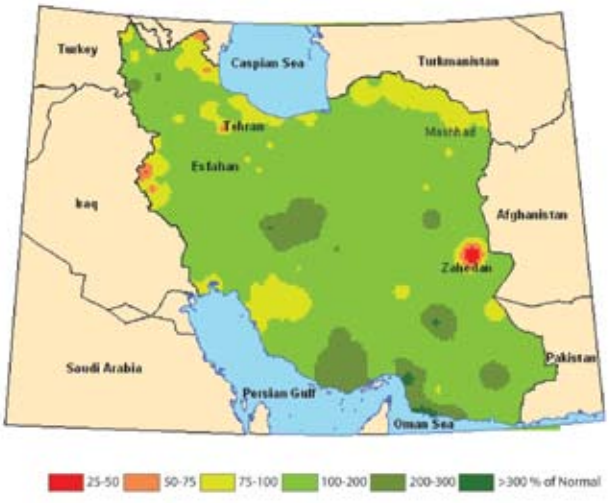

Fig. 6.33. Autumn precipitation anomalies (%) over Iran. [Source: I.R. of the Iran Meteorological Organization.]

of Iran were up to 8°C cooler than normal during December. Snow and cold weather penetrated northern Iran, with heavy rainfall in eastern and southern Iran. For the country, the average of precipitation in autumn was 83 mm. The largest anomalies were recorded in Hormozgan Province, with 2.2 times the normal precipitation (Fig. 6.33). From a seasonal perspective, precipitation totals were normal to above normal in much of Iran during autumn 2006.

(v) Significant weather events

Significant weather events included drought, heat and cold waves, flooding, and dust and sandstorms. Floods occurred in northern Iraq in February and November, in Turkey in July, in Pakistan from late July through mid-August, in Afghanistan in August and November, and in Iran's Ardebil Province in May. Heavy rain triggered mudslides in Tajikistan in May and in northern Pakistan on 3 July. In addition, significant drought continued throughout some parts of the region. For example, significant drought across Afghanistan occurred in July as rainfall had been lacking since April 2006. Dust storms blew and spread out over a wide area, covering some parts of Afghanistan, southeastern Iran, and western Pakistan during summer and autumn. Other extreme events, such as a severe winter storm accompanied by heavy snowfall in some provinces of Afghanistan, and near Dushanbe in Tajikestan, caused economic losses.

g. Europe and the Middle East

1) Overview—A. Obregón, P. Bissolli, and J. J. Kennedy

CAMS-OPI precipitation and air temperature anomalies over Europe are shown in Figs. 6.34 and 6.35, respectively. Europe experienced above-normal temperature anomalies across nearly the entire continent in 2006.[6] For the 35°–75°N and 10°W–30°E region the annual average land surface temperature was 1.15° ±0.08°C above the 1961–90 average (based on CRU TEM3; Brohan et al. 2006). The annual average near-surface temperature, incorporating land and sea surface temperatures, was 0.93 ±0.05°C above the 1961–90 mean (Fig. 6.36). The highest positive annual anomalies of more than +4°C were found in

[6] Contributing countries (national meteorological and hydrological services) to this section are Armenia, Austria, Bulgaria, Cyprus, Denmark, Finland, France, Germany, Iceland, Italy, Kazakhstan, Lithuania, Norway, Portugal, Romania, Russia, Spain, Sweden, and the United Kingdom.

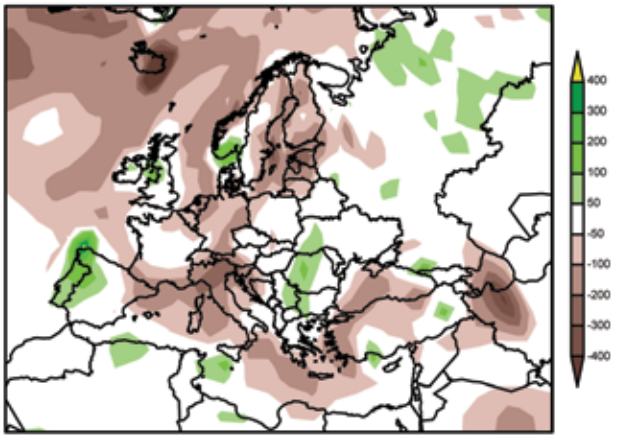

Fig. 6.34. European 2006 annual precipitation anomalies (mm, 1979–2000 base) from CAMS-OPI.

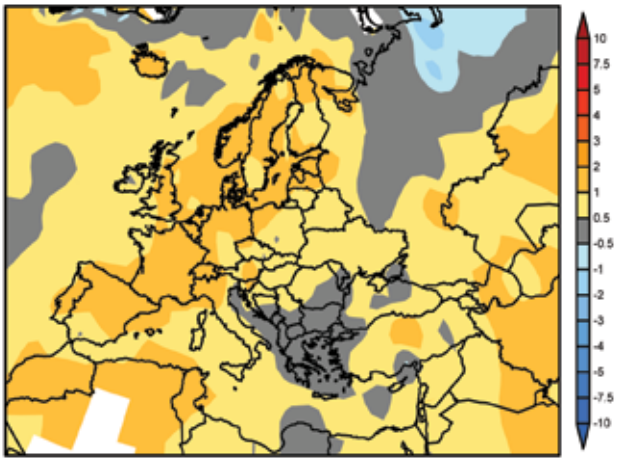

Fig. 6.35. European 2006 annual temperature anomalies (°C, 1971–2000 base) from CAMS-OPI.

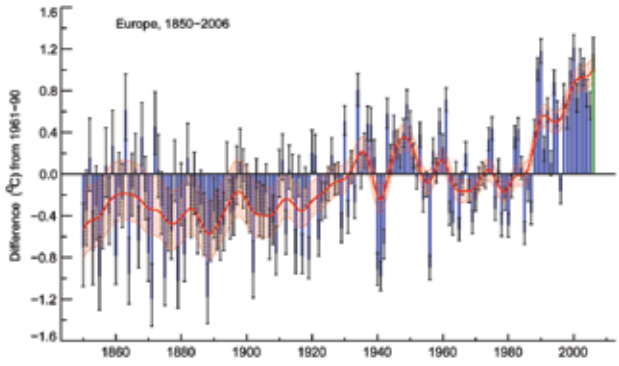

Fig. 6.36. Time series of area average land surface temperatures over Europe (35°N–75°N, 10°W–30°E) from 1850 to 2006 (data are from Brohan et al. 2006). The blue bars show the individual annual values and the thin gray bars indicate the two standard error range on the annual values. The value for 2006 is shown in green. The smooth red curve and shaded area show the annual values after smoothing with a 21-point binomial filter and represent roughly the interdecadal variability in the data and its uncertainty.

northern parts of Greenland and around Svalbard. Large parts of Scandinavia, northwestern, western, and central Europe, and even most parts of the Iberian Peninsula experienced anomalies above +1°C, exceeding the 90th percentile in many areas, and the 98th percentile in more limited areas in the HadCRUT3 dataset. The United Kingdom, Spain, and the Netherlands reported their warmest years in recorded history. The eastern parts of Europe had smaller anomalies of less than +1°C. Slight negative anomalies (down to about −0.5°C) were only registered locally in southern and southeastern Europe. Seasonal temperature anomalies in Europe increased throughout the year from winter 2005/06 through to autumn 2006.

Precipitation amounts for the climatological year of 2006 (December 2005–November 2006) were generally above average in eastern and southeastern parts of Europe, with anomaly maxima over the Arctic islands, and in Greece and southern Italy, while wide areas over the western part of Europe received below-average rainfall. Areas receiving less than 80% of normal precipitation amounts were restricted to the region between the Alps and the Pyrenees, and southern Spain, as well as some coastal regions in the north. Precipitation anomalies averaged over 2006 were generally lower than those in 2005. However, the seasonal variation throughout the year was quite high.

2) Nordic region—C. Achberger, J. E. Box, and D. Chen

Weather and climate conditions in the Nordic region (comprising Sweden, Norway, Denmark, Finland, Iceland, and Greenland) are characterized by a continued pattern of warm anomalies in observational records for 2006 as compared to recent decades. The Fennoscandinavian countries (Norway, Sweden, Finland, and Denmark) and Iceland experienced a warm summer and an extremely warm autumn. Surface climate conditions in this area are to a large extent controlled by the atmospheric circulation over northern Europe and the North Atlantic region. Synoptic weather typing, according to the scheme by Lamb (1950), has been used to estimate the impact of the large-scale atmospheric circulation on the surface weather conditions in this region (e.g., Chen 2000). Compared to the 1961–90 mean, the frequency of daily southwesterly and westerly weather types were above normal, which can explain the warmer-than-normal conditions in 2006. Positive deviations from the normal weather-type distribution are especially obvious during autumn, with stronger-than-normal large-scale flow from westerly and southerly directions and increased number of anticyclonic days. These flow conditions in autumn are consistent with the warm and wet weather that prevailed in extended parts of Fennoscandinavia.

(i) Fennoscandinavia and Iceland

Annual temperatures in Fennoscandinavia and Iceland were, on average, well above the long-term means for 1961–90: 1°–2.5°C depending on the region (Fig. 6.37). For Denmark, 2006 was the warmest year since 1874. The annual mean temperature was 1.7°C above the 1961–90 mean. For Norway, 2006 was one

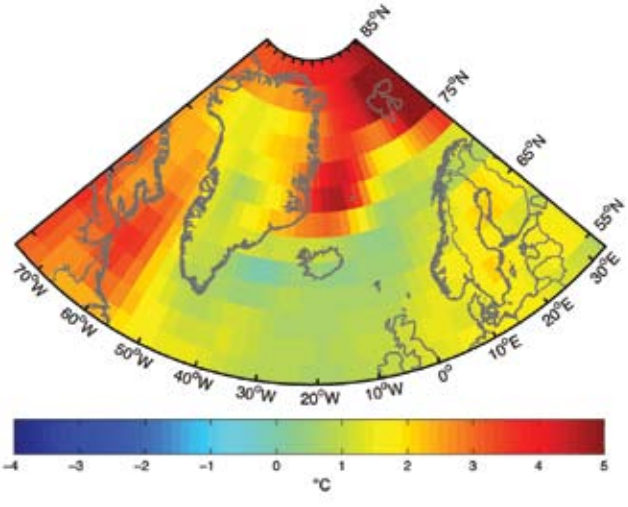

Fig. 6.37. 2006 annual air temperature anomalies (°C; 1961–90 base) across Fennoscandinavia, the North Atlantic, and Greenland. [Source: NCAR–NCEP reanalysis.]

of the three warmest years in the country's temperature record (behind 1934 and 1990). Some Norwegian regions experienced their largest positive deviations from the long-term mean (1961–90), such as Svalbard (+5°C) as well as parts of the county of Trøndelag and the southern regions of northern Norway (+2°–3°C). In Sweden, 2006 was also a very warm year. The annual mean temperature was only 0.3°C below the warmest year, as 2006 ranked as the sixth warmest year during 1860–2006. The Finnish annual mean temperatures were among the 10th–15th highest since 1900. Iceland experienced a warm year. Several selected Icelandic stations reported annual mean temperatures placing 2006 among the 5th to 13th warmest year since about 1870.

Iceland and Norway experienced a rather mild start to the year, with temperatures above the 1961–90 mean, in contrast to Denmark, Sweden, and Finland. Spring was characterized by unusually cold weather in March, occurring almost everywhere in the region. Summer temperatures were well above the long-term mean nearly everywhere. Many very hot days (air temperature > 30°C) were reported in Finland. Norway had its fourth warmest summer since 1900. July temperatures in Denmark were nearly 4°C higher than normal. Swedish summer temperatures were also higher than normal. Temperatures at Svalbard airport were more than 2°C above normal, which made 2006 the second warmest summer since measurements commenced in 1912. The warm summer was followed by an unusually warm autumn in most parts of the Nordic region, especially in Denmark where the monthly mean temperatures from September to December were 3°–5°C above normal, reaching new records. Finland experienced unusually warm weather from the second half of November through the end of 2006. In Helsinki, the monthly mean temperature in December was 4°C, the highest since 1929. In Sweden, September and December were extremely warm.

In some parts of the region, precipitation conditions deviated considerably from the 1961–90 average, especially in western Norway and the Norwegian west coast, which were drier than normal. In contrast, precipitation in Sweden and Denmark were well above normal values. For Sweden, 2006 became the sixth wettest year since 1860. Finland's annual precipitation was close to normal or slightly above. Iceland got rather normal amounts of precipitation, though the southwest of the island had somewhat wetter-than-normal conditions. In several areas, the summer was either rather dry and/or rainfall was unequally distributed over the summer months. Southern and western Finland experienced their driest summers ever recorded. In Sweden, farmers had problems because of the lack of rain in June and July, but heavy thunderstorms and strong showers in August led to serious flooding in many places in southern and middle Sweden. Conditions in Denmark were similar, with only half of its normal rainfall amount in July, but August had 100% above-normal precipitation. Norwegian summer precipitation was below normal for most of the country, but strong showers led to damage from flooding at some places. The Icelandic summer was rather wet with stormy weather during July. Wet conditions continued during autumn in many regions. For example, southern Norway received precipitation well above the normal. Heavy thunderstorms in October brought large amounts of rain to many coastal areas in Sweden, while strong and extended rainfall events in December caused serious flooding in southwestern Sweden. Finland got part of its autumn precipitation as snow, leading to all-time high values of snow cover in southeastern parts of Finland in the beginning of November.

(ii) Greenland

(a) *Upper-air temperatures*

Upper-air soundings available from the IGRA (Durre et al. 2006) indicate a complex vertical pattern of warm tropospheric and stratospheric cold temperature anomalies surrounding Greenland (not shown), compared to the 1971–2000 base period. The general pattern of lower-tropospheric warm anomalies accompanied by cold anomalies near the maximum height of the observations (< 100 hPa) is consistent with overall 1964–2005 warming trends (Box and Cohen 2006). In the lower troposphere, still well above the surface at the 850-hPa level (1.1–1.5-km altitude), for example, annual temperature anomalies were between +0.9° and +3.1°C at six sites surrounding the island. Over east-central and southeastern Greenland at Ittoqqortoormiit/Scoresby Sund and Tasiilaq, respectively, a general pattern of lower-tropospheric warm anomalies is evident with the exception of spring, perhaps influenced by above-normal sea ice concentration (see section 5b). At the upper limit of mandatory observational levels (20 hPa), relatively large (–7.1° to –8.6°C) cold anomalies are evident in the balloon observations but are not abnormal considering relatively large lower-stratospheric temperature variability (e.g., Christy and Drouilhet 1994). What else stands out are +2.4° to +6.6°C warm anomalies centered at 200 hPa in winter for all sites surrounding but Narsarssuaq in the extreme south. Other regional patterns of note include warm anom-

Table 6.1. Greenland station surface air temperature statistics: 2006 versus 1971–2000.

Station Region	Latitude/ longitude	Statistic	Winter	Spring	Summer	Autumn	Annual
Aasiaat/ Egedesminde	68.7°N	Anomaly (K)	3.9	**4.8**	**1.2**	1.0	**2.7**
West	52.8°W	Rank	7	2	6	8	4
Nuuk	64.2°N	Anomaly (K)	2.1	**2.7**	0.9	0.8	**1.6**
Southwest	51.8°W	Rank	11	3	7	11	5
Prins Christian Sund	60.0°N	Anomaly (K)	1.5	**1.5**	**1.1**	0.6	**1.2**
South	43.2°W	Rank	7	3	4	11	4
Tasiilaq	65.6°N	Anomaly (K)	1.8	0.4	0.6	0.0	0.7
Southeast	37.6°W	Rank	4	16	10	22	11
Danmarks-havn	76.8°N	Anomaly (K)	**3.6**	**2.9**	**-0.5**	1.4	**1.8**
Northeast	18.7°W	Rank	4	3	32	8	2

Bold values indicate *Z* scores that meet or exceed one absolute magnitude.

alies below 500 hPa in Autumn (September–November) at Pituffik/Thule AFB, including apparently extreme, but probably erroneous, +7.9°C at 850 hPa for September–November 2006, given disagreement with MSU4 data (J. Christy 2007, personal communication). Another relatively large (+8.5°C) December 2005–February 2006 anomaly at Aasiaat/Egedesminde may also result from observational error. The potentially erroneous seasonal anomalies at these two sites also affect the annual anomalies.

(b) *Coastal air temperatures*

During the last 56 years (1951–2006), when continuous surface air temperature records are available from a collection of stations around the island (Cappelen et al. 2007), the only significant annual anomalies indicate higher-than-normal surface air temperatures (Table 6.1). In 2006, seasonally, for western and southern sites, like in 2005, spring stood out as being warmer than normal. At eastern sites, cold spring anomalies are evident and are significant seasonally, but not enough to effectively cancel the warmer annual anomalies. Eastern winter anomalies were positive, yet eastern summer temperatures were much lower than normal. Eastern glacier melt rates are likely to have been below recent years in 2006, apparently owing to the eastern coastal cooling effect of April–June positive sea ice anomalies. Western and southern summer temperatures imply continued enhanced glacial melting as sea ice is absent in southwestern Greenland at this time of year. Considering the past century at sites around Greenland where long-term records are available (such as Nuuk and Tasiilaq), the 1930s–40s air temperatures rival recent warm temperatures and suggest that recent extreme melt rates are not without precedent.

3) Iberia—R. M. Trigo, R. Garcia-Herrera, D. Paredes, and A. Ramos

(i) Temperature

The Iberian Peninsula registered temperatures above the average throughout the year, with the exception of winter (Fig. 6.38). The annual average 850-hPa temperature across Iberia in 2006 was 1.14°C above normal (with respect to the 1961–90 period average). This significant positive annual anomaly occurred despite the early negative anomaly for the winter (–1.16°C) that was followed by an extremely hot spring (+2.38°C), and a warm summer (+1.50°C) and fall (+1.84°C). It should be stressed that the annual average temperature for 2006 was the hottest in Madrid (since 1900) and Barcelona (since 1925). The corresponding analysis of the associated upper-level 500-hPa geopotential height anomaly field in winter shows intense positive anomalies between the Azores archipelago and northern Europe, while southern Europe is characterized by lower-than-usual values (Fig. 6.38; DJF). Southwestern Europe and northern Africa were under the influence of strong cold-air advection from higher latitudes. Several cold spells

affected Iberia in January and February.

In particular, a strong cold break was observed in late January affecting all of Iberia, as well as France and central Europe. This cold plume reached Lisbon, Portugal, on the western coast of Iberia, producing a number of days with both maximum and minimum temperatures below the 10th percentile of daily long-term records. On 29 January the cold break was responsible for the first snow episode in Lisbon since 2 February 1954!

Unlike winter, the remaining seasons were characterized by warmer-than-normal temperature values, particularly between late May and November, where parts or the entire Iberian Peninsula were affected by five intense heat waves between May and September. These three seasons were generally characterized by high values of 500-hPa geopotential height, with maximum anomalies located in southern (spring), northern (summer), and eastern (fall) Europe. These patterns contributed to the advection of warm air masses with origins from overheated Eurasia and/or northern Africa. Moreover, these intense anticyclonic patterns can induce subsidence over Iberia associated with further heating of the surface layers through enhanced adiabatic heating (Trigo et al. 2005).

(ii) Precipitation

Most of the Iberian Peninsula experienced drier-than-normal conditions during the winter of 2006, as is clearly shown by the seasonal precipitation percentages computed with respect to the 1961–90 base period average. Based on the monthly precipitation dataset from GPCC (Rudolf et al. 2005) it is possible to see that such winter drought conditions affected a much larger European region, with the exception of the western Mediterranean (and northern Africa). From an atmospheric circulation perspective, the 2006 winter was characterized by positive (negative) SLP anomalies north (south) of the Azores–Iberia latitudinal band, inducing the negative (positive) precipitation anomalies mentioned. It should be stressed that the Iberian Peninsula registered one of the worst droughts ever recorded during 2005, particularly in its southern half (Garcia-Herrera et al. 2006). The dryness of yet another winter season had a strong impact on water resources, hydroelectric production, and agriculture. However, the remaining seasons of the year unfolded very differently from winter, with western Iberia characterized by normal (spring), above-normal (summer), and extremely high values (fall) of precipitation. In fact, Portugal, located in western Iberia, registered the third wettest fall since 1931 (Espirito-Santo 2006), with most of the country showing values above 200% of the seasonal average. The spring and fall seasons correspond to the two most important rainfall seasons for northern and eastern Iberia (Trigo and Palutikof 2001). Interestingly, both spring and fall seasons were characterized by negative anomalies of SLP over the Atlantic Ocean and northern Europe. However, the amplitude of these negative anomalies was deeper during fall (compared to spring), and covered the entire Iberian Peninsula, which is related to the intense positive precipitation observed. Nevertheless, the Mediterranean coastal sector, including southern France, eastern Spain, and northern Africa, remained mostly dry between spring and fall. Therefore, at the end of 2006, several Spanish provinces located close to the Mediterranean coast were extremely dry as a consequence of more than two consecutive years with precipitation below the 1961–90 average.

4) Central Europe and the Alpine region—A. Obregón, P. Bissolli, and J. J. Kennedy

(i) Temperature

Annual average temperatures in the region were significantly above average (upper decile of the 1961–90 distribution). Central Europe and the Alpine region experienced one of its warmest years on record with several record-breaking months and seasons. The annual mean temperature of Germany was 9.5°C, which is 1.3°C above normal. Annual average

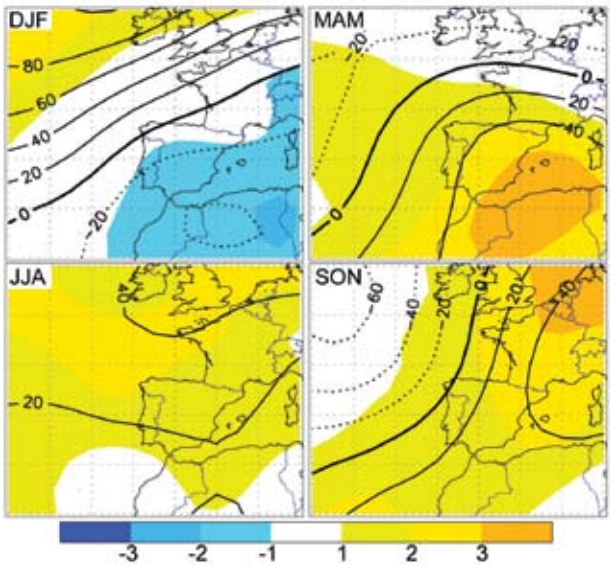

Fig. 6.38. Seasonal anomalies of 500-hPa geopotential height contours and corresponding 850-hPa temperature anomaly field (color, °C) compared to 1961–90 base period. [Source: NCAR–NCEP reanalyses.]

temperature anomalies in Switzerland varied between 1° and 1.7°C above average, placing 2006 as the fifth warmest year in the records since 1864. In most areas of Austria, temperature anomalies in 2006 ranged between 0.2° and 1.0°C above average. Poland and the Czech Republic also experienced above-average temperatures ranging between 1° and 2°C above the mean temperatures of the reference period (1961–90).

Temperatures in Germany, Poland, and the Czech Republic were significantly below the long-term average at the beginning of the year. In Germany, mean January temperatures were 2.1°C below the long-term mean. In Poland and the Czech Republic, temperatures were even lower and Warsaw reported an average temperature anomaly of –5.0°C for January. Temperatures in February also remained below average over the whole region. March was the coldest in Germany for 10 years (anomaly of –2.0°C).

The alpine region experienced below-average temperatures from January to March with anomalies ranging from –0.5° to –1.5°C. In some regions of Austria temperatures were between –2° and –3°C and temperatures down to –24°C were measured during the first 20 days of March in Tyrol, with the lowest value on 13 March. These lower temperatures are consistent with NAO's negative phase (Casty et al. 2005); the NAO had a reading of –0.82 over the December 2005 to March 2006 winter.

In April and May, temperature anomalies rose to slightly above average (up to +1.5°C). Temperatures in the summer months (JJA) showed an extreme contrast. August was well below average in all regions. July was dominated by an extended anticyclone over the Azores, which was stationary over Europe for a long time. This led to an extreme heat wave in central Europe and adjacent areas (Fig. 6.39). The average temperature in Germany was 21.8°C, the warmest in the 106-year record, with an anomaly of 4.9°C above the 1961–90 mean. Temperature anomalies in July in the Czech Republic were 4°–5°C above average. In Vienna, Austria, where observations started in 1775, a new July record for monthly mean temperature (23.9°C) was set. The warmest areas, with anomalies above 5°C, were found in the northern parts of the Alps. August was somewhat cooler than normal across the region.

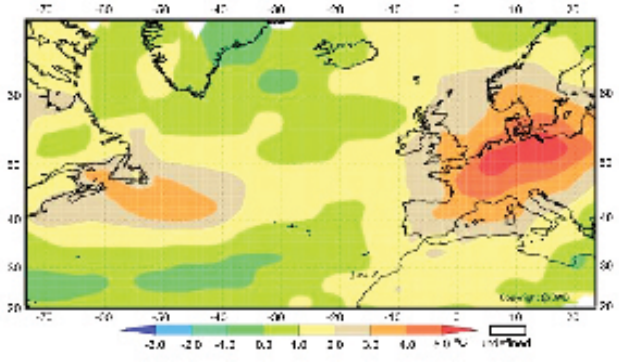

Fig. 6.39. Monthly average near-surface air temperature anomalies (°C; 1961–90 base) for July 2006. [Source: DWD via CLIMAT messages and ship data.]

Autumn was extraordinarily warm in central Europe and neighboring areas. It was by far the warmest autumn in central Europe since meteorological measurements began. Seasonal temperature averages in Germany were 3.2°C above the long-term mean. Remarkably, September average temperatures (16.8°C, +3.5°C anomaly) across the region were even higher than in August (15.4°C, –1.1°C anomaly). These extreme temperature anomalies are mostly explained by the anomalous southwesterly flow. In Germany, December was the warmest it has been for 32 years (3.4°C above normal). Northern Germany, the Czech Republic, and Poland experienced anomalously high temperatures exceeding the 90th percentile in places. The highest anomalies occurred in northeastern Poland (> 4°C).

(ii) Precipitation

Precipitation in central Europe in 2006 was close to average. Northern Germany and parts of Poland were drier than average while southern Germany and the Czech Republic experienced slightly above-average precipitation. Annual precipitation anomalies averaged over the entire area of Germany were 93% of normal. Austria experienced below-average precipitation (70%–90%) in the southern provinces, eastern Tyrol, Carinthia, and southern Styria, but totals were above average (110%–130%) in the north. In Switzerland, negative precipitation anomalies were restricted to southwestern regions and most parts of Switzerland experienced 110%–140% of their normal precipitation amount in March and April and the significantly wet months of May and August.

In winter, the region was drier than normal with 74% of the normal precipitation amount in Germany. January was particularly dry with only 39% of normal rainfall. Precipitation during the winter mostly fell as snow. February saw the heaviest snowfall in southern Germany for more than 10 years. Rainfall amounts in spring were significantly above average in many parts of central Europe. Germany received 130% of its normal rainfall. In April, melting of the large amounts of lying snow coupled with above-av-

erage precipitation resulted in one of the largest spring floods in the past 50 years in southern and eastern Germany. The Elbe River rose to record levels in parts of northern Germany, breaking the records set during the 2002 flood.

Summer precipitation was correlated with temperature; the warm June and the extraordinarily hot July were also remarkably dry (50% and 65% of the normal in Germany). In July, areas of the Czech Republic, eastern Germany, and the Bavarian forest received less than one-fifth of the normal average rainfall for the month. Prague (Karlov) reported only 12.5% of its normal precipitation. August was unusually wet. Autumn saw drier-than-normal conditions in Germany (80% of the normal rainfall), and some areas along the Danube River received only about 30% of the average. In southern and eastern Austria, anomalies ranged between 40% and 80%. Rainfall totals in September were significantly below average over large parts of Germany, Austria, Poland, and the Czech Republic.

(iii) Notable events

On the evening of 31 October–1 November, a severe storm occurred over northern Germany. Wind gusts of more than 150 km h^{-1} were registered over the northern German islands. On the island of Borkum, the water level reached that of the historical flooding event of 1962.

5) Western and northwestern Europe—A. Obregón, P. Bissolli, and J. J. Kennedy

(i) Temperature

Temperatures in northwestern Europe in 2006 were above average in all areas, with parts exceeding the 98th percentile of the 1961–90 distribution. The United Kingdom and the Netherlands, which have some of the longest weather records in the world, reaching back to 1659 and 1706, respectively, reported their warmest years in history. Annual average temperatures were 1.42°C above the 1961–90 average in the United Kingdom. In Ireland, it was the warmest year for at least nine years with annual mean air temperatures reaching up to 1°C above the normal. The mean annual temperature of 10.6°C in Dublin was the highest value since reliable measurements began there in 1855. The CET is the oldest continuous temperature dataset in the world (Parker and Horton 2005; Parker et al. 1992). The mean CET for 2006 was 1.35° ±0.09°C above the 1961–90 average and exceeded all values in the series going back to 1659.

Across Ireland and large parts of the United Kingdom, March was the only month with widespread below-average temperatures. The Low Countries and France experienced an unusually cold winter. Temperatures in spring were close to or slightly above average in the Netherlands and France, while summer temperatures were considerably above average in June and July. August was, by contrast, rather cool. July 2006 was the warmest month on record for the Netherlands and Belgium, where records began in 1830. The mean temperature for July was around 5°–7°C above the 30-year meteorological average. Temperature anomalies in July in France were above 4°C in most parts of the country, where it was the hottest July in the 57-year record and the second hottest month overall behind August 2003.

The warmest September in the CET series (16.8° ±0.2°C, +3.2°C anomaly) contributed to the warmest autumn (12.6° ±0.12°C). Indeed, in central England, autumn 2006 was nearly seven standard errors warmer than the next warmest autumns recorded in 1730 and 1731 (11.8°C). Autumn was also the warmest ever in the De Bilt (Netherlands) series, which started in 1706. The mean temperature of 13.6°C in De Bilt was exceptionally high even compared to the previous record temperature of 12.0°C. September was the warmest ever recorded in the Netherlands. France experienced temperatures above the 90th percentile in October and November. October 2006 was the second warmest month in France since records began in 1950 with an anomaly relative to 1971–2000 of +3.3°C.

(ii) Precipitation

Annual average precipitation was close to the long-term mean for the northwestern European countries. However, there was significant seasonal and regional variability. The United Kingdom as a whole registered 107% of normal annual rainfall (1961–90). With 112% of normal rainfall, Scotland was the wettest British region in 2006. In Ireland, annual rainfall totals were above normal over most of the country.

The United Kingdom had its driest winter since 1964. France, Belgium, and the Netherlands experienced their highest negative rainfall anomalies in January and June, with totals in large parts of the country below the 10th percentile. Spring precipitation was slightly above normal in most of the region, with the highest anomalies in Northern Ireland, Wales, and western parts of England. May was a significantly wet month in Belgium, Ireland, England, and Wales, where monthly precipitation totals were above the 90th percentile (w.r.t. 1979–2000) and the England and Wales region reported its wettest May

COUNTRY SPOTLIGHT: BOSNIA AND HERZEGOVINA—*Z. Majstorovic*

Bosnia and Herzegovina can be divided into three climate regions, which are covered by 13 professional meteorological stations. The lowest air temperature in 2006 was recorded in January: –24.7°C in Bjelasnica. The highest air temperatures was recorded in June in Mostar (41.2°C) Annual precipitation ranged from a high of 1218 mm in Bihac to a low of 716 mm in Zenica. The lowest monthly precipitation total was recorded in October: 11 mm in Jajce. The highest monthly precipitation total occurred at Ivan Sedlo (197 mm) in August. Overall, Bosnia and Herzegovina was 0.4°C warmer normal in 2006, while annual precipitation was slightly lower than normal.

Winter 2005/06 was slightly colder than average. December was near normal, January was significantly colder, and February was slightly colder than average. Precipitation was slightly higher than normal, mostly due to December rains, but the sums in January and February were below normal. Spring 2006 had near-normal temperatures: March was colder than normal, April was slightly warmer, and May was near normal. Precipitation was wetter than average, especially in March when the largest snow cover on record was reported in Bjelasnica: 345 cm. Average summer temperatures were near normal, but there were several periods of extremely high temperatures (especially in June), and some with temperatures below the LTM. Precipitation was slightly wetter than normal; some eastern locations reported their wettest August on record. Mean temperature during autumn (all 3 months; OND) were above normal, especially in October when the mean monthly temperature anomaly was +2°C. Fall precipitation was below normal.

for 23 years.

Summer rainfall in England and Wales was the lowest for a decade. Eastern Scotland, South Wales, and the southwest were particularly dry. Extremely dry conditions occurred in the Netherlands in June and July with very low rainfall amounts (only 39% of the normal in July), especially in the western part, which had less than 10 mm of rainfall. In contrast, August was extremely wet (above the 90th percentile) in the Netherlands, Belgium, and northern France. The Netherlands reported 297% of normal values in August.

Autumn was dry in the Low Countries and northern France, while conditions in Ireland, the United Kingdom, and western France were much wetter (150% of the normal in Ireland). The Netherlands received only 16% of the monthly average rainfall in September. Precipitation in France was lower only in its northern part, while wetter conditions occurred in the south of the country. Northern Ireland registered its second wettest September since 1985. Scotland experienced its wettest November (155% of the normal with some stations in the west receiving more than double the monthly average) and December in a rainfall series that began in 1914.

(iii) Notable events

At the end of September, the extratropical remnants of Hurricane Gordon brought strong winds and rain to the United Kingdom, particularly to Northern Ireland and Scotland. The remnants of Gordon produced widespread and sustained rainfall across Northern Ireland and Scotland, with winds gusting to 130 km h^{-1} in Northern Ireland. The southwest of England was also affected by high winds.

6) Baltic States and eastern Europe—A. Obregón, P. Bissolli, and J. J. Kennedy

(i) Temperature

In 2006, the region experienced above-average temperatures nearly everywhere, with anomalies increasing with latitude. The highest positive anomalies were observed in the Baltic States (e.g., Lithuania 0.9°–1.7°C). Temperature anomalies in eastern Europe were mainly between 0.5° and 1.0°C.

The year started with unusually low temperatures in January across the whole region, except northern parts of Estonia. Temperature anomalies during the first month were lowest in Belarus and Ukraine. The Baltic States were affected by the cold wave and experienced similarly low temperatures. In Serbia, a new record-low temperature of –39.0°C was measured in Karajukica Bunari on 26 January. February and March were also cold throughout most of the region.

The rest of the year saw mostly above-average temperatures throughout the region. The heat wave in July affected the western part of eastern Europe. Serbia experienced a remarkable heat wave between 20 and 29 July with temperatures of 5°C above the long-term mean. August showed a dipole pattern in temperature anomalies. The Baltic States and eastern regions of Belarus and Ukraine experienced high temperatures, exceeding the 90th percentile, while temperatures in Hungary, Slovenia, western Slovakia, parts of Croatia, Serbia, and Bosnia and Herzegovina were below the long-term mean. Autumn temperatures were generally well above average, especially in the Baltic States, Slovakia, and Hungary. The year ended with extremely high mean temperatures.

Temperatures in December mostly exceeded the 90th percentile. The capitals of Lithuania and Estonia reported mean temperature anomalies around +7°C. The influence of the Siberian air masses was significantly reduced by cyclones from the North Atlantic region.

(ii) Precipitation

In 2006, wide areas of eastern Europe experienced normal or above-average precipitation, while the Baltic States were mostly drier than normal. Precipitation in Lithuania was near normal due to an extremely wet August; Vilnius received more than 180% of its August average. The wettest regions were generally found in eastern Europe, with highest rainfall anomalies in Bulgaria.

Winter 2005/06 was drier than average in the Baltic States and wetter than average in eastern Europe. Spring precipitation totals were higher than usual in most areas, with the exception of the Baltic States. The distribution of summer rainfall across the whole region was similar to that seen in the spring with negative anomalies in the Baltic States and positive anomalies in eastern Europe. During the last months of the year, drier-than-normal conditions were to be found in Croatia and Bosnia and Herzegovina.

(iii) Notable events

An extraordinarily swift thaw in April produced extensive flooding along the Danube, which reached its highest level in more than a century. Areas in Hungary, Serbia, Romania, and Bulgaria were most affected. In Budapest, the water level of the Danube exceeded the record set in 2002. Romania was affected by several extreme weather events during the summer: a deadly mudslide in northern Romania in June and flooding in July within the same region.

7) Southeastern Europe—A. Obregón, P. Bissolli, and J. J. Kennedy

(i) Temperature

Temperatures in southern Europe were above average in 2006 through much of the region. Greece and the European part of Turkey experienced slightly above average temperatures. In the western regions of southern Europe, temperature anomalies were considerably higher. Italy had annual anomalies on the order of +1°C in the northern and central regions and about +0.5°C in the south.

In early 2006, Greece, Turkey and southern regions of Italy were also unusually cold. The monthly average maximum temperature in Athens was 2.1°C below the climatological norm. Temperatures in the European part of Turkey were below the 10th percentile. However, some areas on the Italian islands (Sicily and Sardinia) were also warm in the spring (anomalies up to 4°C), exceeding the 90th percentile.

Summer temperatures were generally above average. In Italy, June was characterized by warming in the north and in some points in the south (anomalies up to 3°–4°C). In July, most of Italy experienced temperatures above the 90th percentile. Monthly average maximum temperatures in the northeast of Italy reached new records in some regions. Temperatures in southern parts of Greece were above the 90th percentile in August, while regions in northern Italy were colder than the 10th percentile. Southern Italy, particularly Sicily, experienced unusually high temperatures in August. In Messina, an historical high temperature of 41.8°C was recorded. In Bologna, it was the second hottest autumn since 1948. December was colder than normal over Greece. Temperatures in large parts of Italy were above the 90th percentile during this month.

(ii) Precipitation

Most parts of northern Italy experienced drier-than-normal conditions, while central and southern Italy, Greece, and Turkey received positive rainfall anomalies. In the Po Valley in northern Italy, the low precipitation amounts caused drought conditions with reduced water availability. Spring was generally drier than average in Italy and Greece, due mainly to an unusually dry May. Summer conditions were generally wetter than normal in southern Italy and Greece, while northern Italy remained dry, especially in June. During this month, most of northern Italy experienced precipitation below the 10th percentile (1979–2000 base period).

Lower-than-average precipitation was also observed in Italy as a whole during autumn. Greece was significantly wet in September (rainfall above the 90th percentile), but precipitation was well below average in November (below the 10th percentile) in most regions. Rainfall on the Greek Aegean island of Samos was 920% of the average October value. December was dry across most of southeastern Europe, especially in southern Greece, although southern Italy and Sicily were very wet.

8) Middle East—A. Obregón, P. Bissolli, and J. J. Kennedy

(i) Temperature

Annual average temperatures were above average over nearly the whole region. The anomalies were

mostly between 0° and +1°C and partly above +1°C in the eastern parts (Georgia, Armenia, Azerbaijan, and western Kazakhstan). The cold spell that dominated Europe in January also affected the Caucasian countries and western Kazakhstan, where temperatures were lower than the 10th percentile with anomalies between −6° and −10°C. In February, warmer air from the southeast extended into the region and temperatures exceeded the long-term average during most of the spring season. The summer, too, was generally above average, with high anomalies in June and August, while July was mostly near average. A heat wave occurred in Cyprus between 19 August and 28 August, with maximum and minimum temperature anomalies of 2°–5°C above normal. The autumn was mostly warmer than normal. Significant anomalies occurred in October when eastern parts of the region were 3°C above average.

(ii) Precipitation

Precipitation totals from December 2005 to November 2006 were mainly near normal. Cyprus and Azerbaijan were the exceptions in that they were very dry, with some areas receiving less than 50% of the annual precipitation average. The annual average for Cyprus was 77% of the normal, although October and November were particularly wet.

h. Oceania

1) Australia—A. Watkins and B. Trewin

Despite only weak-to-moderate El Niño conditions in the Pacific, Australia, as in 2002, experienced above-normal pressures during the year, which suppressed convection and kept cold fronts south of the continent. As a result, significant dry conditions were experienced over much of the country by the second half of 2006. For many of these areas the drought of 2006 added to significant longer-term rainfall deficiencies, with large regions having experienced little recovery from the droughts of 1997/98 and 2002/03, resulting in severe hydrological drought throughout much of eastern and southwestern Australia.

However, a vigorous wet season across northern Australia, as well as the inland penetration of tropical cyclones into remote areas of western Australia early

COUNTRY SPOTLIGHT: ARMENIA—A. Hovsepyan

The year 2006 was 1.2°C warmer than normal all over Armenia (Fig. 6.40). It was the seventh warmest year in Armenia since 1929. Annual precipitation totals were close to the 1961–90 normal. The northeastern and southern parts were very dry, while central parts received above-average precipitation. Winter 2005–06 was rather warm, with seasonal temperatures 1°C above the 1961–90 mean. The summer was the hottest in 70 years; seasonal temperatures exceeded the 1961–90 mean by 2.7°C. Mean summer precipitation was only 60% of normal.

January was colder than normal by 1.5°C all over Armenia. Precipitation exceeded the normal by about 40%. Temperatures in February were higher than normal by 1°–1.5°C, except in the Ararat valley, where negative anomalies reached –1.5°C. March was very warm (anomalies of 2°–3°C) and dry (60%–70% of normal precipitation) over the country. April was warm and rainy across Armenia. Precipitation totals exceeded the normal by 60%–70%. Climatologically, April–May is the wettest period of the year in Armenia, but in 2006, some regions reported no rain in May. Severe drought developed across the country in June. Mean monthly temperature was above normal by 4°–4.5°C. August was very hot and dry, as monthly temperature anomalies reached 3.5°–4°C. During a heat wave (6–15 August) maximum temperatures reached up to 42°C.

In September, the monthly mean temperature was 2°–4°C higher than normal. October was quite warm (2.7°C higher than normal) and wet (precipitation totals exceeded the normal by 150%–250%). December was very cold. The monthly mean temperature was 2.2°C below normal. Precipitation was generally about 60% of normal.

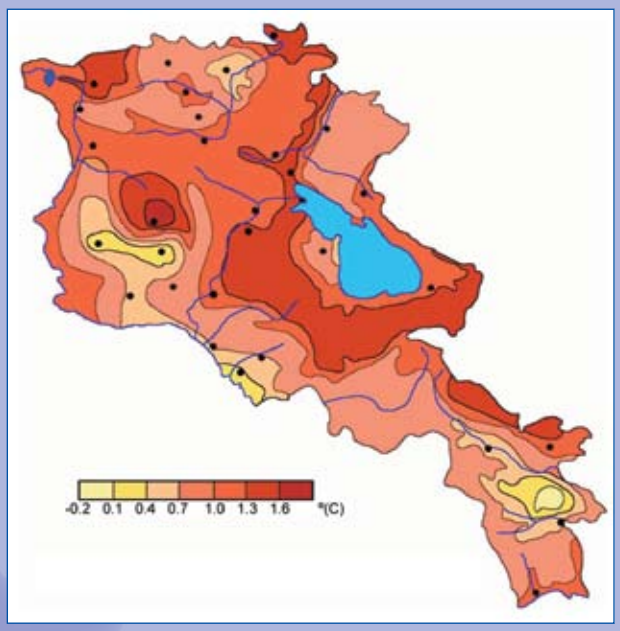

Fig. 6.40. Annual average air temperature (°C) anomalies for Armenia.