in the records. In some places in Norway, it was the warmest autumn since measurements started in 1867. In Denmark, autumn 2006 was the warmest since 1873 and had an average as high as 12.2 °C (anomaly +3.4 °C). It was also the warmest autumn in the Netherlands (13.6 °C), here for the last three centuries. According to the time series of Brussels-Uccle, Belgium, such a warm autumn statistically does not occur more frequently than once in 500 years. The same applies to other locations in Central Europe (e.g. in Germany). The areal mean in Germany was 12.0 °C (anomaly +3.2 °C), which is by far the highest since 1901 (Fig. 0.22). France recorded by far the warmest autumn since the start of the time series in 1950 (mean anomaly +2.9 °C). Switzerland again set another record: the previous record of autumn 1987 was exceeded by about 1 °C. Austria, too, measured the highest autumn mean temperatures ever, except for the regions of Styria and Carinthia. Bologna (Italy), had its second warmest autumn (anomaly +2.0 °C) since 1948 after autumn 2000. Portugal recorded the 3rd warmest summer after 1997 and 1983; the seasonal mean minimum reached the highest value for 76 years.

Autumn 2006 was also exceptional in eastern parts of the Region: Estonia had the second warmest autumn since 1865 (anomaly +2.8 °C). With a seasonal mean of 9.2 °C, autumn 2006 was the warmest in Latvia for the past 72 years. To find a warmer autumn, one has to go back to 1934 when it was half a degree warmer. Belarus, too, had an exceptional warm autumn

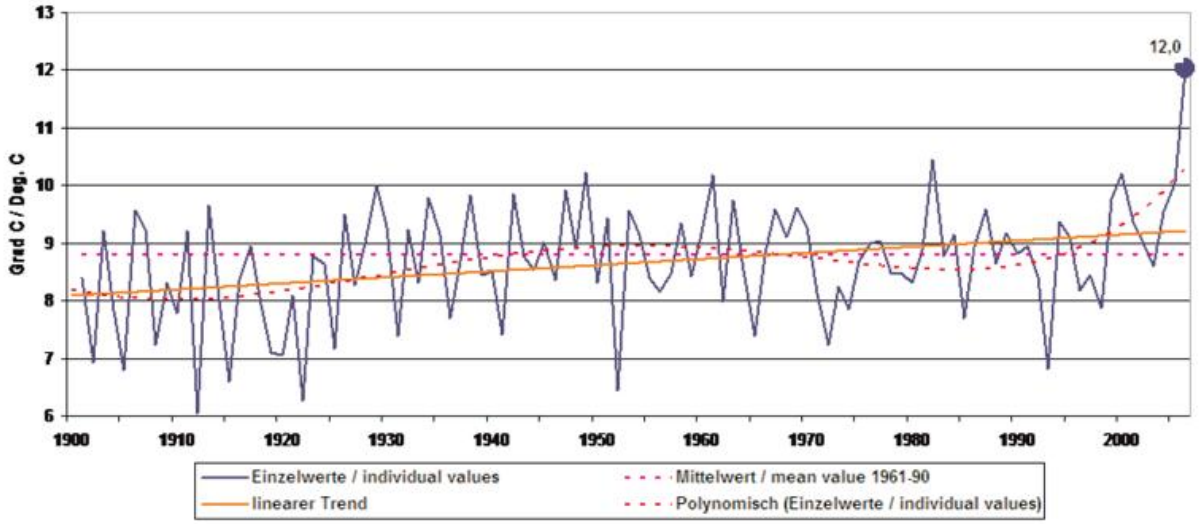


Fig. 0.22: *Autumn temperatures (°C) 1901-2006 in Germany with linear and polynomial trend. Source: Deutscher Wetterdienst*

which statistically occurs only once in 60 years. In most parts of European Russia, in contrast, this autumn was warm, but not like it was in 2005. In Zagreb-Gric (Croatia), autumn 2006 was the second warmest since 1862 after autumn 1926.

Precipitation

Precipitation anomalies in 2006 varied strongly from season to season.

Winter 2005/06 was dry (<80% of the normal) in almost the whole of western Europe, around the Baltic Sea, and in most of Turkey and Cyprus. It was wet in the north, i.e. in Greenland, Svalbard and western Iceland, but also in many places in the eastern half of the Region and the western Mediterranean.

Parts of western Norway received only 50% of the normal precipitation, while other parts of the country (Finnmarksvidda, Trøndelag) had considerably more than the normal, up to 238% (station Kautokeino).

In Ireland, it was particularly dry in the south of the country (Fig. 0.23). It was the driest winter since at least the early 1990s at most Irish stations and the driest since 1964 at both Mullingar and Kilkenny, and also in the United Kingdom.

Spring 2006 was mainly wet in most of the Region, except the west coast of Norway, the Baltic countries (e.g. Lithuania: 60-95% of the normal) and most of the south of the Region where it was partly very dry, e.g. in some parts of Italy.

A larger part of southeastern Norway received 125-150% of the normal, parts of west Norway only 70-80% of the normal precipitation. In lower parts of southern and eastern Norway the snow amount was the highest recorded for many years.

Some stations in Switzerland (e.g. Zurich and Berne), recorded the highest precipitation amounts in spring since 1864. In the western- and northernmost parts of Austria, precipitation totals amounted to up to 200% of the normal.

Summer 2006 was very dry in some larger areas, especially in most parts of northern Europe, the United Kingdom and Ireland, on the coasts of the western Mediterranean, and large parts of the southeast of the Region. Armenia recorded only 60% of the normal precipitation. Some wet areas occurred in eastern Central Europe, near the central and eastern Mediterranean and in parts of the Iberian Peninsula.

Fig. 0.23: *Percentage of normal rainfall (1961-1990) in Ireland in winter 2005/06. Source: Met Eireann, Ireland*

In southern and western parts of Finland, summer 2006 was the driest ever recorded. In Helsinki Kaisaniemi, the whole summer precipitation was only 35 mm which was the lowest summer total since 1845. Hailuoto station on the northwest coast of Finland recorded countrywide the lowest sum with 25 mm for the whole summer. The longest continuous period without any precipitation in Finland was observed in Kauhava in the west of the country. It was also very dry in northeastern Sweden: only 35 mm in Haparanda, near the Finnish border, during the whole summer, which is the lowest amount since 1860. This drought resulted in the largest forest fire since 1933 in Sweden with an area of about 15 km² devastated near Haparanda.

The precipitation totals in most parts of Lithuania fell to 45-95%, in the western borderland even down to 30%.

In the Netherlands, at least one meteorological station recorded 50 mm or more precipition on 13 days, which sets a new record.

Albania recorded an unusually wet summer, especially in mountainous areas.

Autumn 2006 was especially dry in Greenland, on the Norwegian west coast as well in the majority of Central Europe and most areas around the Mediterranean except the northeast. Most of the other parts of the Region were wetter than normal.

In parts of eastern Norway, autumn 2006 was the 4th or 5th wettest since 1867.

Precipitation amounts in Austria were only 40-80% of the normal in southern and eastern parts of the country, partly also in the north.

It was the driest autumn in Dubrovnik (Croatia) since 1961 (Fig. 0.24). Less than 50% of the precipitation was recorded in Albania.

In Portugal, autumn 2006 recorded the 3rd highest precipitation amount of all autumns since 1931. Some places recorded even the highest or second highest precipitation total with up to 300% above the normal (Fig. 0.25). In Spain, too, the autumn precipitation was rather plentiful that year; however, this was welcome after a long drought period that lasted for two years.

On one day Deir Elzour (Syria) recorded a precipitation total of 56 mm.

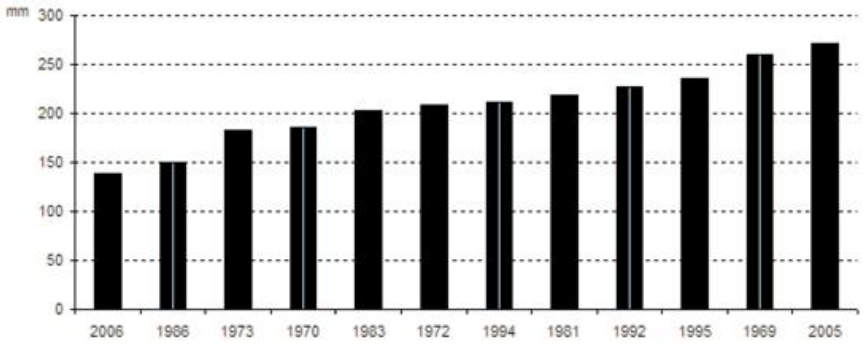


Fig. 0.24: *The driest autumns in Dubrovnik (Croatia), period 1961-2006 and their seasonal totals.*
Source: Meteorological and Hydrological Service, Croatia

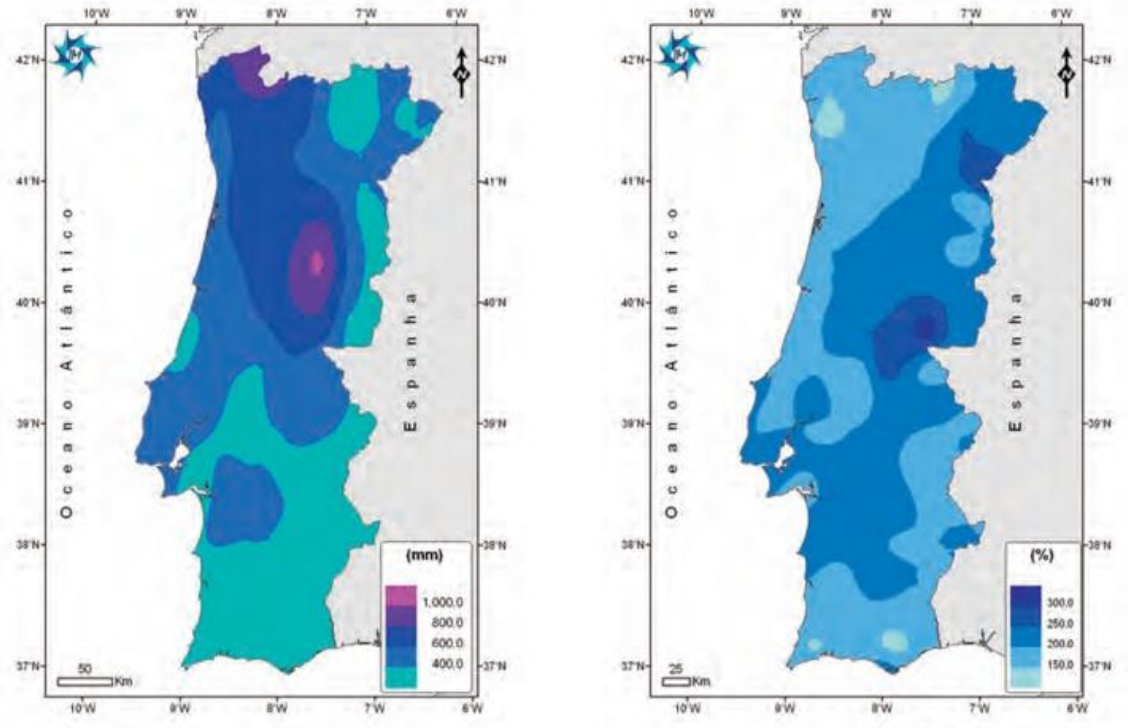


Fig. 0.25: *Precipitation totals (left) and percentage of the 1961-1990 normal (right) in Portugal in autumn 2006.*
Source: Institute of Meteorology, Portugal

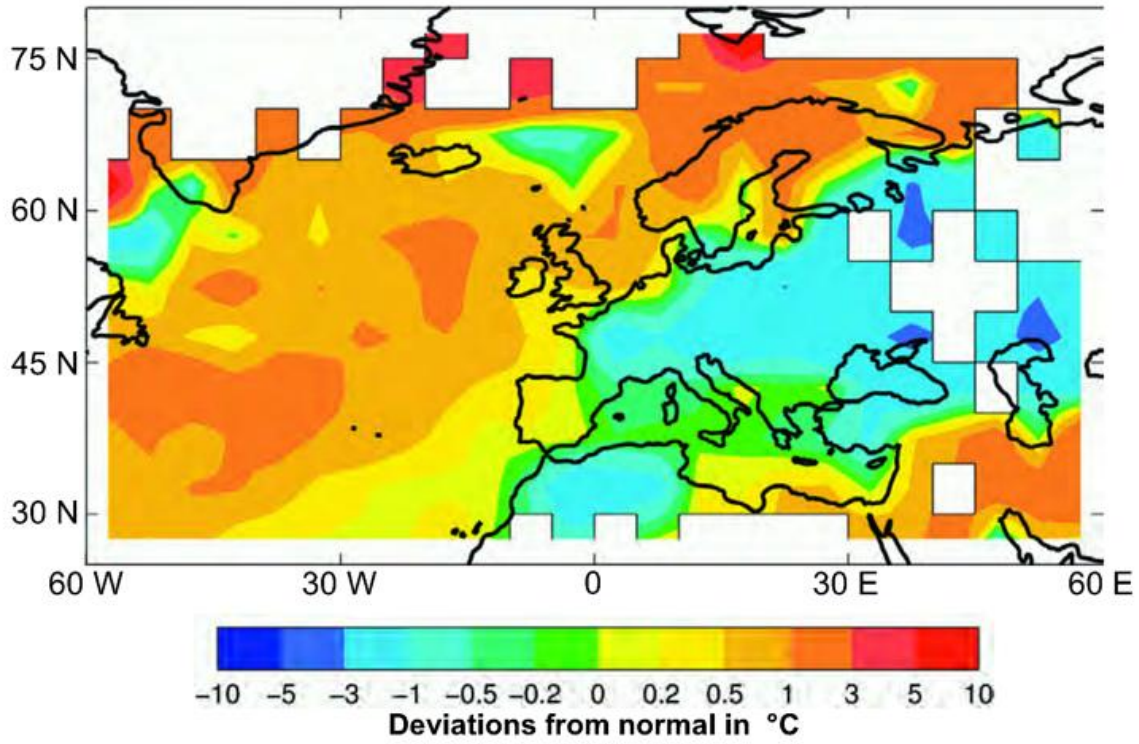
Seasonal Maps

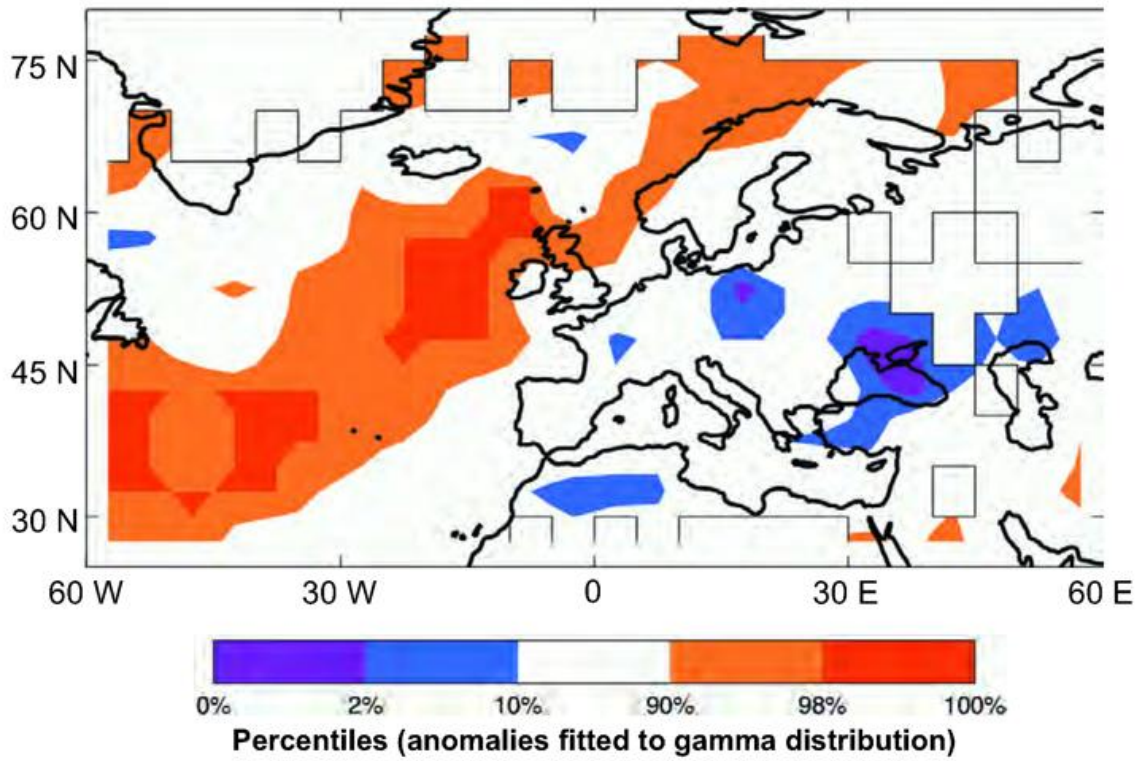
Surface temperature anomalies

Reference period: 1961-1990

Source: Hadley Centre of Climate Prediction and Research, U.K.

December 2005 - February 2006



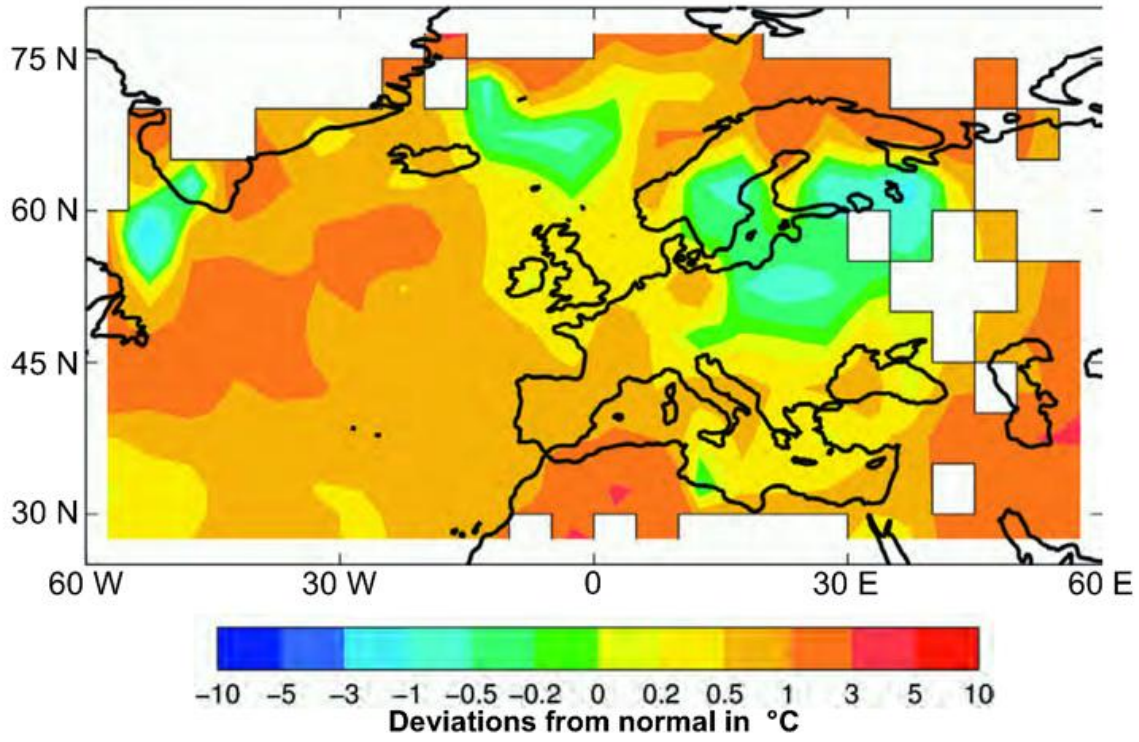


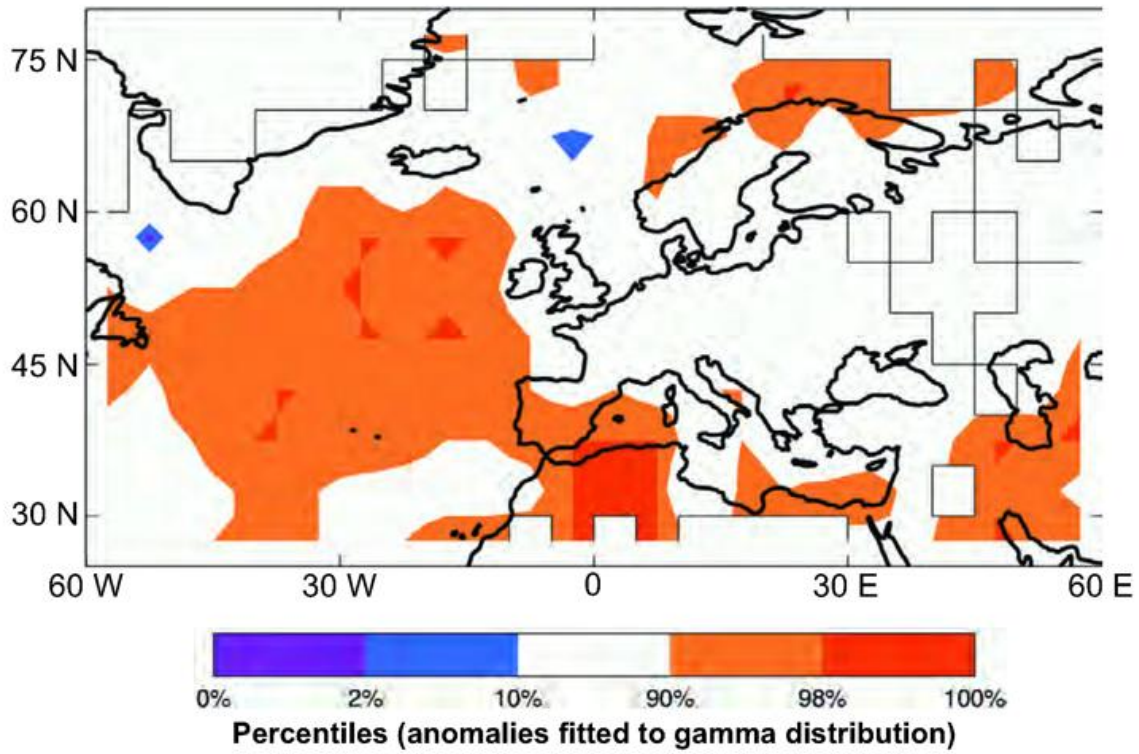
Surface temperature anomalies

Reference period: 1961-1990

Source: Hadley Centre of Climate Prediction and Research, U.K.

March 2006 - May 2006



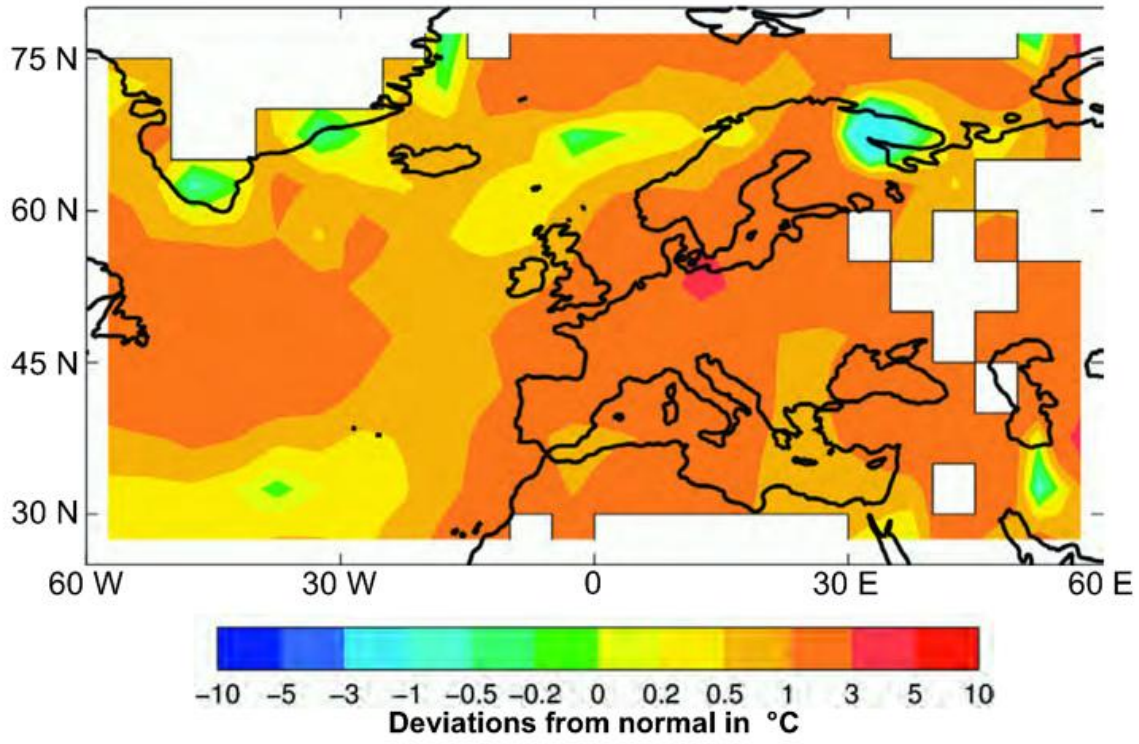


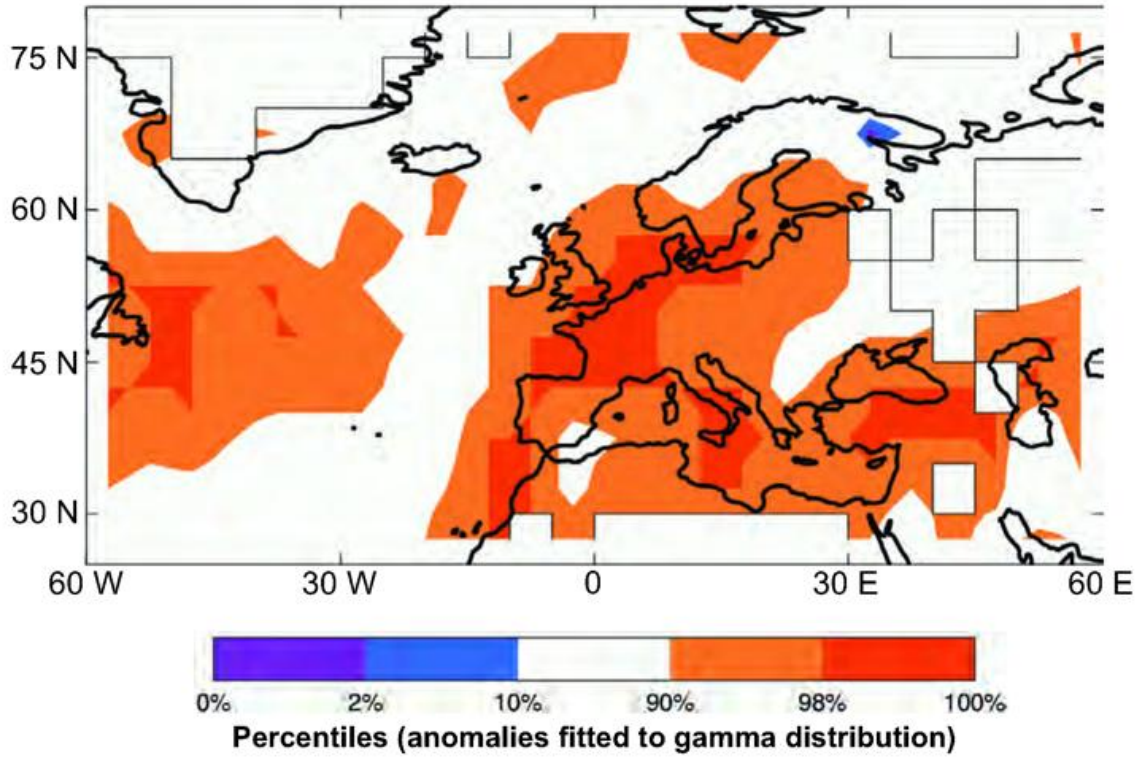
Surface temperature anomalies

Reference period: 1961-1990

Source: Hadley Centre of Climate Prediction and Research, U.K.

June 2006 - August 2006



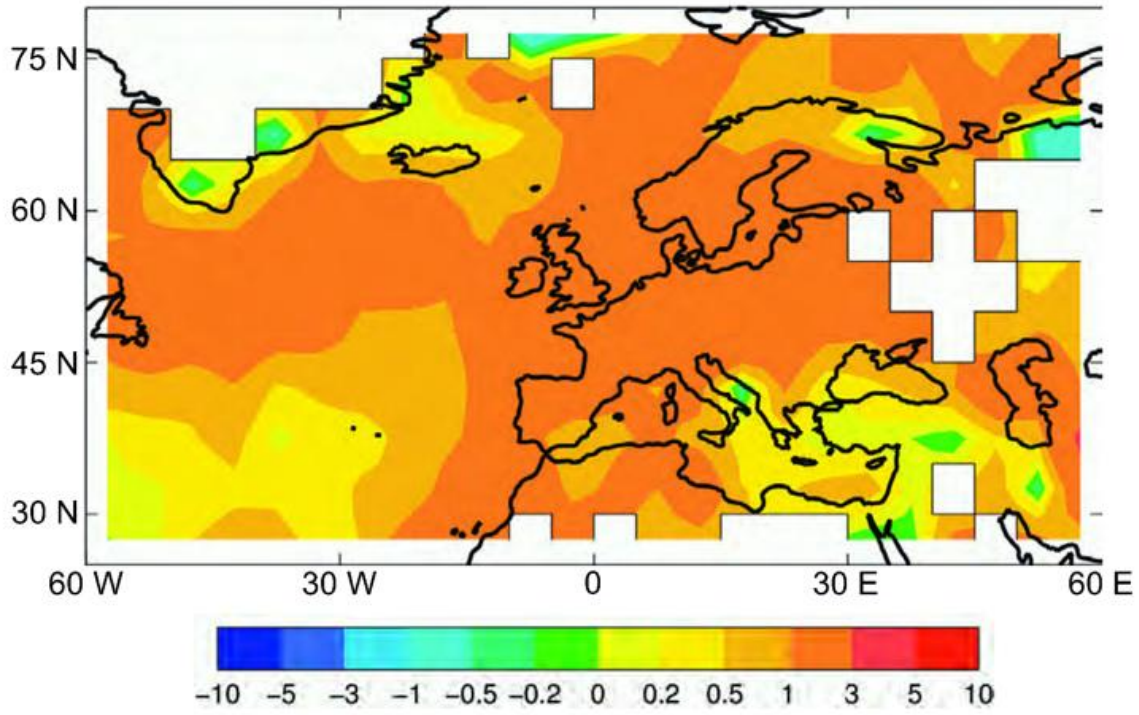


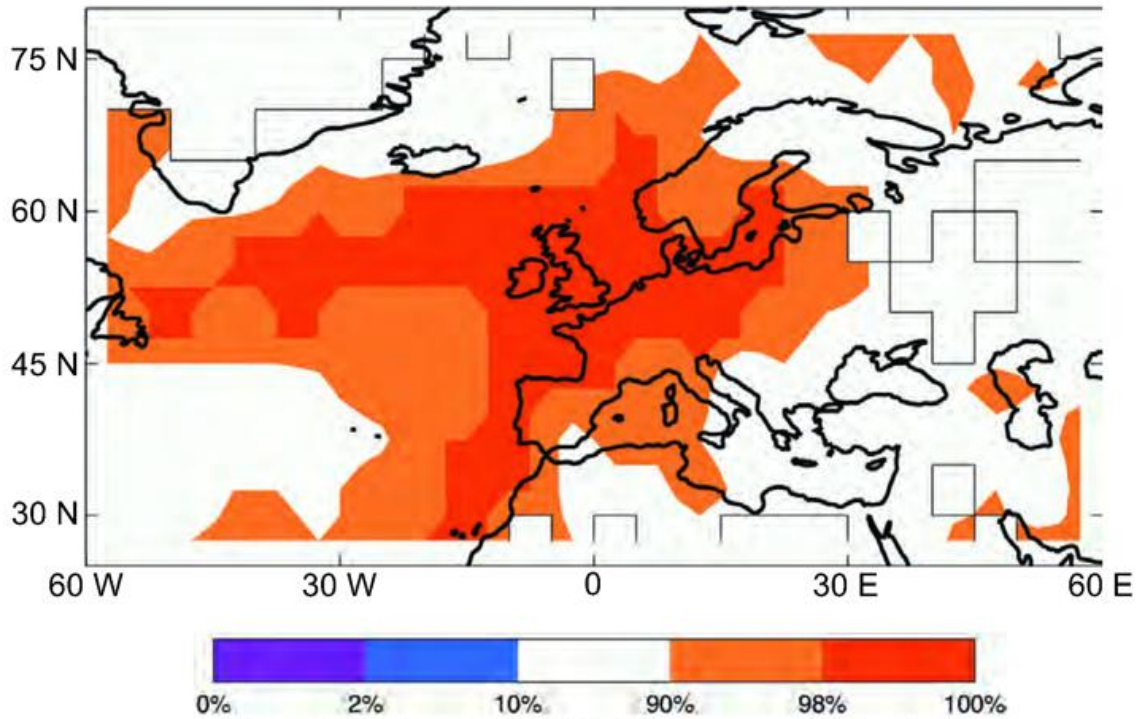
Surface temperature anomalies

Reference period: 1961-1990

Source: Hadley Centre of Climate Prediction and Research, U.K.

September 2006 - November 2006





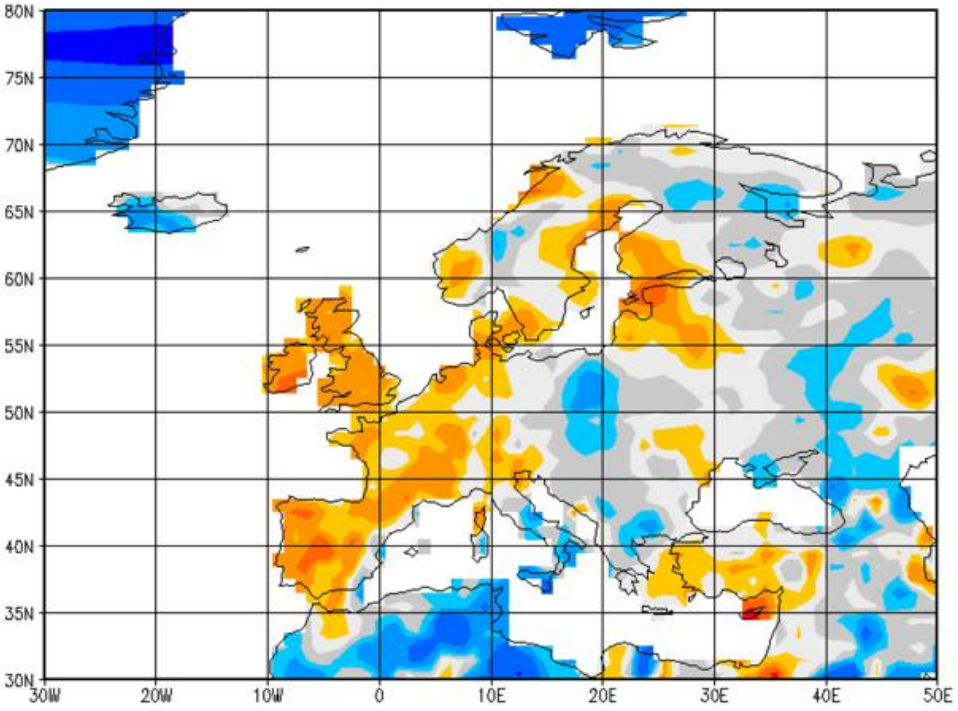
Percentiles (anomalies fitted to gamma distribution)

Precipitation in percent of normal

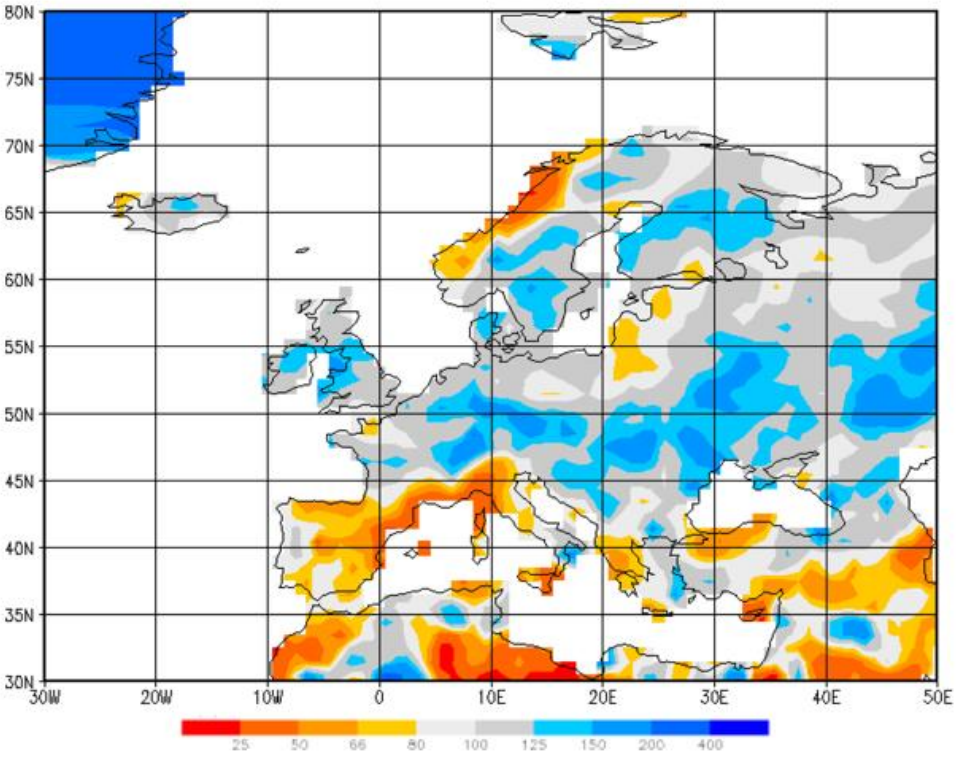
Gauge-based analysis 1.0 degree, reference period: 1961-1990

Source: GPCC / Deutscher Wetterdienst

December 2005 - February 2006



March 2006 - May 2006

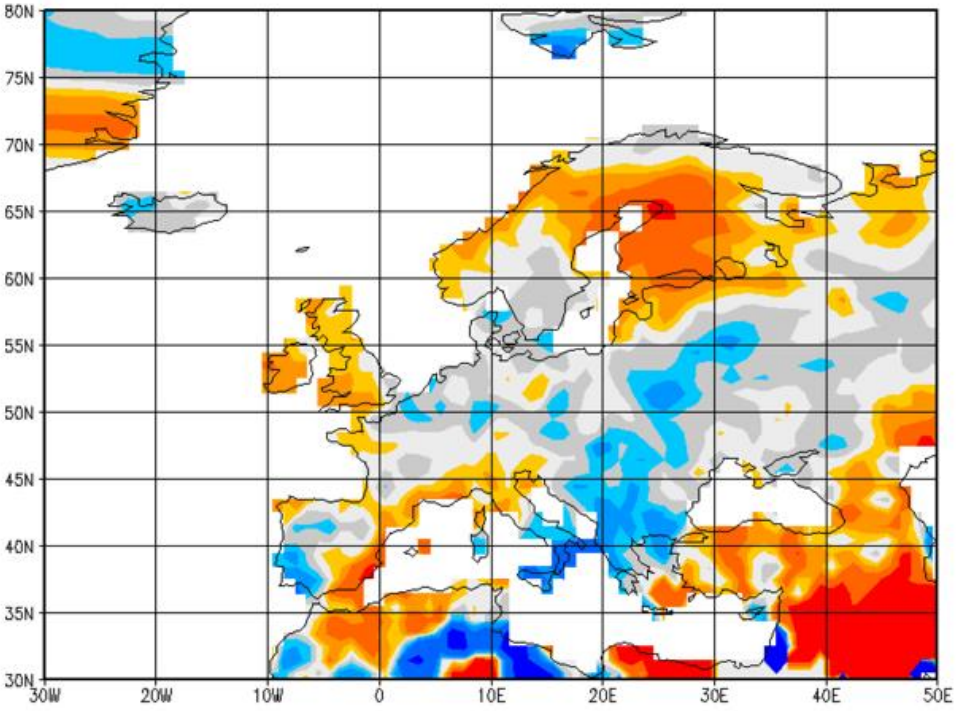


Precipitation in percent of normal

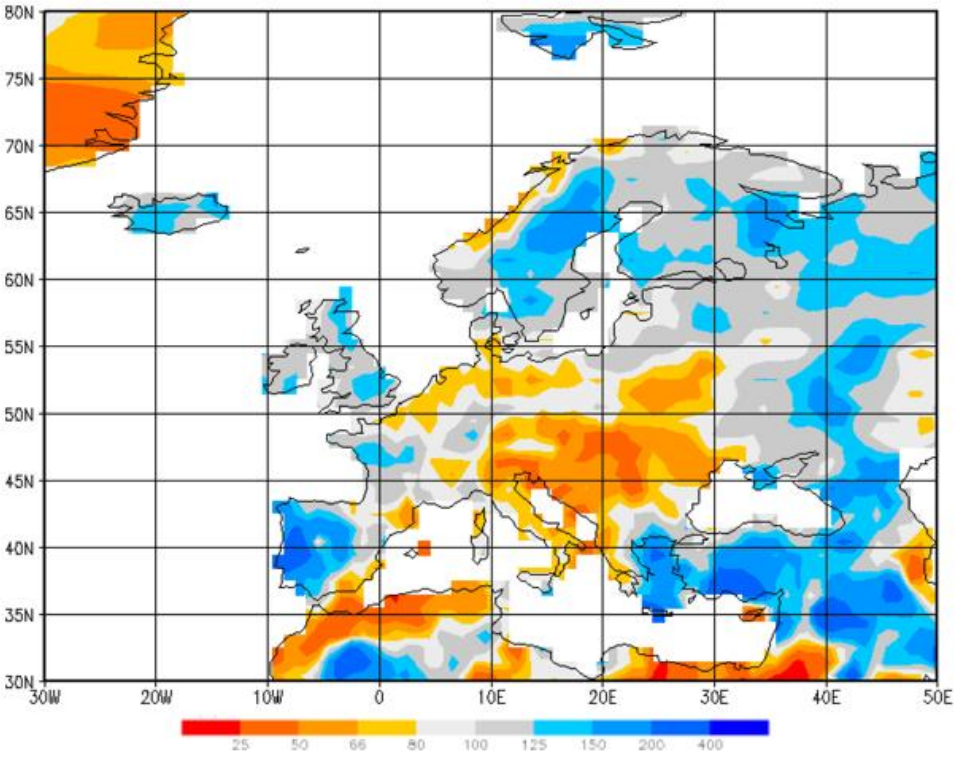
Gauge-based analysis 1.0 degree, reference period: 1961-1990

Source: GPCC / Deutscher Wetterdienst

June 2006 - August 2006



September 2006 - November 2006



Monthly and Annual Tables

Temperature and precipitation values with deviations from the 1961-1990 means
(some stations have shorter reference periods)

WMO No.	Station	January 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.	February 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.
01008	Svalbard/Spitsb.	-2,7	+12,7	26	12	-9,8	+5,9	20	1
01025	Tromsoe	0,2	+4,2	95	14	-2,3	+1,4	102	16
01492	Oslo	-2,4	+1,9	40	-9	-3,2	+0,8	64	28
02196	Haparanda	-7,7	+4,4	45	1	-12,0	-0,7	16	-16
02485	Stockholm	-2,3	+0,5	11	-28	-2,6	+0,4	28	1
02974	Helsinki	-4,9	+2,0	18	-23	-9,2	-2,4	17	-14
03091	Aberdeen	4,7	+2,0	21	-60	4,0	+1,1	59	8
03772	London	5,4	+1,2	17	-35	4,7	+0,2	41	6
03967	Dublin Casement Aerodrome	5,6	+1,2	18	-48	4,8	+0,4	45	-6
04030	Reykjavik	2,0	+2,5	153	77	3,3	+2,9	87	15
04320	Danmarkshavn	-15,9	+7,2	93	82	-24,8	-0,5	17	6
04360	Angmagssalik	-7,5	0,0	120	8	-5,2	+2,5	54	-37
06186	Copenhagen	-0,6	-1,1	16	-35	0,6	+0,1	21	-10
06260	De Bilt	1,5	-0,7	15	-51	2,9	+0,4	59	10
06447	Brussels	1,7	-0,9	19	-48	2,3	-1,2	83	30
06590	Luxemburg	-1,0	-1,0	26	-45	0,5	-0,6	49	-13
06660	Zurich	-2,2	-1,7	25	-42	0,0	-0,9	56	-14
06700	Geneva	0,3	-0,7	23	-46	1,4	-1,1	72	2
07510	Bordeaux	5,3	-0,5	49	-51	5,0	-2,1	100	14
07650	Marseilles	6,3	-0,4	56	9	6,5	-1,4	19	-35
08222	Madrid	5,6	-0,5	36	-10	6,7	-0,8	35	-9
08314	Mahon/Minorca	9,7	-0,8	52	-14	9,8	-0,9	63	6
08495	Gibraltar	12,5	-0,9	166	45	12,9	-0,9	75	-25
08515	Santa Maria/Azores	15,1	+0,7	54	-46	14,9	+0,9	146	60
08535	Lisbon	10,2	-1,2	54	-56	11,2	-1,1	76	-35
10384	Berlin-Tempelhof	-3,7	-3,5	21	-22	0,1	-0,7	43	9
11035	Vienna	-3,3	-2,6	48	10	-0,6	-1,9	35	-7
11518	Prague	-5,4	-3,0	9	-14	-1,9	-1,1	18	-5
11903	Slica	-7,5	-3,6	44	0	-3,7	-2,6	37	-7
12160	Elblag	-7,3	-4,9	16	-31	-2,0	+0,2	35	10
12375	Warsaw	-8,3	-5,0	21	-1	-3,2	-1,2	30	9
12843	Budapest	-2,4	-0,8	33	1	-0,7	-1,8	44	12
13274	Belgrade	-0,5	-0,9	44	-5	1,9	-0,8	64	20
14015	Ljubljana	-1,6	-0,5	47	-35	0,5	-0,9	47	-33
14445	Split	6,7	-0,7	58	-25	7,7	-0,4	76	8
14654	Sarajevo	-2,1	-1,2	36	-35	0,5	-1,0	54	-13
15420	Bucharest	-4,0	-1,6	40	0	-1,2	-1,1	46	10
15614	Sofia	-2,7	-1,1	36	9	-0,4	-0,9	38	5
16158	Pisa	4,4	-1,7	87	12	6,9	-0,2	96	23
16597	Luqa	12,4	+0,2	216	127	11,9	-0,5	37	-24
16716	Athens	7,6	-2,6	64	20	10,1	-0,5	28	-15
16754	Heraklion/Crete	10,8	-1,2	82	-8	12,0	-0,1	104	27
17062	Istanbul	4,4	-1,2	104	5	5,8	-0,1	106	39
17130	Ankara	-1,7	-1,8	36	-11	0,4	-1,5	67	31
17170	Van	-3,1	+1,1	90	55	-1,3	+2,1	48	14
17300	Antalya	9,0	-0,9	319	80	11,1	+0,8	85	-106
17609	Larnaka	11,8	+0,3	93	28	12,7	+1,0	17	-40
22113	Murmansk	-7,1	+4,6	28	-5	-10,8	+0,4	12	-10
26038	Tallinn	-3,7	+1,8	10	-35	-7,3	-1,6	36	7
26629	Kaunas	-7,2	-2,2	20	-17	-6,3	-2,0	18	-9
26730	Vilnius	-7,8	-1,7	9	-32	-7,5	-2,7	34	-4
26850	Minsk	-8,4	-1,5	8	-32	-8,4	-2,6	29	-5
27595	Kasan	-16,1	-3,0	24	-9	-13,8	-2,3	41	13
27612	Moscow	-10,8	-1,5	24	-18	-13,3	-5,6	36	-1
33345	Kiev	-7,5	-1,9	17	-30	-6,1	-1,9	33	-13
33815	Kisinev	-6,6	-3,3	39	-1	-3,1	-1,4	22	-16
34300	Kharkiv (Charkow)	-9,8	-2,9	28	-16	-9,0	-3,3	35	3
34880	Astrakhan	-11,2	-5,8	20	7	-4,2	+0,7	7	-3
35188	Akmola	-23,0	-7,2	14	-3	-10,7	+5,2	17	3
37789	Yerevan	-4,1	-0,9	61	32	-1,5	-0,5	46	8
40080	Damascus	6,6	+0,7	16	-13	9,1	+1,2	31	7
40180	Tel Aviv	13,1	+0,8	179	30	14,7	+1,8	52	-46
40199	Eilat	15,2	0,0	2	-3	18,2	+1,3	0	-5
40265	Mafraq	8,2	+1,0	20	-14	10,0	+1,3	25	-6
60030	L.Palmas/Gran Can.	16,6	-0,9	124	107	17,6	0,0	25	3

WMO No.	Station	March 2006 Temp. mean	March 2006 (°C) dev.	March 2006 Prec. total	March 2006 (mm) dev.	April 2006 Temp. mean	April 2006 (°C) dev.	April 2006 Prec. total	April 2006 (mm) dev.
01008	Svalbard/Spitsb.	-13,1	+1,6	4	-17	0,0	+11,7	7	-5
01025	Tromsoe	-4,3	-2,1	84	20	3,0	+2,3	13	-47
01492	Oslo	-3,4	-3,2	48	2	4,8	+0,2	57	15
02196	Haparanda	-10,2	-3,4	8	-27	1,8	+2,3	35	6
02485	Stockholm	-2,9	-3,0	26	0	5,4	+0,8	26	-4
02974	Helsinki	-6,6	-3,7	31	-3	3,8	+0,9	35	-2
03091	Aberdeen	3,2	-1,3	118	60	7,1	+0,8	24	-29
03772	London	6,0	-0,5	45	-2	10,0	+1,1	33	-12
03967	Dublin Casement Aerodrome	5,6	-0,4	53	4	7,9	+0,1	28	-19
04030	Reykjavik	0,9	+0,4	52	-30	2,0	-0,9	71	13
04320	Danmarkshavn	-22,0	+1,4	29	12	-10,1	+7,2	47	37
04360	Angmagssalik	-6,1	+2,1	70	-18	-3,6	+0,5	39	-34
06186	Copenhagen	0,2	-2,4	25	-17	6,6	0,0	36	-6
06260	De Bilt	3,9	-1,1	104	41	9,0	+1,0	40	-12
06447	Brussels	4,5	-1,0	65	11	9,3	+0,5	46	-11
06590	Luxemburg	2,9	-1,1	95	25	8,7	+1,2	51	-10
06660	Zurich	3,1	-1,1	169	100	8,8	+1,0	189	102
06700	Geneva	5,1	-0,2	138	57	10,2	+1,2	117	51
07510	Bordeaux	10,4	+1,6	185	109	12,4	+1,1	27	-45
07650	Marseilles	10,5	+0,3	5	-39	15,0	+1,8	2	-46
08222	Madrid	11,2	+1,2	34	1	14,9	+2,7	46	-8
08314	Mahon/Minorca	12,4	+0,8	29	-26	15,6	+2,3	8	-42
08495	Gibraltar	15,3	+0,3	104	29	17,1	+0,9	54	-6
08515	Santa Maria/Azores	15,8	+1,2	74	-5	15,5	+0,3	60	5
08535	Lisbon	14,1	+0,4	126	57	16,8	+1,7	51	-13
10384	Berlin-Tempelhof	1,7	-2,5	32	-5	9,3	+0,7	46	5
11035	Vienna	3,4	-1,9	79	38	11,6	+1,4	72	22
11518	Prague	1,1	-1,9	35	7	8,8	+1,1	54	16
11903	Slica	0,7	-2,3	33	-9	10,2	+1,7	45	-2
12160	Elblag	-0,9	-3,0	20	-15	7,4	+0,6	75	33
12375	Warsau	-0,6	-2,6	14	-14	9,1	+1,3	35	3
12843	Budapest	4,6	-1,0	28	-1	13,3	+2,2	32	-6
13274	Belgrade	6,5	-0,7	104	54	13,6	+1,2	97	38
14015	Ljubljana	4,4	-1,0	129	31	11,5	+1,6	119	10
14445	Split	9,3	-1,1	57	-18	15,3	+1,4	59	-7
14654	Sarajevo	4,0	-1,1	135	65	10,6	+1,2	77	3
15420	Bucharest	4,6	-0,2	68	30	11,3	0,0	60	14
15614	Sofia	5,0	+0,4	78	40	11,0	+1,1	22	-28
16158	Pisa	8,8	-0,7	22	-54	12,8	+0,3	23	-56
16597	Luqa	13,3	-0,1	26	-15	16,6	+1,1	3	-20
16716	Athens	12,8	+0,2	40	-1	16,9	+0,8	29	4
16754	Heraklion/Crete	13,6	+0,2	22	-34	16,7	+0,4	47	17
17062	Istanbul	8,6	+1,1	93	31	12,8	+0,8	17	-32
17130	Ankara	7,5	+1,4	40	4	13,1	+1,9	29	-19
17170	Van	3,0	+1,9	46	3	9,8	+2,5	40	-14
17300	Antalya	13,3	+0,6	78	-24	17,2	+1,1	87	39
17609	Larnaka	14,1	+0,8	27	-22	17,9	+0,5	24	13
22113	Murmansk	-8,0	-1,2	36	16	1,8	+3,7	13	-8
26038	Tallinn	-4,9	-2,7	46	17	5,0	+1,6	27	-9
26629	Kaunas	-2,7	-2,5	22	-10	6,5	+0,5	29	-14
26730	Vilnius	-3,4	-2,8	30	-9	6,2	+0,5	48	2
26850	Minsk	-3,1	-1,7	43	1	7,0	+1,0	30	-12
27595	Kasan	-5,2	+0,1	71	45	5,5	+0,9	37	1
27612	Moscow	-3,7	-1,5	47	13	6,0	+0,2	44	4
33345	Kiev	0,0	-0,7	62	23	9,7	+1,0	30	-19
33815	Kisinev	2,7	-0,2	89	54	10,9	+0,7	37	-5
34300	Kharkiv (Charkow)	-0,3	0,0	48	21	9,1	+0,2	12	-24
34880	Astrakhan	3,6	+2,3	17	3	11,7	+0,6	28	10
35188	Akmola	-1,6	+6,5	15	1	7,4	+2,5	29	7
37789	Yerevan	8,3	+3,2	14	-27	13,1	+1,5	82	31
40080	Damascus	12,6	+1,6	3	-14	16,6	+1,1	23	12
40180	Tel Aviv	16,1	+1,2	3	-59	19,0	+0,8	92	69
40199	Eilat	21,1	+1,1	0	-4	24,4	+0,2	0	-4
40265	Mafraq	12,6	+1,1	1	-28	16,2	+0,4	22	12
60030	L.Palmas/Gran Can.	17,9	-0,5	4	-6	19,4	+0,7	17	11

WMO No.	Station	May 2006 Temp. mean	May 2006 (°C) dev.	May 2006 Prec. total	May 2006 (mm) dev.	June 2006 Temp. mean	June 2006 (°C) dev.	June 2006 Prec. total	June 2006 (mm) dev.
01008	Svalbard/Spitsb.	0,9	+4,6	4	-2	4,8	+2,6	13	3
01025	Tromsoe	7,0	+2,1	27	-21	9,1	-0,2	71	18
01492	Oslo	12,0	+1,2	80	28	16,0	+0,8	58	-7
02196	Haparanda	7,6	+1,5	41	10	13,0	+0,2	6	-35
02485	Stockholm	11,4	+0,7	42	12	17,0	+1,4	31	-14
02974	Helsinki	10,7	+0,8	42	7	16,3	+1,4	28	-16
03091	Aberdeen	9,1	+0,1	38	-21	13,6	+1,5	28	-25
03772	London	13,9	+1,4	92	41	18,3	+2,6	12	-39
03967	Dublin Casement Aerodrome	11,2	+0,7	75	17	15,1	+1,8	20	-28
04030	Reykjavik	6,4	+0,1	33	-11	9,4	+0,4	58	8
04320	Danmarkshavn	-4,8	+1,8	7	3	-1,5	-2,2	1	-4
04360	Angmagssalik	0,6	0,0	20	-37	4,8	+0,7	45	-7
06186	Copenhagen	12,3	+0,3	51	8	16,9	+0,8	11	-43
06260	De Bilt	14,5	+2,2	90	29	16,7	+1,5	18	-50
06447	Brussels	14,2	+1,3	116	45	17,3	+1,6	26	-53
06590	Luxemburg	13,4	+1,6	143	62	17,7	+2,8	65	-17
06660	Zurich	13,3	+1,2	74	-29	17,7	+2,5	42	-82
06700	Genava	14,5	+1,3	110	32	19,5	+2,8	50	-41
07510	Bordeaux	16,4	+1,8	47	-30	21,3	+3,5	25	-31
07650	Marseilles	19,1	+2,0	8	-34	22,9	+2,0	3	-25
08222	Madrid	19,7	+3,7	16	-25	23,4	+2,7	30	4
08314	Mahon/Minorca	18,3	+1,5	4	-33	22,6	+1,8	6	-8
08495	Gibraltar	19,4	+0,9	1	-34	21,5	+0,4	3	-8
08515	Santa Maria/Azores	17,5	+0,8	79	49	18,7	0,0	38	16
08535	Lisbon	19,6	+2,2	<1	-39	21,1	+0,9	44	23
10384	Berlin-Tempelhof	14,4	+0,5	61	5	18,8	+1,4	13	-62
11035	Vienna	14,9	+0,1	76	15	19,4	+1,4	66	-8
11518	Prague	13,4	+0,7	108	31	17,2	+1,3	63	-10
11903	Slica	13,3	-0,4	103	39	17,7	+1,1	78	-7
12160	Elblag	13,3	+0,4	61	20	16,3	+0,9	60	-34
12375	Warsaw	14,2	+0,8	38	-21	18,2	+1,6	15	-57
12843	Budapest	15,9	-0,1	91	36	20,3	+1,2	169	106
13274	Belgrade	17,2	0,0	41	-30	20,1	0,0	138	48
14015	Ljubljana	15,5	+0,9	177	55	20,5	+2,7	46	-109
14445	Split	19,7	+1,3	52	-4	23,4	+1,2	45	-6
14654	Sarajevo	14,5	+0,4	60	-22	16,9	0,0	78	-13
15420	Bucharest	16,0	-0,7	32	-38	20,2	0,0	30	-47
15614	Sofia	15,3	+1,0	18	-55	18,0	+0,3	144	72
16158	Pisa	17,3	+1,0	48	-11	21,1	+1,3	0	-44
16597	Luqa	20,8	+1,7	2	-5	24,2	+1,2	1	-2
16716	Athens	21,3	+0,7	<1	-16	25,9	+0,8	21	14
16754	Heraklion/Crete	20,3	+0,5	1	-15	24,2	+0,7	0	-3
17062	Istanbul	17,3	+0,8	2	-29	22,0	+0,9	45	24
17130	Ankara	16,6	+1,1	30	-25	21,6	+2,0	32	-5
17170	Van	14,6	+1,9	35	-14	21,5	+3,9	<1	-21
17300	Antalya	21,0	+0,7	12	-16	25,9	+0,9	22	13
17609	Larnaka	21,8	+0,9	2	-5	25,6	+1,3	<1	<1
22113	Murmansk	5,6	+1,8	48	16	11,4	+2,0	50	-3
26038	Tallinn	10,1	+0,4	23	-14	15,9	+1,4	21	-32
26629	Kaunas	12,5	-0,2	75	19	16,5	+0,5	18	-57
26730	Vilnius	12,3	-0,2	46	-16	16,5	+0,7	21	-56
26850	Minsk	12,5	-0,4	75	13	17,0	+0,9	59	-24
27595	Kasan	13,6	+0,4	57	20	20,9	+3,6	30	-40
27612	Moscow	12,4	-0,5	56	-2	18,2	+1,6	55	-21
33345	Kiev	14,4	-0,7	130	77	18,4	+0,2	119	46
33815	Kisinev	15,7	-0,4	97	46	19,8	+0,4	82	7
34300	Kharkiv (Charkow)	15,4	-0,2	46	-1	20,6	+1,7	51	-7
34880	Astrakhan	17,3	-1,0	36	12	26,2	+3,3	6	-16
35188	Akmola	14,0	+0,9	29	-4	21,3	+2,3	52	17
37789	Yerevan	18,2	+1,9	26	-34	25,9	+5,3	3	-26
40080	Damascus	21,7	+1,5	1	-3	25,7	+1,1	0	<1
40180	Tel Aviv	21,6	+0,5	0	-3	25,1	+1,1	0	0
40199	Eilat	28,5	+0,1	0	-1	32,5	+0,8	0	0
40265	Mafraq	20,7	+0,9	0	-3	24,0	+1,3	0	0
60030	L.Palmas/Gran Can.	20,8	+0,9	<1	-2	21,7	+0,3	0	0

WMO No.	Station	July 2006 Temp. mean	July 2006 (°C) dev.	July 2006 Prec. total (mm)	July 2006 dev.	August 2006 Temp. mean	August 2006 (°C) dev.	August 2006 Prec. total (mm)	August 2006 dev.
01008	Svalbard/Spitsb.	7,5	+1,5	20	7	6,6	+1,8	30	5
01025	Tromsoe	10,7	-1,0	77	5	11,4	+0,5	21	-61
01492	Oslo	20,0	+3,6	37	-47	18,1	+2,9	114	24
02196	Haparanda	15,7	+0,2	18	-32	17,1	+3,8	8	-55
02485	Stockholm	20,8	+3,6	32	-40	19,2	+3,0	145	79
02974	Helsinki	19,1	+2,5	4	-69	18,4	+3,4	38	-42
03091	Aberdeen	16,9	+3,1	18	-42	14,7	+1,1	50	-25
03772	London	22,4	+4,6	24	-22	17,8	+0,4	69	18
03967	Dublin Casement Aerodrome	17,7	+2,8	14	-40	15,4	+0,8	66	-12
04030	Reykjavik	11,1	+0,5	43	-9	11,4	+1,1	43	-19
04320	Danmarkshavn	4,2	+0,5	35	21	2,7	+0,3	15	1
04360	Angmagssalik	6,1	-0,3	26	-23	7,4	+1,4	104	43
06186	Copenhagen	21,7	+4,5	26	-43	18,1	+1,1	158	95
06260	De Bilt	22,3	+5,5	15	-60	16,4	-0,3	181	110
06447	Brussels	23,0	+5,5	48	-27	16,3	-1,0	202	139
06590	Luxemburg	23,5	+6,6	12	-56	15,1	-1,3	175	103
06660	Zurich	22,5	+4,9	47	-70	14,7	-2,0	185	52
06700	Geneva	23,7	+4,4	48	-20	16,8	-1,6	137	57
07510	Bordeaux	24,7	+4,5	46	-1	19,4	-0,5	72	18
07650	Marseilles	27,9	+4,1	9	-5	23,3	+0,1	7	-22
08222	Madrid	27,2	+2,8	8	-5	24,1	+0,2	10	1
08314	Mahon/Minorca	26,7	+2,5	<1	-4	24,7	+0,2	2	-24
08495	Gibraltar	24,7	+1,0	2	1	24,3	+0,1	6	0
08515	Santa Maria/Azores	21,6	+0,8	12	-13	22,6	+0,4	92	52
08535	Lisbon	23,9	+1,5	<1	-5	24,3	+1,5	3	-3
10384	Berlin-Tempelhof	24,4	+5,6	56	4	17,7	-0,7	76	15
11035	Vienna	23,9	+4,0	38	-24	17,7	-1,5	212	147
11518	Prague	22,1	+4,6	28	-38	15,8	-1,2	95	25
11903	Slica	21,4	+3,2	31	-28	17,1	-0,2	82	13
12160	Elblag	21,6	+4,8	36	-58	17,5	+0,8	118	37
12375	Warsaw	23,5	+5,6	20	-47	17,9	+0,6	165	102
12843	Budapest	24,4	+3,5	20	-32	19,3	-1,0	155	104
13274	Belgrade	24,6	+2,9	23	-43	21,0	-0,3	121	69
14015	Ljubljana	23,6	+3,7	105	-17	17,7	-1,4	225	81
14445	Split	27,7	+2,3	8	-20	24,1	-1,1	128	78
14654	Sarajevo	19,4	+0,5	116	37	18,0	-0,5	173	102
15420	Bucharest	22,5	+0,5	64	0	21,5	+0,3	70	12
15614	Sofia	20,4	+0,4	88	32	20,6	+1,2	63	11
16158	Pisa	26,2	+3,4	41	18	22,7	+0,2	125	68
16597	Luqa	27,0	+1,1	<1	<1	26,6	+0,3	1	-6
16716	Athens	28,2	+0,4	2	-3	29,2	+1,6	0	-5
16754	Heraklion/Crete	25,5	-0,2	0	-1	27,7	+2,1	0	-1
17062	Istanbul	23,9	+0,7	1	-18	26,1	+3,1	33	7
17130	Ankara	23,2	+0,3	2	-12	27,2	+4,6	<1	-12
17170	Van	22,3	+0,4	22	18	24,1	+2,9	2	-5
17300	Antalya	28,9	+0,8	<1	-5	28,8	+1,1	3	1
17609	Larnaka	27,5	+0,6	2	2	28,0	+0,9	1	1
22113	Murmansk	11,9	-0,9	98	38	11,8	+0,8	33	-32
26038	Tallinn	19,0	+2,7	28	-51	17,7	+2,4	45	-39
26629	Kaunas	20,9	+3,8	71	3	17,8	+1,5	166	103
26730	Vilnius	20,8	+3,9	45	-33	17,6	+1,3	152	80
26850	Minsk	20,4	+3,1	76	-12	17,7	+1,2	255	183
27595	Kasan	18,1	-1,3	63	-6	18,5	+1,3	72	5
27612	Moscow	18,0	-0,1	35	-57	17,5	+1,1	129	55
33345	Kiev	21,0	+1,7	68	-20	19,9	+1,3	52	-17
33815	Kisinev	22,1	+1,2	53	-16	22,1	+1,6	68	23
34300	Kharkiv (Charkow)	20,9	+0,6	27	-33	22,5	+3,0	40	-10
34880	Astrakhan	24,6	-0,7	5	-18	27,1	+3,8	<1	-19
35188	Akmola	18,8	-2,5	39	-11	17,6	-0,1	9	-31
37789	Yerevan	24,9	+0,3	65	51	28,8	+4,9	0	-9
40080	Damascus	26,9	+0,6	0	0	27,8	+1,8	0	0
40180	Tel Aviv	26,8	+1,1	0	0	27,5	+1,4	0	0
40199	Eilat	33,6	+0,7	0	0	34,9	+2,1	0	0
40265	Mafraq	24,4	+0,3	0	0	25,7	+1,5	0	0
60030	L.Palmas/Gran Can.	23,5	+0,2	<1	<1	24,4	+0,3	<1	<1

WMO No.	Station	September 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.	October 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.
01008	Svalbard/Spitsb.	1,7	+1,2	12	-11	-5,5	0,0	12	-3
01025	Tromsoe	7,9	+1,1	92	-2	1,6	-1,3	105	-20
01492	Oslo	15,0	+4,2	57	-33	8,5	+2,1	163	79
02196	Haparanda	9,5	+1,6	57	-6	0,5	-2,0	70	6
02485	Stockholm	15,6	+4,4	23	-32	9,8	+2,3	90	40
02974	Helsinki	13,7	+3,7	24	-49	7,5	+2,1	193	120
03091	Aberdeen	14,5	+2,8	52	-16	11,4	+1,5	138	61
03772	London	18,6	+3,6	78	27	14,6	+2,9	64	6
03967	Dublin Casement Aerodrome	15,5	+2,5	74	5	12,0	+1,7	87	19
04030	Reykjavik	10,5	+3,1	64	-3	4,8	+0,4	106	20
04320	Danmarkshavn	-3,2	+1,0	8	-3	-12,8	+0,8	10	-2
04360	Angmagssalik	4,4	+1,3	64	-4	-0,5	+0,3	25	-57
06186	Copenhagen	17,0	+3,4	31	-31	12,8	+2,9	58	-1
06260	De Bilt	17,9	+3,9	9	-58	13,6	+3,1	109	37
06447	Brussels	18,4	+3,9	9	-50	14,2	+3,3	56	-14
06590	Luxemburg	17,5	+4,1	17	-53	12,8	+3,7	92	17
06660	Zurich	16,9	+3,1	110	18	12,7	+3,4	63	-6
06700	Geneva	18,0	+2,9	61	-21	13,6	+3,3	105	27
07510	Bordeaux	20,5	+2,6	98	24	17,2	+3,2	55	-33
07650	Marseilles	21,7	+1,4	94	47	18,8	+2,7	40	-38
08222	Madrid	21,9	+1,4	7	-23	16,8	+2,0	119	74
08314	Mahon/Minorca	23,1	+0,9	60	6	20,8	+2,3	19	-65
08495	Gibraltar	23,1	+0,3	6	-9	20,5	+1,0	134	70
08515	Santa Maria/Azores	22,0	+0,6	76	19	19,7	+0,4	189	105
08535	Lisbon	22,1	+0,4	57	31	19,6	+1,1	247	167
10384	Berlin-Tempelhof	18,5	+3,9	13	-33	12,8	+2,8	26	-10
11035	Vienna	17,5	+2,1	17	-28	12,3	+2,4	11	-30
11518	Prague	16,6	+3,3	10	-30	10,8	+2,5	29	-1
11903	Slica	15,9	+2,5	14	-42	9,7	+1,4	15	-35
12160	Elblag	16,8	+4,1	42	-28	11,0	+2,1	33	-20
12375	Warsaw	16,0	+2,8	31	-12	10,7	+2,4	40	2
12843	Budapest	18,6	+2,2	20	-20	13,4	+2,5	14	-20
13274	Belgrade	19,2	+1,5	24	-27	15,2	+2,8	21	-19
14015	Ljubljana	17,7	+2,2	108	-22	13,4	+3,0	19	-96
14445	Split	22,4	+1,0	117	56	18,8	+1,9	4	-75
14654	Sarajevo	15,7	+0,6	41	-29	12,2	+1,8	81	-7
15420	Bucharest	16,9	0,0	62	20	11,5	+0,7	37	5
15614	Sofia	16,5	+0,7	36	-3	12,0	+1,6	60	23
16158	Pisa	20,3	+0,8	176	87	17,2	+1,9	69	-51
16597	Luqa	24,1	0,0	24	-16	21,8	+1,1	90	0
16716	Athens	23,9	-0,3	27	17	19,3	0,0	98	46
16754	Heraklion/Crete	23,7	+0,6	19	1	19,9	+0,2	169	93
17062	Istanbul	20,3	+0,6	59	18	16,7	+1,4	38	-33
17130	Ankara	18,2	-0,1	78	59	13,6	+1,0	37	10
17170	Van	18,0	+1,2	4	-10	11,6	+1,5	47	-1
17300	Antalya	24,9	+0,4	30	17	19,6	-0,1	495	425
17609	Larnaka	26,3	+1,2	0	0	22,0	+0,7	46	27
22113	Murmansk	6,5	-0,2	69	17	0,1	-0,9	79	37
26038	Tallinn	14,3	+3,5	41	-41	8,7	+2,4	108	38
26629	Kaunas	14,6	+2,5	90	31	9,7	+2,8	48	-3
26730	Vilnius	14,3	+2,7	83	18	9,1	+2,5	56	3
26850	Minsk	13,7	+2,0	51	-9	8,4	+2,1	51	2
27595	Kasan	13,3	+2,1	35	-11	4,8	+1,3	51	4
27612	Moscow	13,3	+2,4	60	-4	7,0	+2,0	53	-5
33345	Kiev	15,5	+1,6	36	-11	9,7	+1,6	39	4
33815	Kisinev	17,1	+0,9	53	5	12,0	+1,9	14	-13
34300	Kharkiv (Charkow)	15,4	+1,3	59	18	9,4	+2,1	34	-1
34880	Astrakhan	18,8	+1,5	12	-14	12,5	+3,4	45	28
35188	Akmola	13,2	+1,2	22	-2	4,3	+1,5	35	5
37789	Yerevan	21,6	-1,8	9	-1	15,2	+2,4	45	13
40080	Damascus	24,6	+1,4	0	0	18,9	+0,8	30	18
40180	Tel Aviv	26,8	+2,0	0	0	23,3	+1,3	115	89
40199	Eilat	31,4	+1,0	0	0	27,3	+0,6	0	-4
40265	Mafraq	24,0	+1,3	0	-1	19,2	+0,1	13	6
60030	L.Palmas/Gran Can.	24,9	+1,1	7	-1	23,1	+0,6	99	89

WMO No.	Station	November 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.	December 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.
01008	Svalbard/Spitsb.	-4,1	+6,4	27	14	-6,3	+7,0	26	14
01025	Tromsoe	1,0	+1,8	90	-14	0,9	+3,9	139	35
01492	Oslo	4,1	+3,4	150	75	2,4	+5,2	68	12
02196	Haparanda	-2,9	+1,2	100	42	-2,0	+7,5	86	44
02485	Stockholm	4,9	+2,3	40	-13	4,9	+5,9	34	-12
02974	Helsinki	1,5	+1,4	68	-4	3,0	+7,1	60	2
03091	Aberdeen	7,5	+2,5	69	-6	4,2	+0,7	30	-43
03772	London	9,3	+2,1	98	43	7,5	+2,4	64	7
03967	Dublin Casement Aerodrome	8,0	+1,3	89	19	6,9	+1,6	108	31
04030	Reykjavik	1,2	+0,1	87	14	2,2	+2,4	95	16
04320	Danmarkshavn	-16,9	+3,0	7	-3	-21,5	+0,3	3	-10
04360	Angmagssalik	-5,2	-0,5	36	-60	-2,7	+4,5	145	42
06186	Copenhagen	8,1	+2,6	76	14	7,2	+5,0	56	-2
06260	De Bilt	9,2	+3,3	93	12	6,5	+3,3	75	-5
06447	Brussels	9,1	+3,0	72	-4	5,9	+2,4	93	17
06590	Luxemburg	7,2	+3,4	93	10	3,8	+2,8	70	-10
06660	Zurich	7,0	+3,1	42	-40	2,5	+1,9	55	-18
06700	Geneva	7,7	+2,5	60	-34	3,4	+1,4	59	-29
07510	Bordeaux	11,9	+2,8	68	-26	5,2	-1,2	49	-50
07650	Marseilles	13,9	+3,2	25	-33	8,3	+1,0	47	-9
08222	Madrid	11,9	+2,5	134	70	6,6	+0,2	28	-23
08314	Mahon/Minorca	17,1	+2,7	3	-74	13,1	+1,3	138	64
08495	Gibraltar	17,3	+1,2	97	-44	14,1	0,0	38	-108
08515	Santa Maria/Azores	17,6	+0,2	60	-42	16,2	+0,8	163	68
08535	Lisbon	16,3	+1,8	260	146	11,6	-0,2	80	-28
10384	Berlin-Tempelhof	7,9	+3,0	35	-14	5,7	+4,3	33	-20
11035	Vienna	7,8	+3,2	32	-18	3,5	+2,6	17	-26
11518	Prague	6,1	+3,3	7	-25	3,2	+3,8	15	-11
11903	Slica	5,9	+2,9	31	-38	0,1	+1,8	12	-45
12160	Elblag	6,4	+3,1	114	58	5,1	+4,8	37	-15
12375	Warsaw	5,9	+2,7	43	1	4,0	+4,9	26	-6
12843	Budapest	7,7	+2,9	20	-32	2,4	+2,0	5	-35
13274	Belgrade	8,9	+1,9	24	-30	4,1	+1,8	52	-6
14015	Ljubljana	8,8	+4,2	58	-77	4,6	+4,6	59	-42
14445	Split	12,4	+0,2	48	-60	10,4	+1,7	7	-93
14654	Sarajevo	4,9	+0,1	46	-45	1,1	+1,3	64	0
15420	Bucharest	6,3	+1,1	29	-20	1,2	+1,0	11	-32
15614	Sofia	5,4	+0,4	26	-21	0,4	-0,1	31	-8
16158	Pisa	11,8	+1,4	107	-17	8,8	+2,0	105	20
16597	Luqa	17,7	+0,7	57	-23	16,0	+2,2	81	-31
16716	Athens	13,3	-2,2	24	-26	10,5	-1,7	13	-58
16754	Heraklion/Crete	14,9	-1,7	70	11	13,0	-0,8	15	-59
17062	Istanbul	10,6	-1,0	82	-7	7,9	-0,2	17	-105
17130	Ankara	5,6	-1,5	19	-14	1,2	-1,4	1	-48
17170	Van	3,0	-1,0	49	7	-3,4	-2,5	44	10
17300	Antalya	13,5	-1,3	126	-24	11,3	-0,1	66	-157
17609	Larnaka	16,0	-0,4	16	-28	12,8	-0,4	8	-68
22113	Murmansk	-6,0	-0,9	35	-5	-3,3	+6,0	46	8
26038	Tallinn	3,2	+2,0	33	-35	4,4	+7,3	59	4
26629	Kaunas	4,4	+2,3	48	-5	4,0	+6,4	48	4
26730	Vilnius	3,5	+2,3	44	-13	3,3	+6,2	36	-19
26850	Minsk	2,7	+1,9	35	-17	2,7	+6,5	17	-36
27595	Kasan	-3,0	+0,2	59	13	-2,4	+6,7	46	9
27612	Moscow	0,7	+1,8	51	-7	1,2	+7,3	32	-20
33345	Kiev	3,4	+1,3	25	-26	2,4	+4,7	11	-41
33815	Kisinev	6,4	+2,0	10	-29	3,3	+3,6	1	-37
34300	Kharkiv (Charkow)	2,1	+0,8	60	16	0,9	+4,3	10	-35
34880	Astrakhan	3,0	-0,3	30	11	0,3	+2,2	26	11
35188	Akmola	-3,2	+2,7	53	31	-7,0	+5,6	30	13
37789	Yerevan	6,6	0,0	9	-21	-3,4	-3,9	33	7
40080	Damascus	10,5	-1,3	25	3	4,7	-2,5	2	-24
40180	Tel Aviv	17,5	-0,5	38	-30	13,5	-0,3	125	-13
40199	Eilat	20,3	-1,2	0	-3	15,6	-1,0	<1	-6
40265	Mafraq	11,9	-1,6	1	-16	6,7	-2,1	12	-16
60030	L.Palmas/Gran Can.	21,9	+1,5	9	-12	18,4	+0,1	6	-15

WMO No.	Station	Year 2006 Temp. mean	(°C) dev.	Prec. total	(mm) dev.
01008	Svalbard/Spitsb.	-1,7	+4,7	201	18
01025	Tromsoe	3,8	+1,0	916	-57
01492	Oslo	7,7	+2,0	936	167
02196	Haparanda	2,5	+1,4	490	-62
02485	Stockholm	8,4	+1,8	528	-11
02974	Helsinki	6,1	+1,6	558	-93
03091	Aberdeen	9,2	+1,3	645	-138
03772	London	12,4	+1,9	637	38
03967	Dublin Casement Aerodrome	10,5	+1,2	677	-58
04030	Reykjavik	5,4	+1,0	892	94
04320	Danmarkshavn	-10,5	+1,8	272	140
04360	Angmagssalik	-0,6	+1,1	748	-184
06186	Copenhagen	10,1	+1,5	565	-71
06260	De Bilt	11,2	+1,8	808	3
06447	Brussels	11,3	+1,4	835	35
06590	Luxemburg	10,2	+1,9	888	13
06660	Zurich	9,8	+1,3	1057	-29
06700	Geneva	11,2	+1,4	980	35
07510	Bordeaux	14,1	+1,4	821	-102
07650	Marseilles	16,2	+1,4	315	-229
08222	Madrid	15,8	+1,5	503	47
08314	Mahon/Minorca	17,8	+1,2	385	-213
08495	Gibraltar	18,6	+0,4	686	-89
08515	Santa Maria/Azores	18,1	+0,6	1043	268
08535	Lisbon	17,6	+0,8	999	246
10384	Berlin-Tempelhof	10,6	+1,2	455	-129
11035	Vienna	10,7	+0,8	703	90
11518	Prague	9,0	+1,1	471	-55
11903	Slica	8,4	+0,5	525	-161
12160	Elblag	8,8	+1,2	647	-43
12375	Warsaw	9,0	+1,2	478	-41
12843	Budapest	11,4	+1,0	631	113
13274	Belgrade	12,7	+0,8	753	69
14015	Ljubljana	11,4	+1,6	1139	-254
14445	Split	16,5	+0,7	659	-166
14654	Sarajevo	9,6	+0,1	961	43
15420	Bucharest	10,6	0,0	549	-46
15614	Sofia	10,1	+0,4	640	77
16158	Pisa	14,9	+0,9	899	-5
16597	Luqa	19,4	+0,8	539	-14
16716	Athens	18,2	-0,3	347	-22
16754	Heraklion/Crete	18,5	0,0	529	28
17062	Istanbul	14,7	+0,6	597	-100
17130	Ankara	12,2	+0,5	372	-41
17170	Van	10,0	+1,3	428	43
17300	Antalya	18,7	+0,3	1323	246
17609	Larnaka	19,7	+0,6	237	-92
22113	Murmansk	1,2	+1,3	547	69
26038	Tallinn	6,9	+1,8	477	-190
26629	Kaunas	7,6	+1,2	653	45
26730	Vilnius	7,1	+1,1	604	-79
26850	Minsk	6,9	+1,1	729	52
27595	Kasan	4,5	+0,8	586	46
27612	Moscow	5,5	+0,6	625	-63
33345	Kiev	8,4	+0,7	622	-27
33815	Kisinev	10,2	+0,6	565	18
34300	Kharkiv (Charkow)	8,1	+0,6	450	-69
34880	Astrakhan	10,8	+0,8	233	13
35188	Akmola	4,3	+1,6	344	26
37789	Yerevan	12,8	+1,3	391	-23
40080	Damascus	17,1	+0,6	131	-16
40180	Tel Aviv	20,4	+0,9	604	37
40199	Eilat	25,3	+0,5	2	-27
40265	Mafraq	17,0	+0,5	94	-65
60030	L.Palmas/Gran Can.	20,8	+0,3	293	176

Monthly Surveys

January

- **Cold in most of Europe, but very mild in the north**
- **Dry in most of the Region, wet in some northern areas, in the western Mediterranean and parts of the southeast**

Ridges over the Atlantic extended to the north, forming large high pressure systems over northern and later also over central Europe. Mild und humid Atlantic air masses moved very often at the west flank of these high pressure systems far to the northernmost parts of the Region. Extremely high temperature anomalies were registered over these areas, particularly in Svalbard; it was up to more than 12 °C warmer than normal there, which was extremely mild (Fig. 1.1), the warmest January ever recorded and even warmer than any previously recorded April. The Arctic Sea ice extent was the lowest since the beginning of satellite measurements in 1979. Within these mild air masses, numerous low pressure systems moved over Iceland, Greenland and Svalbard; and thus, up to more than 400% of the normal monthly precipitation amounts were reached there (Fig. 1.2). Ny-Ålesund in Svalbard measured a new record for diurnal precipitation since 1969 with 34 mm on January 16. Sometimes these low pressure systems also touched parts of northern continental Europe. However, in most parts of Norway, Sweden and Finland it was mild, but dry, since low pressure influence was only weak. Stations in the county of Finnmark (northern Norway) registered a new record for maximum temperature.

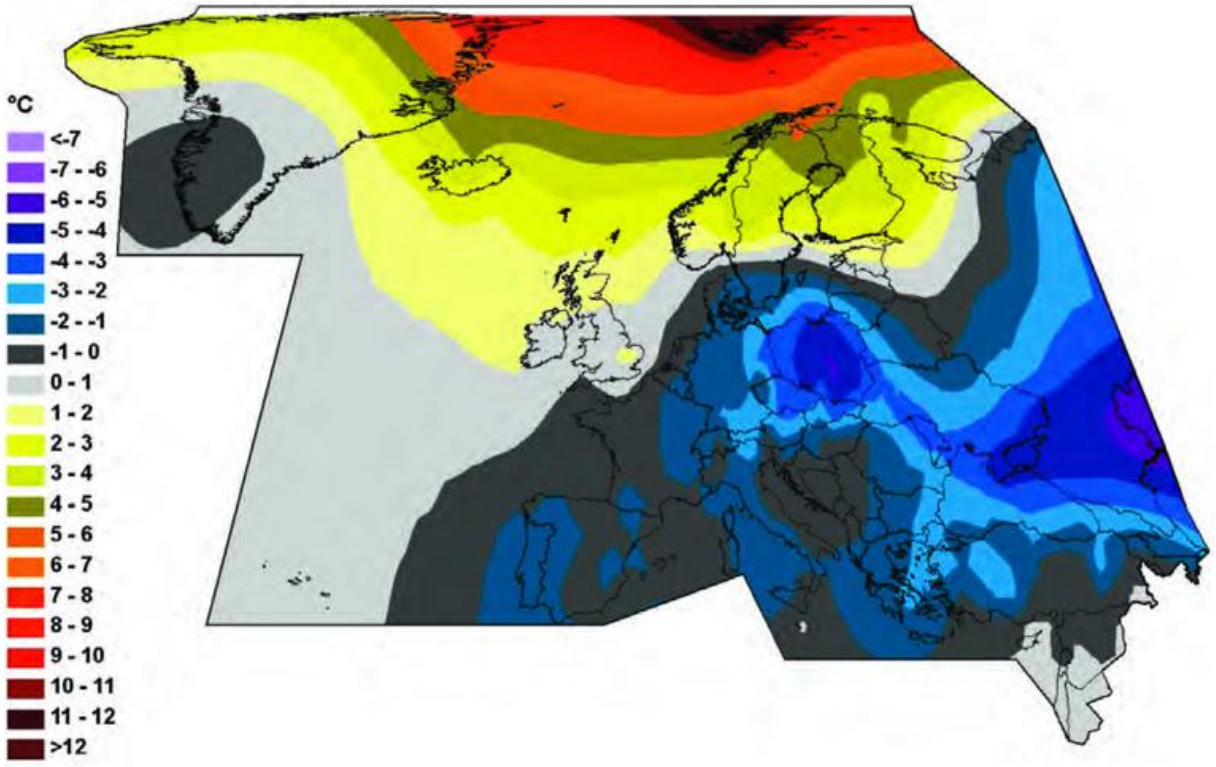


Fig. 1.1: *Monthly mean temperature anomalies in January 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

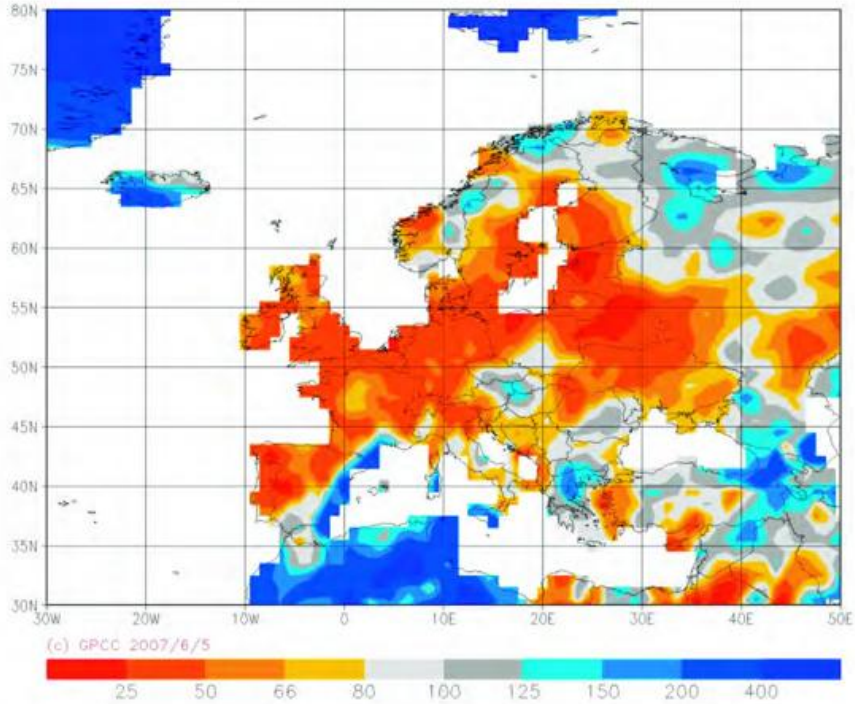


Fig. 1.2: *Monthly precipitation amounts for January 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

Most of the rest of the Region was dominated by continental air masses this month coming from the east and moving at the south flank of the north European high to eastern, central and even western Europe. Locations in the easternmost parts of the Region in west Kazakhstan and Russia experienced the negative monthly temperature anomalies of the Region at below -5 °C, parts of west Kazakhstan even down to nearly -10 °C (Fig. 1.3). In most of eastern central Europe, anomalies were between -5 and -2 °C. The remaining parts of the Region were also colder than normal, except northern Scandinavia, the United Kingdom and Ireland, the Atlantic and a small area in the southeast, but including western and southern Europe. Although the anomalies were smaller there, they were nevertheless outstanding. It was e.g. the coldest January since 1997 in the Netherlands. In Luxembourg (airport), 26 frost days were counted, but none of these was below -10 °C. Portugal recorded minimum temperatures below zero at approximately half of the stations, down to -8 °C and up to 21 frost days, which were 2-3 times as many as normal, particularly in the centre and the south of the country; some of these days were also ice days (maximum temperature <= 0 °C).

Especially the last third of January was very cold; in Russia and the Ukraine the whole second half of the month was cold with night temperatures frequently below -30 °C. The lowest minimum temperature in Poland, however, was down to -32.1 °C in the central part of the country on January 1. Latvia had a warm start to the year, but on January 17 a very cold arctic air mass flowed in, which reduced the air temperature by about 25 °C in one and a half days. The coldest period was during January 19-22 when the daily average air temperature was 15-19 °C below normal and the minimum air temperature reached -32 °C. These were not only the coldest days in 2006, but also the coldest January 19-22 period ever recorded in Latvia. Since the snow had melted before this cold spell came, there was no snow cover which could protect plants and thus they suffered from frost damage during the cold spell. Lithuania, too, recorded low temperatures on January 20-21 down to -31 °C in the east, with only little snow and soil freeze depths down to 95 cm. This cold spell appeared even in Norway, which was otherwise very mild on average. Strong cold winds from the landward side resulted in very strong icing conditions in the northern coastal areas of Norway on January 18-20.

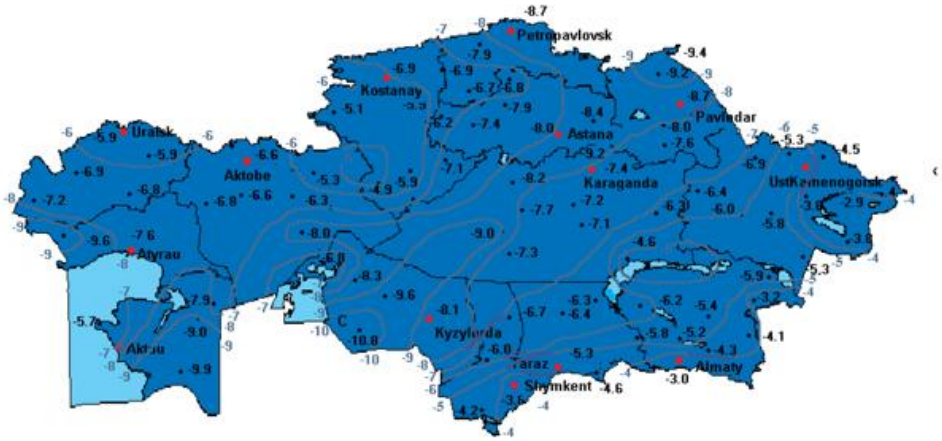


Fig. 1.3: *Monthly mean temperature anomalies in January 2006 (reference period 1961-1990) in Kazakhstan.*
Source: Kazhydromet, Kazakhstan

Central and southeastern Europe experienced this cold period too. In southern and eastern parts of Germany, daily minimum temperatures below -20 °C were measured at several stations on January 22-25. The Rhine-Main-Danube channel was closed during that time. Hungary had its annual temperature minimum of -25.1 °C on January 24. The cold spell was also registered on January 23-28 in the whole of Serbia, with minimum temperatures below -10 °C, in the highland down to -39 °C, which was nearly a new record. Temperature decreased frequently to below -25 °C in Romania during the last decade of the month, with a minimum of -33 °C on January 27. The Black Sea froze at the shore, floating ice formed along the Danube, causing an interruption to river traffic for the first time since 1984. Moldova, too, had a cold spell at that time (January 20-27) with temperatures down to -30 °C; this is recorded only once in 20-25 years on average. Macedonia also experienced an extreme cold spell during January 23-29; the daily mean temperature in Skopje dropped from 4 °C on January 22 to -10 °C two days later (Fig. 1.4). In many eastern and central European countries there were some deaths due to this cold weather.

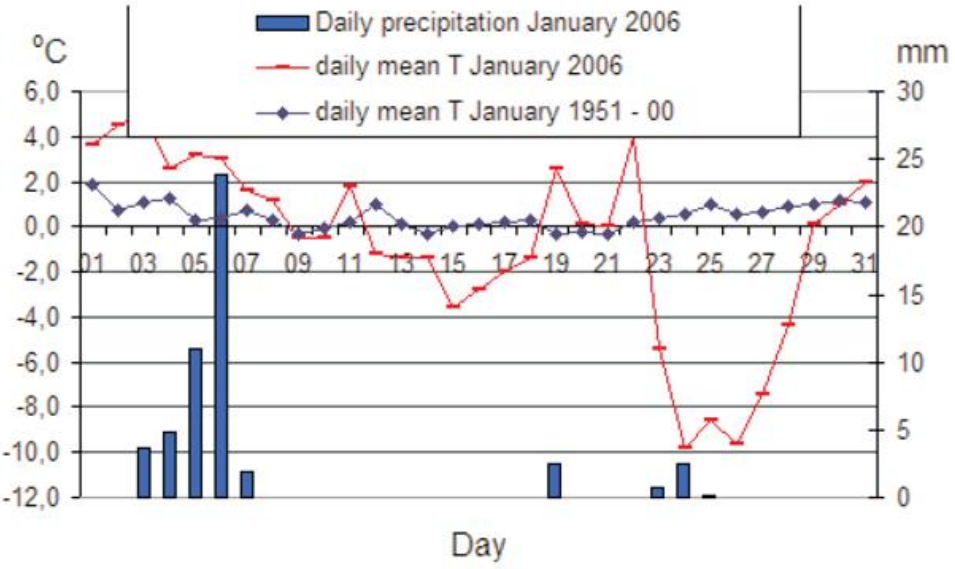


Fig. 1.4: *Daily mean air temperatures and precipitation totals forJanuary 2006 in Skopje Zajchev Rid(Macedonia), in comparison to the long-term temperature mean 1951-2000.*
Source: Hydrometeorological Service of Republic of Macedonia

At the end of the month, Scotland, too, became very cold; temperatures below -12 °C were recorded on January 31.

Beside the low temperatures, extended snowfall was also a remarkable feature this month. The year started already with heavy snowfall in Central Europe. In Poland, a snow cover appeared at the beginning of the month and remained during the whole of January. In southern Germany, the roof of an ice pavilion collapsed on January 2 due to a heavy snow load. Repeated heavy snowfall was also reported from Upper and Lower Austria and the province of Salzburg from January 3-17, leading to numerous accidents, collapses of roofs and damage to forests. Slovenia, too, had quite a persistent snow cover throughout the month which was deepest in the beginning of the month. On January 5, falling temperatures and a snowstorm caused serious road accidents in Bulgaria and blocked the road traffic across the country. This snowstorm was also reported from Romania. In Serbia, snow cover in the mountains remained for the whole of the month.

January 27-30 was a period of heavy rain and snow fall in France, particularly where the southern half of France was concerned. Switzerland recorded its first extraordinary snowfall of th season in the southern part of the Alps at that time. After two days of intense snowfall, the Ticino region had a snow cover of 60-90 cm on January 28. It was the greatest snow depth in the Ticino lowlands since 1986. The snow masses caused considerable interruptions to traffic, many roads were impassable. However, not only the quantity, but also the low density of the snow was exceptional, due to temperatures significantly below zero, especially at the beginning of the event.

Further to the south, some areas in Sicily (Italy), Greece and Turkey were covered by snow. Heavy snowfalls were also reported from Armenia, especially during January 23-26, when all flights were cancelled at Zvartnots airport. On January 29, snowfall occurred even in coastal and lowland regions of Portugal; these are places where such phenomena do not happen often. In Lisbon, for example, the previous occurrence of snowfall was on February 1-2, 1954.

Since the continental air masses were also very dry, the precipitation amounts in most parts of Europe were far below normal; less than 50% of the normal precipitation fell in many places. England, Wales and Northern Ireland had their driest January since 1997. In the east, also Belarus recorded its driest January (for 60 years) with only 22% of the long-term average. Slovenia was especially dry in the second and third decade; there was almost no precipitation during that period. In the south, this January was the 2nd driest in Portugal for 17 years.

Higher than normal precipitation, on the other hand, was registered in the western Mediterranean, partly more than twice the normal, due to a trough moving from central Europe to this area at the beginning of the year. This January, Malta had 22 rainy days, some of them being accompanied by thunder and hail. There were also some heavy local positive precipitation anomalies in Greece and south of the Caucasus, because some of the low pressure systems of the western Mediterranean moved further to the east. In the Ararat Valley (Armenia) twice the amount of the normal monthly precipitation total was recorded. Cyprus received heavy rainfall with hail on January 11 in the eastern parts of the island, causing floods and damage to properties and crops. A large number of 16-20 days with rainfall was reported from northern and central Israel, compared to a normal of 13-15 days. There was a continuous rainfall period of 12 days from January 7-18 in central Israel which occurs only once in 10-12 years.

February

- **Cold in most of Europe, very mild over the North Sea and in the southeast**
- **Dry in most of northeastern and western Europe, other parts of Europe locally wet**

High pressure influence was still dominating most of February in northern and western Europe, and mild and humid air masses were still moving to the northernmost parts of the Region. The temperature anomalies in Svalbard were not as high as in January, but still very high at more than +5 °C; in western Greenland more than +4 °C were registered (Fig. 2.1). Iceland recorded its 4th warmest year in Reykjavik since recordings began in 1870. Bergen-Florida in Norway measured 13.2 °C, which was a new record for February in Bergen since 1867.

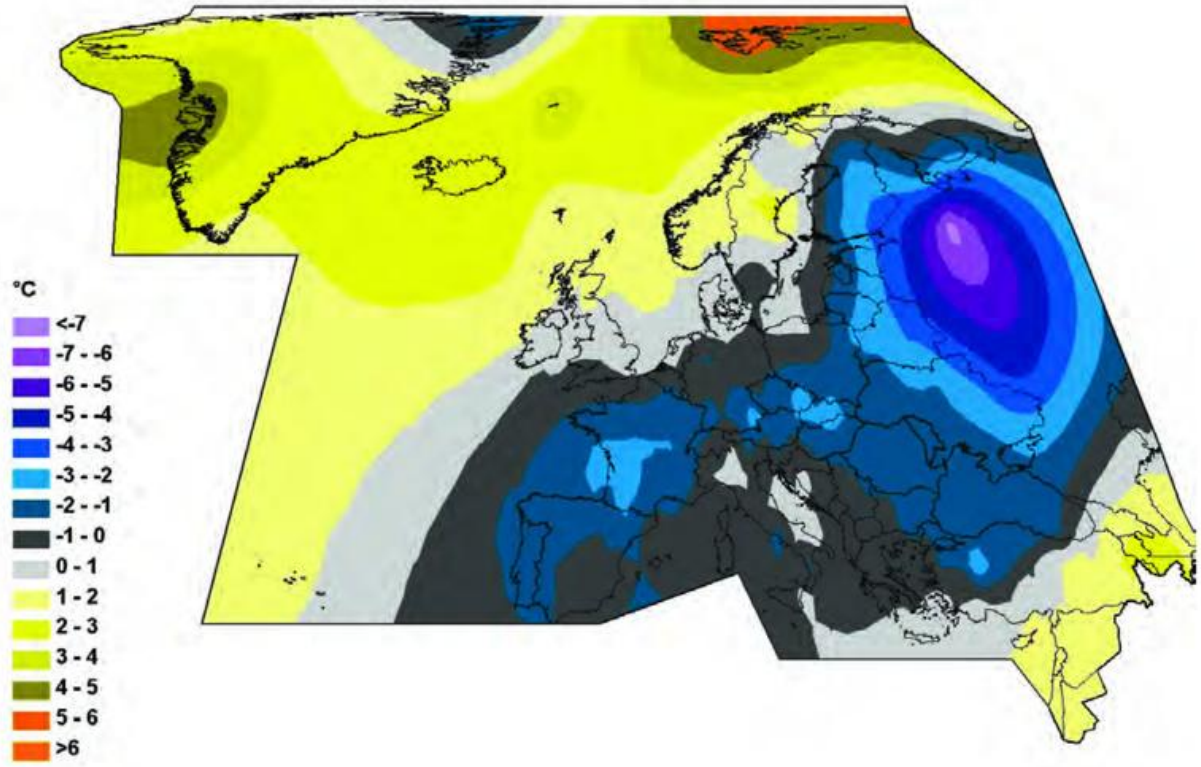


Fig. 2.1: *Monthly mean temperature anomalies in February 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

It was also still wet on Svalbard, Greenland and parts of Iceland (Fig. 2.2). In Norway, a station in the county of Sør-Trøndelag received 361 mm during 4 consecutive days until February 1, resulting in serious flooding in that area.

At the east flanks of north European high pressure systems, cold dry air flowed particularly to eastern Europe, but also further to the west and south. It was very cold in northern European Russia with monthly mean anomalies down to -7 °C and less than 50% of the monthly precipitation; only further to the south, in the western regions of the north Caucasian district, was it very wet. In Estonia, no temperatures above zero were recorded in large parts of the country during the whole month. A minimum temperature of -26.8 °C was measured in Poland on February 6, and also in the Ukraine there were minima far below -20 °C in that month. Towards the west, in Scotland, temperatures below -12 °C were measured on February 1.

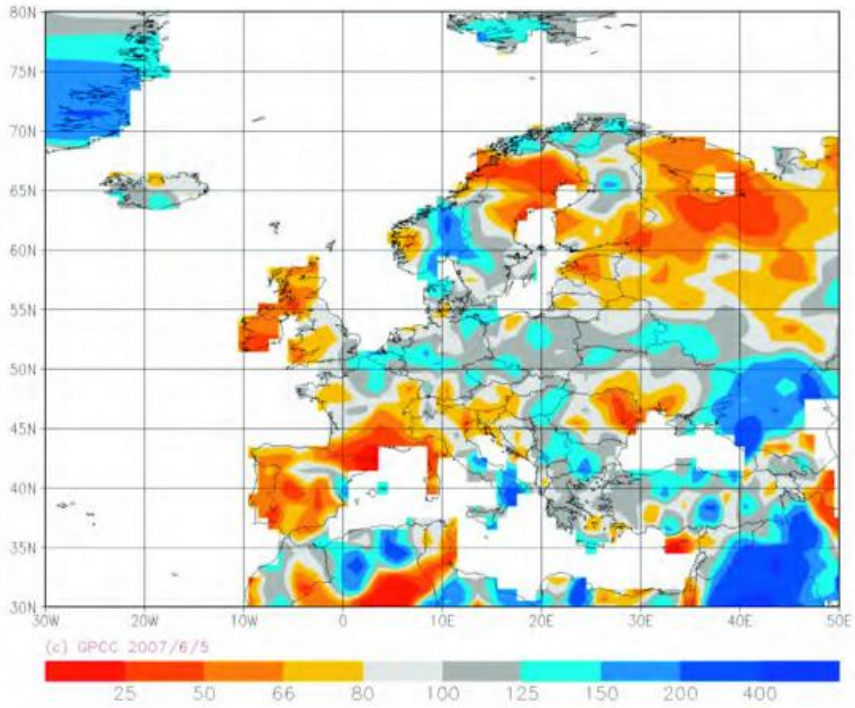


Fig. 2.2: *Monthly precipitation amounts for February 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

The rest of Europe also remained cold on average, but in contrast to January, more low pressure systems could develop and move within some large cold troughs. Thus, it was locally and regionally wetter than normal in parts of central and southeastern Europe. A lot of snow fell even in the lowlands, e.g. in southern Germany snow depths reached up to 150 cm on February 7-11, causing traffic problems and collapsing of buildings and roofs due to high snow loads. Heavy snowfall also occurred in Austria at the northern border of the Alps. In Poland, the snow cover remained during the whole month. Snow storms were reported from Romania on February 16 and 25-28. In Serbia, it snowed during most of the month.

Some parts of the western Mediterranean, too, remained cold and wet, e.g. the Balearic Islands, southern Italy and Crete (south Greece). St. Valentine's night was the coldest night of the year in Malta with a 2 m air temperature of 3.8 °C, and on February 15, the air temperature at grass height level was -1 °C.

In contrast, western Europe was mostly under Atlantic high pressure influence with low precipitation. Especially southern France was very dry. However, France, the Iberian Peninsula and even the southwest of the United Kingdom were mainly within the cold air mass. The number of frost days in the inner northern central regions of Portugal amounted to 21 days as in January 2006, again 2-3 times the normal number.

The areas of the Middle East were mostly no longer affected by the cold spell this month. It was warmer than normal there, in Armenia and Azerbaijan up to more than +2 °C, only the Ararat Valley was 1.5 °C colder than normal. However, 35 cm of accumulated snow were recorded in northern Jordan (Ras-Muneef, elevation 1150 m) on February 8-9. The high mountainous regions of Armenia received a monthly total of 160% of the normal precipitation. On February 3 there was extensive flooding in south Israel (near Eilat) which caused considerable damage.

March

- **Cold in most of Europe, very mild in Greenland, in southwestern Europe and in the southeast**
- **Dry in most of northern Europe and most parts around the Mediterranean**
- **Western, central and eastern Europe mainly wet**

The warm Atlantic air flow to the north relocated to a more westerly position this month. The highest positive anomalies were registered in western Greenland this month; they were very high, at up to more than +8 °C. Eastern Greenland and Svalbard were less than +2 °C warmer than normal, quite a large reduction compared to the previous two months. The mild air masses brought higher than normal precipitation amounts to Greenland, while Iceland and Svalbard remained mainly dry.

Large cold troughs extended frequently from the northeast over Europe, making March the third cold month in 2006 for most of Europe. The highest negative anomalies were found generally over northern Europe, down to below -4 °C (Fig. 3.1). In northern Finland at Enontekiö, almost -40 °C was reached in early March, in northern Norway (county of Finnmark) the lowest minimum of the year, -41.4 °C, was measured at the station Cuovddatmohkki on March 3. For Norway as a whole this was the coldest March since 1962. In the middle of the month, snow depths were around 50 cm in large parts of southern Sweden. Only around March 20 did the snow start to melt rapidly there. Winter weather prevailed during the whole month in south Finland and the temperature rose to 10 °C anywhere. In Estonia, the ground was frozen twice as deeply as normal (95 cm). For Lithuania it was the coldest month of the year, mean daily

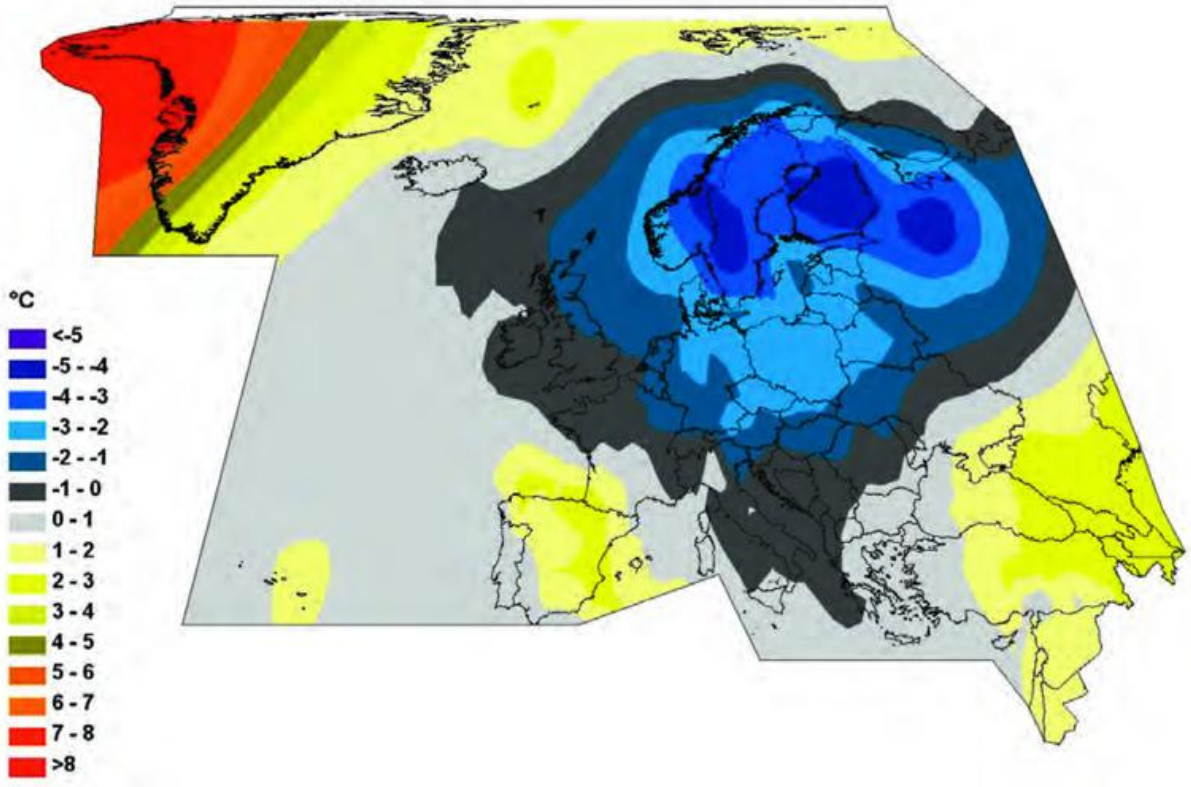


Fig. 3.1: *Monthly mean temperature anomalies in March 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

temperatures rose above 0 °C only at the end of the month on March 27-28; this was almost one week later than normal. Poland recorded a minimum temperature of -20.7 °C in the first decade of March, but a maximum of 19.3 °C at the end of the month and thaw was not registered before March 27. In the Netherlands, the lowest temperature of the year of -11.8 °C was recorded late on March 4. Also in Scotland, March was actually colder than any of the three standard winter months December-February 2005/06; this had not occurred in Scotland since 1975/76. For the second successive year, the lowest air and ground temperatures of the year at almost all stations in Ireland were recorded in early March. In the Alps, wintry weather conditions continued in the first and second decade with frost down to -24 °C in Seefeld/Tyrol. The cold air affected even the south of Europe: in northwest Greece, a temperature drop of more than 12 °C within one day was registered on March 7.

Most of northern Europe was drier than normal (Fig. 3.2) because the low pressure systems took a more southerly route than usual, especially those coming from the Atlantic. Due to the dryness, the largest known grass fire in Iceland started on March 30; about 67 km² were burned.

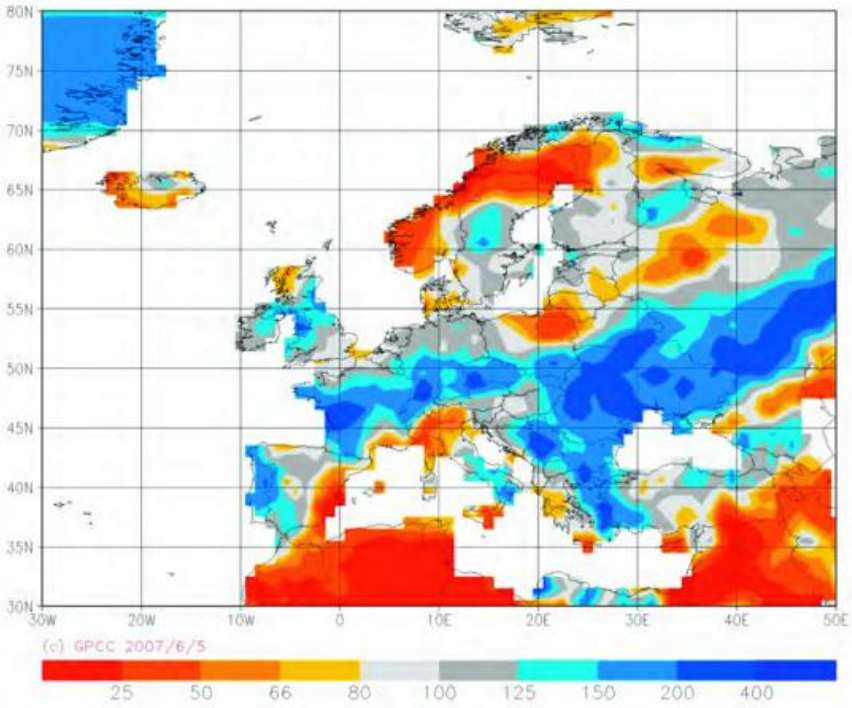


Fig. 3.2: *Monthly precipitation amounts for March 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

Over the eastern North Atlantic, high pressure influence became rare; low pressure systems moved to central, western and eastern Europe at the south flank of the cold air. The monthly precipitation amounts were high over these areas, in same places more than 200% of the normal. At some locations in France it was the highest monthly total for 50 years. Precipitation fell very often as snow. Luxembourg Airport had 10 days of snow this month (on one day a depth of 24 cm) compared to a 1971-2000 average of 5 days. A period of heavy snowfall occurred in western and central Europe in particular on March 3-6. Some places in Scotland saw snow depths rising to 25 cm or more during the first week of March. In northeastern France, record March snow depths since 1950 of 45 cm were registered in Mulhouse and Belfort. Record snow depths were also reported from southern Germany, e.g. 50 cm in Munich on March 5. Many flights at German airports were cancelled or delayed. Another heavy snowfall occurred on March 12 in northern Germany, causing widespread traffic obstructions. A tornado was registered on March 27 in northern Germany (Hamburg) within a temporary warmer air mass, which is rare in that season and such a cold month. Ongoing heavy snowfall already on

March 4-5 led to the most significant quantities of fresh snow measured this year in northern and eastern Switzerland. 54 cm of fresh snow fell in Zurich within one day, 49 cm in Basle and even 60 cm in St. Gall. Heavy snowfalls occurred also in some regions of Austria during the first week of the month, and also Slovenia recorded quite abundant snow especially on March 5; the snow cover did not disappear before the second half of the month, even in Ljubljana. The Slovenian mountain station Kredarica received a maximum snow depth of 440 cm, which was noticeably above normal. In Serbia, snow remained in lower parts until March 20 and on mountains during the whole month. Maximum snow depths in the mountains of Serbia this month were close to the absolute maxima ever recorded.

Around the middle of the month, a storm with heavy rain, snow, flooding and landslides affected especially Romania and Bulgaria, initiated by a Mediterranean cyclone. Widespread thunderstorms were registered in Romania and northern Bulgaria on March 23 and 29, in some places with hail. On March 28, Austria and the Czech Republic were also affected by continuing precipitation, and flooding occurred along the river Thaya. At the end of March, heavy rain and snowmelt caused flooding of the Danube and Elbe rivers with damage particularly in Germany. Also Cyprus in the eastern Mediterranean experienced heavy rainfall and severe thunderstorms on March 27, affecting the area around Nicosia with floods and damage to houses.

The Iberian Peninsula was not affected much by the cold air. Precipitation systems mainly affected Portugal and western Spain, whereas eastern Spain remained very dry (in parts less than 25% of the normal precipitation) and warm (anomalies up to more than +2 °C). For almost the whole country of Portugal this was the first rainy month for a long time; it put an end to the drought conditions in this country which had lasted from the end of 2004 until February 2006.

Most of the areas in the Mediterranean were very dry, except some areas in southern Italy, Albania and western Turkey. In Albania, up to 250% of the normal precipitation were registered. Temperatures were around normal in these parts.

The southeast of the Region was also not touched by the cold air. Temperature anomalies reached up to more than +2 °C over large parts there and precipitation was low, except in the Caucasus region. Extremely high temperatures were reported from Armenia on March 7-9 and March 25, reaching 18-24 °C in southern and central parts of the country.

April

- **Warm in nearly the whole Region, especially in the northernmost parts**
- **Dry, especially in western Europe and near the Black Sea**
- **Wet, especially in parts of northern and central Europe**

In April, a zonal air flow dominated for most of the time, but the frontal zone lay far to the north for that time of year. Warm air often reached especially the northernmost areas of the Region again. As in the winter before, Svalbard experienced extremely high temperature anomalies again, up to more than +12 °C (Fig. 4.1) as in January. 0.0 °C exactly was the monthly mean at Svalbard Airport, (anomaly + 12.2 °C) the highest April temperature since 1911 and even higher than any previously recorded temperature in May. Low pressure systems often moved over Greenland and Iceland; Greenland especially had precipitation amounts of more than 400% of the normal (Fig. 4.2) in parts. Iceland, the Faroe Islands and the Shetland Islands were colder than normal, since they were often located in the colder air mass north of the frontal zone. There was some snow in the north of Iceland during the first half of the month.

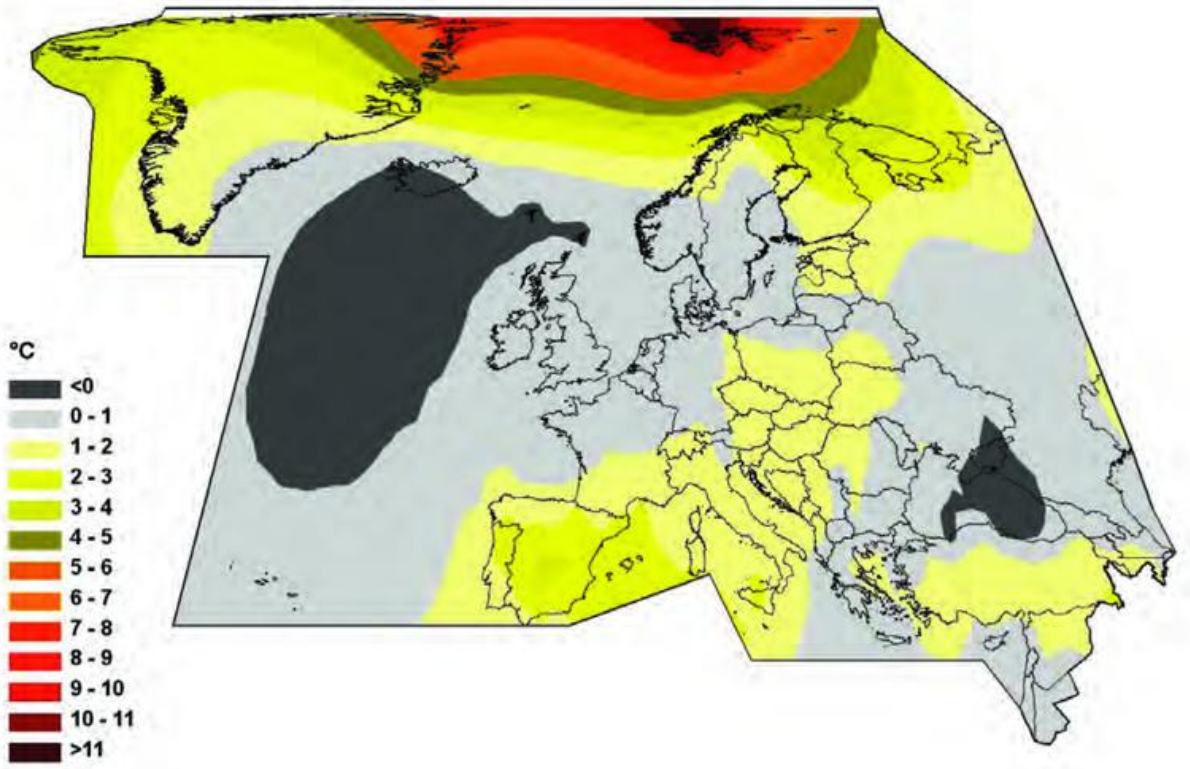


Fig. 4.1: *Monthly mean temperature anomalies in April 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

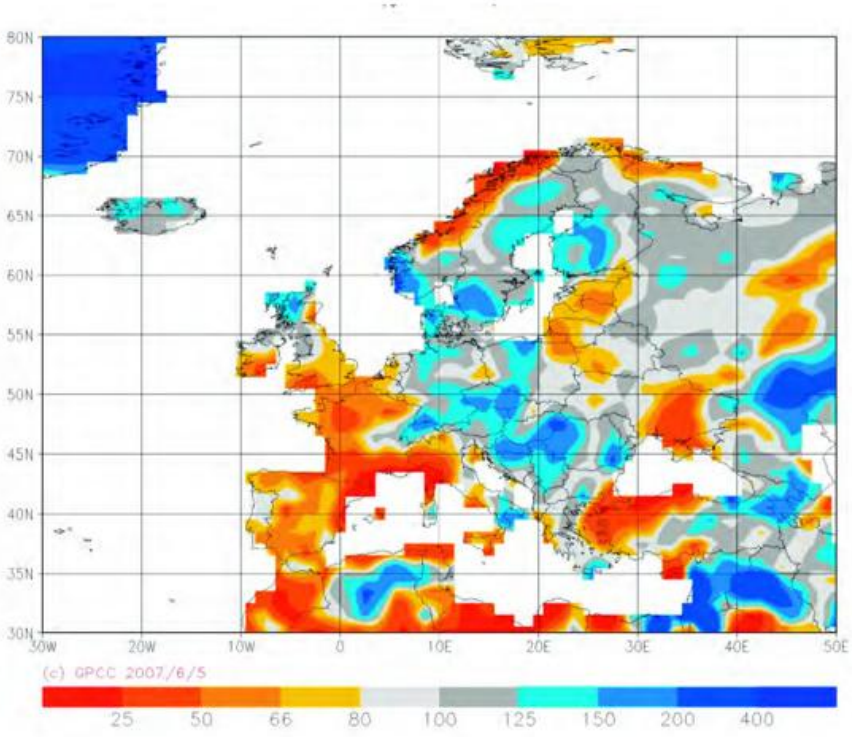


Fig. 4.2: *Monthly precipitation amounts for April 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

The majority of the Region lay within the warmer air mass most of the time and was thus warmer than normal on average, although the anomalies were mostly less than +1 °C, partly between +1 and +2 °C. In northern Norway (parts of east Finnmark), the monthly mean temperature was the second highest since 1867. Especially the second half of the month was warm in some countries, e.g. in Slovenia. Summer days (>= 25 °C) in the second half of the month were recorded in Serbia in most places. To the south, in Crete (Greece), maximum temperatures above 30 °C were measured on April 12 due to foehn. Maxima of 27-31 °C were reached in Armenia (Ararat and Syunik valleys) during a heat wave on April 10-16. During a Sharav event in Israel, the midnight temperature on April 22-23 rose to a peak value of 33-35 °C in the coastal plain, probably the 2nd highest since 1962. On the other hand, a cold spell appeared in Turkey on April 24-26, causing frost damage to trees.

Low pressure systems with precipitation often came from the North Sea to southern Scandinavia and Central Europe, causing higher than normal precipitation amounts in these areas. Sweden recorded the largest spring floods since 1985 along several streams and rivers in its southeastern areas early in April, also resulting from the melt of the large snow amounts which started in March. Heavy precipitation and snow melt led to widespread flooding also along the Danube and Elbe rivers in the first half of the month. The countries affected by this flooding were Germany, Poland, Czech Republic, Austria, Hungary, Serbia, Romania and Bulgaria. Daily precipitation totals on April 3-4 and April 6-7 at stations in Bulgaria close to the River Danube varied between 10 and 30 mm; mean monthly water levels along the River Danube were around 3 m above the long-term mean. Towns in Bulgaria had to be evacuated (Fig. 4.3), some streets were only accessible by boat. Much damage was also reported from Romania, the discharge from the Danube reached nearly historical record levels there on April 15-16. In Serbia, monthly precipitation totals of more than 130 mm were reached locally, exceeding a previous record of the year 1942.

In contrast, most of western and southwestern Europe was mainly dry, since these areas were more often under anticyclonic influence. The northern coasts of the western Mediterranean were particularly dry with amounts of less than 25% of the normal precipitation. The western Mediterranean and especially Spain were considerably warmer than normal with anomalies of locally more than +3 °C.

Fig. 4.3: *The town of Lom (Bulgaria) awaiting evacuation after flooding of the River Danube. Source: National Institute of Meteorology and Hydrology Bulgaria, photo from AP*

In eastern Europe, the cyclonic systems were mostly weaker, therefore high precipitation totals appeared only locally or regionally. Outstanding dry areas (<50% of the normal precipitation) can be found north and south of the Black Sea. On the other hand, the areas east of the Mediterranean experienced high precipitation amounts this month. 260% of the normal monthly precipitation was reported from the Ararat Valley in Armenia.

Extremely heavy precipitation occurred on April 1-2 in Israel. It was the result of an upper air trough over the eastern Mediterranean, accompanied by a surface depression over Syria and Iraq. In the centre of Jerusalem, 128 mm were accumulated on these two days, the largest daily rainfall amount here at least since 1950. At the northern part of the Dead Sea, 65-90 mm were recorded for the same time. Another upper air trough followed on April 4, resulting in thunderstorm activity with hail (hailstones of 4-5 cm in diameter) and a tornado in the western Galilee (see Annual Survey, Wind). A third heavy rainfall period occurred on April 24-25 in the northeast of Israel with 100-130 mm of precipitation in that period, the highest amounts since 1971; more than 50 mm fell within 3 hours, causing flooding in the surrounding area.

May

- **Mostly warm, colder in Iceland and eastern Europe**
- **Wet in most of Europe, dry in the south**

The first half of May 2006 was characterised by two large low pressure systems over the Atlantic and eastern Europe and high pressure over central Europe in between, whereas the airflow was more zonal in the second half of the month. The temperature anomaly distribution of the monthly mean thus reflects especially the patterns of the first half of the month with two colder than normal areas, one over Iceland and the Faroe Islands and the other over most parts of eastern Europe. In Russia, severe frosts were still recorded nearly everywhere, particularly in the Volga-Vyatka region down to -7 °C. The first half of the month was exceptionally cold in Serbia, partly with frost, whereas the second half of the month was considerably warmer, with tropical days in many places. However, the first 10 days of May were warm in Iceland; temperatures in sheltered areas in the southwest of the island reached 20 °C which is highly unusual for this time of the year. Later, around May 20, it became unusually cold for the season with heavy snowfall in the north of Iceland. Most of the other parts of the Region were up to +2 °C warmer than normal on monthly average (Fig. 5.1).

The air masses in the northernmost areas of the Region were still mainly warm, but the temperature anomalies were no longer so high as in April. They exceeded still +4 °C in Svalbard and +3 °C in western Greenland, and the precipitation amounts were also still higher than normal there. The monthly mean temperature in Svalbard and Hopen was the highest ever registered in May.

As in April, it was warmer than normal especially on the Iberian Peninsula and in the western Mediterranean, reaching anomalies of more than +2 °C, in some of parts of Spain more than +3 °C. Some daily maxima were record-breaking, e.g. 39.5 °C in Cordoba was a new record for the month of May. Also for Portugal it was the warmest May (for 41 years). These areas were also very dry due to frequent high pressure influence. This month was the 2nd driest May in Portugal since 1931, after 1990.

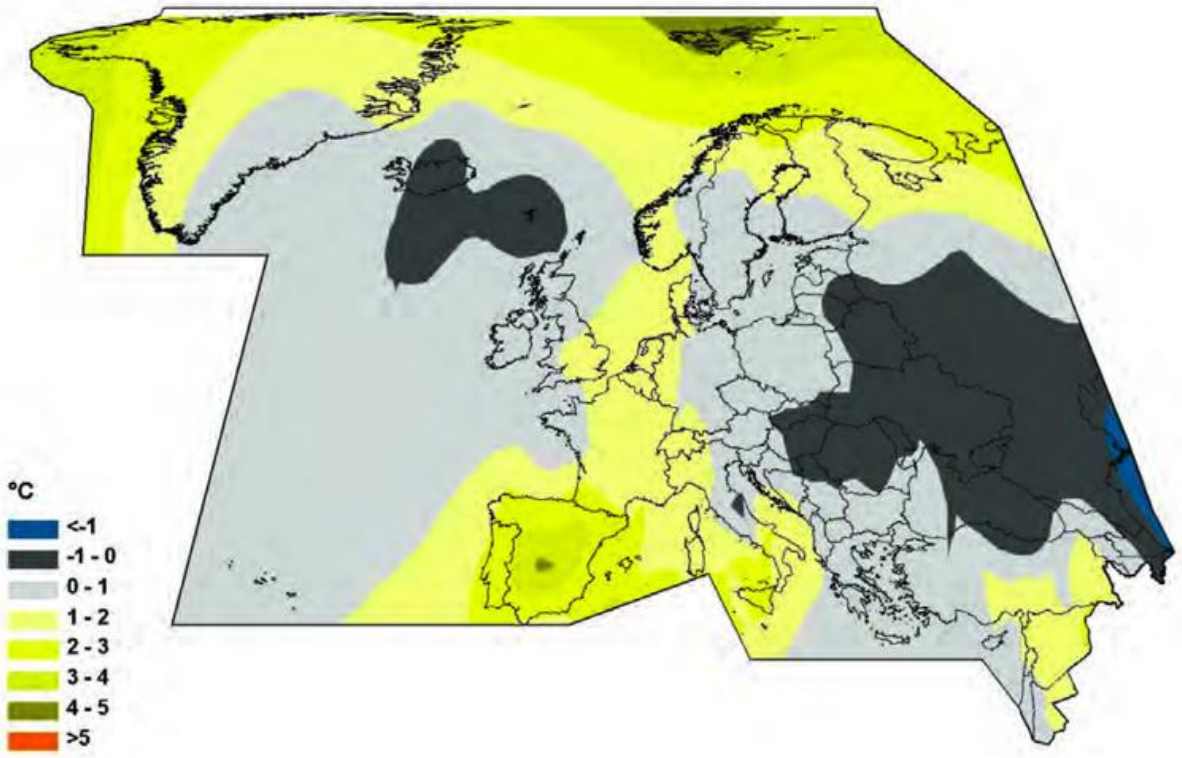


Fig. 5.1: *Monthly mean temperature anomalies in May 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

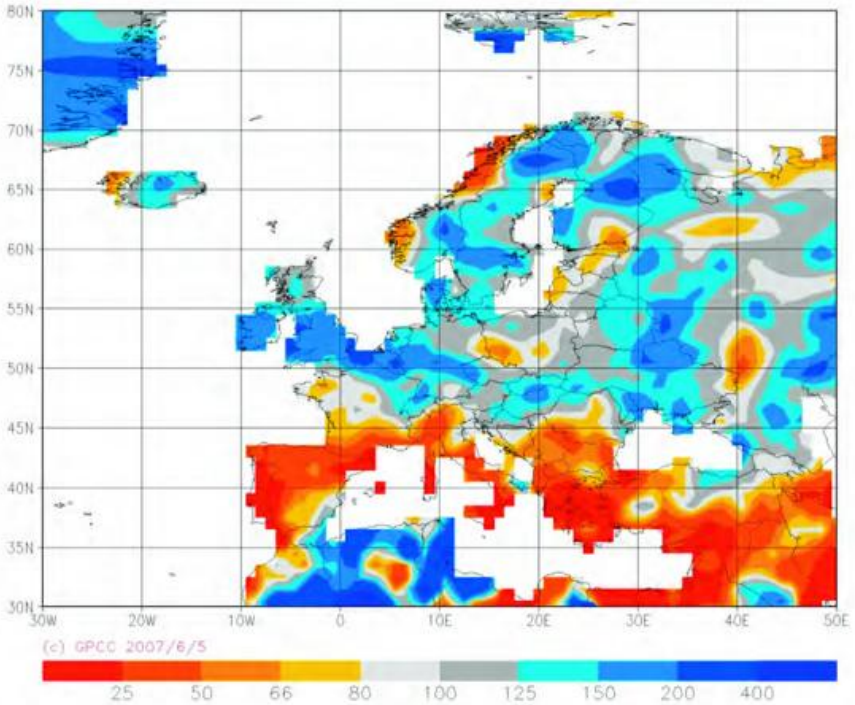


Fig. 5.2: *Monthly precipitation amounts for May 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

Most parts of northern, western, central and eastern Europe were clearly wetter than normal (Fig. 5.2) due to precipitation within the two large low pressure systems mentioned above and also some smaller cyclonic systems passing with the zonal flow over Europe in the second half of the month. A severe thunderstorm on May 20-21 caused damage in France, Belgium and Germany, particularly due to strong gusts. A tornado was also observed in northwest Germany. At the end of the month (May 26-29), heavy rain led to flooding in southeast Germany (north and east Bavaria). On May 31, cold polar air flowed to northern Switzerland and caused snowfall in the Bernese Oberland at altitudes below 600 m. A fresh snow cover at these altitudes in Switzerland is very rare at that time of year, having occurred only 4 times in 50 years. Slovenia, too, experienced a significant drop in temperature during the last days of May.

Further to the east, an aircraft crashed down into the Black Sea due to heavy rain on May 3. Later on, heavy rain, followed by hail causing losses to agriculture, fell in the central region of the Republic of Moldova on May 30; at the station Ungheni, 65 mm of precipitation fell in 45 minutes, normally this is the quantity of the monthly total.

Especially in some countries in eastern Europe, this month started warm and dry, but became cool and wet at the end. May began warm and dry in Estonia. No rain occurred for 18 days there. However, at the end of the month, up to 270% of the normal precipitation for this period was registered on the island of Hiiumaa. Also in Belarus, the first decade of May was the warmest this year, and the third decade the coldest. Poland, too, had a generally bright first part of the month with little precipitation, whereas the second half of the month was colder and wet.

The eastern half of the Mediterranean and the southeast of the Region were very dry too this month and also warmer than normal everywhere. Only during the first decade of May was damage due to hailstorms reported from Turkey. Unusual daily maximum temperatures of up to 38 °C were recorded in Greece on May 23-25. Especially the last pentade of the month was extremely hot in Armenia, with temperatures of 22-27 °C in the mountains and 32-34 °C in the Ararat Valley. In the second half of the month there was no rain in some regions of Armenia, which is very unusual, since April and May are normally the rainiest months of the year in this country.

June

- **Mostly warm, especially in southwestern Europe and in the east**
- **Mostly dry with locally or regionally wet areas, especially in southeastern Europe**

June 2006 was dominated by a meridional circulation pattern over the Region. After a wet and cold start to the month in central Europe, a strong high pressure system over the east Atlantic moved to Europe and then further east, some more ridges followed during this month and led to the beginning of a hot summer weather period in large parts of Europe to coincide with the start of the soccer World Championship on June 9. The frontal zone was quite far to the north, so nearly the whole Region was warmer than normal. Colder than normal areas were only found in east Greenland, northern Norway and a few locations in the Mediterranean. Some low pressure systems within the frontal zone passed Iceland, Svalbard and northern Scandinavia, causing higher than normal precipitation.

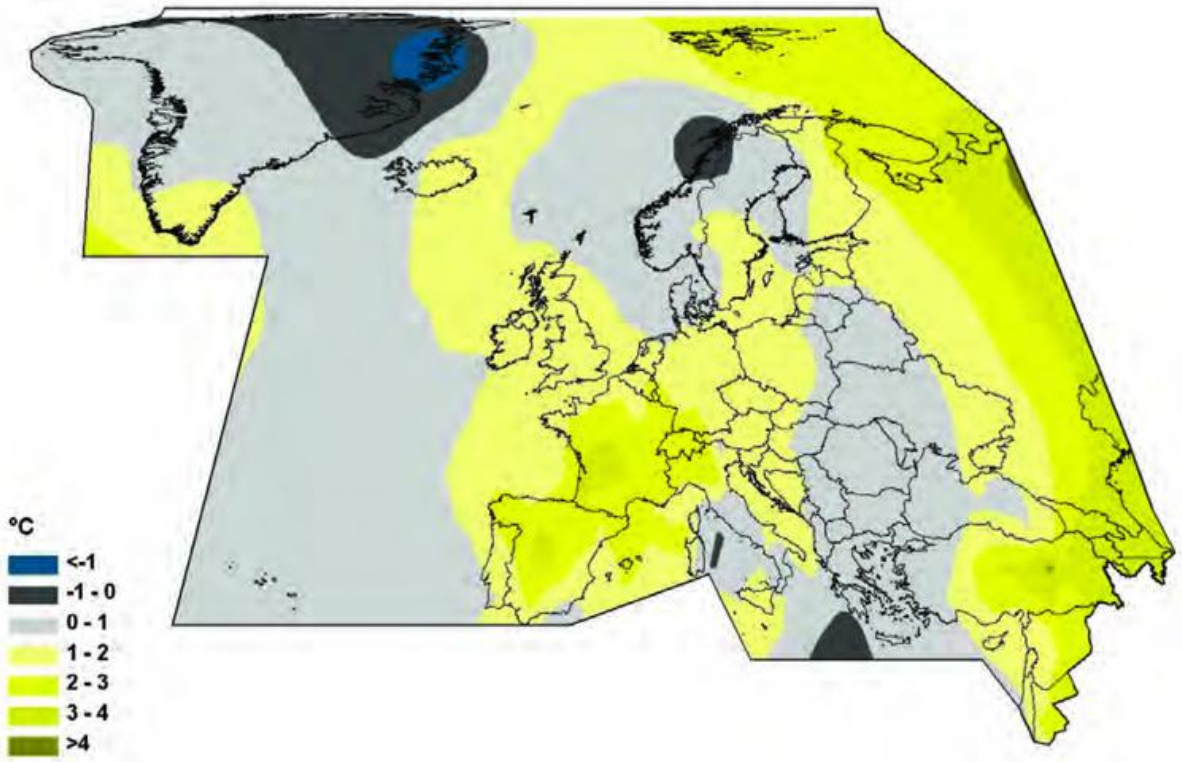


Fig. 6.1: *Monthly mean temperature anomalies in June 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

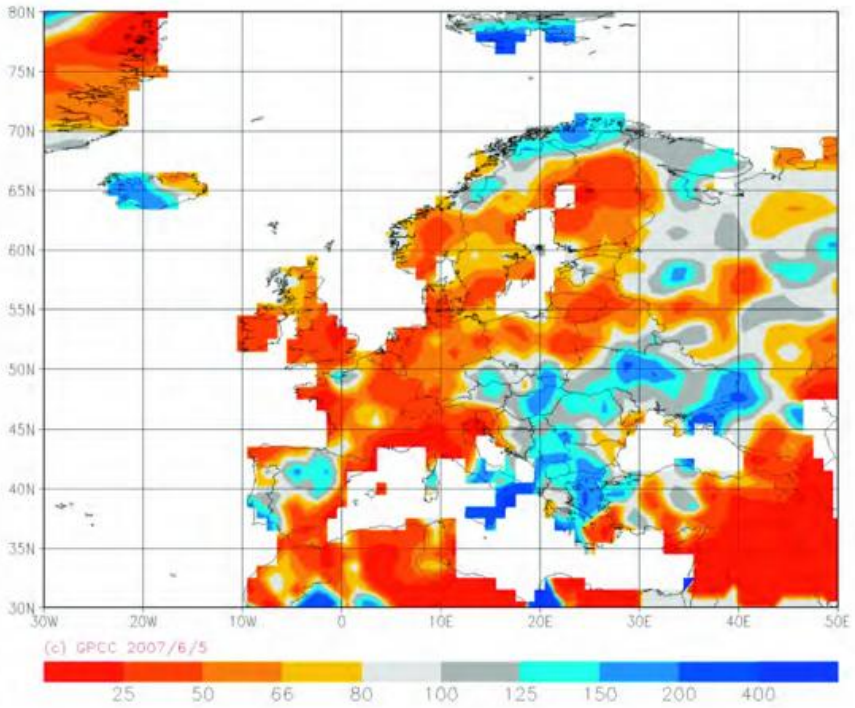


Fig. 6.2: *Monthly precipitation amounts for June 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

Temperature maxima above 30 °C were measured very often this month, even in the northern parts of the Region. Norway recorded the highest maximum temperature of the year at 32.2 °C in the county of Nord-Trøndelag on June 12; central London recorded a daily maximum of 32.4 °C on the same day. High maximum temperatures exceeding 31 °C on June 21-22 were reported from Estonia, and mean daily temperatures were exceeding 20 °C at the same time in Lithuania. Poland had a maximum of 33 °C. European Russia, too, experienced a very warm June; it was the third warmest of its spatially averaged time series and already warm at the beginning of the month. On June 4-6, the temperature rose to 40 °C in the Volgograd and Saratov regions. In the area around Astrahan (near the Caspian Sea) very warm winds were recorded. In North Caucasia, the maximum temperature was above 30 °C for as long as 15-18 days, without any precipitation. By the end of the second decade, soil drought began in the Volgograd region. In Slovenia, the highest ever daily mean and daily maximum temperatures were measured.

Most of the Region was dry too, especially most parts of western, central, northern and northeastern Europe, where the high pressure influence was strongest. Western and southwestern Europe also had large temperature anomalies, partly exceeding +3 °C, notably in France and Spain, locally also in Italy. Another area of similar large anomalies was to be found in the east of the Region (Fig. 6.1).

The dry and sunny period in central Europe was only occasionally interrupted by thunderstorms, e.g. on June 16 when hail stones of the size of tennis balls were registered in Leipzig (eastern Germany); also Austria (Styria) was effected by hail showers that day. Heavy rain with flooding was recorded in Austria on June 28 (county Burgenland in the east) and on June 30 along the valley of the river Thaya in Lower Austria. For this reason, only the west of Austria was dry on monthly average, while the east had a monthly total of more than 200% of the normal precipitation. Severe thunderstorms, locally with hail, occurred particularly on June 29 in Slovenia, but over the whole month it was dry in this country.

Generally, it was mainly wet in large parts of southeastern Europe (Fig. 6.2) and the temperature anomalies were still mostly positive, but smaller there. Heavy rain with flooding near the Danube and Tisza rivers were reported from Hungary on June 7 and another high daily precipitation amount of 107 mm on June 27. Serbia was cold and wet in the first decade as in central Europe, but warm and dry afterwards; the highest maximum temperature in Serbia was 36.2 °C in Cuprija on June 27. In the middle of the month, storms with heavy rain, thunder, hail and landslides lasted for about one week in Romania and Bulgaria. A rain intensity of 30-40 mm/h and hailstones as big as walnuts were reported from Sofia. Also in the Republic of Moldova, heavy rain with hail and strong wind occurred, up to 50 mm of precipitation fell on June 20, which corresponded to 75% of the monthly total.

Daily maximum temperatures of up to 40 °C were reported from Greece on June 19-20 over several areas of the country, mainly over the mainland. The monthly normal maximum is around 30 °C. Malta recorded its highest temperature of the year on June 30 at 38.5 °C, which was far below the record of 43.8 °C in August 1999.

The Middle East was very dry and warm. Parts of Armenia were more than 4 °C warmer than normal, during the first decade even 5-8 °C warmer. A severe drought occurred in this region, only at the end of this month did a cold front cause heavy rainfall, and hailstorms on June 23 and 26, with hailstones of up to 25 mm in diameter, causing losses of crops.

July

- **Very hot, especially in central Europe, cold in Russia**
- **Mostly dry, in the south partly wet**

In July 2006, a more or less stable, mostly meridional circulation pattern was established. Central Europe and surrounding areas were under high pressure influence during nearly the whole month. This situation caused an extremely hot and sunny July, especially in the second half. Temperature anomalies over large parts of central Europe reached more than +5 °C, marking a record heat wave. In some places, this was the warmest July ever registered, e.g. in the central England time series (for 348 years), in De Bilt (Netherlands) for 300 years, in Uccle (Belgium) since 1833, in Luxembourg (airport) since 1947, in France since 1950, in Germany (areal mean) since 1901 and in Vienna since 1775. Also in Switzerland in the lowlands north of the Alps and in most of the Alpine valleys the highest ever July averages were registered, whereas on the southern slope of the Alps the temperatures did not reach the previous highest values recorded in July 1983.

This hot July was exceptional mainly due to the long duration of the heat wave rather than its absolute maxima. At various locations in the Czech Republic, the temperatures frequently exceeded 35 °C, especially in the second half of the month. At most stations in Slovenia both the monthly mean temperature and the number of hot days (maximum temperature >= 30 °C) were among the highest ever observed. In the southern half of France again, maximum temperatures exceeded 35 °C during many days (Fig. 7.1). The duration of the heat wave is also documented by the high number of 27 summer days (>= 25 °C) in Luxembourg (airport); normally only 10 days are to be expected there on average. In the Netherlands, the heat wave during July 15-30 containing 8 tropical days (maximum >= 30 °C) was the longest in a century. Denmark reported the warmest July since 1994, with an average of 19.8 °C, 321 sunshine hours and 15 summer days.

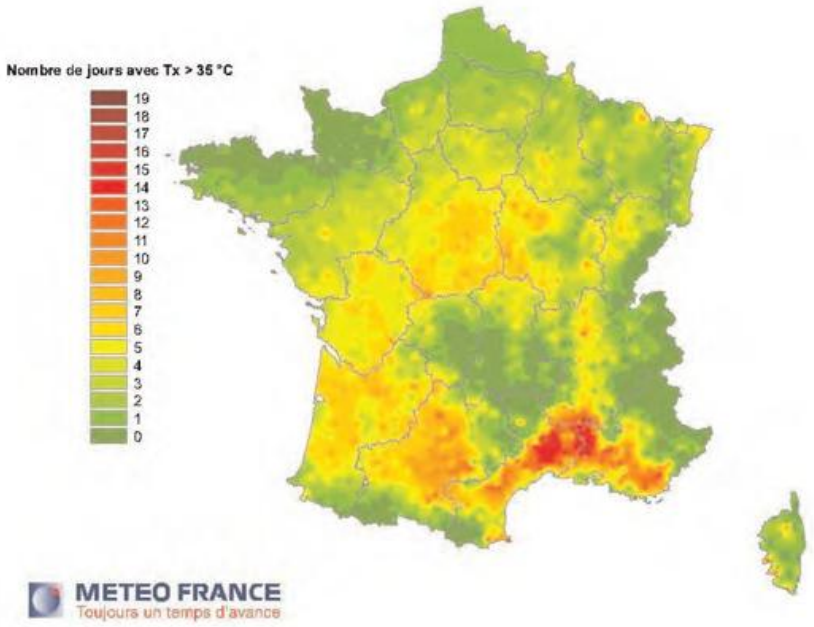


Fig. 7.1: *Number of days with a maximum temperature of > 35 °C in the period 10-28 July 2006 in France.*
Source: Météo France

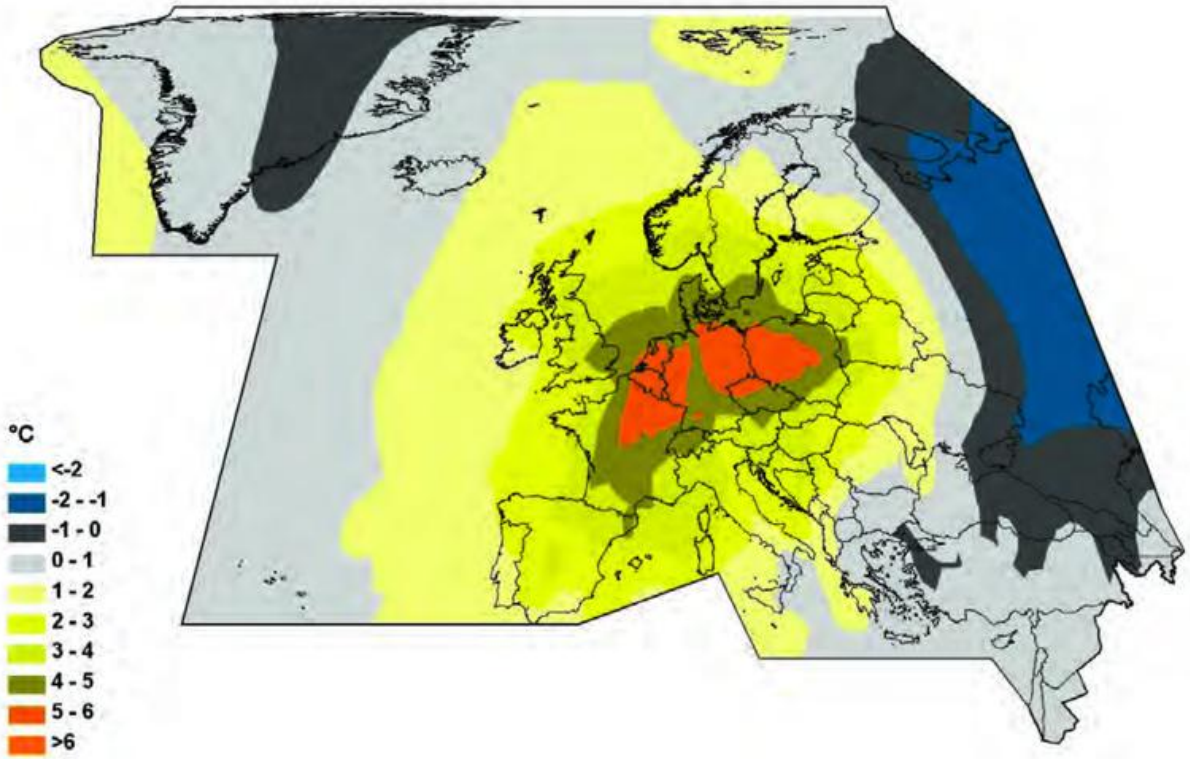


Fig. 7.2: *Monthly mean temperature anomalies in July 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

In the surrounding areas the anomalies were smaller, but still quite high (Fig. 7.2). Sea surface temperatures in the North Sea and Baltic Sea reached record levels too. For the coastal areas in southern Norway it was the warmest July since 1867. A maximum temperature of 35.1 °C was measured in Vöru (southeastern Estonia). In Latvia, 35.3 °C was the highest maximum; it was measured on July 9. July 2006 was the 5th hottest July in Latvia. Poland, too, had a heat wave in the first decade and another in the third decade with maximum temperatures above 36 °C. In western and southwestern parts of Belarus, it was the warmest July since records began, and also in other parts of the country such a hot July occurs only once in 15 years on average.

Some absolute maximum temperatures, nevertheless, were also new records or at least very close. A new UK maximum temperature record for July of 36.5 °C was recorded in Wisley, southwest of London, on July 19, but it was less than the highest known UK value for any month (38.5 °C), which was recorded in August 2003 at Faversham in Kent. The same day, the highest temperature since June 1976 (32.3 °C) was measured at Elphin in Ireland. Luxembourg recorded 35.6 °C as the maximum of the year, and this was also well behind the absolute maximum of 37.9 °C in August 2003. In contrast, the Netherlands set a new national temperature record this July with 37.1 °C in Westdorpe in the southern part of the country, again on July 19. The highest maximum of the year in Hungary was 36.9 °C on July 22, measured in Budapest.

The heat wave even reached the southern parts of the Region. Serbia had an outstanding heat wave on July 20-29; maximum and minimum temperatures exceeded normal values considerably (Fig. 7.3). In Bulgaria the heat wave was during July 25-28 and was the cause of at least 7 field and forest fires. In some coastal and lowland parts of Albania the highest mean maximum temperatures of their time series were registered. It was also the hottest July in Bologna (Italy) since 1999. In Portugal, the duration of the heat wave of 11 days in the Alentejo region was the most significant since 1941 in July. This month was the 3rd warmest in Portugal

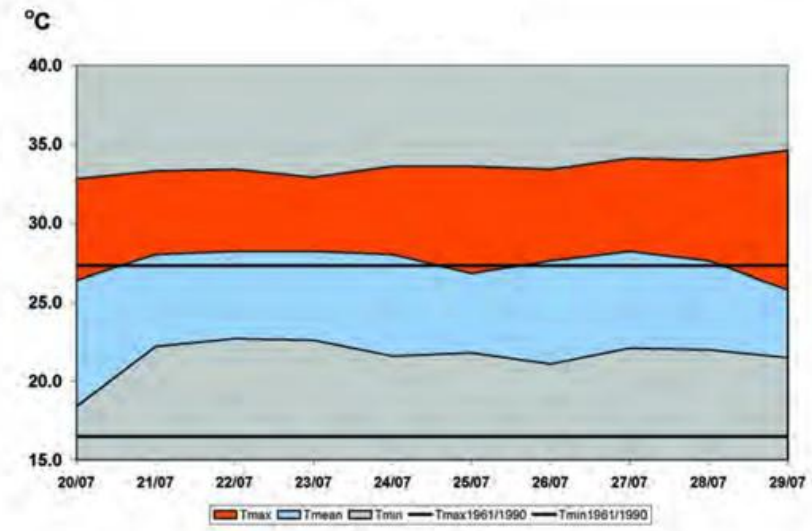


Fig. 7.3: *Maximum, minimum and mean daily air temperature from 20 to 29 July 2006 in Belgrade, Serbia, compared to normal values 1961-1990.*
Source: Republic Hydrometeorological Service of Serbia

since 1931 after 1989 and 1990. It was also the month of July with the longest sequence of tropical nights (minimum temperature >= 20 °C) since 1990 in almost the whole of Portugal, causing high physiological discomfort.

Only in the easternmost part of the Region and partly in Greenland it was colder than normal. Russia and west Kazakhstan had the strongest negative of the Region, but they were not lower than -2 °C. On July 20, the cold spell reached Latvia too; the temperature fell to 2.5 °C and some frost was observed on the grassland. Such a low temperature had not been measured in Latvia at that time of the year for the last 55 years. In Israel the July temperature was close to normal; here it was the first July since 1994, which was not significantly warmer than normal.

Most of Europe was not only warm this month, but also very dry (Fig. 7.4). In Sweden, the dryness, which already started in June, became problematic for the farmers; only late in July did heavy thunderstorms become more frequent. Less than 25% of the normal precipitation fell around the Baltic Sea. Some districts in Estonia received only 3% of the normal precipitation. In Latvia it was the 2nd driest July for 83 years, in some places, e.g. in Riga, it was absolutely the driest ever measured. The hot and dry weather resulted in 1700 registered fires in Latvia, 2.5 times more than in July 2005, and in severe agricultural losses. Drought conditions also resulted in Poland. In the south, it was also dry in northern Italy in the whole Po Valley. On July 22, the Po River reached its minimum daily discharge of 168 m²/s at Pontelagoscuro close to the Po delta; this was the lowest recorded at this location since 1918. Malta was without any rain this month.

In some other parts of the Region, it was very dry too, but sometimes interrupted by heavy precipitation events. Heavy thunderstorms were reported from eastern Finland with large hailstones up to 7 cm in diameter. In the central parts of Europe a few local areas with high precipitation were recorded, mainly due to local thunderstorms. Switzerland was in most areas extraordinarily dry and sunny, but locally exceeded the normal amount of precipitation, due to showers and thunderstorms. On July 24, 30 mm of rain fell within one hour in some parts of Budapest in Hungary, but the monthly total was low. In northern Romania, heavy precipitation caused flooding on July 1-3, and also Bulgaria, the Ukraine and Turkey, partly also Italy were affected by this precipitation event during the first week of the month; especially the Black Sea coast suffered from the flooding of camping sites. The station Malko Turnovo in Bulgaria reported 301 mm of precipitation on July 3, the highest daily amount in that region since 1915.

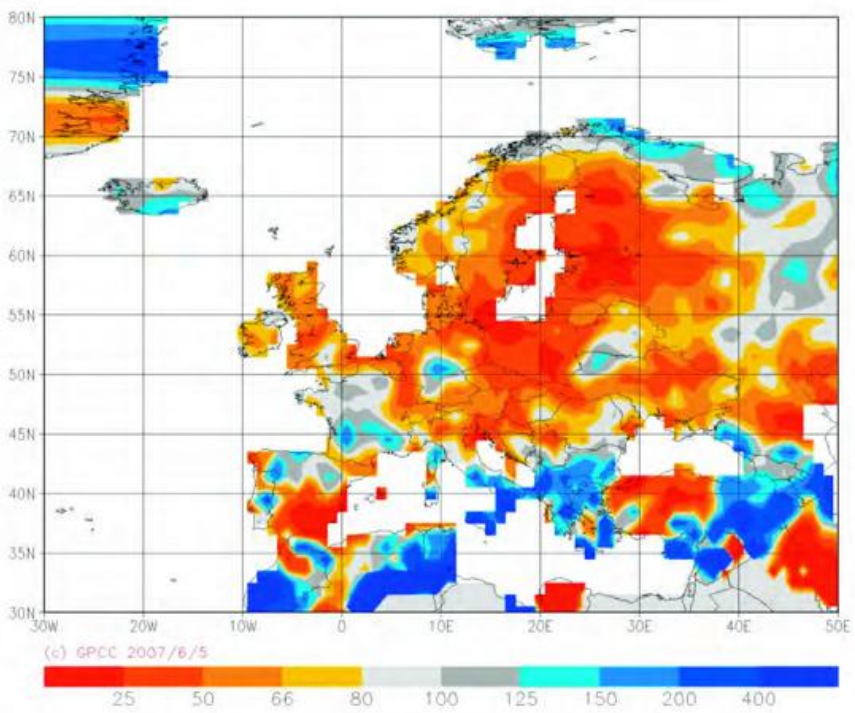


Fig. 7.4: *Monthly precipitation amounts for July 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

In the south of European Russia, dry weather persisted this month, while frequent and torrential precipitation was observed in the northeast.

Larger wet areas with respect to the monthly precipitation total were only to be found in the north (parts of Greenland, Svalbard) and parts of the south (especially southern Italy, Greece, Cyprus and parts of the Middle East). The spatial average precipitation in Cyprus, occurring mainly in the first week of the month, was 15 mm, but this was almost 600% of the normal. In the Ararat Valley in Armenia about 400% of the normal monthly precipitation total was recorded, due to some heavy rainfall events.

August

- **Cool and wet in central Europe**
- **Warm and dry in northern Europe and in the southeast**

In August 2006 the weather situation changed abruptly and put an end to the July heat wave in central Europe right at the very beginning of the month. The high pressure configuration was replaced by a large low pressure pattern coming from the northwest to central Europe and leading to a cool and wet period there. This new circulation pattern remained mainly the same for the whole month, since new lows followed from the northwest. Nearly the whole of central Europe was cooler than normal, in parts more than 2 °C (Fig. 8.1), and all the western, central and also some eastern parts of Europe were very wet, with more than 200% of the normal precipitation over large areas (Fig. 8.2), partly over 400%.

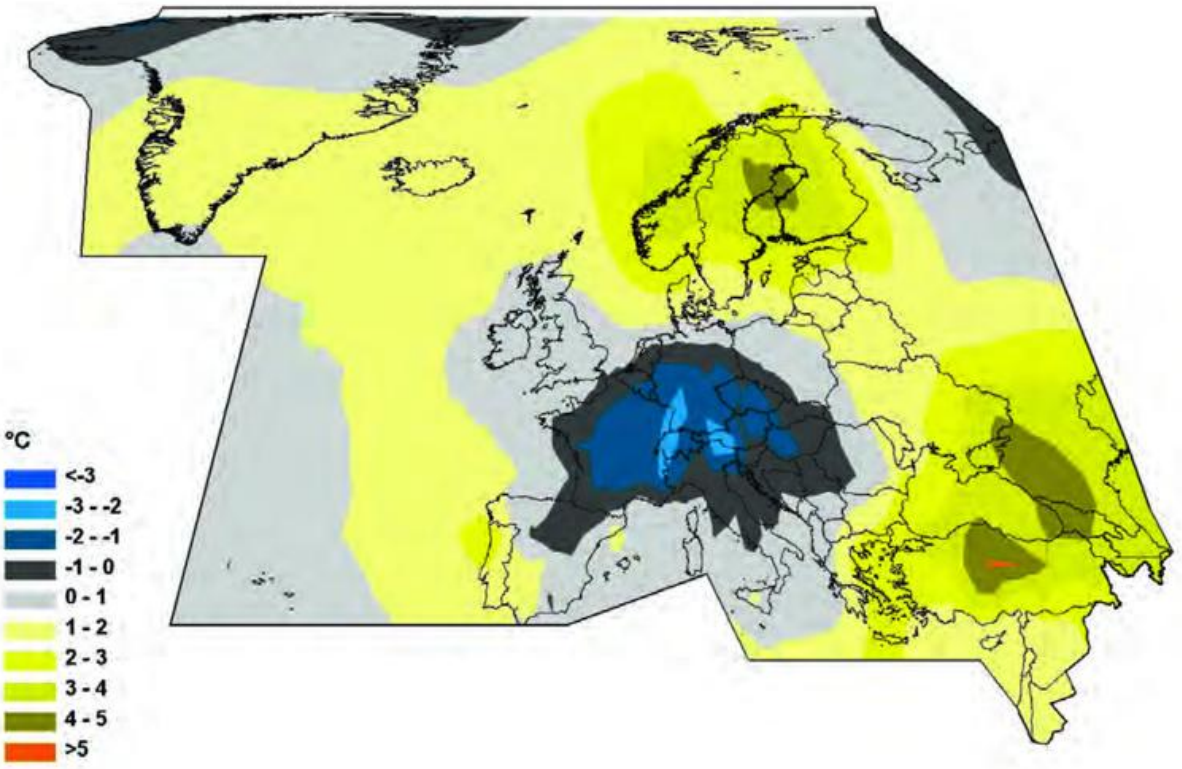


Fig. 8.1: *Monthly mean temperature anomalies in August 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

In some countries this August was one of the wettest ever recorded. In Germany and in the Netherlands, it was the wettest August since 1901, in Denmark the 3rd wettest since 1874. 191 mm fell in Belarus during the whole month; this was 273% of the normal and this amount had never been measured since 1891. At the coast of Slovenia, the highest monthly total ever registered was recorded with 325 mm. In Serbia, monthly precipitation totals achieved new records locally, e.g. in Loznica. In west Albania up to 450% of the monthly precipitation normal was registered this month.

The high rainfall totals of this month were partly due to a high number of rainy days, but also to local heavy rainfall events in various places of the Region. The southern parts of Sweden and Norway were wet, due to many and heavy thunderstorms and showers. Some stations in Sweden measured more than 100 mm in one day. In the southernmost province of Skåne, the drought which had lasted for a long time earlier that summer was replaced by such wet conditions that harvesting had to be delayed. In Lund (southern Sweden) the monthly total of 264 mm was a new record for August. Over 100 mm of rain also fell in the country of Surrey in the UK in around six hours on the afternoon of August 13. Luxembourg Airport reported a high number of 26 rainy days (normally there are 12). Three days of continuous precipitation led to numerous local floods in the counties of Salzburg and Lower Austria up to August 6. Poland recorded downpours exceeding 250 mm a day in some places. Torrential precipitation also fell in many places in Romania, resulting in high monthly totals locally (Fig. 8.3). Extreme rain with daily totals up to 100 mm was reported from northeastern Bulgaria on August 28. Heavy rain occurred also in the northern regions of the Republic of Moldova on August 26, followed by hail of 6 cm in diameter and strong winds. In the Mediterranean, Italy reported intense precipitation with hail and strong gusts of wind occurring in the countryside close to Ferrara in the Po Delta on August 3 (Fig. 8.4), causing damage to buildings and disruption of traffic on the main roads. In terms of temperature, Bologna in Italy recorded its coldest August mean minimum temperature since 1985 and the coldest mean maximum since 1978.

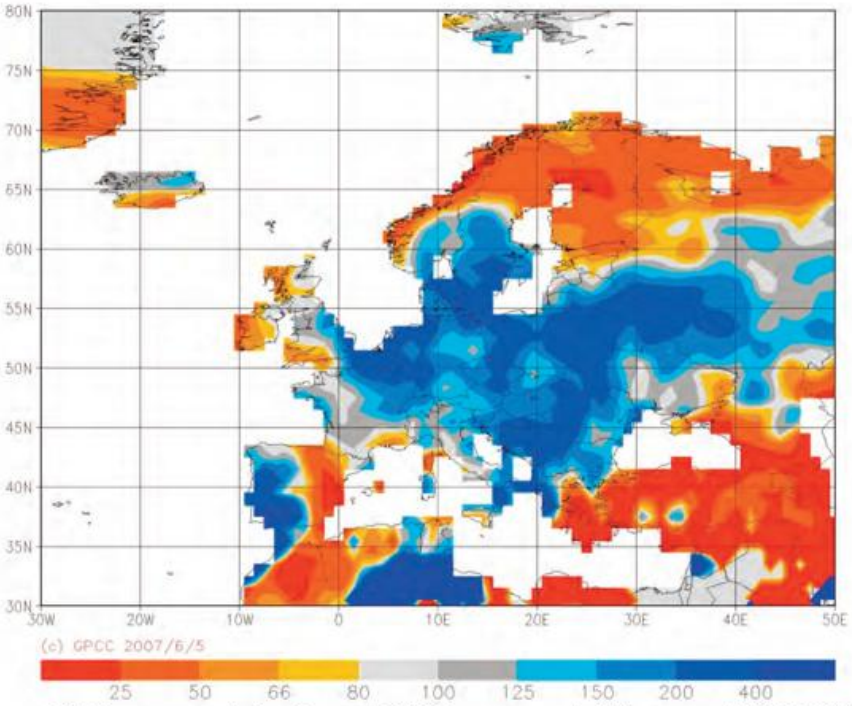


Fig. 8.2: *Monthly precipitation amounts for August 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

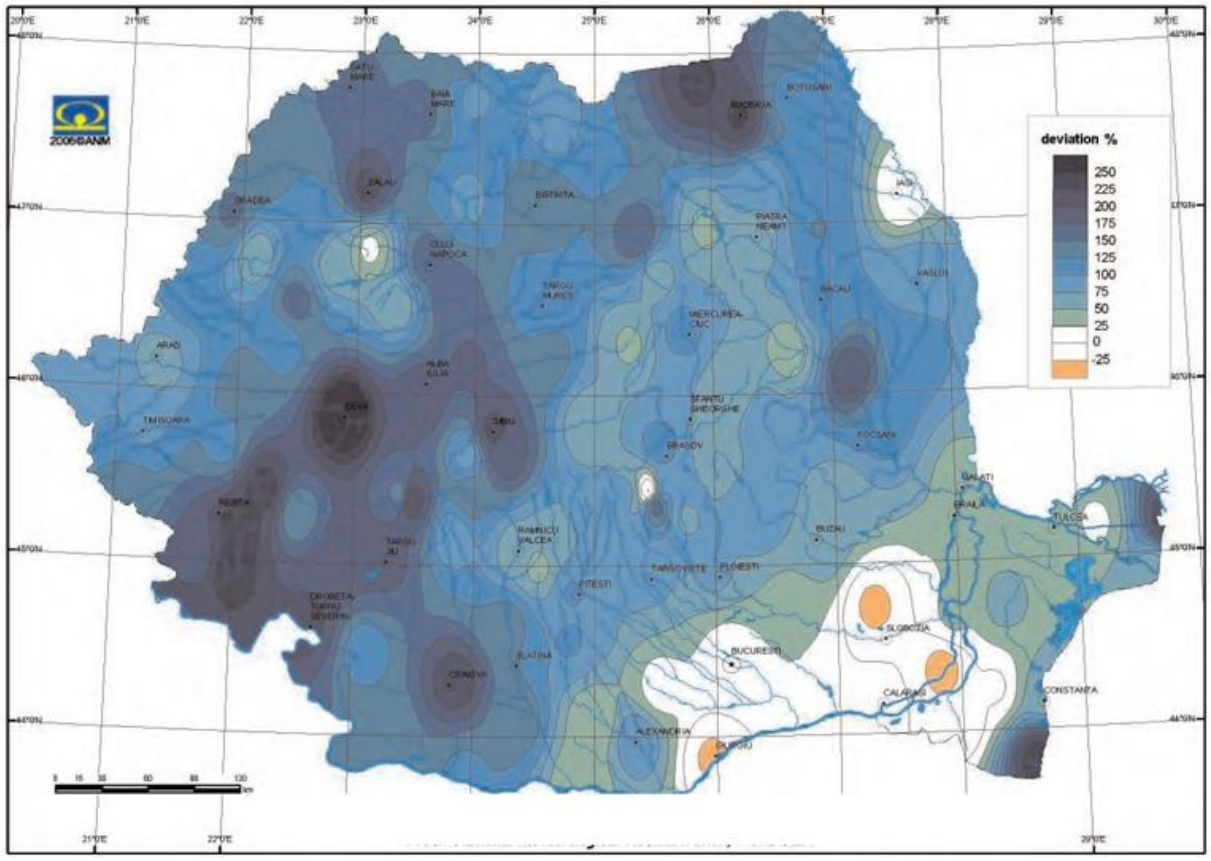


Fig. 8.3: *Deviations of monthly precipitation totals from long-term averages in Romania in August 2006.*
Source: National Meteorological Administration, Romania

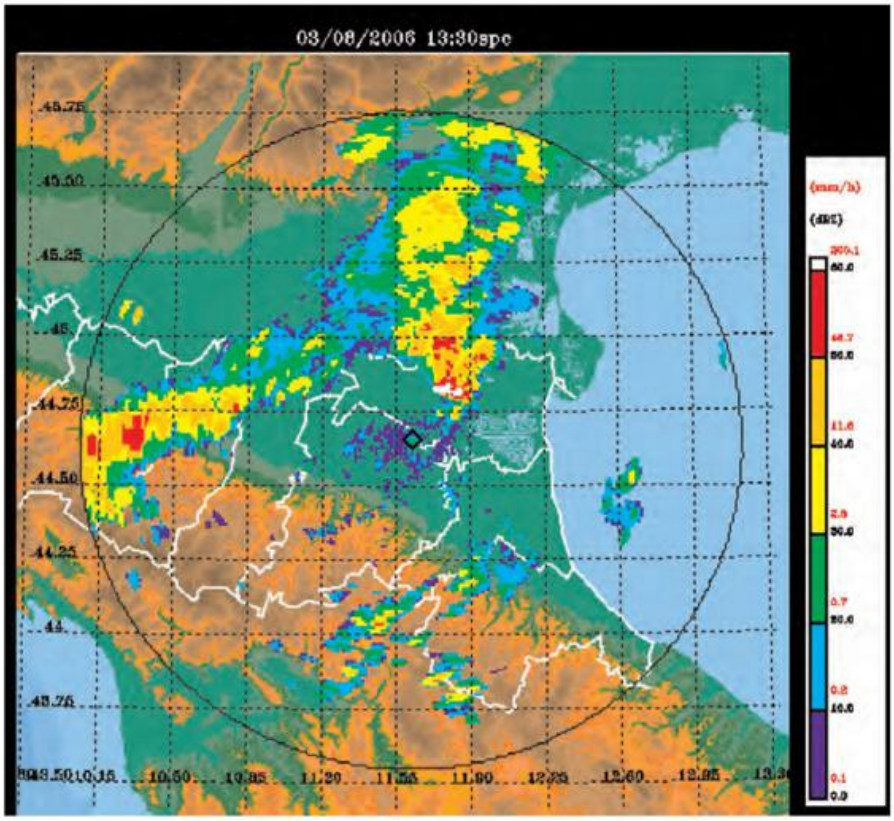


Fig. 8.4: *Radar image of the Po Delta in Italy with interpretation of precipitation intensities, taken at the climax of the heavy precipitation event on August 3.*
Source: Regional Agency of Prevention and Environment, Bologna, Italy

In contrast, northern Europe came under high pressure influence from time to time, so it was warm and dry there. The temperature anomalies exceeded +4 °C in parts; the precipitation was partly less than 25% of the normal. In parts of Norway it was the 2nd warmest August since 1867, for the country as a whole the 5th warmest.

It was also hot and dry in the southeast of the Region with similar anomalies as in the north. Within European Russia, it was especially warm in the south in northern Caucasia and the Lower Volga regions. Locally the anomalies were above +5 °C there. The maximum temperatures were over 30 °C for a longer period of time, in the first half of the month even 37-43 °C, together with long soil droughts, while further in the north, central European Russia (Kaluga region) experienced the rainiest August for 100 years. In the Ukraine, August was the warmest month of the year (in sharp contrast to central Europe), with maximum temperatures of up to 40 °C in the east of the country. A short summer heat wave on August 19-21 was reported from Romania and Greece, mainly on the mainland, with daily maxima around 40 °C. Also in Turkey there was a severe heat wave at that time, causing a forest fire near Izmir. Cyprus reported heat wave conditions during 10 days from August 19-28, when maximum and minimum temperatures were 2-5 °C above normal on average. In Israel, it was the 3rd warmest August in the mountains and the Jordan Valley since 1964. An unusual event occurred on August 20 with 15-20 mm of rain in the Galilee in northern Israel, considering that there is normally no rain at all in Israel in August. In Armenia, the maximum temperatures were about 40-42 °C in Yerevan and the Ararat Valley, the latter was without any rain during the whole month. However, in the northwestern part of Armenia, 80 mm of precipitation was recorded on August 19 (this was 140% of the monthly normal!).

The west part of the Iberian Peninsula was warm and very wet due to heavy thunderstorms, whereas the east was less anomalously warm but very dry. Especially in the first half of August and at the end of the month, long heat waves occurred in Portugal, interrupted by a cooler period on August 15-19. These days were also very rainy.

September

- **Warm nearly everywhere in the Region, especially in northern and central Europe**
- **Dry in parts of northern and most of central Europe and partly in the southeast**
- **Wet, especially in northeastern Europe and around the Mediterranean**

In September 2006, the large-scale circulation pattern changed again considerably. Central and parts of northern Europe frequently came under high pressure influence, whereas low pressure systems were concentrated particularly over the Atlantic, the northeast of Europe and the Mediterranean, in the latter case mostly in the form of cut-off lows. The main result of this configuration was a switch from a cool wet August to a very warm and dry autumn especially over Central Europe. Other parts of the Region remained warm as before, so that higher than normal temperature anomalies were to be found nearly everywhere in the Region (Fig. 9.1). In

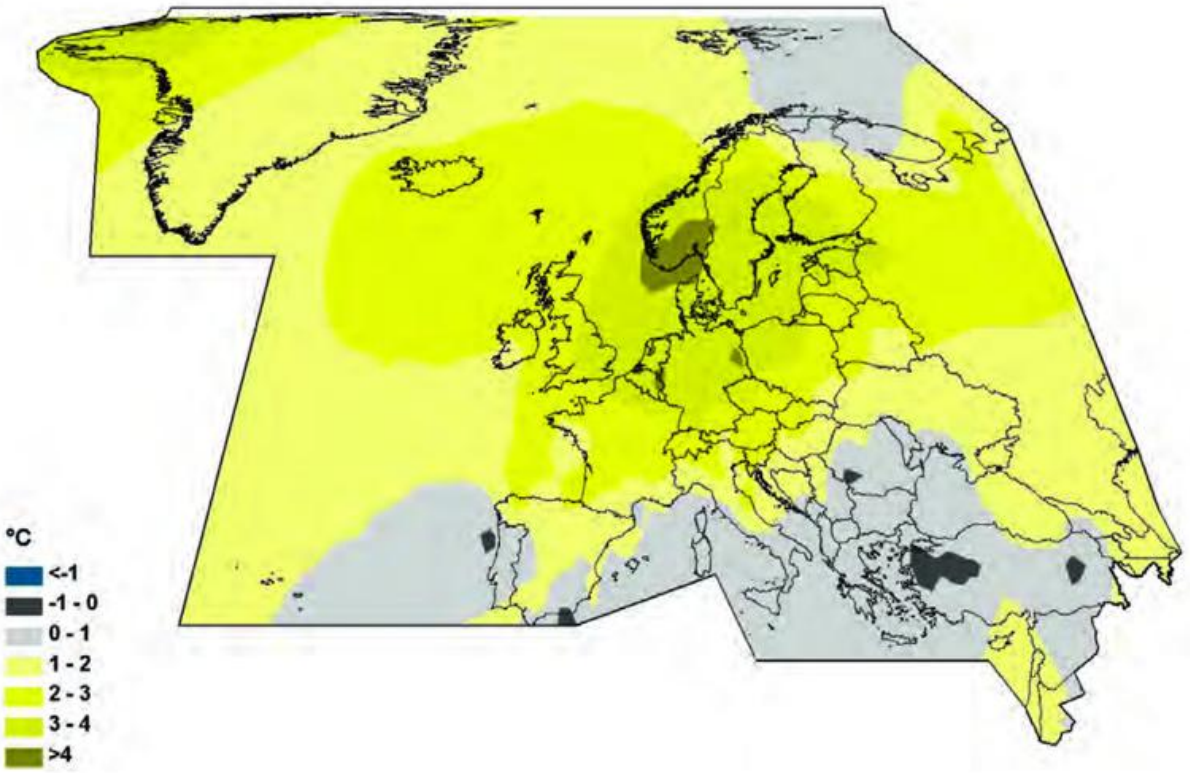


Fig. 9.1: *Monthly mean temperature anomalies in September 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

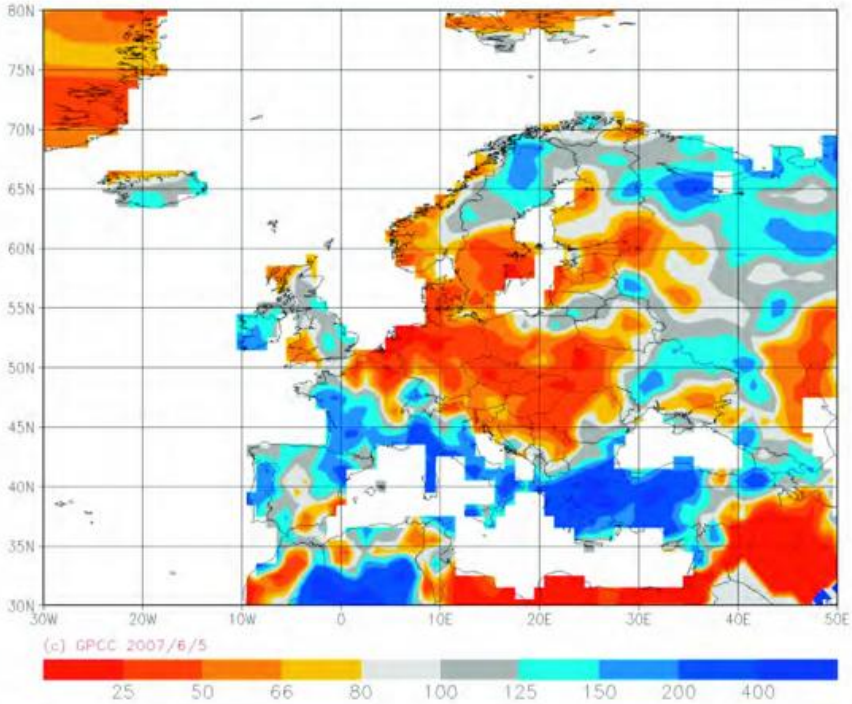


Fig. 9.2: *Monthly precipitation amounts for September 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

most of central and southern north Europe they exceeded +3 °C, in parts +4 °C. These areas were also very dry, partly with less than 25% of the normal precipitation (Fig. 9.2), although a few local thunderstorms with heavy rain occurred.

The Arctic sea ice extent of 5.9 million km² was the second smallest ever measured, only slightly under the previous year 2005.

For parts of southern Norway, the monthly mean temperature was the highest since 1867, and also in southern and central Sweden new records were set. In Denmark, this September shared the temperature record with September 1999 with 16.2 °C as monthly average. On the Faroe Islands, this September was record-breakingly warm at every station of the Danish Meteorological Service. This could be explained by the fact that there was an advection of warm air masses from the south to the Faroe Islands throughout the month. Reykjavik (Iceland) recorded its 4th warmest September since the beginning of measurements in 1870 and the warmest since 1958. In Brussels-Uccle, Belgium, it was the warmest September since the beginning of observations in 1833. Germany, too, reported the warmest September (since 1901), and also in the central England temperature series (348 years) it was the warmest, in other areas of the UK as well. Also for the Netherlands (De Bilt) and Luxembourg Airport it was the warmest September since the beginning of the time series, in France it was the 2nd warmest since 1950. In Tartu, Estonia, it was the 2nd warmest September for 140 years after 1934, in Latvia it was the 3rd warmest. Poland still had maximum temperatures up to 29 °C this month, but also minima down to 3.3 °C. Frosts down to -3 °C were reported from west Kazakhstan on September 18 at night time.

Some parts of northeast Europe and some areas near the Atlantic and around the Mediterranean were also warm, but wetter than normal, particularly in Greece and Turkey, with more than 400% of the normal precipitation in parts (Fig. 9.3). Heavy thunderly rain fell in southern France on September 13-14. On Corsica, locally more than 400 mm of precipitation fell during these two days. High precipitation intensities of more than 100 mm / 24 hours were also recorded in northern Italy on September 14-18. In Portugal, daily precipitation totals exceeded even the normal monthly total in some places from September 21-25.

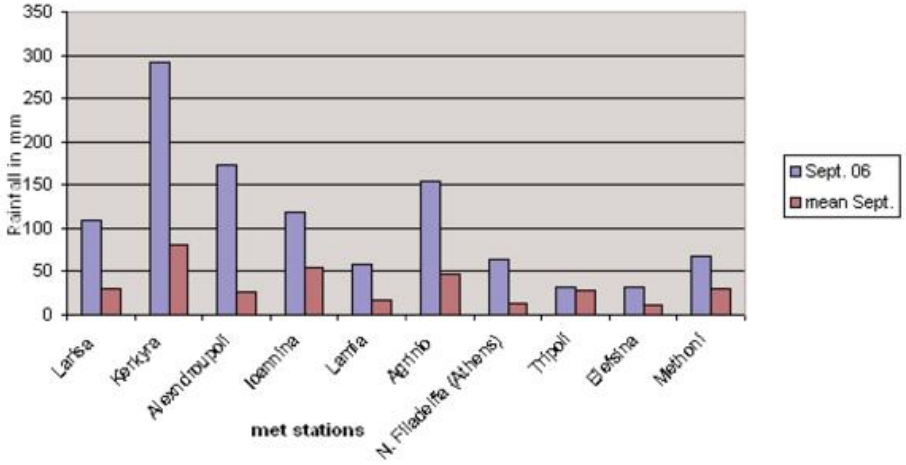


Fig. 9.3: *Monthly precipitation amounts for September 2006 compared to the corresponding long-term mean (various reference periods) at some stations in Greece.*
Source: Hellenic National Meteorological Service, Greece

A few stations in the southern part of the Region (Spain, Romania, Turkey) recorded monthly mean temperatures slightly below normal.

In Portugal, a heat wave which started at the end of August continued until September 10, with anomalies of 10-13 °C of the daily maximum temperature in almost the whole territory, in some locations they were record-breaking. Greece had unusually high maximum temperatures on September 4-7 in some places, partly exceeding 35 °C; the normal maxima are below 30 °C. An extreme Sharav event occurred on September 28-29 in Israel, with temperatures reaching 39-41 °C in the coastal plain and 40-42 °C in the Negev.

October

- **Warm in most of the Region except northern Scandinavia, parts of the Atlantic and the eastern Mediterranean**
- **Wet in most of the Region**
- **Dry in Greenland, western Norway, eastern central Europe, the western Mediterranean, Cyprus and west of the Caspian Sea**

High pressure influence and an airflow of mild maritime air continued mainly over central Europe. Most of the Region remained in a warm air mass. The highest anomalies were again in central Europe with more than +3 °C, as in the previous month and this time also in parts of southern Europe (Fig. 10.1). Another centre of such high anomalies was to be found in southern European Russia.

This October was one of the warmest in central Europe for more than 100 years. In Belgium it was the second warmest after 2001, in the Netherlands, France, Germany and Latvia it was the 2nd warmest, too. The active vegetation period in Lithuania ended 2-3 weeks later than usual, only the end of the month saw the first snow in many regions of that country. Some countries

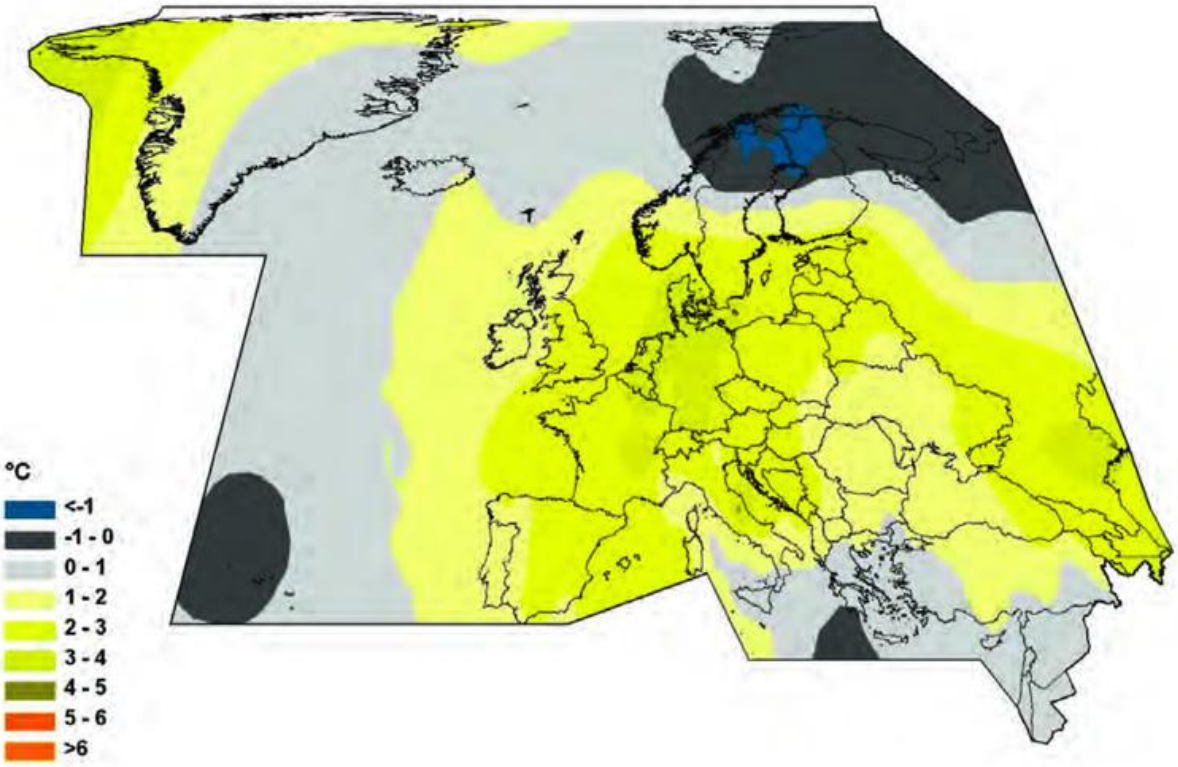


Fig. 10.1: *Monthly mean temperature anomalies in October 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

even recorded this October as the warmest of their time series, e.g. Denmark and Albania. Also the coastal areas of the Norwegian counties of Rogaland and Hordaland experienced the highest registered monthly mean temperatures since 1867. In southern regions of Poland maximum temperatures were still exceeding 25 °C at the beginning of the month. Romania recorded a daily maximum of 34 °C on October 4 in Zimnicea. Serbia had a heat wave from October 21-26 with maximum temperatures >= 25 °C throughout the whole country. Also later in the month, on October 26, some stations in Switzerland registered summery temperatures in the afternoon. 28.8 °C were measured in Vaduz, capital of Liechtenstein; it was the highest October temperature since the beginning of measurements in 1979. In the south, the highest October mean minimum temperature since 1931 was recorded in Portugal; the highest daily value was 19.1 °C at Porto on October 30.

The border line between this warm air mass and the cold Arctic air was still in northern continental Europe. In northern Scandinavia, the temperature anomalies were partly below -1 °C. It was also colder than normal over parts of the Atlantic, notably on some of the western Azores Islands and in small areas of the eastern Mediterranean. On the other hand, it was warm and dry on Greenland.

Due to frequent high pressure influence, it was very dry in eastern central Europe and particularly over the western Mediterranean (Fig. 10.2). Large parts of Italy received less than 25% of the normal precipitation. However, some Atlantic low pressure systems moved over western, central, northern and eastern Europe, resulting in large wetter than normal areas over most parts of Europe. In Sweden and in the western half of the Iberian Peninsula, more than 300% of the normal precipitation fell. Vihti (southern Finland) had a monthly precipitation total of 228 mm which was the highest amount ever recorded in the whole country, but also Helsinki was very wet (Fig. 10.3).

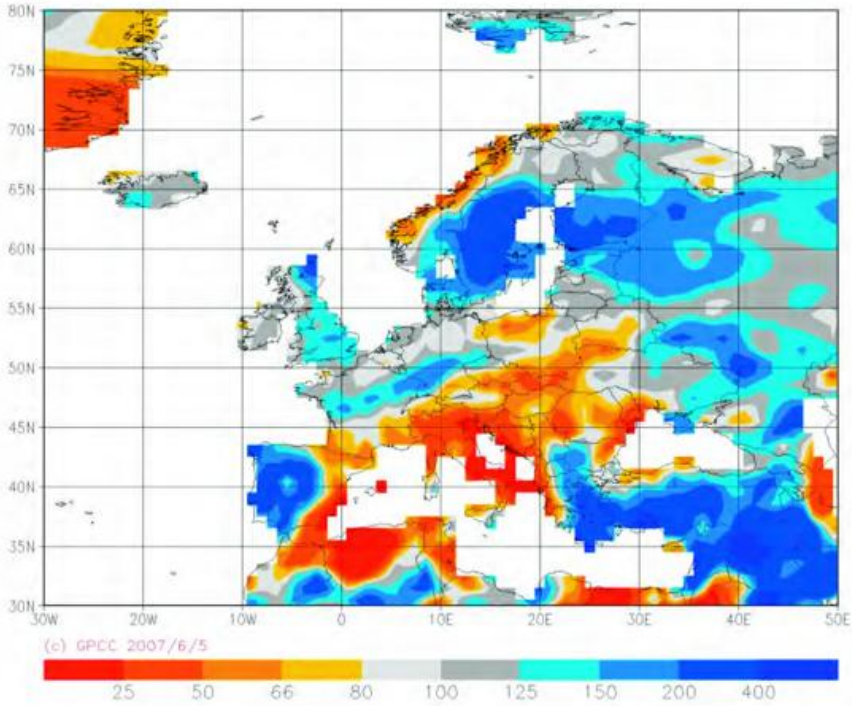


Fig. 10.2: *Monthly precipitation amounts for October 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

In the south, the highest values of the daily maximum precipitation totals ever recorded in any October month were exceeded in some places in Portugal on October 23 and 25, with up to 142 mm in Guarda (central eastern areas; previous record was in 1953). 64 mm fell within 2 hours in Coimbra (central western Portugal) on October 25 at 01-03 UTC, the highest amount since 1973. It was also the 4th rainiest October in Portugal since 1931, especially the period October 19-27 was extremely rainy.

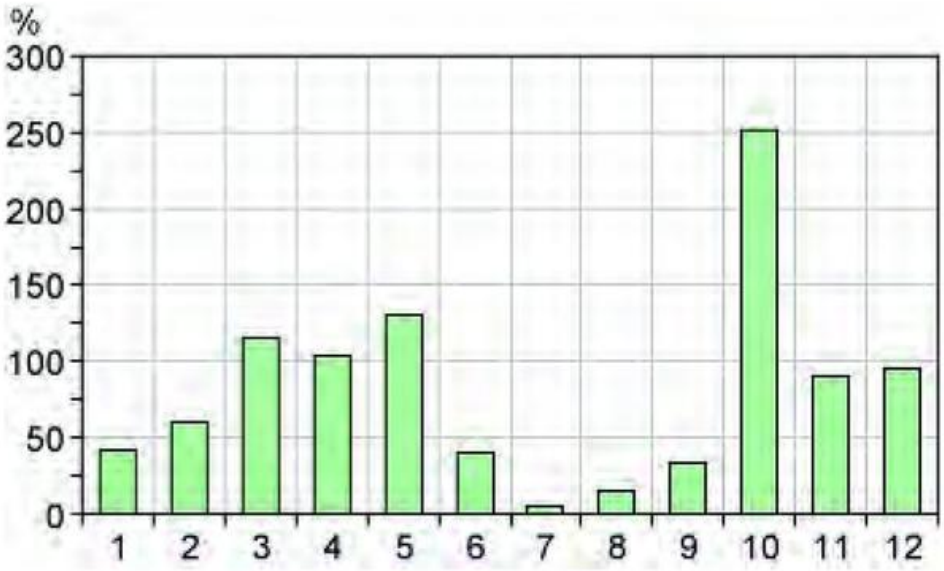


Fig. 10.3: *Monthly precipitation amounts for 2006 in per cent of the normal 1971-2000 at the station Helsinki Kaisaniemi, Finland.*
Source: Finnish Meteorological Institute

The highest monthly precipitation anomalies (monthly totals up to more than 400% of the normal) within the Region were registered near the eastern Mediterranean this month. Many towns in northern Greece were flooded after heavy rain on October 7-8. More heavy rain events in Greece followed on October 17-18 and October 21, and in Turkey, Syria and the Lebanon at the end of the month. Cyprus received 109 mm of precipitation on spatial average; this was more than 300% of the normal and the second highest October total since 1901. It was mainly due to three heavy rainfall events with hail, causing floods and damage to properties and crops. Israel was very rainy too, with monthly totals of 50-100 mm in northern and central parts, locally even 100-150 mm, compared to a long-term average of 20-40 mm. During the last 60 years, there were only two years in which rainfall totals in October were larger. 32 mm of precipitation fell during a few hours in Masrik in the basin of Lake Sevan in Armenia on October 4.

November

- **Warm in most of the Region, cold in southern Greenland, Iceland, parts of Russia and the southeast**
- **Wet in most of the north, dry in most of the south**

The warm air flow over Europe to the north continued in November. In this month, mild air masses reached even the northernmost parts of the Region. Temperature anomalies in Svalbard exceeded +6 °C (Fig. 11.1). Large areas, especially in northern and central Europe, were more than +3 °C warmer than normal; for some areas all three autumn months had reached this anomaly. Also most of the rest of Europe was considerably warmer than normal.

The coastal areas of the Norwegian county Østfold up to Hordaland had monthly mean temperatures which broke all records since 1867. Denmark reported a record-breaking November monthly mean temperature of 8.1 °C since 1938, despite a wintry start in the first days of the month, with snow and frost during night-time. In Brussels, Belgium, this November was the 4th warmest ever registered, in Germany the 3rd warmest, in the Netherlands and France the 2nd warmest. This November was considerably warmer than normal in Vienna (Austria) for almost the whole month (Fig. 11.2). For Estonia, it was the end of the month which was the warmest for 55 years, and also in Latvia, it was the warmest third decade for 83 years. Only the beginning of November (in particular November 3-6) was cold in these parts; temperatures down to -15 °C were measured in southeastern and northern Lithuania and even below that in Poland, whereas the high value of 19.3 °C was the maximum measured in the second half of the month in west Poland. The first decade of November was also cold in Belarus, the only cold one in this autumn. Serbia, too, was mild, especially in the second half of the month. In the southwest, Portugal recorded its 2nd highest November mean minimum temperature since 1931, after 1983, and its 3rd highest monthly mean temperature.

It was colder than normal in the northwest of the Region, particularly in southern Greenland and Iceland (due to a very cold spell in the middle of the month including a snowstorm), and also in the east and the southeast, here especially the eastern part of European Russia, the complete area of the eastern Mediterranean and the Middle East. Albania reported the coldest November of the time series down to 4.5 °C below normal.

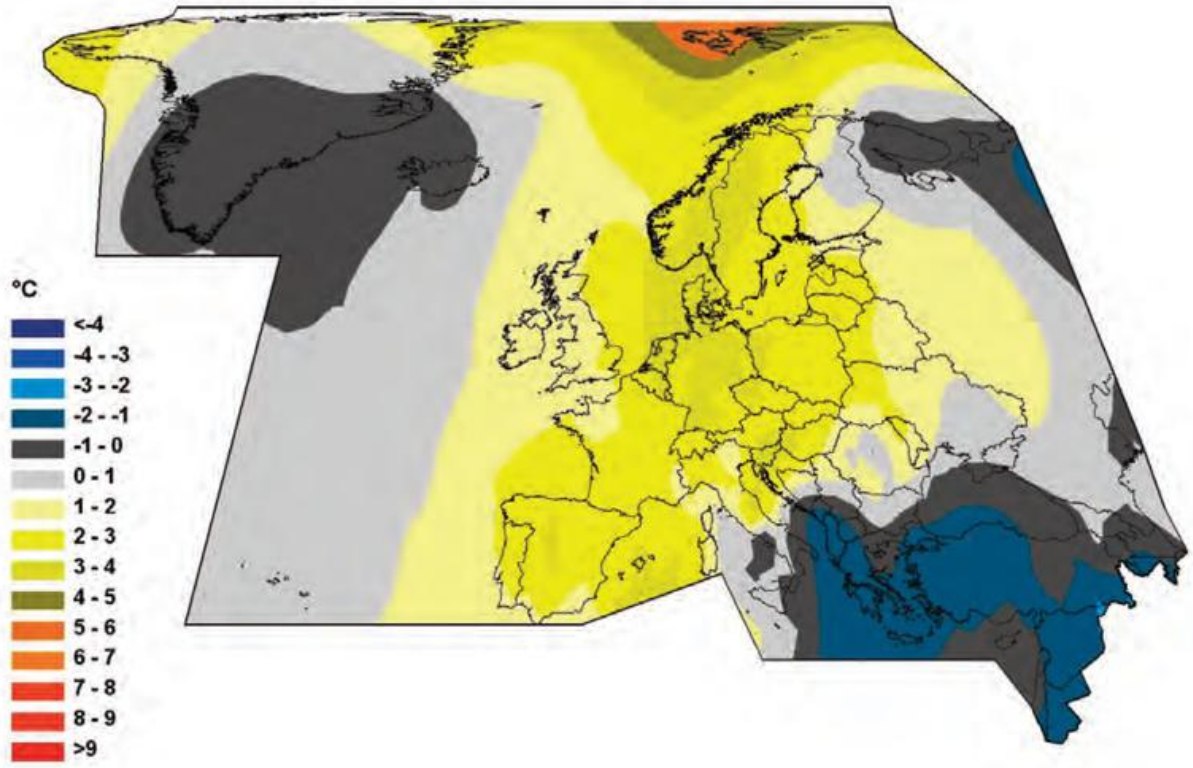


Fig. 11.1: *Monthly mean temperature anomalies in November 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

Due to the warm air flow over Europe, the frontal zone was more relocated to the north than usual and low pressure activity was frequent, particularly in the north. More than 200% of the normal precipitation was registered in Svalbard (Fig. 11.3), and also most of the rest of the northern areas were wetter than normal, except Greenland and the coast of northern continental Scandinavia. For Norway as a whole, the monthly precipitation total was 140% of the normal, the 4th highest since 1900. The whole country of Finland was covered with snow (40-50 cm in the southeast) which was unusual, although the snow had melted away by the end of the month.

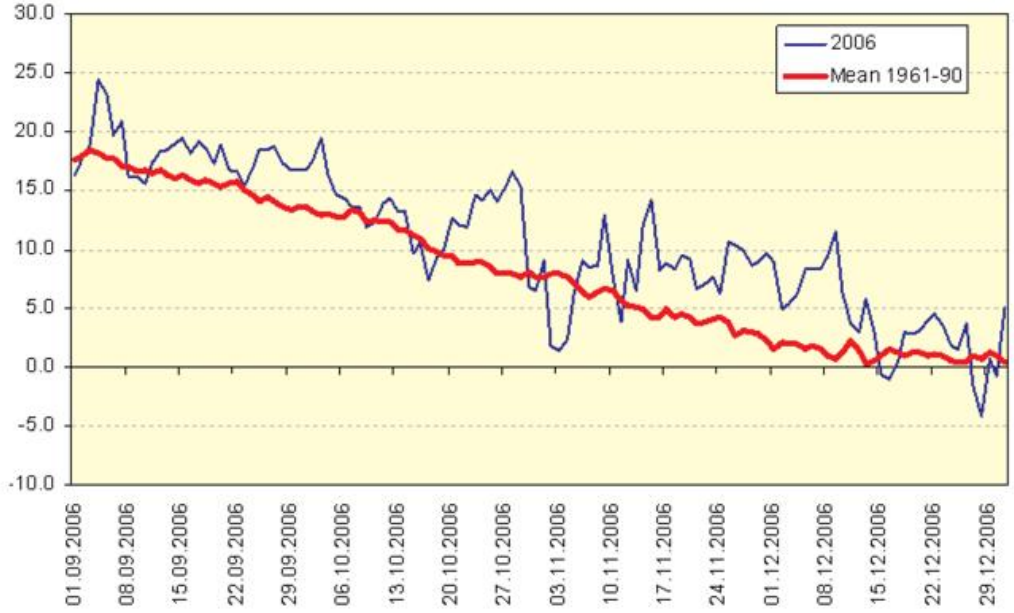


Fig. 11.2: *Daily mean temperature in Vienna (Austria) September – December 2006.*
Source: Central Institute of Meteorology and Geodynamics, Austria

Other wet areas were to be found at the Atlantic and in eastern Europe. Western Scotland experienced its wettest November, with some stations recording well over twice their average rainfall. The station Bishopton, near Glasgow, registered a monthly total of 301 mm.

Most of the southern half of the Region was very dry due to frequent high pressure influence. Precipitation totals in Armenia were 40-60% of the normal. From time to time, local heavy rain and thunderstorms with flooding events occurred in Greece and in Turkey at the beginning of the month. Also Cyprus was relatively wet during the first half of the month, but extremely dry during the second half. Portugal, too, had some heavy precipitation; the total on November 3 in Alvalade (south) was 84 mm and exceeded the highest daily November total recorded before in 1982. Another wet period occurred in Portugal on November 21-29, so that the month as a whole was wetter than normal in contrast to nearly all the other southern countries of the Region. In Faro (Algarve), 44.2 mm were recorded in only one hour on November 29, 09-10 UTC, with 29 mm in just 10 minutes.

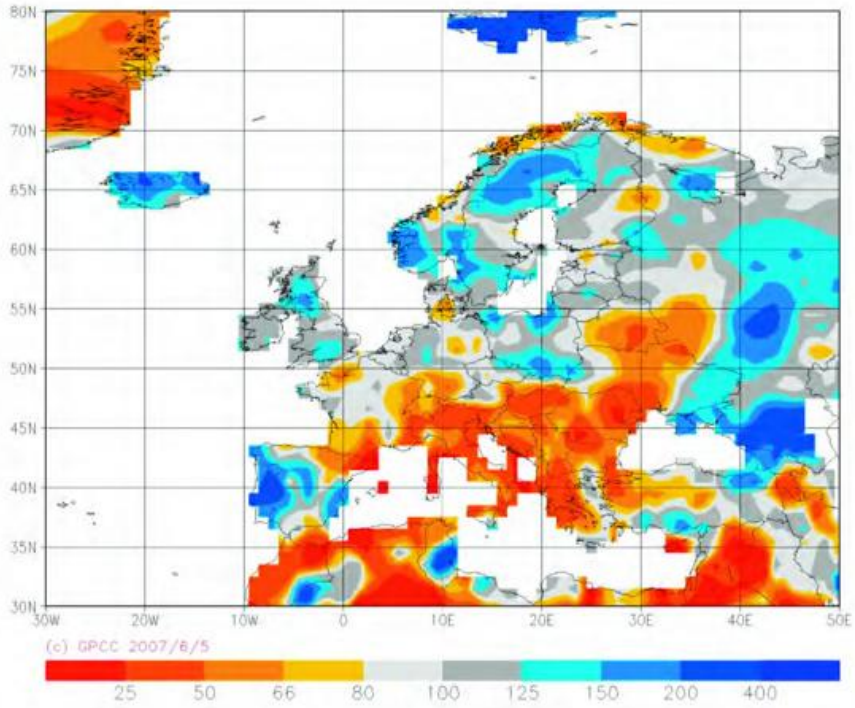


Fig. 11.3: *Monthly precipitation amounts for November 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

December

- **Mostly very mild, especially in the northeast**
- **Very cold in the southeast**
- **Wet in most of the north, dry in most of the south**

In December, the warm air flow over Europe continued but shifted more to the northeast of the Region. Thus, it became extremely mild in northern and northeastern Europe this month. The highest temperature anomalies within the Region were registered in Finland and northern Russia at more than +8 °C (Fig. 12.1). At Helsinki Kaisaniemi, the monthly mean temperature was 4.0 °C, the highest ever measured since 1829. In northern European Russia on spatial average, it was the warmest December since 1930 (Fig. 12.2). Moscow recorded 1.2 °C as monthly mean temperature; this was also a record in the time series, comprising more than 100 years of observations. On December 15, the maximum temperature even reached 9 °C in Moscow. Also in Estonia, such a mild December had not occurred for 140 years (Fig. 12.3), in Latvia for 83 years, at some stations for even a longer time. On December 5 and 6, record temperatures in Latvia were reached with 10-12 °C. Minimum temperatures were as high as 8-10 °C in places in that country; such values are usually measured there in September. Lithuania and Belarus, too, reported their warmest December on record, and also Norway and Sweden, except some of the northernmost parts. Poland recorded maximum temperatures up to 17 °C and no more than 5 days with snow. In Iceland, the first part of December was rather cold, but it became unusually mild after December 17. Heavy rain in the north of Iceland around December 20 resulted in snowmelt, flooding of roads and landslides, causing both loss of property and livestock in various areas.

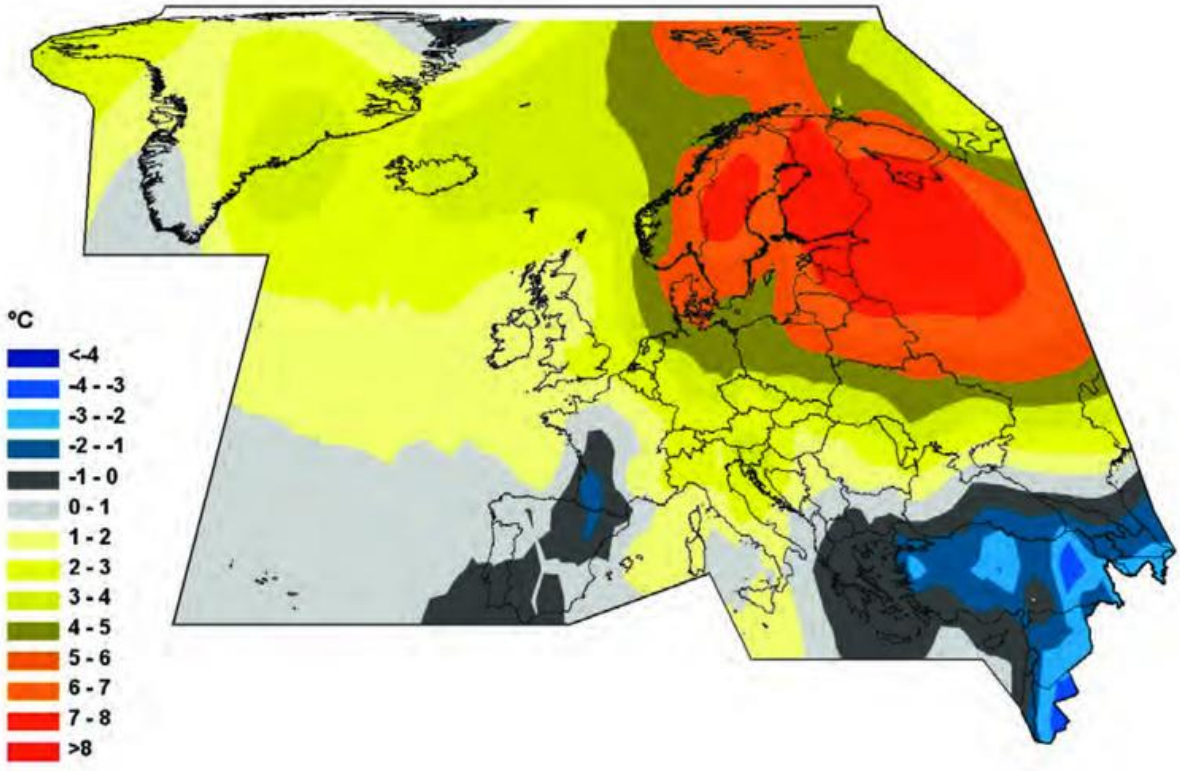


Fig. 12.1: *Monthly mean temperature anomalies in December 2006 (reference period 1961-1990) in WMO Region VI*
Source: Deutscher Wetterdienst

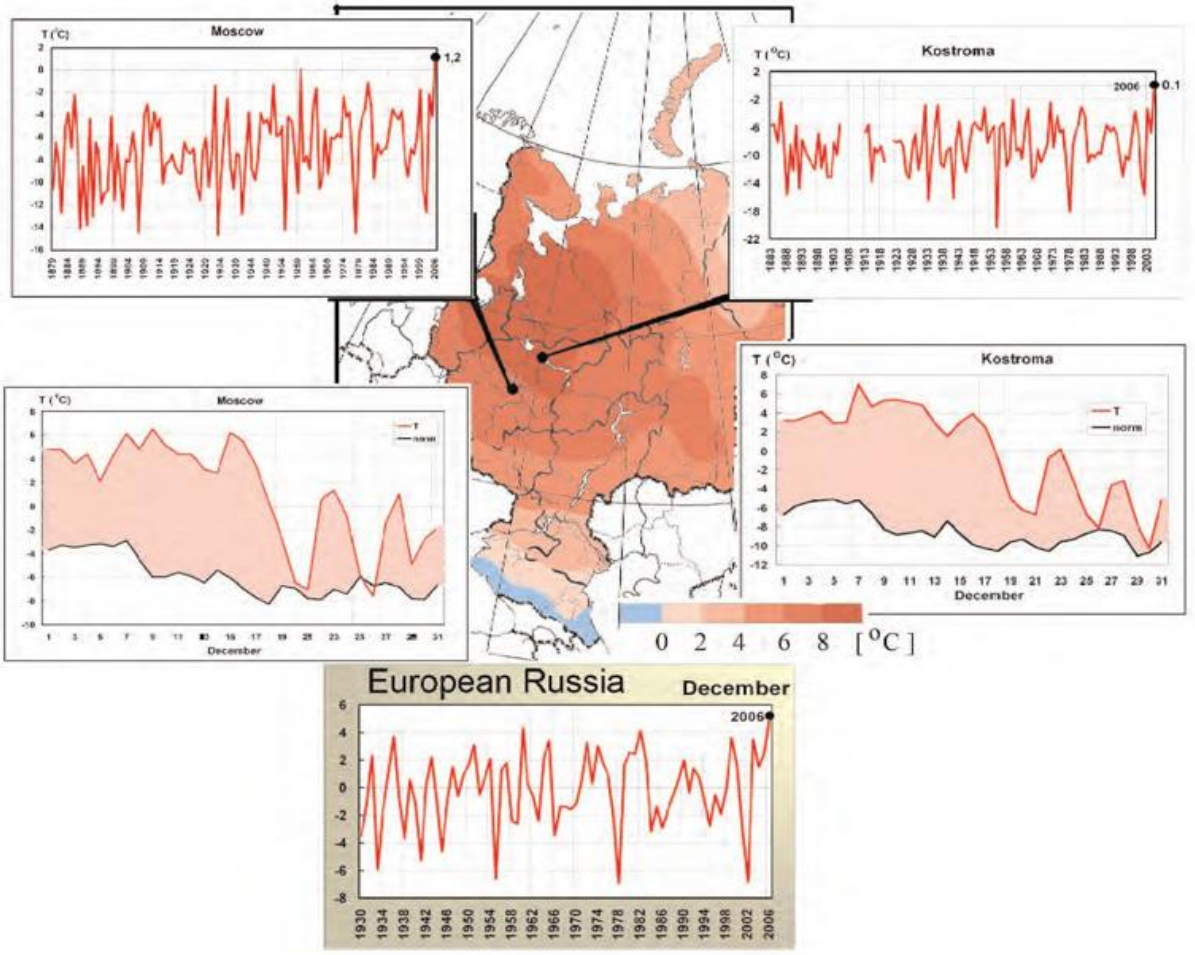


Fig. 12.2: *Monthly mean temperature anomalies in December 2006 (reference period 1961-1990) in European Russia. Insets show monthly temperature time series in December and mean daily air temperature in December 2006 at the meteorological stations of Moscow and Kostroma, and mean monthly air temperature anomalies averaged over the European territory of Russia.*
Source: Roshydromet, Russia

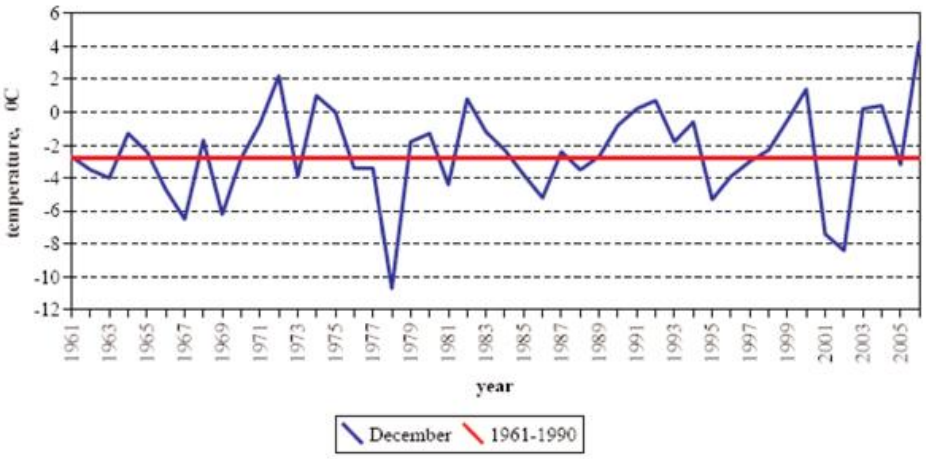


Fig. 12.3: *Monthly mean temperature in Estonia in December.*
Source: Estonian Meteorological and Hydrological Institute

It was also more than 3 °C above normal over most of central and eastern Europe, even in parts of west Kazakhstan, partly also over southern parts. In Denmark, too, this December was record-breakingly warm, nearly 2 °C warmer than the previous record of 1934. For Germany, it was the 3rd warmest December since 1901. Hazel flowering was reported frequently in Germany this month and a pollen warning had to be issued, which was very early in the season. Only at the end of the year (December 27-28) did stronger snowfall and freezing rain appear in Germany, causing many traffic accidents. The airport in Luxembourg had no snow day at all that month, which was very unusual. In the Alps, even at altitudes of 2000 m, could snow rarely be found during the first half of December.

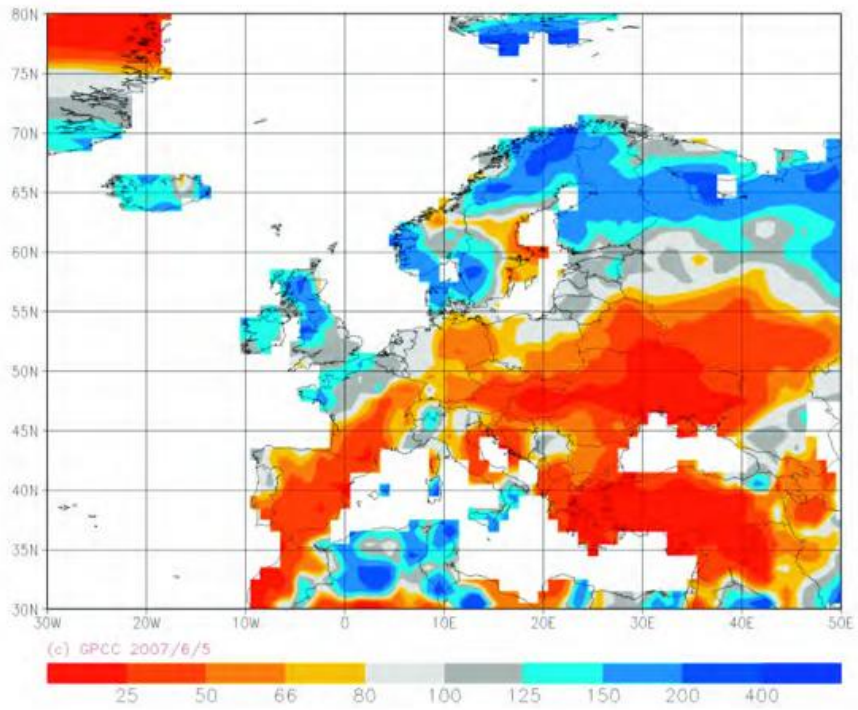


Fig. 12.4: *Monthly precipitation amounts for December 2006 in per cent of the normal 1961-1990 in Europe and adjacent areas.*
Source: Global Precipitation Climatology Centre (GPCC), Germany

The mild air also brought a lot of precipitation to northern Europe, in parts more than twice the normal amount (Fig. 12.4). With 166% of the normal precipitation, Norway experienced its 2nd wettest December since 1900, after 1975. It was also extremely wet in southwestern Sweden, where serious flooding occurred after heavy rains on December 11. The southern half of the Region was mostly very dry due to continuous high pressure influence, except in some places in the western Mediterranean and the Alps. In western Carinthia, Austria, precipitation rose to more than 175% of the normal, caused by a depression over northern Italy around December 9. Israel had a very long dry period until December 20, but large precipitation amounts in the last third, especially on December 26-27 with snowfall in the mountains, including Jerusalem. Snowfall was also recorded in Jordan on these days (28 cm in Shoubak in the south), and the highest daily precipitation total of the year in Jordan was 80.2 mm registered at Salt in the central part of the country on December 26. In contrast, only 7.5 mm of precipitation (7% of the normal) fell in Cyprus during the whole month of December, it was the second lowest amount since 1901.

Widespread fog conditions were observed in Bulgaria during most of the month. During the week of December 11-17, up to 250 flights at the international airport of Sofia were cancelled or diverted.

Some areas in southwest Europe and particularly in the Middle East were colder than normal, mainly due to continental cold air flowing south of high pressure centres from the east to these parts. Especially in eastern Turkey it was partly more than 3 °C colder than normal. Cyprus had at first 3 weeks which were very warm, but towards the end of the month a low pressure system affected the island, and the temperatures dropped below zero on the whole island, causing frost damage to crops. In Israel too, especially the second half of the month was cold. In the northern valleys, the northern Negev and the inland aeras of the coastal plain in Israel there were three periods of ground frost, partly also air frost, which caused damage to potato crops and this happens statistically only once in ten years on average. Jordan recorded its lowest minimum temperature of the year at Shoubak (elevation 1365 m) in the south on December 30 at -12.4 °C. Unusually cold weather was also registered in the Ararat Valley in Armenia (up to more than 5 °C below normal); minimum temperatures fell to -26 °C at an altitude of 800-1000 m there.

Report on ECSN activities

Aryan van Engelen, KNMI

Introduction

The European Climate Support Network is a programme under the auspices of EUMETNET, the Network of (22) European Meteorological Services. In this programme the members co-operate in the field of climate and related activities, in order to expand their capabilities to support the RAVI/European user community through enhanced provision of high quality climate data, products, services, advice and knowledge. Core activity is the initiating and running of a series of projects in order to address the most frequent and urgent user needs of the whole RAVI/European domain. ECSN organises a number of events such as the annual ECSN plenary meetings of its members (EAC), the biennial European Conferences on Applied Climatology (ECAC) in collaboration with the European Meteorological Society (EMS) and the biennial Data Management Workshop.

ECSN is collaborating with the WMO RAVI Working Group on Climate Related Matters (RAVI-WgCRM); especially to address the NMHSs of RAVI that are not (yet) members of ECSN.

MeteoSwiss was responsible member of ECSN.

The 11th ECSN Advisory Committee (EAC) Meeting took place in Exeter, UK, 21-23 June, 2006. The meeting was well organized by the UK Met Office. At the meeting, as a new initiative, a strategic partnership with the RAVI-WgCRM was discussed.

The 6th European Conference on Applied Climatology, together with the Sixth Annual Meeting of the European Meteorological Society, took place in Ljubljana, Slovenia, 4-8 September 2006. This was the most successful ECAC so far, not only because of the large number of participants of about 500, but also because of the high scientific level.

On 28 September 2006, the EUMETNET Council decided to continue the ECSN Programme for a fourth phase, starting on 1 January 2007, for a four year period, with KNMI as Responsible Member.

On 9 December 2006, ECSN launched a joint press release: “Autumn 2006 extraordinarily mild in a large part of Europe”

Projects

S-EUROGRID (SMHI)

The outlines of the Showcase EUROGRID (S-EUROGRID) project were prepared in 2006. The project will start on 1 January 2007 and run for a period of two years. Responsible member is SMHI. Contributing members are Austria, Denmark, Finland, France, Germany, Iceland, Ireland, The Netherlands, Norway, Portugal, Spain, Sweden and Switzerland. Italy and United Kingdom will be participants “in kind”.

S-EUROGRID’s main ambition is to illustrate what the full-scale EUROGRID concept means, which is intended to be a future European shared resource for gridded climate and historical and environmental data.

HRT-GAR (ZAMG)

A new ECSN project, the "High Resolution Temperature Climatology in Complex Terrain – demonstrated in the test area Greater Alpine Region" (HST-GAR), was launched on 1 January, 2006. The project aims at providing high quality data products over mountainous areas in Europe. The principal deliverable will be a monthly temperature field in a 1 km resolution over the 1961-1990 WMO Normal Period and the 1971-2000 Normal Period.

The kick-off meeting was attended by the assembled participants from Austria, Bosnia, Croatia, Czech Republic, Herzegovina, Hungary, Italy, Norway, Slovenia and Switzerland.

Data were collected from 1885 stations, of which 1733 were able to be adopted. A paper "First steps towards a new Temperature Climatology of the Greater Alpine Region (GAR)" has been prepared.

GCMP / EuCLIS (DWD)

The "Generate Climate Monitoring Products" (GCMP) and its successor platform the "European Climate Information System" (EuCLIS) project is aimed at providing standardized climate monitoring products for the European area, in order to meet the requirement of the Services, scientific institutions and the general public. In 2006, 19 NMHSs contributed to this platform (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxemburg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom). A prototype of EuCLIS was presented at the 6th ECAC conference in Ljubljana, where many NMHSs of RAVI expressed their interest to become new contributors. Since then DWD is undertaking activities to turn the prototype into a sustainable operational platform that will probably be launched in 2007.

ECA&D (KNMI)

The European Climate Assessment and Dataset (ECA&D) project of ECSN aims at the creation of a sustainable operational system for data collecting, archiving, quality control, analysis and dissemination. Data collecting refers to long-term daily resolution time series from meteorological stations throughout Europe and bordering areas. Based on this dataset ECA&D will serve as a platform to increase the knowledge of and communication on past changes in (soft) extremes over Europe through the analyses of the historical climatological records. Data were collated with the collaboration of 53 participants (NMHSs predominantly) from 42 countries and datasets, included from EMULATE, STARDEX, GHCND, GSN and MAP. Now the dataset comprises series from some 2200 stations.

ECA&D is widely recognized as a EUMETNET baseline dataset, not only by the European NMHSs but also by a number of strategic bodies such as WMO, EEA and the EU Research Community; the ENSEMBLES and the MILLENNIUM projects.

ENSEMBLES (KNMI, MeteoSwiss)

The focus of the EU-FP6 project "ENSEMBLE-based Predictions of Climate Changes and Impacts" (ENSEMBLES, 2004-2009) is to develop an ensemble prediction system for climate change, based on the principal, state-of-the-art, high resolution, global and regional Earth System models, developed in Europe, validated against quality controlled, high resolution gridded data sets for Europe. Based on the ECA&D dataset MeteoSwiss and KNMI collaborate

in assessing the quality of the dataset (1960-2000) that will be the basis of a daily gridded dataset for the whole of Europe with a 25 km resolution. It is expected that the ENSEMBLES gridded dataset will serve as a baseline dataset for the ECSN project EUROGRID.

Millennium (KNMI)

The EU-FP6 project “Millennium – European climate of the last millennium” (2006-2010) addresses the question as to whether the magnitude and rate of recent climate change will exceed the natural variability of the European climate over the last 1000 years. In 2006 the partners of ECA&D supported this project in collating long instrumental climate time series. This support was also expressed at the 1st MedCLIVAR Workshop in Carmona, focusing on a reconstruction of the Mediterranean climate during the last 1000 years.

At the end of 2006, the ECA&D dataset was officially recognised as deliverable.

The Ozone Layer over Central Europe

Ulf Köhler, Hans Claude and Wolfgang Steinbrecht - Deutscher Wetterdienst

The development of the ozone layer over Central Europe continues the positive trend as observed since the beginning of the nineteen nineties. This trend is documented by the Hohenpeissenberg total column ozone time series (Fig 14.1). This 15-year increase includes the distinct ozone minimum after the eruption of Mt. Pinatubo in 1991, which additionally aggravated the negative trend since the end of the sixties. The mean values of the last years are around 2% below their longterm mean and 5% lower than at the beginning of the measurements.

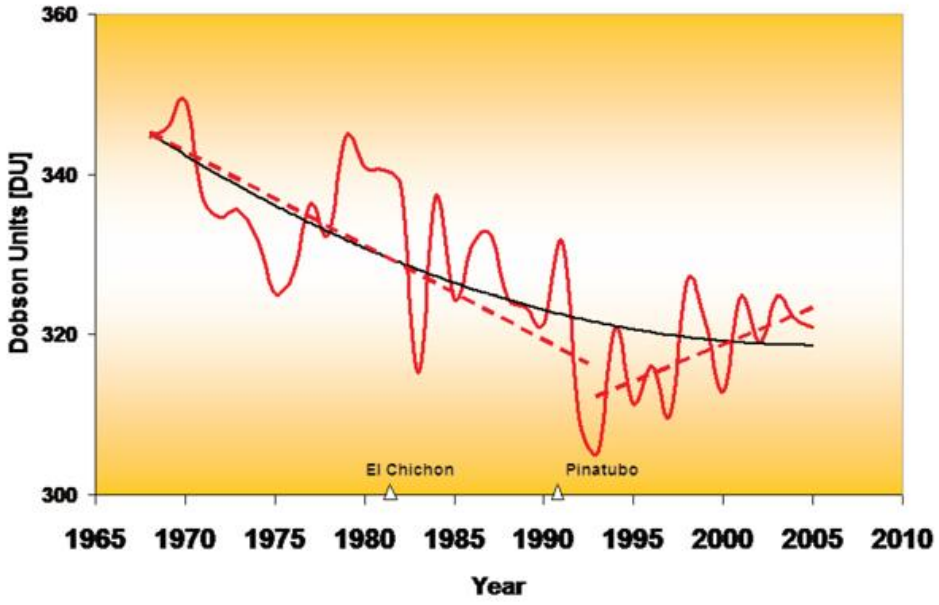


Fig. 14.1: *Annual means of total column ozone above Hohenpeissenberg measured by Dobson and Brewer since 1968 (red curve). The regression lines (dashed red) and the polynomial fit (black) approximate possible trends.*

The causes of trends and fluctuations are the development of the ozone depleting potentials (ODP's) combined with natural influences like solar cycle, and dynamic impacts like e.g. the North Atlantic Oscillation (NAO) and the quasi biennial oscillation of stratospheric winds (QBO) (WMO 2007).

The reduction of effective stratospheric chlorine as a consequence of political protocols (Vienna 1985, Montreal 1987, London 1990, Copenhagen 1992) has begun but its effect on total column ozone has so far been very low.

Figure 14.2 shows the time series of daily total ozone over Central Europe in 2006. It reflects a quite normal year with some outliers in both directions, but most of the daily averages, at least in the first half of the year, are within the bounds of the extreme years 1970 and 2000. However, three significant features are noticeable:

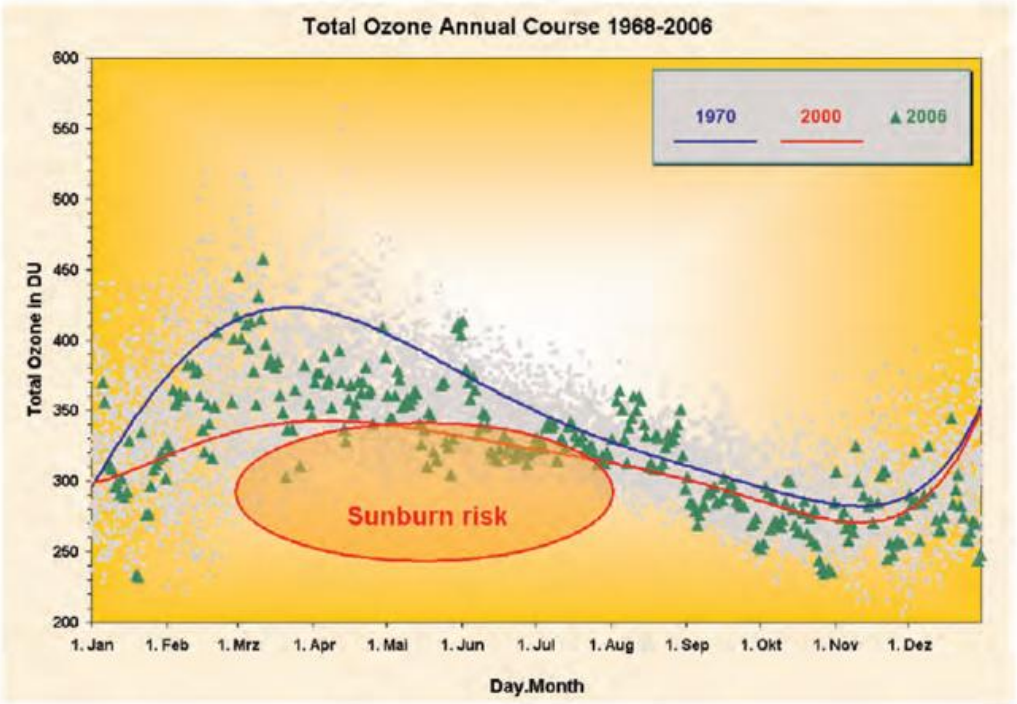


Fig. 14.2: *Daily means of total column ozone above Hohenpeissenberg in 2006 (green triangles) and between 1968 and 2006 (grey dots). The blue line shows the annual course of the maximum year 1970, the red line the minimum year 2000.*

- Two days in January show extraordinarily low thickness of the ozone layer. The deficit on January 19 and 20 was almost –30%. These low values of about 230 DU over Hohenpeissenberg correspond with a so-called mini ozone hole over Western Europe/UK with a minimum below 200 DU. A record minimum of 177 DU was observed in the UK. On the first look this mini hole might only be attributable to a streamer event, which transports ozone poor air from the tropics/subtropics to Western and Central Europe (Fig 14.3). Looking at the development of the ozone distribution above the Northern Hemisphere over a longer period, however, reveals a combination of dynamic effects (streamer) and additional chemical ozone depletion (ozone poor air caused by heterogeneous chemistry coming from northern latitudes). A detailed analysis of ozone sonde profiles and trajectories proved that 2/3 of the ozone reduction come from the UTLS region (streamer effect in the upper troposphere/lower stratosphere) and 1/3 from chemical ozone depletion in the middle and higher stratosphere (Keil et al., 2007). This shows that record ozone minima are possible over Europe at any time.

- High ozone values were observed at the beginning of June and throughout the entire August, whereas ozone was subnormal during the six weeks of the Football World Cup in Germany. This ozone pattern correlates with the weather extremes during the summer 2006. It started with snow fall at Hohenpeissenberg on the 1st and 2nd of June, followed by sunny and hot summer weather due to high pressure systems. August, in contrast, was dominated by low pressure systems with cold weather and much rain over central Europe.

- From September onwards the ozone layer gives evidence of a record fall and winter in weather. As low total ozone values are normally connected with high pressure systems and, subsequently, a warm troposphere, the predominantly subnormal values confirm that the four last months in 2006 were too warm. Fall 2006 was the warmest ever measured in the 225-year long weather records of Hohenpeissenberg. The same applies to the following seasons, i.e. winter 2006/2007 and spring 2007. Since the

amount of total ozone is a combination of different effects at various altitudes, the average total ozone column of these months is indeed low but record minima were not observed.

The coming years will reveal whether the expected recovery of the ozone layer will appear in the data records or not. The global climate change with its various aspects, however, remains a factor of uncertainty, which could compensate the effects of the beginning chemical recovery of the ozone layer. Moreover, the risk of temporary episodes with very low total ozone associated with enhanced UV radiation, harmful to human health, remains.

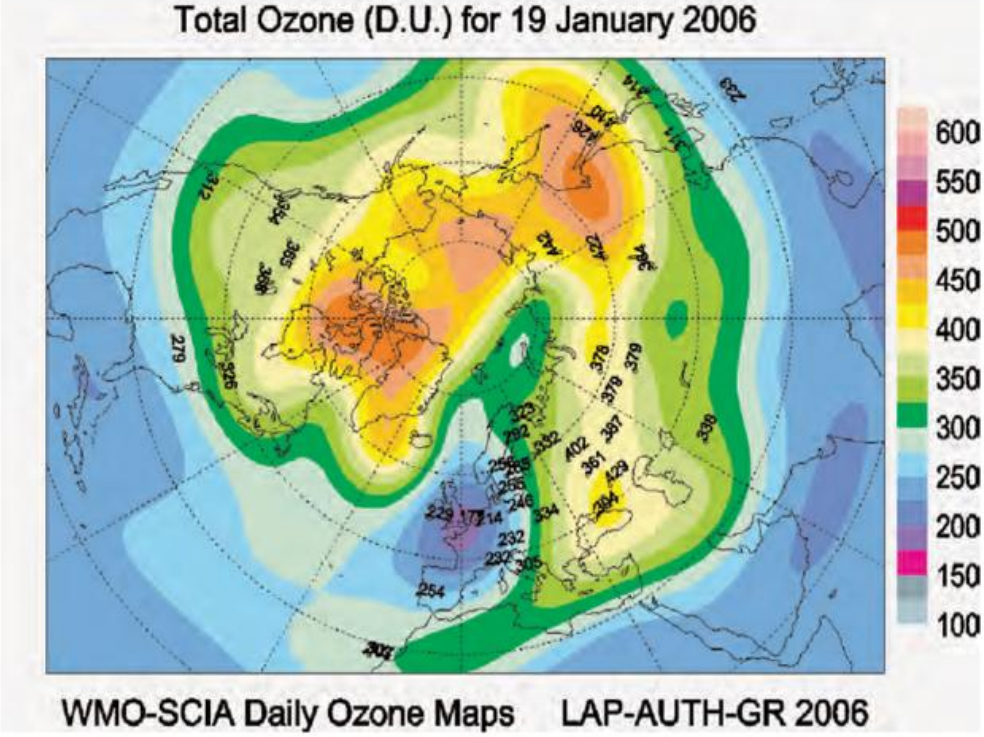


Fig. 14.3: *Distribution of the total ozone column above the Northern Hemisphere on January 19, 2006.*
Source: WMO Total Ozone Mapping Centre, Greece.

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