



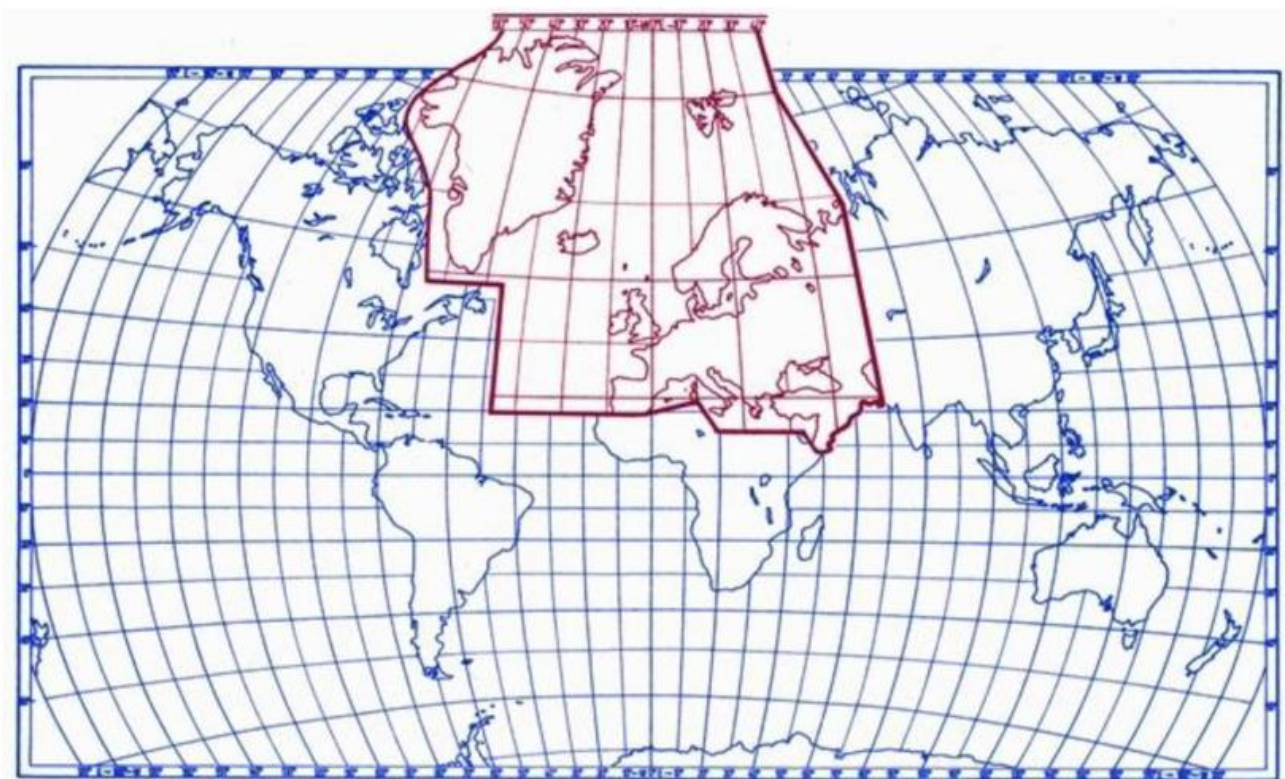
WMO RA VI
RCC Network



Annual Bulletin on the Climate in WMO Region VI

- Europe and Middle East -

2015



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1. Introduction

The Annual Bulletin on the Climate in WMO Region VI (Europe and Middle East with 52 individual countries) provides an overview of climate characteristics and phenomena in Europe and the Middle East for the preceding year. It is mainly based on dedicated national reports from RA VI National Meteorological and Hydrological Services (NMHSs) as well as general climate monitoring information from their official Websites. Supported by the European Climate Support Network (ECSN) and WMO's World Climate Data and Monitoring Programme (WCDMP) the Bulletin provides an excellent example of international collaboration across cultural and political borders since its first publication in 1994. The Bulletin is seen as a regional contribution to WMO's climate system monitoring, complementing and detailing well-known regular global assessments, such as WMO's Annual Statement on the Status of the Climate and the State of the Climate published in the Bulletin of the American Meteorological Society (BAMS). The evolution of the RA VI Regional Climate Centre Network (RCC Network) allowed adding a couple of RA VI-wide maps in order to provide a certain degree of consistency across the information and the national borders. Otherwise, basic methodologies for, and operations of, climate monitoring activities still differ amongst the various RA VI NMHSs. Maps and information compiled in this Bulletin are the result of a selection process. Websites of NMHSs as well as the Webpages of the RA VI RCC Network (<http://www.rccra6.org>) offer useful additional information and regularly produced maps etc. The Bulletin is intended to serve primarily NMHSs in the Region but it might also be interesting for public institutions, research institutes, universities and others.

This annual bulletin includes 4 parts: the annual, seasonal and monthly survey of the climate state in 2015 as well as contributions of the NMHSs to the long-term variability of selected parameters up to 2015 (section 5).

Notes:

Maps of the RA VI RCC Network are based on the following data sources:

- Temperature: CLIMAT data and ship observations provided by the Global Collection Centre (GCC), operated by the Deutscher Wetterdienst
- Precipitation: Global Precipitation Climatology Centre (GPCC), operated by the Deutscher Wetterdienst
- Sunshine: CLIMAT data.
- Anomaly maps of climate indices are provided by the RCC De Bilt Node on Climate Data Services (RCC Node-CD) via the European Climate Assessment & Dataset project (ECA&D) run by Royal Netherlands Meteorological Institute (KNMI)

Sub-regional monthly maps are provided by the Eastern Mediterranean Climate Centre (EMCC).

The following sub-regions are used in this Bulletin:

Central and western Europe (14 countries): Austria, Belgium, Czech Republic, France, Germany, Hungary, Ireland, Luxemburg, Monaco, the Netherlands, Poland, Slovakia, Switzerland, United Kingdom

Nordic and Baltic Countries (9 countries): Denmark, Estonia, Finland, Greenland, Iceland, Latvia, Lithuania, Norway, Sweden

Iberia (2 countries): Portugal, Spain

Mediterranean, Italian and Balkan Peninsula (12 countries): Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Italy, Malta, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Slovenia, Turkey

Eastern Europe (5 countries): Belarus, European Russia, Moldova, Romania, Ukraine

Middle East (9 countries): Armenia, Azerbaijan, Cyprus, Georgia, Israel, Jordan, Lebanon, Syria, western Kazakhstan

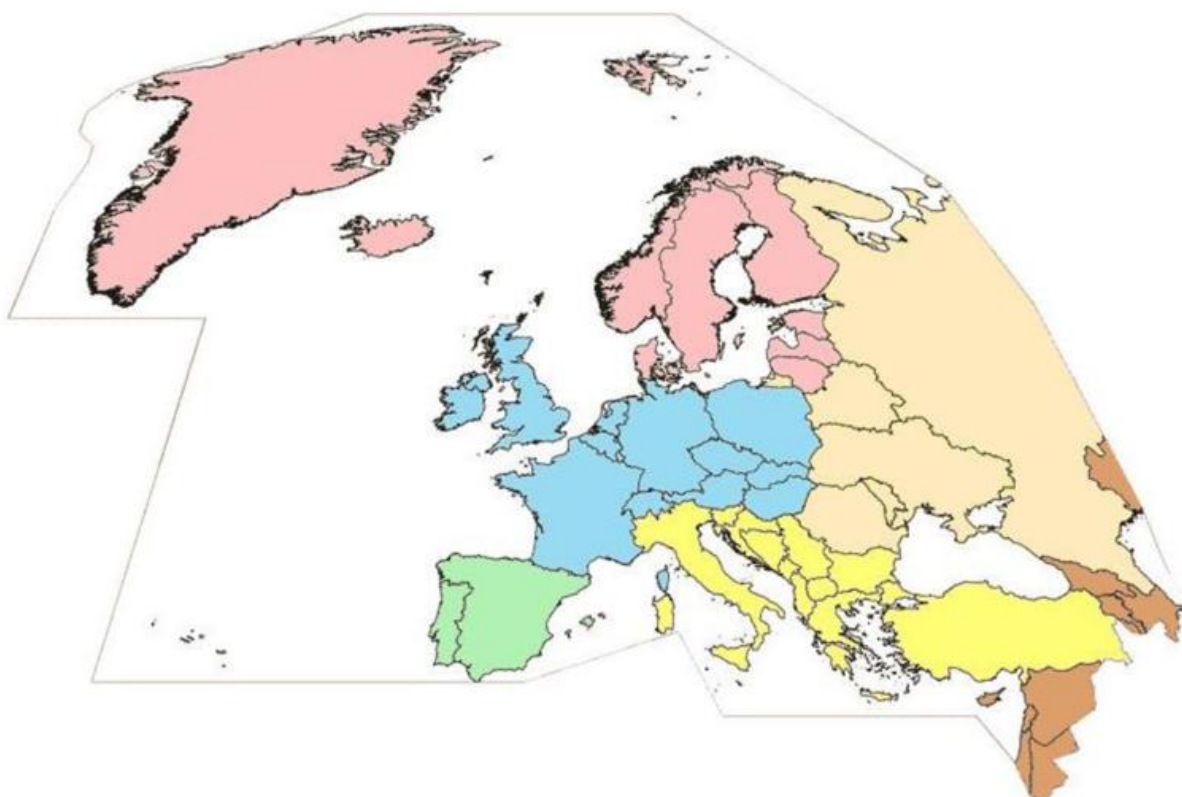


Figure 1.1: Definition of the 6 sub-regions used in this bulletin.

Box 1

Notable anomalies and events 2015

Anomalies

Temperature

- Record breaking year in many European countries (see **Table 2.1**).
- 2015, followed by the year 2014 was globally the warmest year on record, according to several surface temperature observational analyses.
- Unusually temperatures in Israel in April.
- Heat wave over central and southern Europe from June to September.

Precipitation

- In January 2015 extreme monthly precipitation totals in Scandinavia with up to 400% of the normal at some stations; at Eikemo (Norway) 782.3 mm (279 % of the normal).
- Second wettest May since 1900 in Scandinavia.
- Several extremely intense rain-storm episodes of in the southeast of France in August, September and October.
- Long lasting drought and heat in summer extended over an area from southwestern and central Europe up to southwestern Russia.

Sunshine Duration

- Austria experienced its sunniest December on record with 190 % of normal.

Other Anomalies

- Lowest Arctic sea ice extent for March 2015 according to satellite records
- High pressure over Scandinavia in August 2015 accompanied by higher than normal temperatures.

Events:

- Several storm series passed Europe in March 2015
- Extreme precipitation and floods recorded in northern UK during December 2015 (Honister Pass (Cumbria) 341.4 mm/24 hours on the 5th).

2. Annual survey

The climate of 2015 was characterised by a broad range of spatial and temporal anomalies outlined in Box 1 and Figure 2.5. This section presents an overview of the spatial patterns of mean annual climate conditions in 2015 and anomalies related mainly to the normal period 1961-1990 of the selected essential climate variables: sea surface pressure, surface temperature, precipitation, sunshine duration and snow. Sub-section 2.1.4 reveals climate extremes for each participant country. Long-term trends in temperature and precipitation indices offers section 2.2.

More detailed insight into the long-term variability of the temperature and precipitation and also some other parameters from the individual participant countries are presented in section 5.

2.1. Annual averages and anomalies of selected essential climate variables

2.1.1. Sea level pressure

Generally, long-term mean annual sea level pressure distribution in 2015 over the WMO Region VI is dominated by a low pressure trough in the polar area with the Icelandic low that extend from southern Greenland over Iceland to northern Scandinavia. The second pressure system the subtropical high pressure belt extended from the centre over Azores (Azores high) across southern, western and central Europe to European Russia.

2015 the mean sea surface pressure differs to some extent from the long-term mean with a reduced pressure especially in a region west and northeast of Iceland with anomalies of -4 to -6 hPa. Higher pressure anomalies of +2 to +4 hPa occurred above southern and central Europe as can be seen from Figure 2.1 (right; normal period 1961-1990) which indicated in mean a stronger than normal NAO.

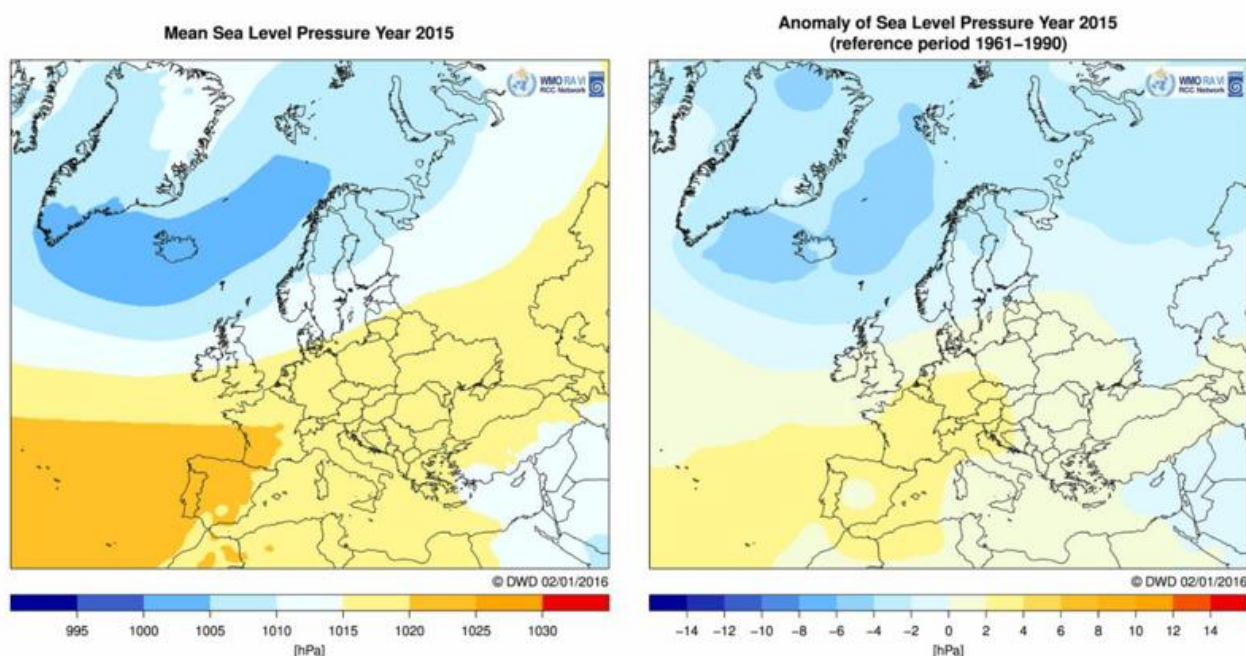


Figure 2.1: Annual mean of sea level pressure (left) and anomalies (right) for the year 2015 with respect to the reference period 1961-1990. (Source: <http://www.dwd.de/rcc-cm>)

2.1.2. Temperature

In the entire European region (35°–75°N, 25°W–45°E) the year 2015 was the warmest since 1950 (slightly warmer than 2014) with an anomaly of 0.9°C above the reference period 1981–2010 or of 1.46°C related to 1961–1990. Many of the European countries reported new records (Table 2.1).

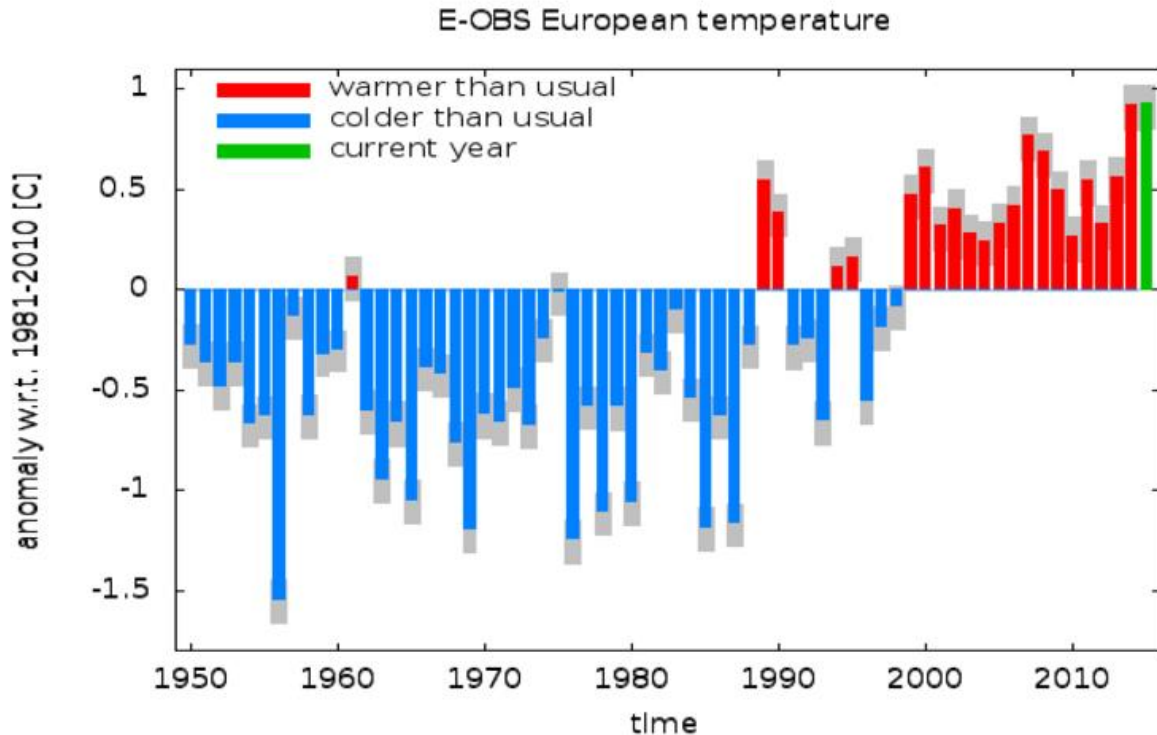


Figure 2.2: Annual temperature anomalies 1950–2015 for Europe (land area; 35°N - 75°N and 25°W - 45°E, reference period 1981–2010; source: www.ecad.eu, van der Schrier et al. 2013)

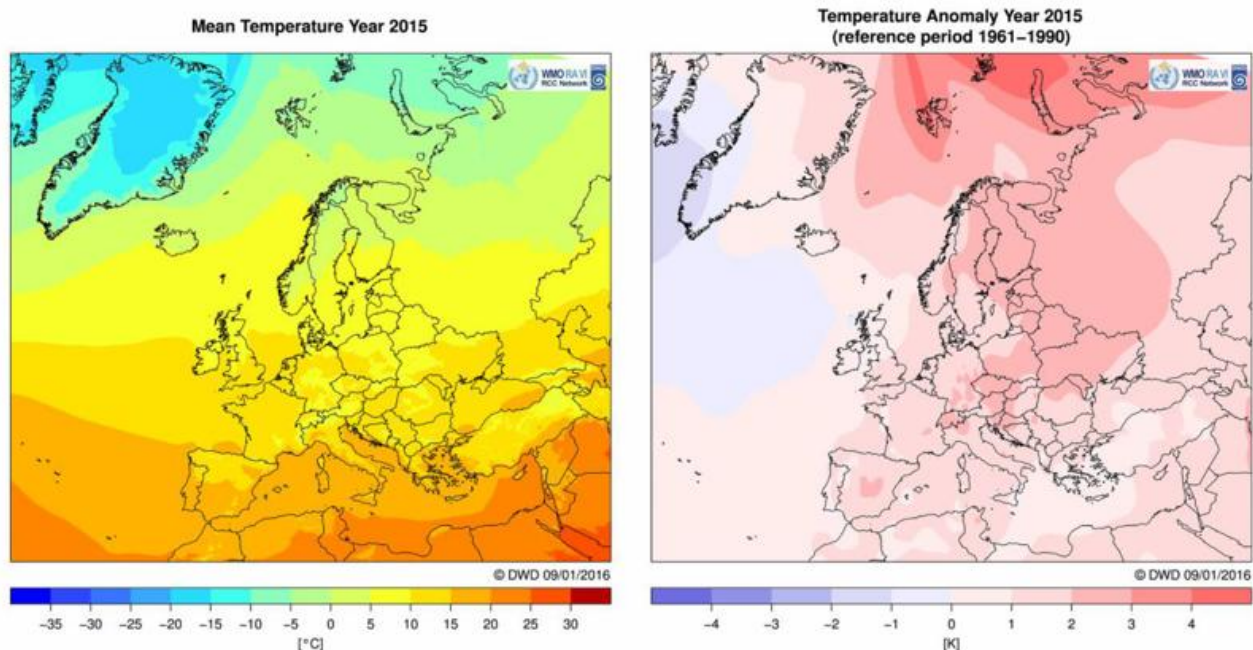


Figure 2.3: Mean annual temperature in °C (left) and anomalies (right) for 2015 (reference period 1961–1990. source: <http://www.dwd.de/rcc-cm>)

The highest annual anomaly of 2.29°C referred to 1961–1990 was observed in the sub-region Eastern Europe followed by Central and Western Europe (1.59°C), the Middle East (1.51), Mediterranean, Italian and Balkan Peninsula (1.48°C) and Iberia (1.41). The sub-region Nordic and

Baltic countries showed the lowest anomalies of 1.26°C (Table 3.2). Most of the months in 2015 were warmer than normal (1961-1990) with remarkably consistent deviations of +2 to +3°C especially from winter to summer across Iberia as well as the Mediterranean, Italian and Balkan Peninsula in winter and summer (cf. section 3.1.2 and 4.2).

The global annual temperature average for 2015 increased also to a record high $0.76 \pm 0.09^\circ\text{C}$ above the 1961–1990 average (WMO 2016, Blunden und Arndt 2016)

A summary of the annual temperature time series and the historical rating can be drawn from section 5. The rank statistics are listed together with the start of the time series and the anomaly of the year 2015 as provided by the NHMS are outlined in the following table.

Table 2.1: Rank statistics and anomalies of annual temperature in 2015 from some participant countries as reported by the National Meteorological and Hydrological Services (NMHSs).

Country	Rank of annual temperature in 2015	start of time series	Anomaly in °C	Reference period
Europe (35°–75°N, 10°W–30°E, E-OBS)	1	1951	1.46	1961-1990
Armenia	3	1961	1.8	1961-1990
Austria	2	1767	2.2	1961-1990
Belarus	1	1881	2.6	1961-1990
Belgium	6	1833	0.8	1981-2010
Bulgaria	2	1901	1.57	1961-1990
Croatia	2 (with 2012)	1862 (Zagreb and other stations)	1.0-2.2	1961-1990
Cyprus	slightly above normal		0.7	1981-2010
Czech Republic	1 (with 2014)	1961	1.9	1961-1990
Denmark	9 (with 1934)	1874	1.4	1961-1990
Estonia	1	1961	2.4	1961-1990
Finland	1	1900	1.9	1981-2010
France	3	1900	1.0	1981-2010
Georgia	4	1950	1 - 3	1961-1990
Germany	2 (with 2000, 2007)	1881	1.7	1961-1990
Greece			0,82	1971-2000
Hungary	2	1901	2.05	1961-1990
Iceland			0.5	1961-1990
Israel	3	1951		1961-1990
Italy	1	1961	1.6	1961-1990
Jordan			1.2	1961-1990
Kazakhstan	3	1936		1961-1990
Latvia	1	1924	2.1	1961-1990
Lithuania	1	1961	2.1	1961–1990
Luxembourg	3 (with 2007)	1947	2.1	1961–1990
Moldova	1-2		2.1-2.7	1961-1990
Montenegro	1-5		1.5-3.1	1961-1990
Netherlands	5	1901(de Bilt)	0.8	1981-2010
Norway	3	1900	1.8	1961-1990
Poland	1	1950	1.8	1971-2000
Portugal	7	1931	0.75	1971-2000
Romania	1	1901	1.96	1961-1990
Russia, European	1	1939	2.07	1961-1990
Serbia	3	1951	1.6	1961-1990
Slovakia	2	1951	2.0	1961-1990
Slovenia	2-3	1951	2-3	1961-1990
Spain	1 (with 2011)	1961	0.9	1981-2010
Sweden	3	1860		1961-1990
Switzerland	1	1864	1.29	1981-2010
Turkey	5	1971	0.8	1981-2010
Ukraine	1	1951	2.4	1961-1990
United Kingdom	16 (near average)	1910	0.4	1981-2010

2.1.3. Precipitation

The annual precipitation amount was close to normal over many parts of continental Europe except for Ireland, northern UK, Denmark, most parts of Scandinavia and south-eastern Europe, where positive anomalies above 10 mm/month were recorded. Parts of Iberia, France, the region around the Alps and parts of eastern Europe showed drier conditions with anomalies below -10 mm/month and also values below the 0.1 percentile indicating a drought situation. The annual figures of the year 2015 give only rough hints of the regions with outstanding precipitation events. Detailed descriptions can be found in the seasonal (3.1.3) and monthly survey (4.3).

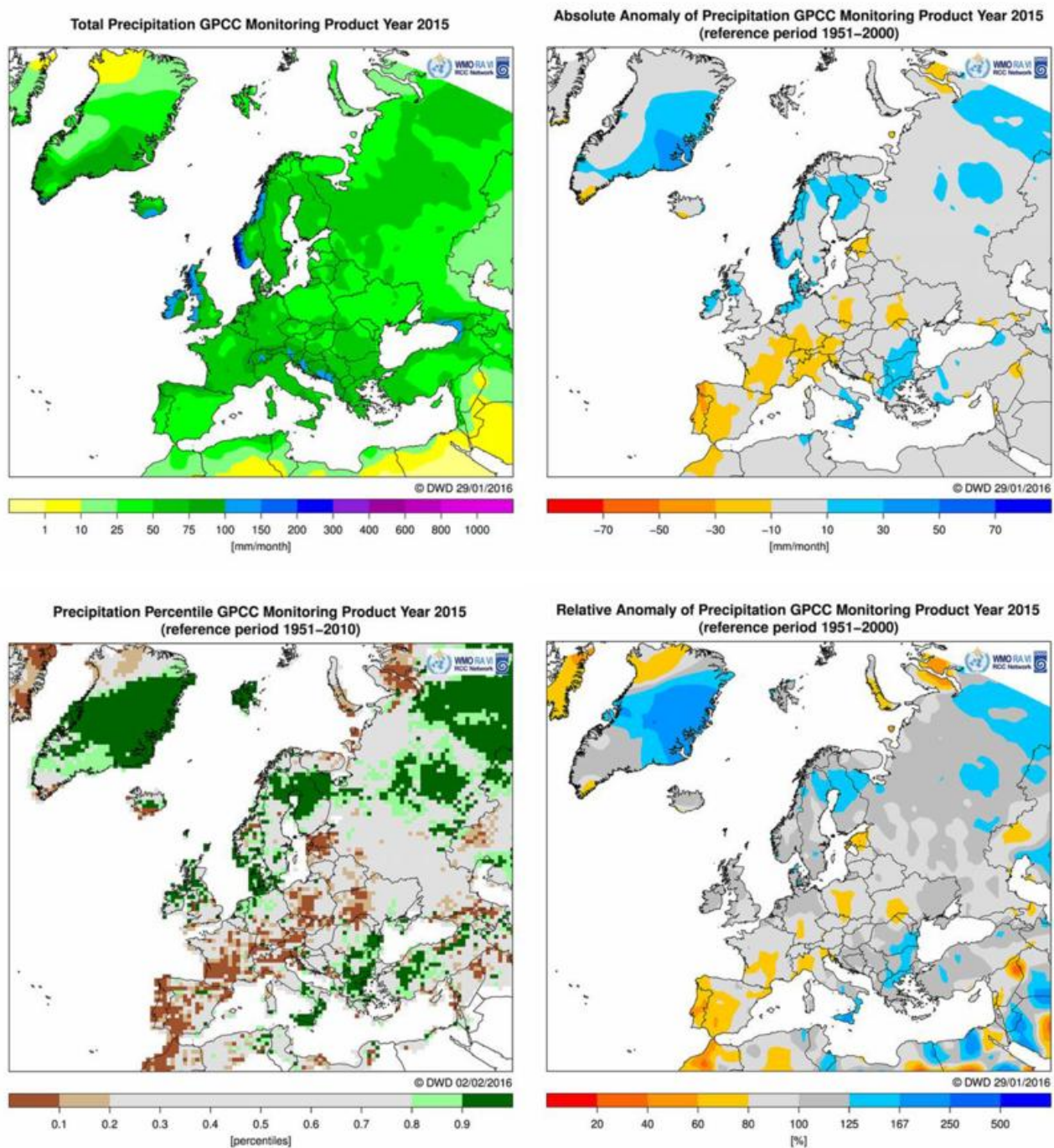


Figure 2.4: Total precipitation (left, top), absolute anomalies (right, top) in mm/month, percentiles (left, bottom) and relative anomalies in % (right, bottom) for 2015 (reference period 1951–2000; source: <http://www.dwd.de/rcc-cm>)

2.1.4. Annual extreme values of temperature and precipitation

In this section an overview is given for the temperature spread and the extreme precipitation for each country. Absolute annual extreme values for 2015 of temperature (minimum and maximum), maximum of total daily precipitation and maximum of total 5 consecutive days with precipitation for each country in the WMO Region VI are given in Figure 2.5.

The spatial pattern of extreme temperature corresponds roughly to those of the temperature anomalies of 2015. The highest maximum temperatures (above 40°C) occurred primarily in sub-regions Middle East, Mediterranean, Italian, Balkan, some countries of Central Europe and Iberian Peninsula. Maximum temperatures higher than 35°C were reported from most of the countries in central and eastern Europe, but also from some of Nordic and Baltic Countries. The one-day precipitation totals (RX1) of more than 150 mm for individual countries are documented in several sub-regions; the highest values occurred in Italy (481 mm/day, at a local station) and Great Britain (341 mm/day). Highest total precipitation from 5 consecutive days (RX5) (above 300 mm) was measured in Great Britain (381 mm), Greece (358.6 mm), Italy (358 mm, only synoptic stations), Austria (350 mm) followed by Slovenia (323 mm).

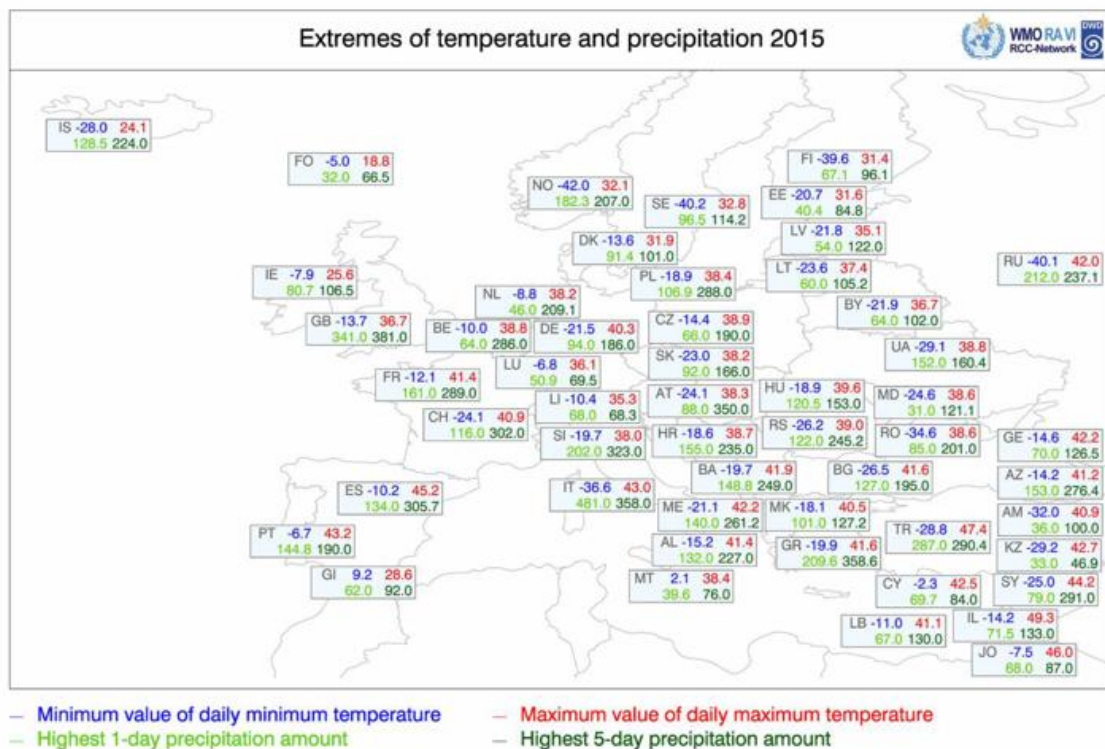


Figure 2.5: Annual extreme values for each country in 2015: first row: Internet country code, lowest daily minimum temperature (in °C, blue) and highest daily maximum temperature (in °C, red); second row: maximum daily precipitation totals (in mm, light green) and maximum 5-daily consecutive precipitation totals (in mm, dark green).

Note: Data (by order or priority) from reports of NMHSs, GPCC, ECA&D or SYNOP; the countries are represented by their Internet country codes. (Source: <http://www.dwd.de/rcc-cm>)

2.1.5. Sunshine duration

As expected, the annual sum of sunshine duration 2015 showed from the south to the north generally gradual decreasing values. More than normal sunshine hours have been primarily noted in most parts of Europe except in Portugal, southern Italy as well as in Turkey and north-eastern Europe. Svalbard, Poland and southern Russia showed in almost every season above normal sunshine (>125 %). Positive anomalies of the same range were also noted in Svalbard.

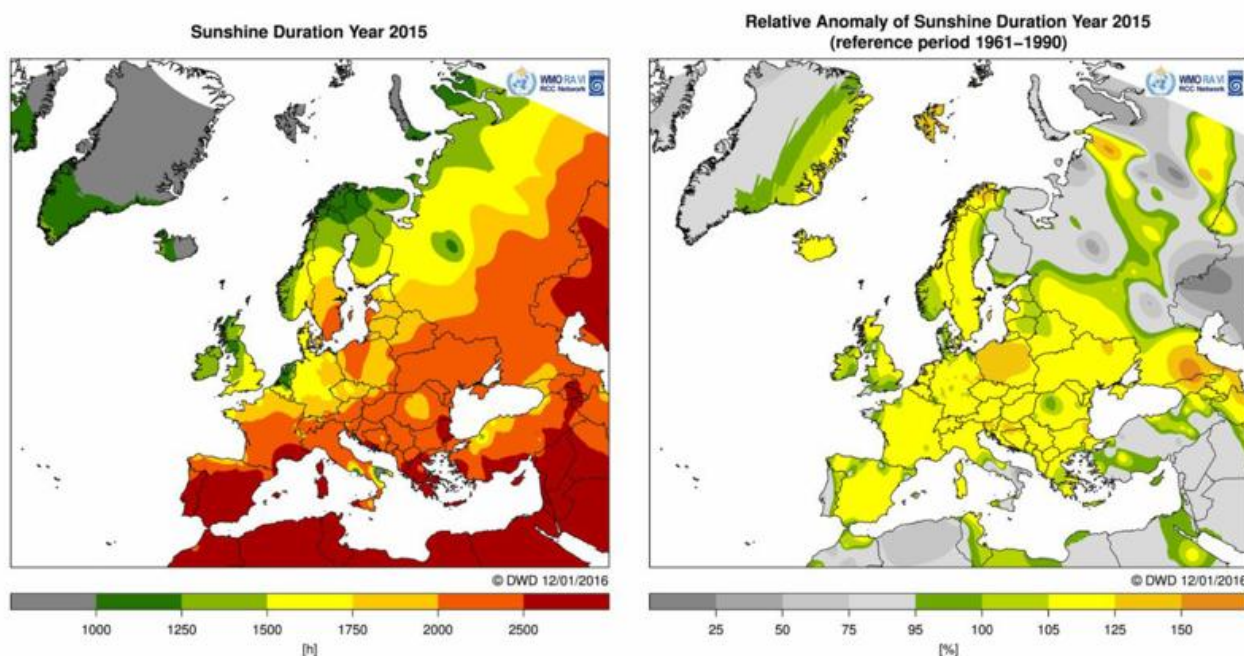


Figure 2.6: Annual sum of sunshine duration (left) and relative anomalies (right) for the year 2015 in hours with respect to the reference period 1961-1990. (Source: <http://www.dwd.de/rcc-cm>)

2.1.6. Drought situation

The drought index (SPI) in 2015 differed only slightly from its normal values. The anomalies from Spain over central Europe to Russia were slightly below normal while northern Europe and south-eastern Europe were slightly wetter. In these areas annual precipitation was above normal linked with floods.

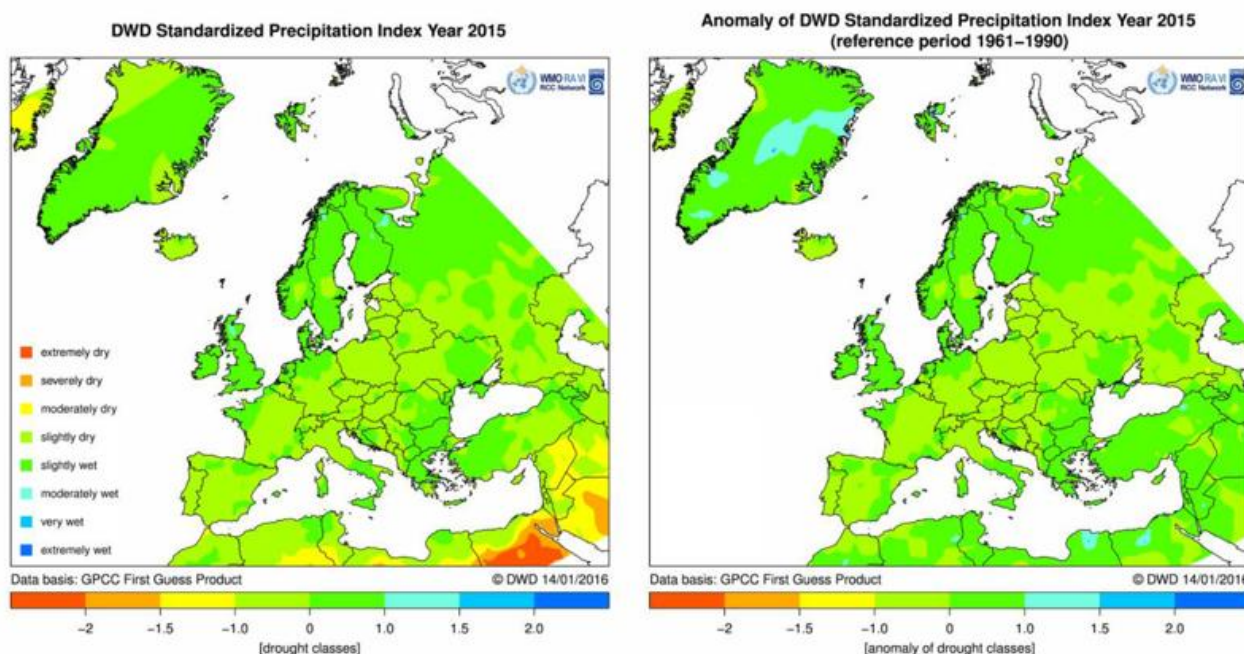


Figure 2.7: Annual modified Standardized Precipitation Index (DWD-SPI) for the year 2015 (left) and its anomalies (right) with respect to the reference period 1961-1990. (Source: <http://www.dwd.de/rcc-cm>)

2.1.7. Snow cover

The snow-season 2014/2015 (September 2014–August 2015) was warmer than normal and consequently in many low land areas in west and south Europe no snow occurred at all. Apart from mountain areas, in the central Europe the partly occasional snow fall events occurred in December. As expected, towards the northern and eastern Europe the snow cover duration was longer and ended in April and May.

However, late snow prevailed in Austria and Switzerland.

In the second half of January 2015 north-westerly and northerly currents brought the winter to **Switzerland**. Even at low altitudes snow fell on both sides of the Alps. In February there was also snowfall down to low altitudes in many parts on both sides of the Alps with colder than normal temperatures. Especially south of the Alps, snowfall was substantial. In mid-February 16 cm of fresh snow fell in Locarno-Monti within two days. In Airolo (1100 m a.s.l.) and San Bernardino (1640 m a.s.l.) snowfall amounted to 63 cm, in Bosco-Gurin (1500 m a.s.l.) as much as 96 cm. One week later a cold air front from northwest covered almost the whole of Switzerland in fresh snow. In low altitude areas north of the Alps amounts remained under 10 cm. South of the Alps 10 to 20 cm of fresh snow were recorded even at low altitudes while at higher altitudes over half a meter was measured.

In winter the absence of snow in **Austria** was remarkable. In the lower parts of the country the days with snow cover was 40 % below the average, because it was the 8th warmest winter on record. Due to the high temperature the larger parts of the precipitation fell in form of rain.

In 2015 the number of days with snow cover in Poland was significantly below the normal and ranged from several days in North and West, through 10-45 days in central part of Poland to above 100 days in the mountains. Snow cover at Kasprowy Wierch (1991 m a. s. l.) in Tatra Mountains was observed on 209 days. The maximum snow depth across the country did not exceeded 20 cm. In the mountains it was higher, reaching 217 cm at Kasprowy Wierch in Tatra Mountains.

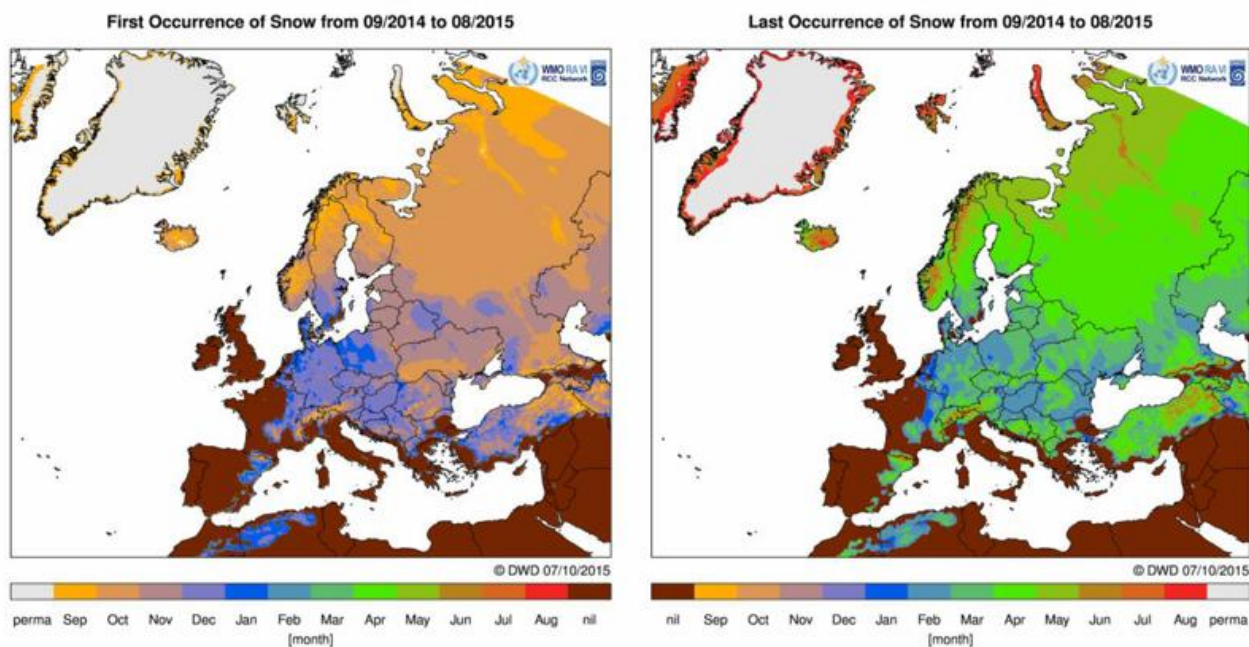


Figure 2.8: First occurrence of snow (left) and last occurrence of snow (right) during the snow-season 2014/2015. (Source: <http://www.dwd.de/rcc-cm>)

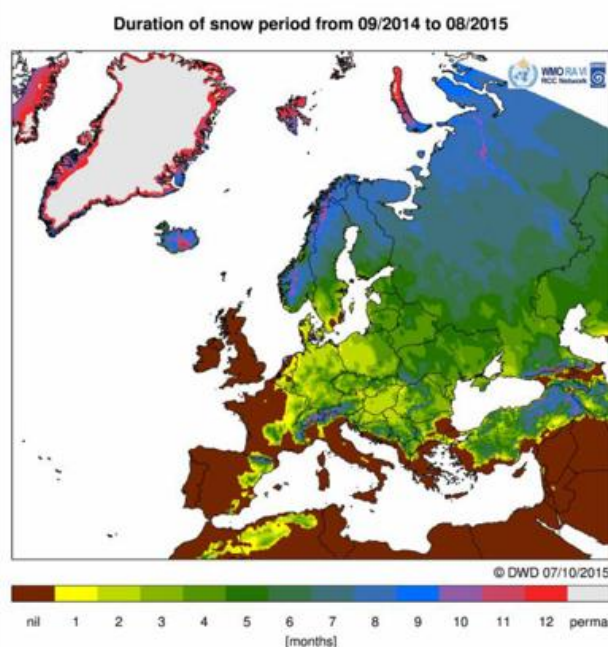


Figure 2.9: Duration of snow cover in the snow-season 2014/2015. (Source: <http://www.dwd.de/rcc-cm>)

2.2. Trends of temperature and precipitation indices 1951-2015

This section presents trends for selected temperature and precipitation indices for the period 1951-2015.

In the northern, north-western and eastern Europe most stations showed an increase in the annual number of wet days (RR1) for the last 65 years while in southern Europe a decreasing trend prevailed. The decreasing and increasing trend at neighbouring stations, however, indicate inhomogeneities in the time series. The number of warm and wet days (WW) increased over whole Europe with exception of Greece. The annual number of summer days (SU) increased in Central and southern Europe while in the north-western and northern Europe no significant changes were observed. The annual numbers of tropical nights (TR) showed increasing tendencies in the south-east part of Region VI while the north-west part noted no significant changes.

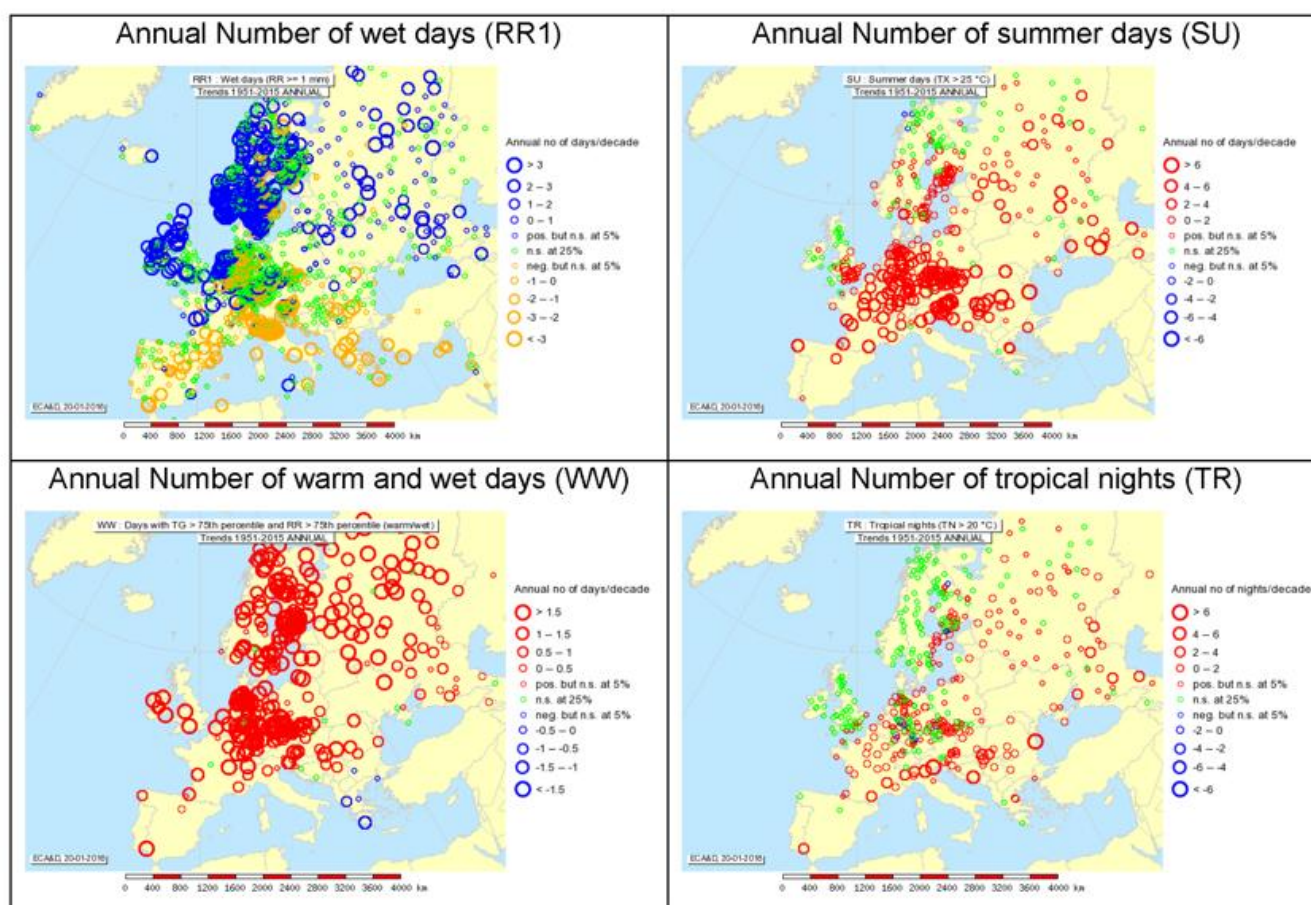


Figure 2.10: Trends of Selected Climate Indices 1951 to 2015 (Source: ECA&D, <http://www.ecad.eu>)

Legend of Figure 2.10:

- RR1, Number of wet days:** count of days where RR (precipitation > 1 mm)
Precipitation below 1 mm/day has no effect on vegetation because it normally evaporates on the same day and is locally effected.
- SU, Number of summer days:** count of days where TX (daily maximum temperature) > 25°C
- WW, Number of warm and wet days:** days with TG (daily mean temperature) > 75th percentile and RR > 75th percentile
- TR, Number of tropical nights:** count of days where TN > 20°C

2.3. Socio-economic impacts of extreme climate or weather events

Several countries reported socioeconomic impacts of climate extremes or weather events. This was done partly given in a standardized structure (WMO guiding table for country submission of information on extreme climate events) or the information was part of the regular monthly reports on the internet or it was separately submitted. However, this information is heterogeneous and does by far not give a complete overview. Not only due to the different administrative structures the information cannot easily be gathered but also many kinds of impact are difficult to estimate. In the following only a short extract will be given.

The following figure (Figure 2.11) shows the number of observed extreme weather or climate event as reported by the NMHSs in 2015. Conclusions should be drawn only with caution because some of the events were reported simultaneously by several countries. The total number of cases for this figure was 316. No diagrams were shown for the injured persons and fatalities as well as the economic losses because the number of reports were too few (about 6, 11 resp. 5). In some cases the reported numbers were not fix but like 'hundreds' or 'few'. The economic damage was estimated as well by some countries but the information is not sufficient to be presented with any reliability of representativeness. The reported economic damages will be summarized individually below.

The most frequent events in 2015 were 'Extreme Precipitation' with 87 events or 25% that also happened in most of the countries with reported 75 fatalities and 56 injured. The second one with 20% or 62 events were 'Heat Waves' that mainly occurred in Central, southern and eastern Europe (Serbia and Portugal reported 7 heat waves, Slovenia 5). Rank three were 'Wind Storms' with an occurrence of 17% or 53 events mostly in winter in the western part of Europe together with extreme precipitation. The next extreme events were 'Floods' (10%, 27 persons injured, 15 fatalities) and 'Droughts' (7%).

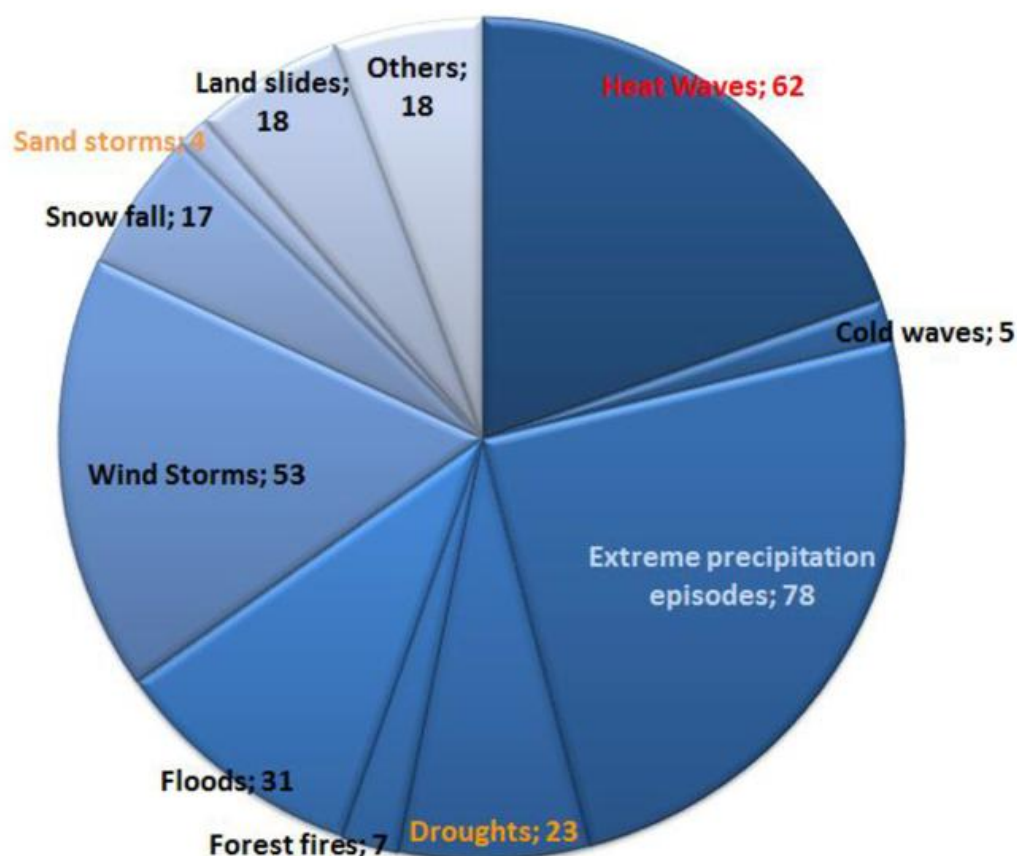


Figure 2.11: Relation of observed extreme weather or climate events in 2015 based on 35 reports from NMHSs (total events reported for 2015: 316)

High economic damage is usually connected with floods, storm, cold spells (all kinds of frost, snow or ice), hail, drought or extreme heat. There are some figures which are summarized in the following but much of this kind of damage cannot be estimated (by meteorologists).

From 8th to 11th January the winter storms Elon and Felix hit mainly Germany, Scandinavia and the UK with high wind speeds, thunderstorms, hail, heavy rain and snowfall. Thousands of buildings, schools, houses were damaged. Many weather-related accidents occurred, air and rail traffic were also affected. The overall loss amounted to 500 Million €.

South-central and eastern Bulgaria as well as northwest Greece was hit by an extreme precipitation episode from 1st to 3rd February 2015. The geographical extent in Bulgaria was 23,300 km² (5 districts). On February 1st the highest daily precipitation amount was 210 mm, recorded in Kirkovo (Bulgaria) corresponding to the double of the monthly normal mean. In Greece a 3 day precipitation of 359 mm was observed at station Derviziana during 30, 31st January and 1st February 2015. Greece also reported wind gusts of 46 m/s. This heavy rain caused flooding especially in the eastern Rhodopes area (Bulgaria) accompanied by landslides. More than 2,300 houses were damaged, roads and farmland flooded. 14 people lost their lives and the loss summed up to 660 Million Euro.

Snowfall affected southern Bulgaria from 5th to 7th March 2015 on a geographical extent of 23000 km² (6 districts). During these three days maximum wind gusts of 24 m/s in Burgas or 34 m/s in Sliven, torrential rain and snowfall in Momchilgrad with 238 mm in 48 h, Krumovgrad with 148 mm in 48 h and Haskovo with 125 mm in 48 h were measured. The total snowfall for two days varied from 200% (Krumovgrad) to 420% (Momchilgrad, Kardjali region) of snowfall average. The snow reached heights up to 1.5-2 m. Landslides were activated especially in south-central and southwestern Bulgaria. Above 1120 towns and villages were left without electric supply in south-central Bulgaria and 30 electrical towers were broken. The estimated damages were about 16 Mio. € and 4 people died.

On 8th July 2015 extremely severe thunderstorms and hailstorms broke out in the western, central and southern parts of Austria. Most damages were registered in Carinthia. According to the regional insurance company, it was the worst natural disaster according to economic losses in Carinthia in their 150 year history. Due to the extreme storms 11 were injured and damages around 150 Mio. € were caused.

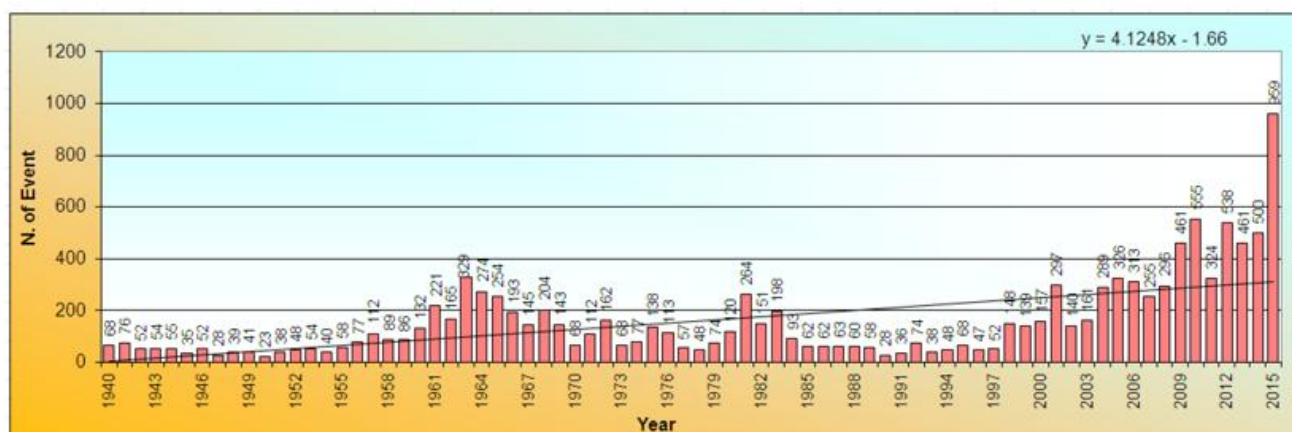


Figure 2.12: Annual count of extreme events occurred in Turkey from 1940-2015 (Diagram as provided by the NHMS).

The number of extreme events in Turkey in 2015 reached 959. (Figure 2.12). There is an increasing trend in extreme events (41 events/decade).

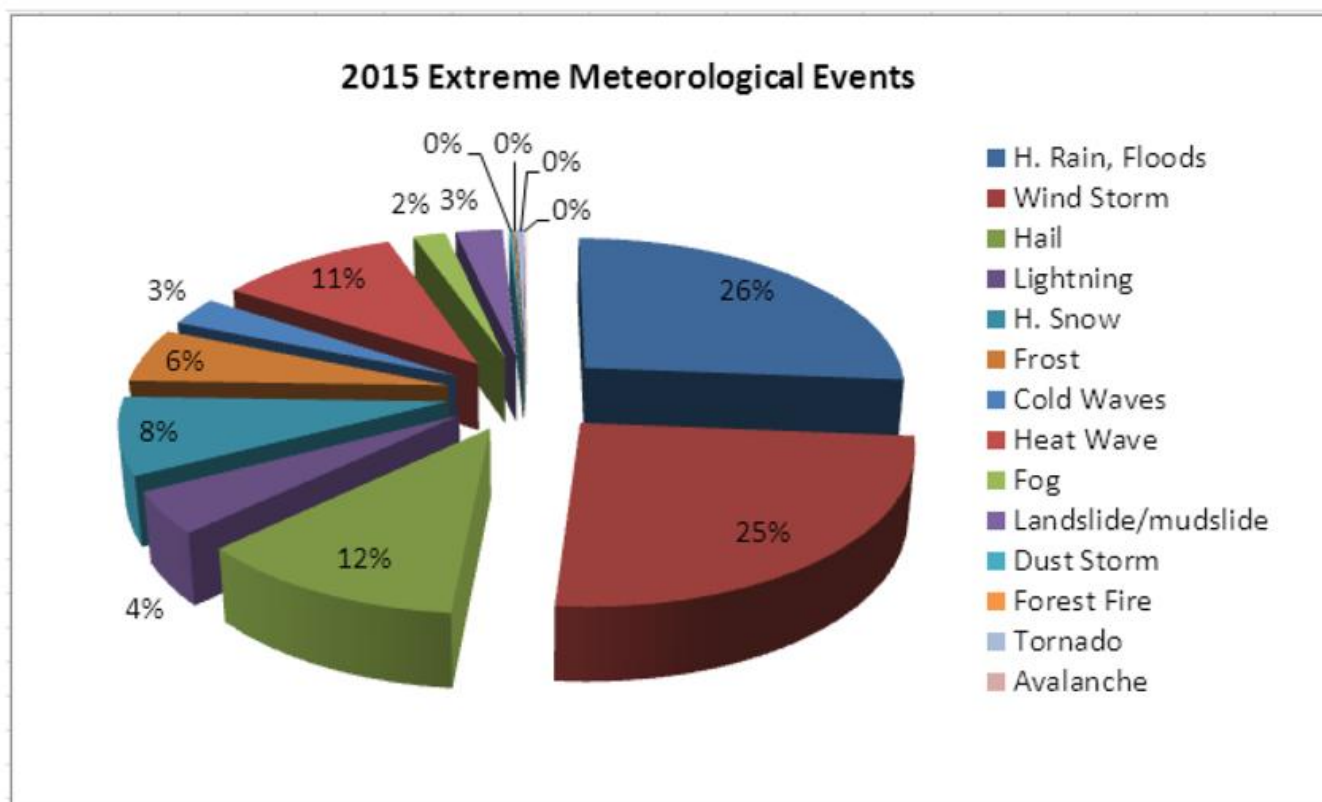


Figure 2.13: Distribution of extreme events occurred in Turkey in 2015 (Diagram as provided by the NHMS).

During 2015 most hazardous extreme events were heavy rain/floods (26%), wind storm (25%), hail (12%), heat wave (11%), heavy snow (8%), frost (6%), lightning (4%), cold wave (3%), landslide/mudslide (3%) and fog (2%) respectively (Fig. 14). Although rare, 1 forest fire, 2 dust storm, 1 avalanche and 4 tornados also occurred in 2015.

3. Seasonal survey

This section presents an overview of the spatial patterns of seasonal mean climate conditions in 2015 and anomalies related mainly to the normal period 1961-1990 of the selected essential climate variables: sea level pressure, circulation indices, surface temperature, precipitation and sunshine duration.

3.1. Seasonal averages and anomalies of selected climate variables

3.1.1. Sea level pressure and circulation indices

The pressure distribution in **winter 2014/2015** showed similar patterns for the mean and the anomalies. In seasonal average the Icelandic low possessed a core pressure below 995 hPa and the Azores high a core pressure above 1030 hPa. This indicates that the two pressure centres were intensified in relation to the reference period. This can also be seen in the North Atlantic Oscillation index (NAO) with values above 1.0 in all three winter months (Table 4.1) associated with several storms in northern Europe. In Eastern Europe and the eastern Mediterranean the negative pressure anomalies were associated with several low pressure systems.

In **spring 2015** both circulation centres, the Icelandic low and Azores high were well distinct. The Icelandic low with a centre pressure below 1000 hPa (or anomalies of -8 hPa related to 1961-1990) was located west of Iceland. The Azores high was situated southwest of the Azores. The positive anomaly above 4 hPa was located above France.

In spring the NAO index was only moderate but positive. The EA/WR index changed between April and May from positive to negative values. In May the situation changed. The negative SCA is characterized by higher temperatures than normal in western Europe, below normal precipitation in southern Europe and wet conditions over Scandinavia. All the indices fit together and confirm the maps below.

Table 3.1: Seasonal mean values of selected northern hemisphere teleconnection indices standardized to the 1981-2010 reference

	NAO	EA	EA/WR	SCA	POL	AO
Winter 2014/2015	1.42	0.16	-0.53	0.32	0.38	0.85
Spring 2015	0.65	0.93	-0.04	-1.08	0.10	1.27
Summer 2015	-1.33	0.79	0.29	-0.59	0.11	-0.46
Autumn 2015	0.73	0.64	-0.17	0.44	-0.42	0.51

Note that all values are standardized with the reference 1981 to 2010. North Atlantic Oscillation (NAO); East Atlantic Pattern (EA); East Atlantic/West Russia Pattern (EA/WR); Scandinavia Pattern (SCA); Polar/Eurasia Pattern (POL); Arctic Oscillation (AO)

(Sources: ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh and http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/monthly_ao_index.b50.current.ascii.table)

In **summer 2015** both circulation centres were shifted southwards. Therefore high pressure over Greenland could establish with anomalies of more than 8 hPa. Most of Europe showed above normal pressure anomalies coincided with above normal sunshine duration and below normal cloud cover leading to several heat waves. Highest anomalies of more than 2 hPa dominated above the Baltic States and Belarus reflecting the situation of August. Only northern and western Europe as well as the eastern Mediterranean Sea showed below normal anomalies.

The calculated CPC-NAO index with -3.14 for July 2015 was very extreme. Only once in the 66 years an identical index value was calculated in 1993. This must be seen in combination with the East Atlantic/West Russia Pattern (EA/WR) indicated below normal pressure in northern Russia.

The circulation pattern in **autumn 2015** was marked by a well-developed Iceland low with the core west of Iceland (below 1000 hPa). The anomalies around Greenland reached values below -4 hPa. Below normal pressure occurred also in a band from south Italy to southern Russia. The Azores-high was also well developed together with a second high over Kazakhstan with core pressure above 1020 hPa. One centre of above normal pressure anomalies was located over Scandinavia and the other over northern Russia with values above 4 hPa.

The circulation indices in **autumn 2015** with values below ± 1 were not representative because the monthly values showed different signs.

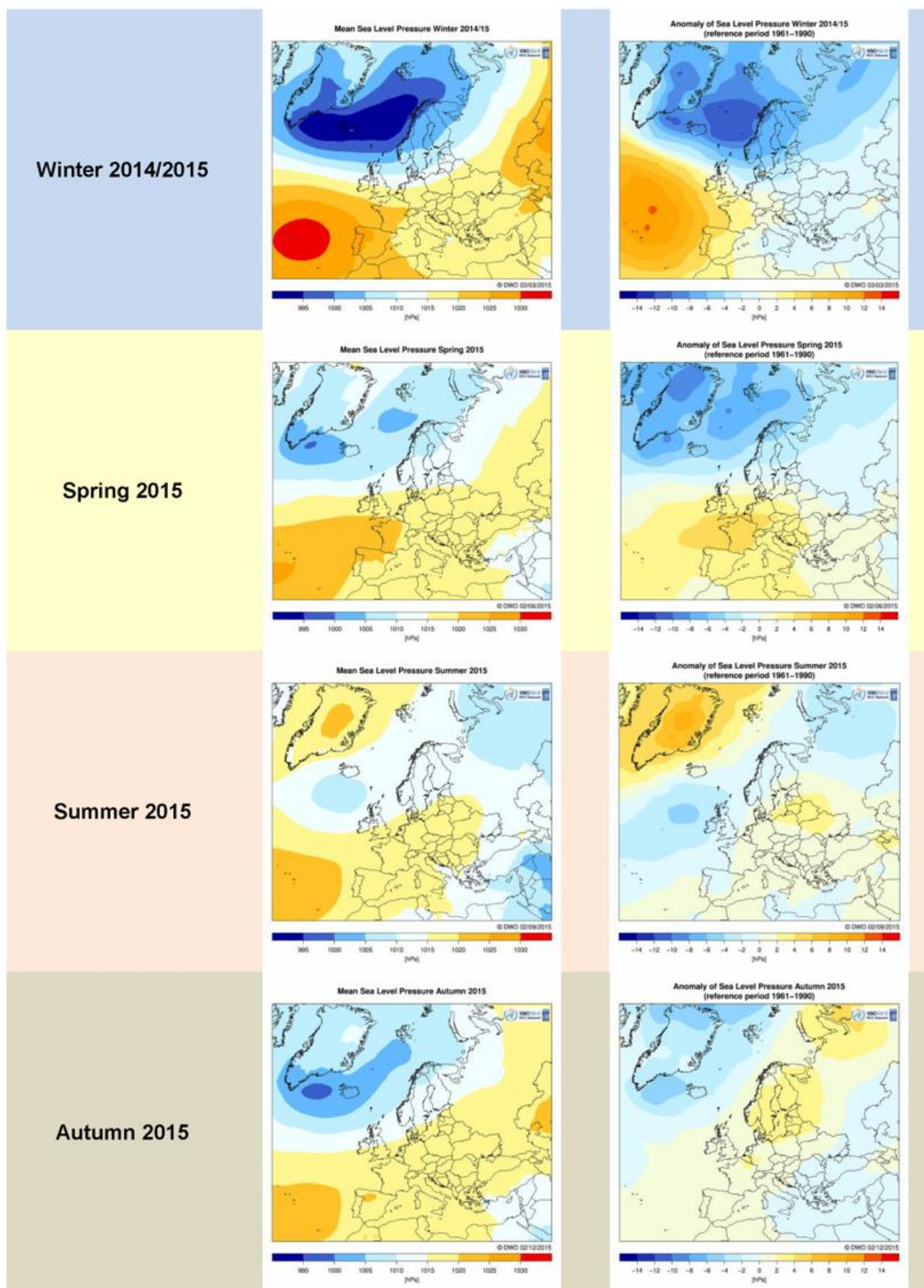


Figure 3.1: Seasonal sea level pressure (left, in hPa) and anomalies (right, in hPa) in 2014/2015, reference period 1961-1990 (Source: <http://www.dwd.de/rcc-cm>)

3.1.2. Temperature

On average for the whole WMO Region VI and sub-regions the temperature in all seasons in 2014/2015 (except Iberia in winter) was warmer than the normal period 1961-1990. In regional view, however, some differences existed (Tab. 3.2).

Table 3.2: Seasonal and annual average of temperature anomalies over land areas in °C for each sub-region in the year 2015 (reference period: 1961-1990)

Sub-Region	Winter 2014/2015	Spring 2015	Summer 2015	Autumn 2015	Year 2015
Central and western Europe	1.37	1.18	2.03	0.80	1.59
Nordic and Baltic countries	2.13	0.58	0.62	1.74	1.26
Iberia	-0.29	2.24	2.33	0.67	1.41
Mediterranean, Italian and Balkan Peninsula	1.36	1.04	2.35	1.39	1.48
Eastern Europe	3.21	2.18	1.01	0.80	2.29
Middle East	1.70	0.81	1.80	1.97	1.51

The temperature anomalies for **winter 2014/15** showed values lower than normal only in southwest Europe and values higher than normal in northern, central and eastern Europe. The positive anomalies reached values of more than 4°C in Scandinavia, northern Russia and in the area between Turkey and Armenia.

Some ranks of warm winters based on web-available bulletins by NMHSs are given below:

Table 3.3: Seasonal rank statistics for winter mean temperature (2014/2015) as provided by the NMHSs.

Country	Rank	Time series available since
Europe (35°–75°N, 10°W–30°E, E-OBS)	1	1950
Global	1	1880/1881
Austria	8	1767
Belarus	5	1945
Denmark	13	1874
Estonia	4	1961/62
Switzerland	2	1864

Spring 2015 was in most parts of Europe more than 1°C warmer than the reference period 1961-1990. Especially Spain and southern France showed anomalies of more than 2°C, northern Scandinavia more than 3°C and northern Russia more than 4°C. Only central Turkey, Ireland, Greenland and western Iceland noted normal or below-normal temperatures.

Summer 2015 was characterized by a long lasting heat wave from end of May to end of August. The temperature anomalies pattern for summer revealed a belt of positive values of more than 3°C from Spain to Ukraine while northern Europe and the British Isles noted normal or below normal temperature.

Autumn 2015 was characterized by warmer conditions than normal in nearly whole Europe. Especially the region north of Spitzbergen and Russia was partly more than 4°C warmer. Turkey and Scandinavia, especially Finland, had also higher temperatures with anomalies of more than 3°C above the reference period 1961-1990.

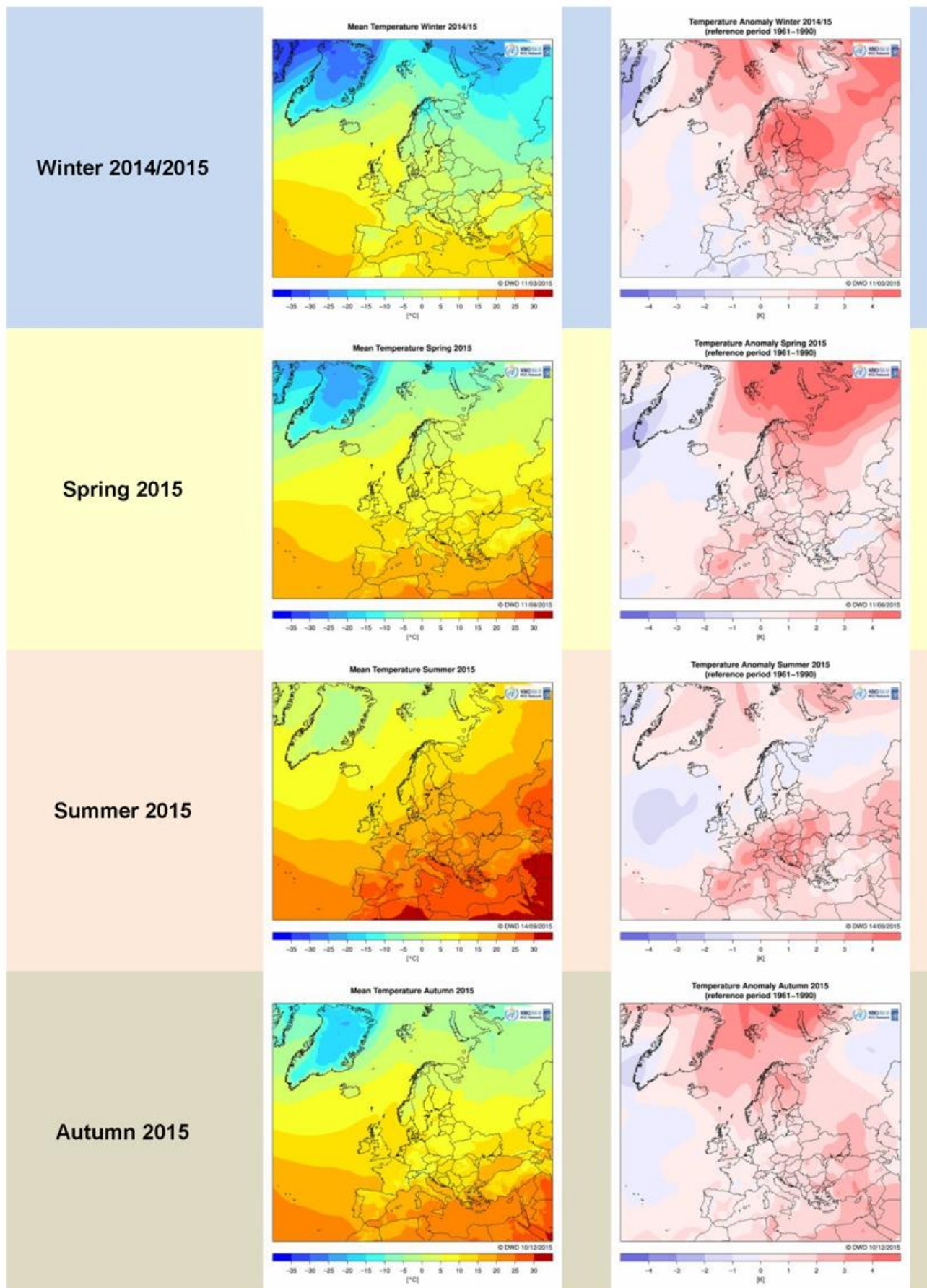


Figure 3.2: Seasonal mean temperature (left, in °C) and anomalies (right, in K) in 2014/2015, reference period 1961-1990 (Source: <http://www.dwd.de/rcc-cm>)

3.1.3. Precipitation

In **winter 2014/15** most regions of Europe received normal or above normal precipitation. Some regions like northern Spain (partly more than 300%), Scotland, southern Norway, the Balkan and eastern Mediterranean area received up to 250% of their seasonal precipitation amount. Ireland reported the highest seasonal total of 702.0 mm (148 % of the long term mean) at Newport, the lowest seasonal total with 150.0 mm (68% of the long term mean) at station Carlow (Oak Park). In Croatia the precipitation amount for winter 2014/2015 was within the range from 71% to 225% of the multi-annual average. In Montenegro the total amount of precipitation ranged from 196 mm in Rozaje to 1522 mm in Cetinje. In Norway precipitation was very variable this winter and ranged from more than 300% (in the west) down to 25% in the east (lee side). The highest daily and seasonal precipitation sum with 147.5 mm (19th February 2015) resp. 1846 mm was recorded at station Hovlandsdal. The predominance of northerly and north-westerly winds in the Biscay resulted in heavy precipitation along the Pyrenees with up to 300 % of the normal. Precipitation in the winter months was higher than usual in Finland with more than 200 mm in western and central areas.

A precipitation deficit noted Portugal, southern Spain, southern France and Georgia.

Precipitation anomalies for **spring 2015** showed more than normal precipitation in northern and western Europe. Scandinavia and Ukraine recorded partly more than 150%. In some parts in western Norway the precipitation was 2-2.5 times higher than normal. The wettest station was Hovlandsdal with 1150 mm (209% of normal). At this station also the highest daily precipitation was measured on 8th March with 123.8 mm. In the UK existed a high contrast between western Scotland (with totals of more than 130% or 900 mm) and southern England (less than 70% or around 90 mm). For Scotland it was the second wettest spring since 1910.

In north-western Spain and northern Portugal less than 60% precipitation occurred. In Portugal 3 heat waves brought only 45% of normal precipitation. Precipitation deficit exhibited (<60%) also southern France, central Germany and the Middle East. France registered nearly 20% less precipitation than normal.

Precipitation anomalies for **summer 2015** showed above normal precipitation in western and northern Europe and in Russia of partly more than 150%. The surplus in Turkey was even more than 250%. Western and southern France as well as north-eastern Spain received due to some extreme precipitation events above normal precipitation. In France new records were set in August at station Gonneville (Brittany) with 178.4 mm (more than three times the normal amount) and Montpellier with 234.2 mm (nearly seven times the normal amount). Due to the higher than normal pressure combined with a long lasting heat wave below normal precipitation was observed especially in central Europe. Western and southern Iberia had a precipitation deficit that lasted since the beginning of the year. The affected area of Portugal by drought on August 31 was for severe and extreme drought categories 74% that is the 2nd worst in 70 years (100% in 2005 and 73% in 2012). Since 1st June, Warsaw received less than half of the normal precipitation (172 mm). A total of 47 mm of rain has fallen in Belgrade during the same time, which is less than 30% of normal. In the Ukraine the precipitation deficit caused low river levels. In Germany this summer was the driest of the last 50 years.

Precipitation anomalies for **autumn 2015** showed higher precipitation than normal in the Balkan, parts of southern Italy, northern Germany, Denmark and parts of Finland. In nearly entire Serbia the sums of autumn precipitation exceeded the mean of the 1961-1990 period; station Negotin recorded 358.5 mm or 234%, for example. In Greece precipitation amount for autumn was higher than normal due to some heavy precipitation events accompanied by floods and tornadoes which caused a lot of damage. Northern Germany was also wetter than normal. With 101 mm mean precipitation in November 2015 it was 34.6 mm or 52.1% above the reference period 1961-1990.

In contrast, most parts of western Europe, Iceland, northern Italy, the Baltic States and parts of Scandinavia were drier than normal. Spain obtained in autumn 165 mm precipitation that is 18% less than normal. France was also drier, the rainfalls were about 15% less than normal. In UK September and October were very mild, precipitation anomalies for September were 56% and for October 57% only November with 145% was wetter than normal.

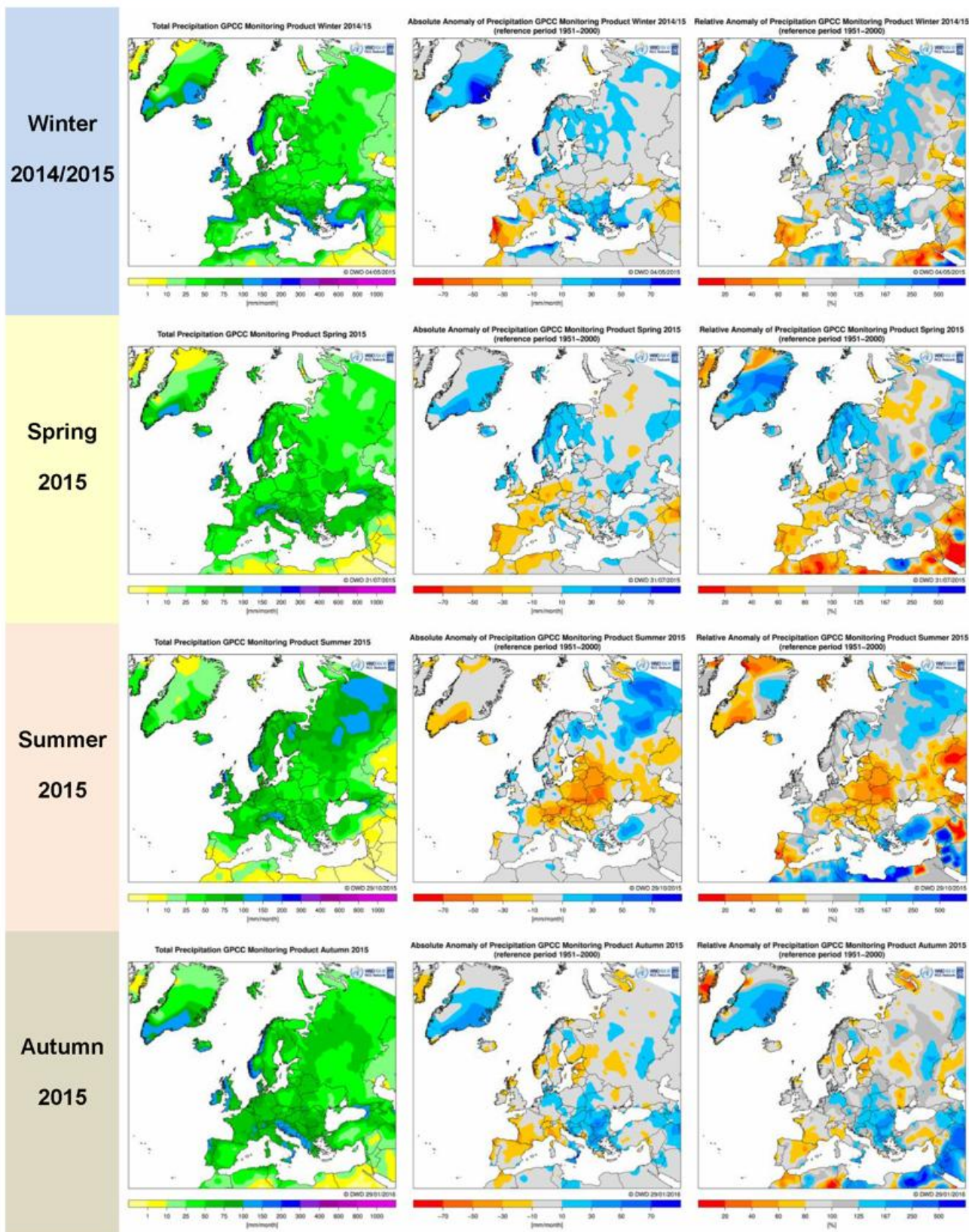


Figure 3.3: Seasonal total precipitation (left, in mm/mon), absolute anomalies (middle, in mm/mon) and relative anomalies (right, in %) in 2014/2015, reference period 1951-2000 (Source: <http://www.dwd.de/rcc-cm>)

3.1.4. Sunshine duration

In **winter 2014/2015** the sunshine duration in many parts of Europe dropped below 100 %. Only Spain, southern Italy, the Balkan States, western Poland and northern Scandinavia were sunnier than normal. It is very remarkable that Svalbard and northern Scandinavia had a sunshine duration above 150 %. The cloud cover in winter was nearly everywhere below normal.

In **spring 2015** most of Europe registered above normal sunshine duration. Sunshine deficit revealed Finland, northern Sweden, south Italy, parts of Turkey and parts of Russia. The cloud cover in spring was also below normal.

Most of Europe reported in **summer 2015** above normal sunshine duration, except Russia, northern Finland and eastern Mediterranean. Only some parts of Great Britain received the normal amount of sunshine. The cloud cover was also below normal.

In **autumn 2015** most of Europe registered above normal sunshine duration, except Russia, Romania, parts of Turkey, south Italy, Portugal, southern Great Britain, Ireland, northern France and western Germany. The cloud cover was from Germany to the Black Sea normal and in the other parts of Europe below normal.

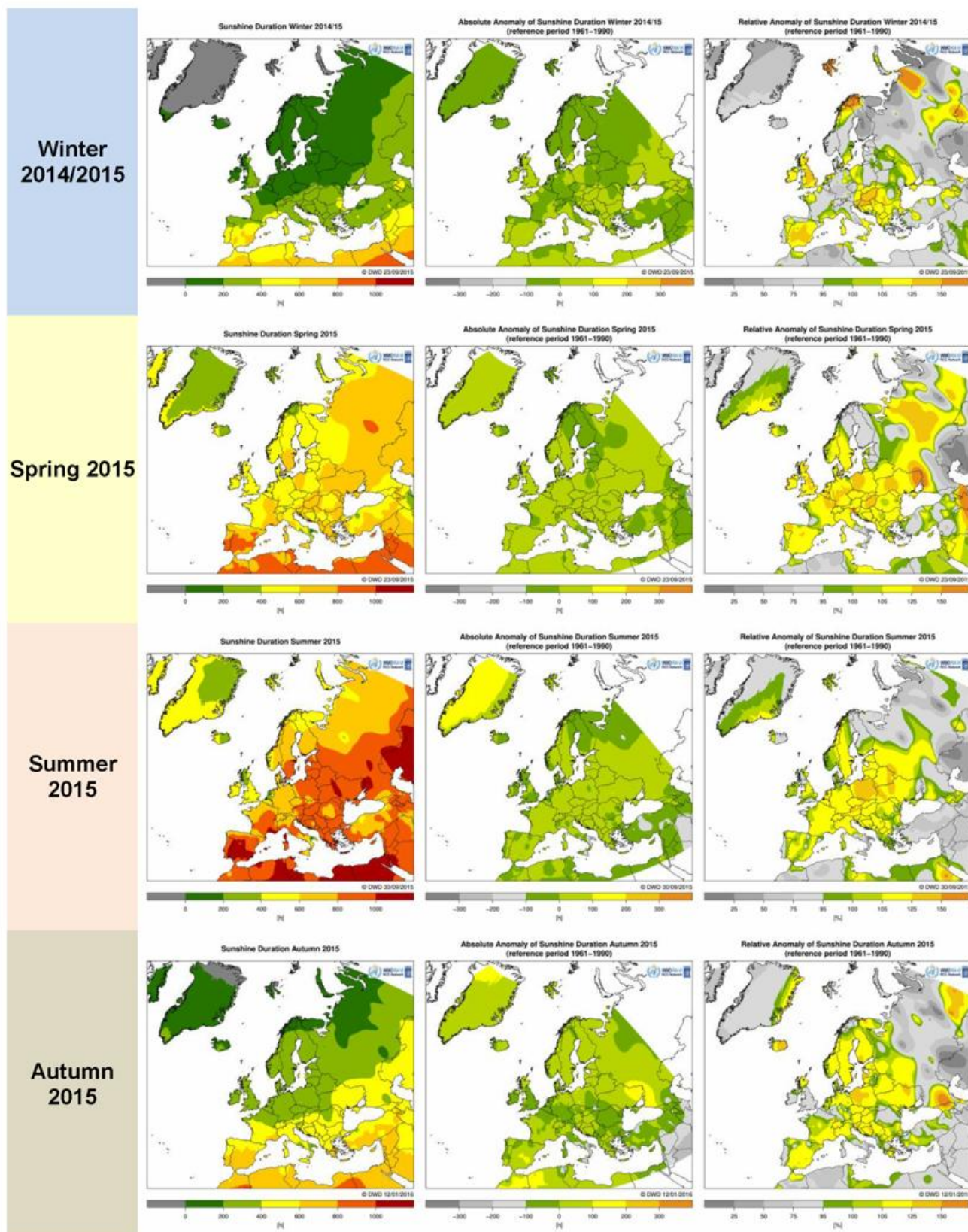


Figure 3.4: Seasonal sunshine duration (left, in hours), absolute anomalies (middle, in hours) and relative anomalies (right, in %) in 2014/2015, reference period 1961-1990 (Source: <http://www.dwd.de/rcc-cm>)

3.1.5. Drought

The **Winter 2014/15** was in most parts of Europe normal. Only Greenland, northern Spain, northern UK and some regions in Scandinavia and Balkan were wetter than normal.

In **Spring 2015** Scandinavia, Ukraine, northern UK and Greenland were very wet whereas Central and south-western Europe was dry.

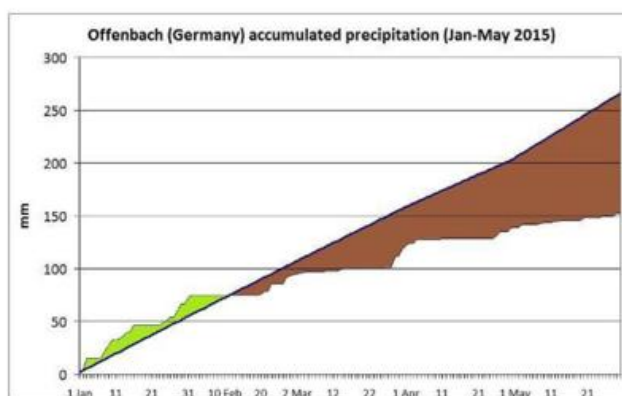
The Baltic countries, Belarus, the Ukraine, southern Spain and Portugal were severely dry in summer. In autumn the Balkan was wetter than normal.

From April to August a severe drought covered an area from the Baltic States across Poland, Belarus and Ukraine to Romania. The loss calculated by MunichRe sums up to 1,500 Million Euro. The dry conditions with lack of rain affected the water supply, fisheries, tourism and about 16,600 km² of farmland. August was extremely dry in Belarus (the driest ever measured), only 11 mm or 16% of the normal was measured. The monthly precipitation for August in Ukraine was 24 % of the normal (15 mm). It was the driest month in the series going back to 1891 in Ukraine.

Drought over southwestern and central Europe

In **May** the area with precipitation deficit extended from western Poland across Germany, France, Spain and Portugal. The relative precipitation anomaly for May showed values below 40% and in central Spain values below 20%. In Offenbach (Germany) a deficit existed since mid of February 2015. During February and May only 80 mm instead of 194 mm was registered or 41 % of the normal value.

In Spring the situation in north-western Spain was very dry and the weather service of Portugal published following overview.

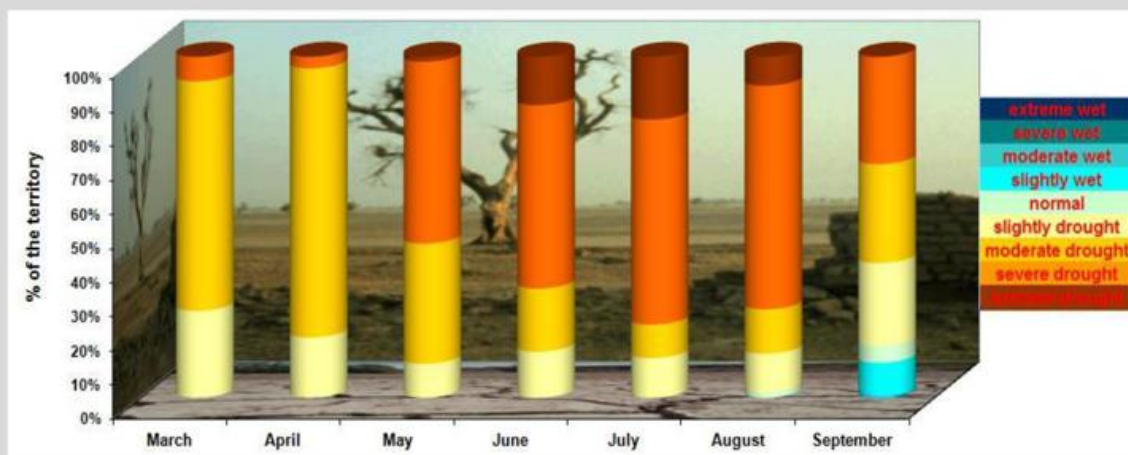


Accumulated precipitation from January to May 2015 in Offenbach (Germany). source: DWD)

Drought Situation in Portugal:

The drought began in March, in the whole territory, intensifying until the end of July, maintaining in August in almost the entire territory and starts to decreasing in September.

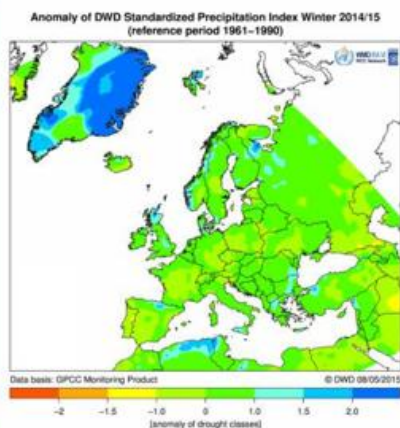
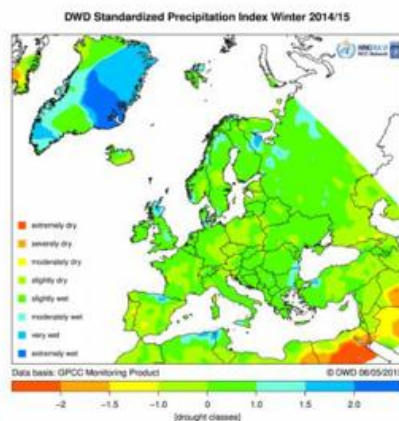
The months with higher severity were from May to July, with almost the entire territory in the classes of moderate to extreme drought, according to PDSI index.



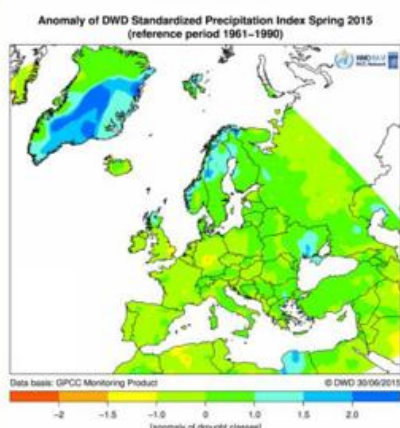
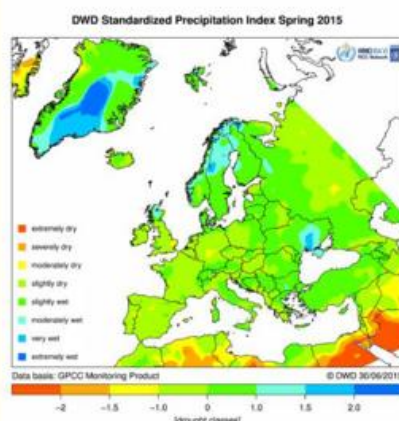
Percentage of territory (area) in the different classes of meteorological drought index PDSI between March and September 2015

PDSI - Palmer Drought Severity Index - meteorological drought index, it responds to weather conditions that have been abnormally dry or abnormally wet. It is based on the supply-and-demand concept of the water balance equation, taking into account more than just the precipitation deficit at specific locations.

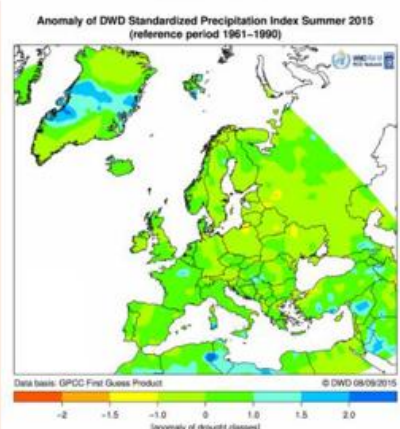
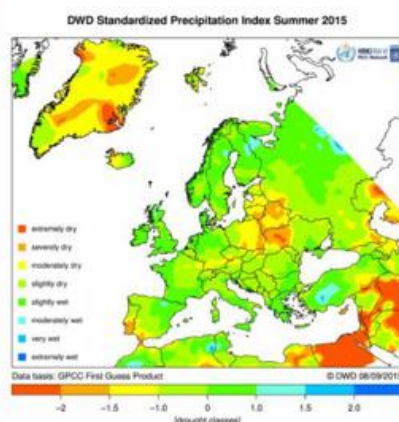
Winter 2014/2015



Spring 2015



Summer 2015



Autumn 2015

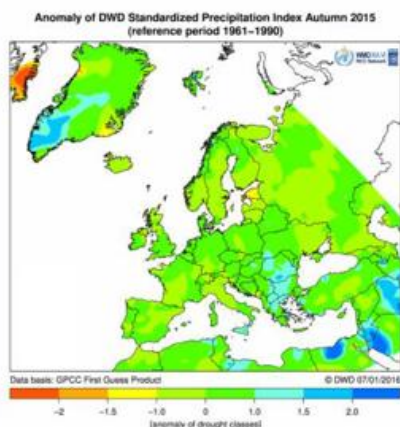
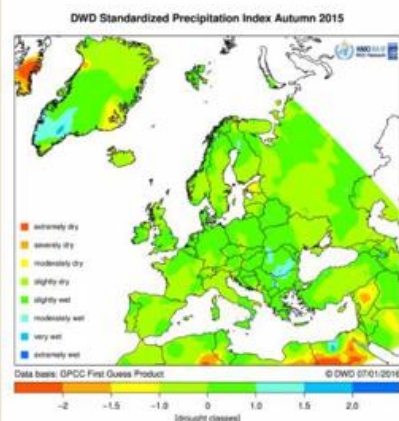


Figure 3.5: Seasonal standardized precipitation index (SPI, left, in drought classes) and anomalies (right) in 2014/2015, reference period 1961-1990 (Source: <http://www.dwd.de/rcc-cm>)

4. Monthly survey

The following monthly survey integrates relevant information from the Monthly Bulletins 2015 on the Climate in WMO Region VI - Europe and Middle East (available on <http://www.dwd.de/rcc-cm>).

It contains highlights, means and anomalies of sea level pressure, temperature, precipitation and sunshine duration for each months as well as monthly overviews of extremes and notable events.

4.1. Sea surface pressure and circulation indices

This chapter about the atmospheric circulation provides information on selected northern hemisphere teleconnection indices which are considered to be relevant for WMO RA VI and it discusses influences of circulation patterns upon anomalies and outstanding events. The information is based upon the Monthly Bulletins on the climate in WMO RA VI and was completed by reports of the NMHSs. The discussion partly refers to atmospheric circulation patterns in the mid-/upper troposphere not shown here. (See <http://www.ncdc.noaa.gov/teleconnections/> and <http://www.cpc.ncep.noaa.gov/products/CDB/index.shtml>)

Table 4.1: Monthly values of selected northern hemisphere teleconnection indices standardized to the 1981-2010 reference and the Arctic Oscillation, for January to December 2015

Year	Month	NAO	EA	EAWR	SCA	POL	AO
2015	1	1.57	1.11	-0.24	-0.18	-0.03	1.092
2015	2	1.05	-0.04	-0.92	-0.37	2.09	1.043
2015	3	1.12	1.20	0.27	0.39	0.68	1.837
2015	4	0.64	0.88	1.12	-1.49	-0.88	1.216
2015	5	0.19	0.71	-1.50	-2.15	0.50	0.763
2015	6	0.24	1.06	-0.78	-1.52	-0.20	0.427
2015	7	-3.14	0.22	2.01	-1.11	0.39	-1.108
2015	8	-1.10	1.08	-0.37	0.87	0.13	-0.689
2015	9	-0.49	0.15	-1.67	1.09	-0.13	-0.165
2015	10	0.99	0.22	0.59	0.62	-0.47	-0.250
2015	11	1.70	1.55	0.56	-0.40	-0.66	1.945
2015	12	1.99	3.14	1.28	0.08	0.58	1.444

Note that all values are standardized with reference to the period 1981-2010. North Atlantic Oscillation (NAO); East Atlantic Pattern (EA); East Atlantic/West Russia Pattern (EAWR); Scandinavia Pattern (SCA); Polar/Eurasia Pattern (POL); Arctic Oscillation (AO)

(Sources: ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh and

http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/monthly_ao_index.b50.current.ascii.table)

January 2015 started with a high North Atlantic Index (NAO) where both, the Azores high and the Icelandic low were more intensive than normal. Both were also shifted to north-east. This leads to more westerly winds and higher temperature anomalies (see section on temperature). Two storms passed **Scandinavia** Svea (2nd January 2015) and Egon (10th January 2015) with wind gusts of nearly 40 m/s. Two low pressure systems (Elon, Felix) with high wind speeds, thunderstorms, hail, heavy rain and snowfall crossed UK, Germany and Scandinavia. Thousands of buildings, schools, houses were damaged. Weather-related accidents occurred; air and rail traffic was affected. The airport of Helgoland, Germany was also damaged. After MunichRe the loss of this two winter storms was estimated to about 500 Million Euro and caused 3 fatalities.

From 30th January – 03rd February 2015, a severe weather event caused extending floods over the west (mainly northwest) part of **Greece, Albania and Bulgaria**. As a result of the heavy rain flooding occurred; in Bulgaria an area of about 23300 km² and in Greece about 70 km² of farmland was flooded. The 3 day precipitation at station Zlatograd, Bulgaria, summed up to 123 mm while at station Derviziana, Greece 358.6 mm/72h was measured and a wind speed of 46 m/s at station

Paximada, Greece on 31st January. In Greece more than 2300 houses were damaged with 14 fatalities. The loss was estimated to about 660 Million Euro after MunichRe.

In **February 2015** the Azores high was more intense than normal with sea level pressure anomalies of more than +10 hPa. The Icelandic low was also more intense with anomalies below -14 hPa and shifted to the north. In eastern and southern Europe negative pressure anomalies prevailed. Both, the North Atlantic Oscillation (NAO) and Arctic Oscillation (AO) index showed values of more than 1. In Lithuania strong winds of up to 29 m/s were observed at the 8th of February in Ventspils. A deep low pressure, which was renamed to Ole of the Norwegian weather service, drew in the northernmost part of Scandinavia on 7th and was accompanied by strong winds. In Katterjåkk in Lapland (Sweden) 20 cm of snow was observed, the strongest wind was reported from Stekenjokk (Sweden) with 38 m/s in average and 43 m/s in the wind gusts.

In **March 2015** the two pressure centres were more intensive. The Icelandic low had anomalies of -14 hPa and the Azores high of more than +8 hPa. The second high pressure centre over Russia was about 8 hPa higher than the long term mean. Therefore the North Atlantic Oscillation index (NAO) with 1.12 and the East Atlantic Pattern (EA) with 1.20 showed above normal values. The Arctic Oscillation (AO) with an index value of 1.837 was very high.

Several storm series passed Europe

The storm Anton affected between 4th and 7th March 2015 **UK, France, Corsica, Italy and Croatia** in combination with the Bora and caused damages by storm gusts. In western parts of Scotland the storm was combined with flooding, exacerbated by snowmelt. Three other storms between 22th and 31st March 2015 (Isegrim, Mike and Niklas) crossed **UK, Netherlands, Denmark, Germany, France, Spain, Italy, Slovenia, The Former Yugoslav Rep. of Macedonia, Greece, Turkey, Romania** up to the **Ukraine** with locally damages, flooding and hail. In France from 29th to 31st March 2015 several monthly records were broken with wind speed above 35 m/s. Storm Niklas from 30st March and 1st April 2015 caused 11 fatalities and a loss of more than 1,400 Million Euro (after MunichRe). Due to the high wind speed of more than 30 m/s trains and cars were damaged, rail traffic disrupted and the air traffic were also affected.

April 2015 was characterized by a secondary high pressure centre over Western Europe (in addition to the Azores high) on monthly average. At the **Swiss** station Zürich-Fluntern a new record for April since 55 years was measured with a station pressure of 968.2 hPa (1036.5 hPa reduced to mean sea level). High pressure influence dominated over the whole Mediterranean region except eastern parts (Middle East, eastern Turkey and South Caucasus). In contrast, low pressure extended from northern to eastern Europe.

In **May 2015** sea level pressure anomalies were highest between the Azores high and Iberia with values of +2 to +4 hPa. The Icelandic low was more intense and shifted to the east with anomalies below -10 hPa above Scandinavia. In Eastern Europe negative pressure anomalies prevailed. Both, the North Atlantic Oscillation (NAO) and Arctic Oscillation (AO) index showed nearly normal values. But the Scandinavia Pattern (SCA) with a value of -2.15 explains much of the circulation. The negative SCA is linked with drier and warmer weather in Iberia and colder and wetter conditions in Scandinavia.

In **June 2015** sea level pressure anomalies were positive in the area between Iceland and Greenland and over central Europe indicating a north-eastward shift of the Azores high. The Icelandic low was also shifted north-eastward. For June the dominant circulation pattern for Europe was the Scandinavia Pattern (SCA) with an index value of -1.52.

In **July 2015** the two Atlantic pressure centres were more intensive. The Iceland low had anomalies of below -6 hPa and was shifted to the south. The Azores high had anomalies of up to +2 hPa. The second high pressure centre over Greenland was more than 12 hPa higher than the long term mean. A second low pressure system over north-eastern Europe with a central pressure below 1000 hPa and anomalies below -10 hPa resulted in a negative North Atlantic Oscillation index (NAO) of -3.14 the lowest value in the time series of CPC since 1950 (together with July 1993). The Arctic Oscillation (AO) with an index value of -1.108 was also negative.

In **August 2015** the Icelandic low was more intensive with a core pressure below 1005 hPa and was shifted to the south. The pressure anomalies were lowest between Iceland and the British Isles with values below -6 hPa. The high pressure over Scandinavia is striking with values of more than 1020 hPa and anomalies of more than +6 hPa. This high pressure was responsible for the highest temperatures in Scandinavia during this summer.

During **September 2015** the Iceland low was shifted to the west located at the southern edge of Greenland with anomalies below -2 hPa. The pressure anomalies of the Azores high ranged from below -2 hPa up to +2 hPa. The second high pressure centre located over Kazakhstan had a similar core pressure like the Azores high (above 1020 hPa). The positive anomalies were centred over north Scandinavia with more than 6 hPa above than the long term mean and ranged from the British Isles to European Russia. The North Atlantic Oscillation index (NAO) of -0.49 and the Arctic Oscillation (AO) of -0.165 were not very remarkable but the East Atlantic/West Russia Pattern (EA/WR) with a value of -1.67 and the Scandinavia Pattern (SCA) with 1.09.

In **October 2015** the Iceland low had a core pressure below 1000 hPa that was below his long term average. The high pressure centre was located over Scandinavia and East-Europe. The positive pressure anomalies were centred above Scandinavia with values of more than 6 hPa. This pressure distribution caused more sunshine and little precipitation. The NAO-Index of about 1.0 was above normal although the Azores high was not well developed. In southern Europe the pressure anomalies were below normal with values of -4 hPa west of Portugal.

In **November 2015** the Iceland low was shifted to the north-east located between Iceland and Scandinavia with anomalies below -12 hPa. The pressure anomalies of the Azores high ranged from below -2 hPa up to +6 hPa. The second high pressure centre located over eastern Russia had a similar core pressure like the Azores high (above 1025 hPa). The anomalies were centred over north Siberia with more than 6 hPa above the long term mean. The pressure anomalies in Scandinavia, east Europe and Middle East were below normal. The North Atlantic Oscillation index (NAO) of 1.7 and the Arctic Oscillation (AO) of 1.9 were remarkable high.

In **December 2015** the Icelandic low was very strong with a core pressure below 995 hPa. Its core was located west of Iceland and the Azores high was shifted to the Mediterranean area. The high had a strong core pressure above 1030 hPa. The positive anomalies over the Mediterranean area were above 14 hPa and the negative anomalies over Iceland below -14 hPa. This high pressure caused less precipitation over southern Europe. The NAO-Index with 1.1 was above normal which reflected this strong low and high pressure system.

The low pressure over the North Atlantic was accompanied by winter storms. Those named Desmond and Eva brought high wind speeds, heavy rain, coastal and river flooding, channels burst their banks and more than 7000 houses were damaged. Bridges were damaged, roads blocked and tens of thousands of houses were without electricity. 5 people died and a loss of about 2600 Million Euro in UK, Ireland was estimated by MunichRe.

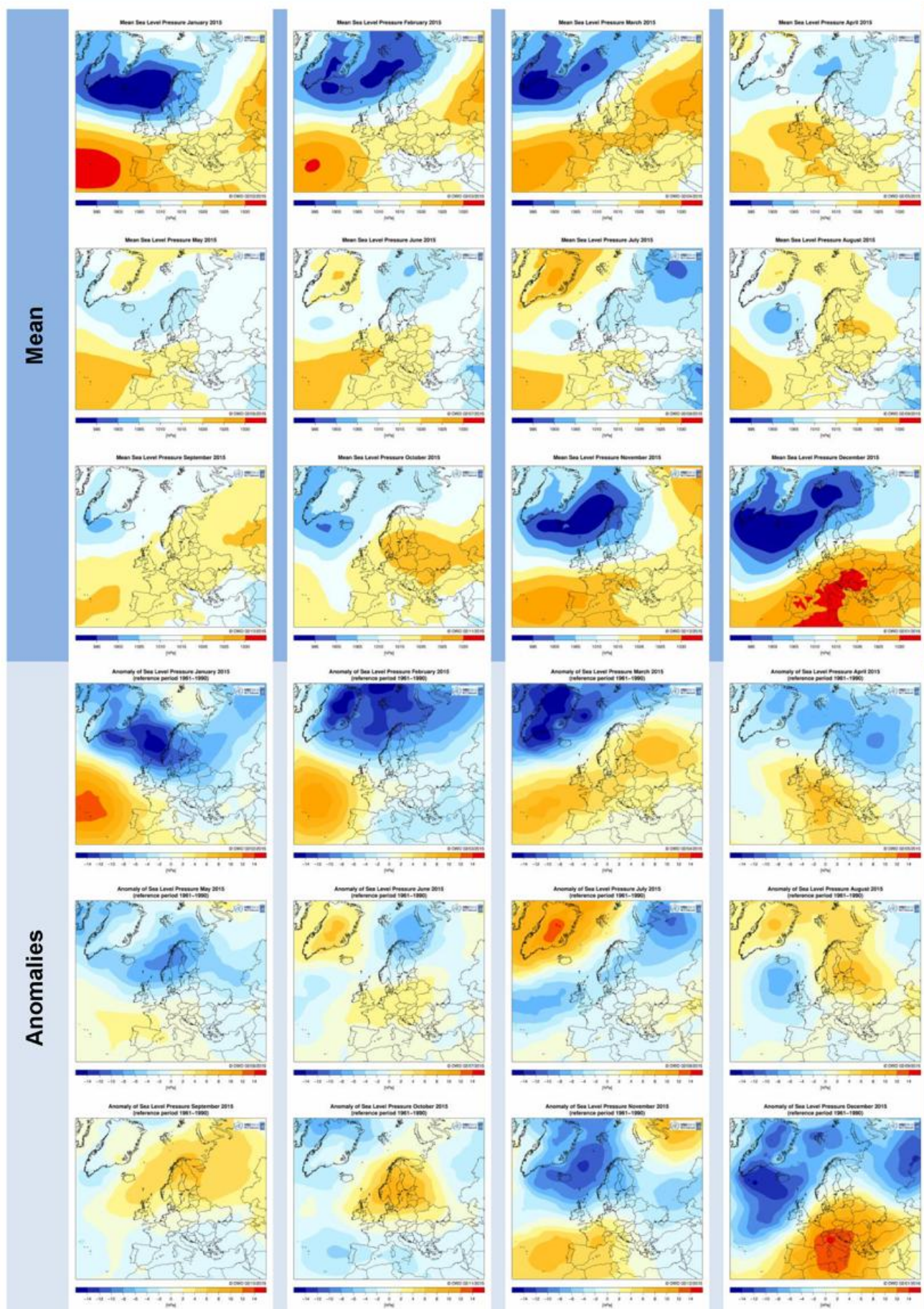


Figure 4.1: Mean and anomalies of sea level pressure in hPa for each month of the year 2015. (First row January, February, March, April)

4.2. Temperature

In most of the months and sub-regions it was warmer than normal as can be seen from Table 4.2. The Mediterranean area had positive anomalies throughout the whole year 2015 and in Eastern Europe anomalies above 3°C occurred in four months.

Table 4.2: Monthly and annual area average temperature anomalies in °C for each sub-region in the year 2015 (reference period: 1961-1990)

Region	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Central and western Europe	1,59	2,19	0,44	1,56	1,41	0,58	1,18	2,25	2,68	-0,07	-0,39	2,86	4,44
Nordic und Baltic Countries	1,26	2,87	1,63	1,62	1,34	-1,22	0,24	0,60	1,02	1,86	1,35	2,00	1,84
Iberia	1,41	-0,14	-0,91	1,32	2,33	3,07	2,66	3,07	1,27	-0,64	0,76	1,91	2,26
Mediterranean	1,48	1,76	0,52	0,80	0,48	1,86	1,26	3,36	2,42	1,70	0,58	1,88	1,15
Eastern Europe	2,29	2,99	4,61	3,96	0,65	1,94	1,84	-0,17	1,36	3,40	-0,21	2,20	4,85
Middle East	1,51	1,24	2,00	1,58	-0,33	1,18	1,89	1,46	2,07	3,39	1,38	1,13	1,12

In **January 2015** Eastern Europe showed anomalies above 3°C up to above 4°C. Only western Spain and Portugal had negative anomalies. In Norway some stations reported 5 to 7°C higher temperature than normal, for the whole country it was 2.6°C above normal. Latvia reported monthly mean air temperature between -1.7°C and +1.0°C that is 4°C – 5°C above normal. The temperature anomaly in Austria was 2.7°C which is rank 17 in the 248 year long time series. At station Graz-Strassgang (Austria) a new record for January maximum temperature was set with 21.7°C. In Lucerne (Switzerland), the daily mean temperature reached 15.1°C (daily maximum 19.3°C), which has never been registered in the available measurement series since 1871 in winter months (December to February). For the first time maximum temperatures above 20°C in January were registered in Germany.

Monthly temperature for **February 2015** showed very high positive anomalies in the North-East with more than 4°C and negative anomalies in the South-West down to about -2°C to -3°C. The average air temperature in Latvia was -0.2°C in February which was 4.6°C warmer than normal and the thirteenth warmest February in observational history. February was abnormally warm over most of European Russia, with mean monthly air temperature anomalies of 6°C -8°C.

The monthly temperature for **March 2015** showed positive anomalies for most of Europe. Highest anomalies occurred in the North-East with more than 4°C. With an average temperature of 3.4°C in Latvia, this month was 4.7°C warmer than normal. This was the third warmest March in Latvia ever recorded. Estonian average temperature was 2.5°C and consequently 3.6°C higher than normal. The anomalies in Finland reached partly more than 4°C above the long term mean and 3.3°C to 4.9°C in Lithuania. For whole Norway the anomalies were 3.8°C above normal but in the northern part they reached values of 5°C - 7°C. In Sweden several stations observed new records and topped those from last year. Some Arctic stations recorded monthly temperature anomalies for March 2015 of more than +8°C above their long term mean (Svalbard Airport, Barentsburg).

March 2015 globally the warmest March since 1891

The Tokyo Climate Center estimated the monthly anomaly of the global average surface temperature for March 2015 (i.e. the average of the near-surface air temperature over land and the

SST) to $+0.31^{\circ}\text{C}$ related to the 1981-2010 average ($+0.76^{\circ}\text{C}$ above the 20th century average), and therefore the warmest March since 1891.

NOAA also declared March 2015 as the warmest in the 136-year period of record (12.7°C , mean global land and ocean surface temperatures), surpassing the previous record of 2010 by 0.05°C . The Northern Hemisphere had its second highest March temperature on record, behind only 2008, while the Southern hemisphere tied with 2002 for third highest.

Lowest Arctic sea ice extent for March 2015 in the satellite record

Arctic sea ice extent for March 2015 averaged 14.39 million square kilometres. This is the lowest March ice extent in the satellite record. It is 1.13 million square kilometres below the 1981 to 2010 long-term average of 15.52 million square kilometres. It is also 60,000 square kilometres below the previous record low for the month observed in 2006.

Links/References:

Arctic: [Arctic Sea Ice News & Analysis \(http://nsidc.org/news/newsroom/archive/2015-03/\)](http://nsidc.org/news/newsroom/archive/2015-03/)

Japan: [Global temperature March 2015 \(http://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/mar_wld.html\)](http://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/mar_wld.html)

USA (NOAA): <http://www.ncdc.noaa.gov/sotc/global#temp>

Monthly mean temperature anomalies in **April 2015** were positive in the west and negative in the east part of Region VI and ranged from -4°C in eastern Turkey up to more than $+4^{\circ}\text{C}$ in Algeria. Norway's Finnmark recorded values of up to $+4^{\circ}\text{C}$, Svalbard Airport even 6.9°C above normal. At the 20th of April at several stations new record breaking temperature were registered with up to 24.2°C . In southern Finland the anomalies were about 1°C and 2°C to 3°C in Lapland.

Unusually temperatures in Israel in April

An unseasonably late winter weather system occurred on April 10th-12th. Northern Israel received 50-100 mm and central Israel 30-70 mm precipitation. Snow piled up on Mount Hermon in the North (at an altitude of ~ 2000 meters) accumulating to around 20 centimetres and snow was also reported on Mount Meron (1200 meters). Some areas in northern Israel experienced heavy hail storms on April 12th in the afternoon and the hail remained on ground overnight. The event was outstanding for mid-April, with only 3-4 such winter-like weather events in the last 60 years. Temperatures were exceptionally low – a maximum daily temperature of $15-16^{\circ}\text{C}$ in the coastal plain and less than 10°C in the mountain regions - more than 12°C below average. These low temperatures are unusual, the last time they occurred in 1997 (Figure 4.2 left). The cold spell was preceded by a Sharav on April 8th with daily temperatures of $37-38^{\circ}\text{C}$ in the coastal plain and 30°C at midnight. It was followed by a rapid cooling of $17-18^{\circ}\text{C}$ on the next day (Figure 4.2 right).

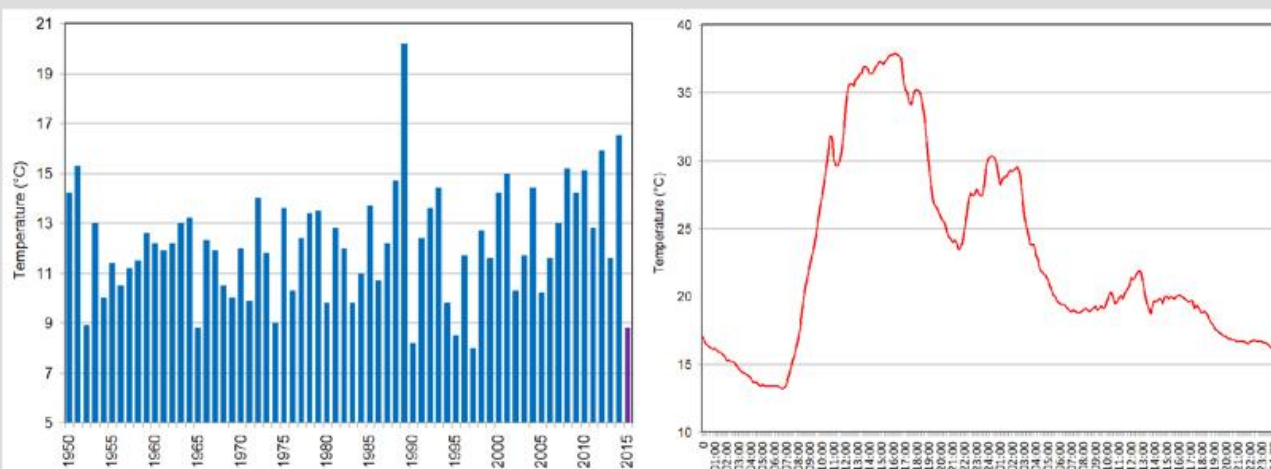


Figure 4.2: Lowest daily maximum temperature ($^{\circ}\text{C}$) in Jerusalem for each year in April 1950-2015 (left) and Temperature ($^{\circ}\text{C}$) in Bet Dagan (central coastal plain) on April 8-9th 2015 (left, Source: Israel Meteorological Service)

Another late and cool event occurred on April 21st-23rd. Precipitation amounts were small, yet snow fell over Mount Hermon, accumulating to several centimetres. Light snowfall was reported from

Mount Meron. This snowfall is very unusual for late April. The daily minimum temperature in Zefat (Upper Galilee) on April 24th was 3°C, the lowest ever recorded during this period (**Figure 4.3**, left).

A short time after this cold spell, a Sharav event occurred on April 27th-29th. In the Jordan Valley and the Arava temperatures were above 40°C. Elat had a maximum temperature of 43.3°C, very close to the April absolute maximum of 43.4°C from 2008 (**Figure 4.3**, right).

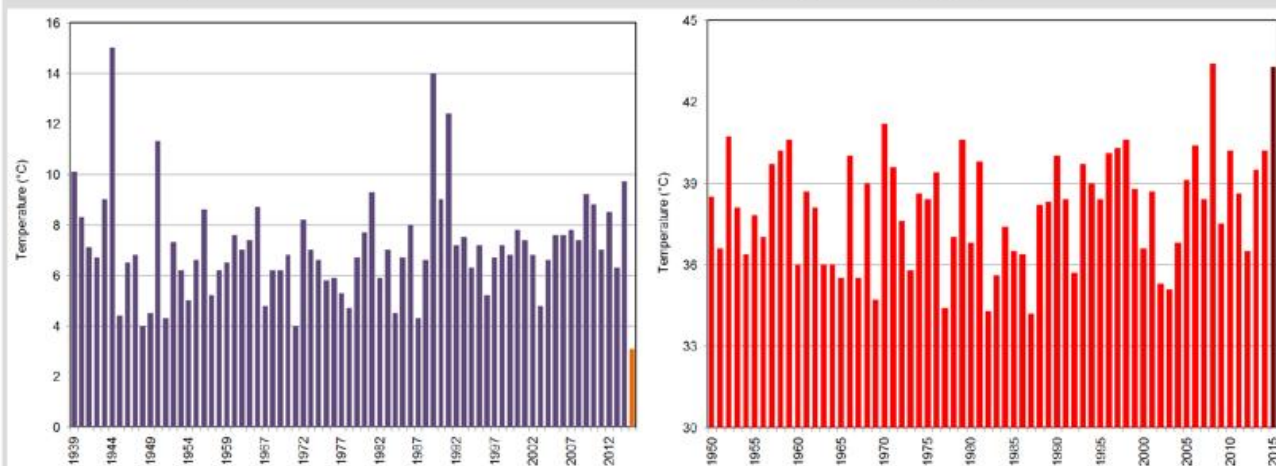


Figure 4.3: Lowest minimum temperature in April's third decade (21st - 30th) for each year in Zefat (Upper Galilee) 1939-2015 (right) and absolute maximum temperature in Elat in April 1950-2015 (left, Source: Israel Meteorological Service)

Monthly temperature for **May 2015** showed very high positive anomalies in the northern Russia and Spain with more than 4°C and negative anomalies in the north-west (from Ireland across Scandinavia, the Baltic States and Belarus) down to about -2°C to -1°C. At single days the temperature in Iberia reached more than 40°C, in Spain up to 42.6°C.

Monthly temperature for **June 2015** showed very high positive anomalies of more than 4°C in northern and southern Russia. The other area of high positive anomalies concentrated on south-western Europe with values of up to 4°C. Negative anomalies prevail from Ireland in the north-west across Scandinavia and northern Central Europe to the Baltic States with a minimum of -3°C in Sweden. At several days the temperature in Spain reached up to 43.7°C and in Portugal up to 41.6°C.

The monthly temperature for **July 2015** was dominated by very high positive anomalies of more than 4°C in south-western and central Europe. Negative anomalies occurred from Ireland in the north-west across Scandinavia, northern-central Europe to the Baltic States and northern Russia with a minimum of -3°C in northern Russia. In contrast during several days the temperature in southern Europe reached more than 40°C. In July several heat waves propagated from Iberia across central to Eastern Europe. Therefore July 2015 became the warmest July in many European countries.

Monthly temperature for **August 2015** showed very high positive anomalies especially in central Europe of more than 4°C. Negative anomalies occurred in Ireland, over the east Atlantic and north-eastern Russia. At single days the maximum temperature reached values of 40.3°C in Germany, 38.4°C in Poland or 41.5°C in Portugal. In Austria the monthly mean temperature ranked on the fourth place of the warmest August since measurements started in 1767 with 2.7°C above the mean. Only the August of the years 1807, 1992 and 2003 were warmer. From 1st to 4th August, Jordan saw temperatures nearly 8°C above normal, reaching 47.0°C at Wadi Elrayyan (WMO statement on the status of the global climate in 2015).

Heat waves over south-western and central Europe

At the beginning of **May** warm air came from Africa to Europe. Station Decimomannu in Sardinia (Italy) registered 38.4°C, the highest temperature in Europe on the 05th. During the second week, on the 14th May, remarkable temperature conditions were observed in Spain and Portugal with temperatures of 40°C to 44°C. In Portugal station Beja reported on the 14th May 40°C and on the consecutive 19 days maximum temperatures above 30°C, 14 days more than normal. The mean daily maximum temperature in Portugal of 25.46°C was +4.5°C higher than normal, being the highest value for May since measurements begun in 1931. At station Sevilla San Pablo (Spain) the maximum temperature in May reached every day above 25°C (summer days) and at 24 days values above 30°C (hot days) which are a new record. Even Lanzarote airport (Canary Islands, 13th of May) outperformed its May record with 42.6°C by +6°C. Agadir-Al Massira (Morocco) registered a maximum temperature of 45.6°C.

During **June**, temperature in Iberia, France and Italy were above normal, especially in the first decade and the last days of the month when extremely high temperature were recorded in both the daily maximum and night minimum. In these episodes record breaking heat waves reached the Iberian Peninsula and propagated to central Europe and Italy and further eastwards.

In **Portugal** June 2015 was the hottest of the last 10 years and the 5th warmest since 1931. The monthly average temperature was 21.8°C and +2.4°C higher than the normal value. The monthly mean of the maximum temperature with 29.0°C was +3.6°C higher than the long term mean, being the 3rd highest value for June since 1931. The absolute maximum temperature in Portugal was registered with 43.2°C at station Beja on the 29th June 2015.

June in **Spain** was also very warm, with an average temperature of 22.5°C or 1.4 K above the long term mean of this month (period: 1981-2010). Therefore it was the sixth warmest June since 1961 below the average temperature for the years 2003, 2004, 2005, 2009 and 2012.

In **Italy** the first ten-day period was the warmest of the month, especially in the central and northern regions, where the average anomalies of the maximum temperature exceeded the long term mean by 5°C, and at some places even by 7°C. Apart from Sicily, during this first ten-day period minimum temperature was higher in the central and northern part of Italy where the average deviation was about +3°C and even exceeded +6°C in some stations.

In **France** temperature in June remained with 1.5°C above normal during almost all the month. From 28th June onwards the maximum temperatures were 4°C -8°C warmer than normal over most of the country. On June 30th, they exceeded seasonal values by +12°C in the western part where records were broken with local peaks in the south-western France with 40.7°C in Arcachon (Gironde).

In **Austria** temperature anomalies were +1.4°C above normal. This was the 10th warmest June since 1767 for Austria. The absolute maximum temperature was 34.5°C at station Gars am Kamp (267 m a.s.l.)

In **Switzerland** it was the 4th warmest June with 33.2°C since beginning of measurements in 1864. The whole country was 1.8°C warmer than in mean of 1981–2010.

In **Germany** the maximum temperature of 35.0°C was recorded on the 5th June. However, the monthly mean temperature of 16.0°C was only 0.6°C or 0.3°C higher than the mean of the reference period (1961-1990 or 1981-2010).

The heat also reached **United Kingdom** with a record breaking maximum temperature of 32.5°C on the 30th at Heathrow-Airport (Greater London).

Hot air from Africa induced several heat waves in **July** with very high maximum temperatures as shown in the table below. The first heat wave reached on the 1st July the **United Kingdom** with the highest temperature since August 2003. The maximum temperature of 36.7°C at Heathrow (Greater London) was a new UK record for July. The heat wave reached also **Scandinavia** for some days and the mercury climbed to more than 30°C. In **Germany** the heat wave reached on the 5th July its peak with a new record breaking value of 40.3°C (at station Kitzingen). During the next days **Switzerland** registered its maximum value of 39.7°C on the 7th July and **Hungary**

39.3°C on the 8th. This first heat wave ended with severe thunderstorms and winds gusts, heavy rain and hail (of 3-4 cm diameter) in central Europe.

After a break of 2 days the next heat wave reached France on the 10th July but still remains in southern Europe.

On the 16th July the heat intensified again and culminated in new record breaking values in **Portugal** (42.1°C at station Mirandela) and **France** (41.4°C at station Brive) and propagated to the north and east. On the 18th July the heat reached the Black Sea. This third heat wave persisted in western Europe until the 24th and 25th in eastern Europe. In south Europe the heat wave lasted until the end of the month.

In **Austria** the highest temperature of 38.3°C was recorded on 19th July at 2 stations: Krems (203 m) and Langenlebam (175 m). This was the first time in Austrian history that the morning temperature at 8 o'clock (06 UTC) was above 30°C (at stations Seibersdorf, Pottschach and Wiener Neustadt). Station Ljubljana (**Slovenia**) registered 21 hot days (T >30.0°C) that is a new record. Several other Slovenian stations documented also all-time records of hot days.

The implications of these high temperatures have not only caused strong thunderstorms with heavy rain, hail and flooding or damages at houses by lightning and forest fires. The long duration of this heat caused a precipitation deficit leading to shrinking water reservoirs and also low river levels (as reported from Poland, Russia and Germany). The agriculture had crop losses due to early harvesting as reported from Moldova and Germany.

Table 4.3: Selected countries and their statistics for July 2015 (as reported by the NMHSs)

Country	Rank	time series	Anomaly (°C)	Reference period	Absolute maximum in °C	Day of occurrence
Austria	1	1767	+3.1	1981-2010	38.3	19
France	3.	1900	+2.0	1981-2010	41.4	16
Germany	7.	1881	+1.4	1981-2010	40.3	5
Hungary	-	-	-	-	39.3	8
Italy	-	-	-	-	42.8	31
Norway	-	1900	-0.7	1961-1990	31.4	2
Poland	-	-	-	-	36.4	4
Portugal	13.	1931	+1.0	1971-2000	42.1	16
Romania	-	-	-	-	38.6	30
Serbia	2.	1950	+3 to +5	1961-1990	38.4	19
Spain	1.	1961	+2.5	1981-2010	45.2	6
Sweden	-	-	-	-	32.8	2
Switzerland	1	1864	+3.6	1981-2010	39.7	7
United Kingdom	-	-	-0.7	1981-2010	36.7	1

Notes: ranking of the country mean temperature and the start of this time series, as well as the anomalies with respect to the reference period as available by the national meteorological services

The average global land surface temperature for **August** 2015 was +1.14°C above the 20th century average (NOAA National Centers for Environmental Information, State of the Climate: Regional Analysis for August 2015, published online September 2015, retrieved on September 25, 2015 from <http://www.ncdc.noaa.gov/sotc/global-regions/201508>). It was the highest August value in the 1880-2015 record, exceeding the previous record set in 1998 by +0.13°C. For Europe the land surface temperature in August 2015 exceeded by +2.25°C the reference mean of 1910-2000 and was the warmest August since 1910 (start of the time series). In many European countries this August breaks several records.

In **Austria** it was the 4th warmest **August** since measurements began in 1767. **Germany** reported the 2nd highest mean monthly temperature for August since 1881. Also Wroclaw (**Poland**) experienced with 38.9°C an all-time high August temperature on the 8th. The 12th of August was the ninth consecutive day in Warsaw with a temperature of 32.2°C or higher. At the same time a great part of Europe had a rainfall deficit. Since 1st June, Warsaw has received less than half of the normal precipitation (172 mm). During the same time Belgrade recorded 47 mm total rain amount, which is less than 30% of the normal. In the **Ukraine** the precipitation deficit caused low river levels. In **Germany** this summer was the driest of the last 50 years. The affected area in **Portugal**

by drought on August 31st was for severe and extreme drought categories 74% that is the 2nd worst in 70 years (100% in 2005 and 73% in 2012).

This high temperature in combination with precipitation deficit stimulated wildfires in every country around the Mediterranean Sea e.g. Spain, Portugal (<http://forest.jrc.ec.europa.eu/effis/>).

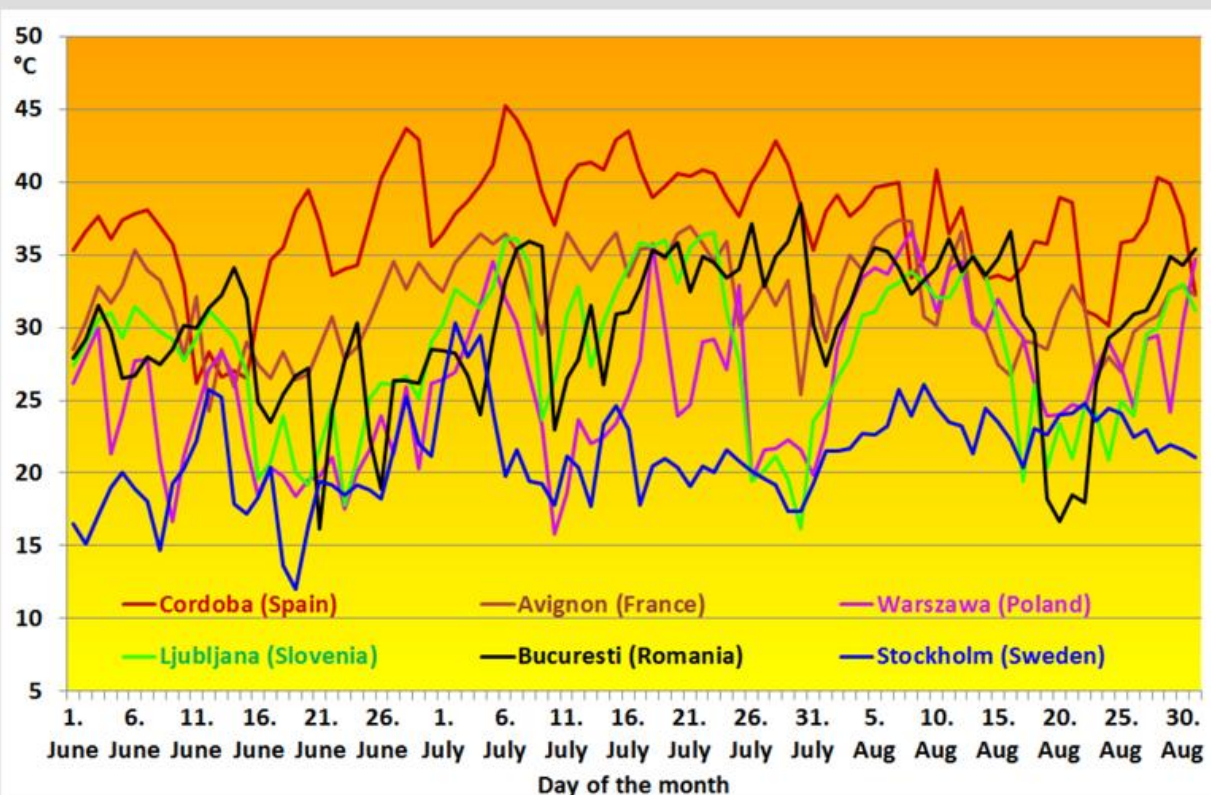


Figure 4.4: Daily maximum temperature (in °C) for several European SYNOP-stations from June to August 2015

From June to August 2015 several heat waves passed over different regions at different times. Southern Spain (at station Cordoba) noted most of the time more than 35°C and on the 6th of July even 45.2°C. In Avignon (southern France) the maximum temperature remained above 30°C from 25th June until 13th August (with the exception of 3 days). In Central Europe (at station Warszawa) and the Balkan (at station Ljubljana) 5 heat waves (maximum temperature above 30°C) were observable, at the beginning of June, at the beginning and in mid-July as well as at the beginning and the end of August. In eastern Europe (in Bucharest) the heat waves arrived some days later. In contrast, the heat wave reached northern Europe only on 2nd July with a maximum temperature in Stockholm (Sweden, the country wide maximum was 32.8°C) of 30.3°C.

Links/References:

Austria: <http://www.zamg.ac.at/cms/de/wetter/news/extreme-hitze>

Austria: [Hitzewellen: 2015 eines der extremsten Jahre der Messgeschichte](#)

Austria: [HISTALP - Österreich Sommerbericht 2015](#)

Central Europa: [Hitze/heftige Gewitter Mitteleuropa - 03.08.-16.08.2015](#)

France: https://donneespubliques.meteofrance.fr/?fond=produit&id_produit=129&id_rubrique=29

Germany: [Agrarwetter im Sommer 2015](#)

Slovenia: [Heat and storms during the period from 11 to 26 July 2015](#)

Switzerland: Abschluss Hitzewelle Juli 2015

Switzerland: Hitzewelle - Stufe 4 auf der Alpensüdseite

Switzerland: [Hitzewelle: Eine klimatologische Betrachtung](#)

United Kingdom: Heatwave 1st July 2015

USA (NOAA): Summer heat wave arrives in Europe

Global: [NOAA National Centers for Environmental Information, State of the Climate](#)

The anomaly pattern of the temperature in **September 2015** was divided in two parts. The western part of Europe was colder than normal with anomalies below -2°C in France and above $+4^{\circ}\text{C}$ in the Ukraine, southern Russia and Turkey. The heat wave was shifted eastwards with maximum temperature above 40°C in Turkey and some new station records. In Israel, at Sedom, the minimum temperature on the 9th September was 36.5°C , which is the highest daily minimum temperature ever recorded in Israel. This temperature broke the record of Tiberias (36.0°C) from 1936 (WMO statement on the status of the global climate in 2015).

Most of central and eastern Europe had in **October 2015** negative temperature anomalies of down to -2°C . Scandinavia, the United Kingdom, Ireland and southern Europe showed positive anomalies of up to $+4^{\circ}\text{C}$ in central Turkey and Middle East. In the North between Greenland and Novaya Zemlya the anomalies reached values of more than $+4^{\circ}\text{C}$.

Temperature anomalies in **November 2015** showed overall positive values of more than $+4^{\circ}\text{C}$ in central Europe, Finland and the extreme North. Some countries reported new records like Germany. In Germany the elevated stations had anomalies of more than $+4^{\circ}\text{C}$ (e.g. Hohenpeißenberg 4.3°C above the reference period 1981-2010). On average over France, it was $+2.7^{\circ}\text{C}$ warmer than normal, ranking the 3rd November among the warmest since 1900, behind 1994 and 2014. November was also exceptionally warm in a large part of Finland. At several observational stations in the southern and western parts of Finland, the month was even record mild.

In **December 2015** nearly whole Europe was more than $+4^{\circ}\text{C}$ warmer. Colder as normal it was in Greece, Turkey and parts of the Middle East (locally below -3°C) as well as southern and western Greenland and the northern Atlantic showed negative anomalies, especially in central Turkey, southern Greenland and the northern Atlantic. Germany observed with $+5.6^{\circ}\text{C}$ above normal ($+0.8^{\circ}\text{C}$) its warmest December on record. The UK also noted the warmest December in a series from 1910. With 7.9°C it was 1.0°C warmer than the previous warmest December. It was also easily the warmest December in the Central England temperature (CET) series from 1659. Switzerland had the warmest December since the beginning of the measurements 1864, with record temperatures anomalies between 5.6 and 5.8 K above normal (1981-2010) on Jungfrauoch (3580 m a.s.l.), Säntis (2502m a.s.l.) und Grosser St. Bernhard (2472 m a.s.l.) which is 2°C above the last records. Estonia reported a monthly mean temperature $+3.3^{\circ}\text{C}$ (anomaly 6.1°C), the second place since 1961.

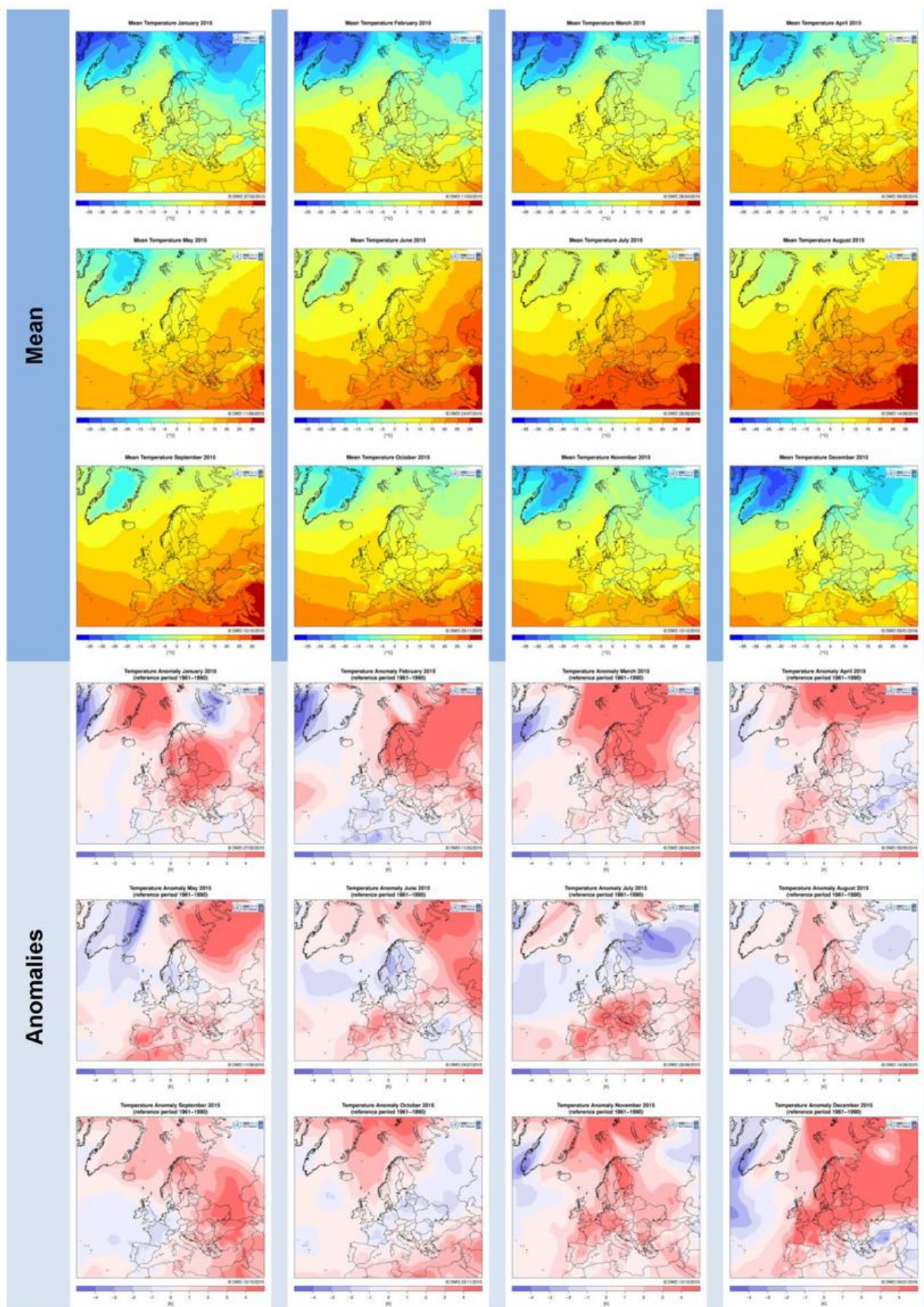


Figure 4.5: Mean and anomalies of temperature (in °C) for each month of the year 2015. (First row January, February, March, April)

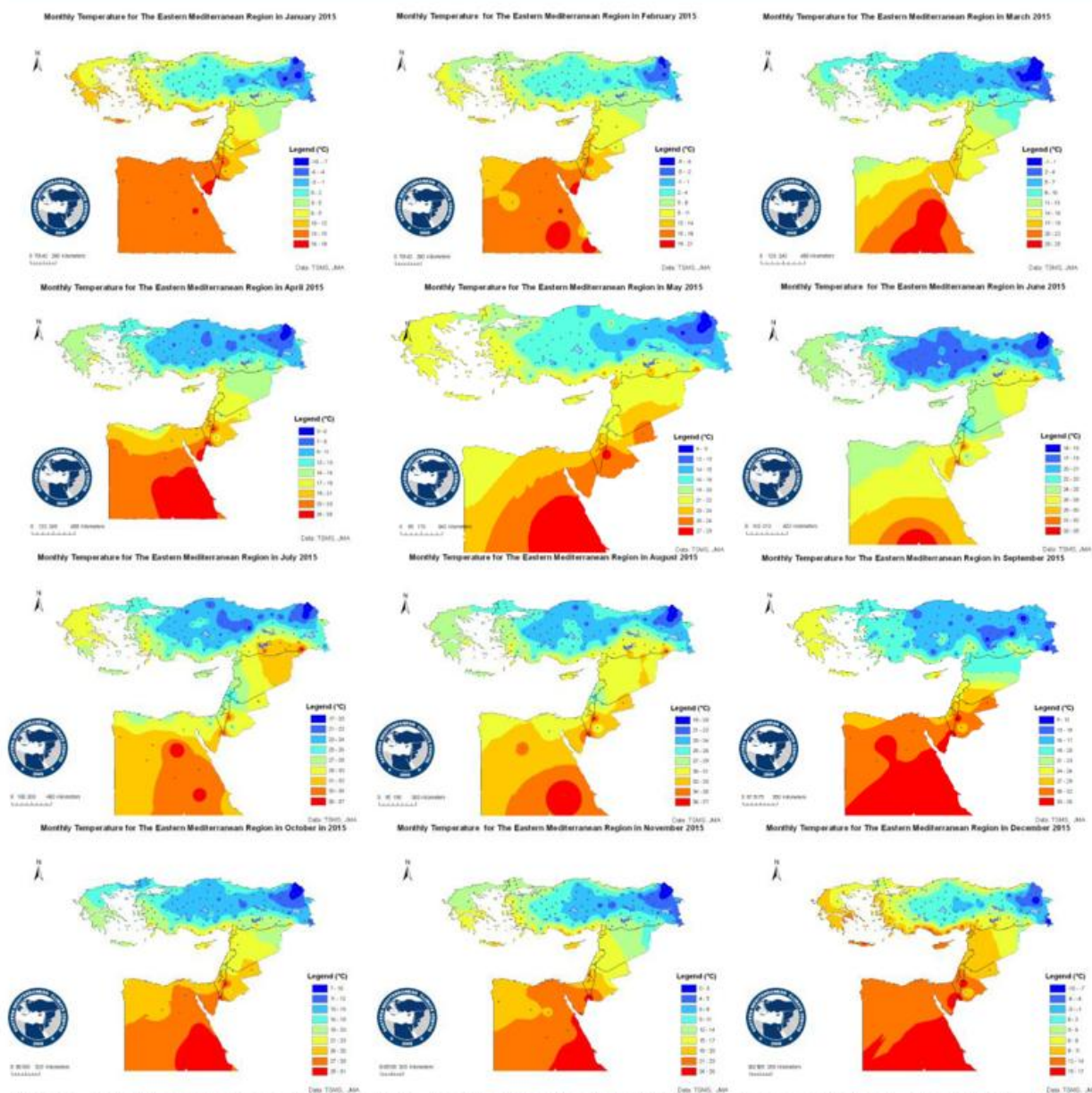


Figure 4.6: Monthly mean temperature (°C) for the Eastern Mediterranean region as provided by the Eastern Mediterranean Climate Center (EMCC).

4.3. Precipitation

According to the sunshine duration in **January 2015** most of central, eastern and northern Europe show higher than normal precipitation with values of more than 250% in Scotland, although it was very sunny. The overall UK rainfall total was 126% of the average. The West-Mediterranean was drier than normal except the coastal zone of northern Spain with partly more than 300 mm as reported by the national weather service AEMet. There was also widespread heavy rain over Cyprus that caused flooding and landslides (WMO statement on the status of the global climate in 2015).

Extreme precipitation in Scandinavia

In Finland precipitation levels for **January** were exceptionally high close to the western coastline and also in the area stretching from Kainuu to Sea Lapland. Precipitation volumes in these areas were nearly twice as high as normal for January. In western parts of the country many weather observation stations recorded the highest precipitation levels for January since 1961.

During January in a larger part of Lithuania registered 60-80 mm of rain and up to 85-110 mm in the western part, equivalent to 150–200% of the long term mean.

In Norway the monthly total precipitation was 140% at some stations up to 400% of the normal; at Eikemo 782.3 mm (279% of the normal).

In Sweden station Piteå reported a new record of 133.6 mm for January since 1860. In this month also several other station records were broken in Sweden.

Links/References:

Finnish Meteorological Institute: [January saw high precipitation and wide temperature fluctuations.](#)

Norway: [Været i Norge - Klimatologisk månedsoversikt - Januar 2015](#)

In **February 2015** most of central Europe, southern Scandinavia, the Baltic States and south-west Iberian Peninsula were drier than normal with values less than 20% of the long term mean. South-eastern Europe, Norway and the British Isles were wetter than normal. Most parts of Austria reported a precipitation deficit of more than 50%, at station Kollerschlag only 8% of the long term mean was registered. Monthly precipitation totals for whole Norway were 135% of the normal. Some stations received between 250% and 350% and others in the south only 25% of the normal. The highest amount was measured at station Lurøy with 467.0 mm or 237%. The relative precipitation anomaly in Portugal ranged from values of 10% in Castelo Branco to 100% in Portimão. Compared with the average values the accumulated monthly precipitation in northern Spain exceeded 200%, at some stations even 300%. The precipitation amount in Croatia for February ranged between 37% and 300% or 15 and 99 mm. Heavy rain also affected countries in southern Europe with flooding in parts of Albania, the Former Yugoslav Republic of Macedonia, Greece and Bulgaria (WMO statement on the status of the global climate in 2015).

In **March 2015** most of western Europe and Russia were drier than normal with values less than 50% of the long term mean. South-eastern Europe, Norway and Scotland were wetter than normal. The precipitation amount for Portugal in March were much lower than the respective normal values throughout the country and ranged from 0.4 mm in Vila Real to 55.4 mm in Viana do Castelo. The percentage values were less than 50% relative to the normal in the north and central part and less than 75% in much of the southern region. In France the precipitation deficit was 20% below normal, locally in the centre of Brittany about 50%. In contrast, in Corsica the precipitation amount often exceeded 250 mm, at station Campile a new record was set with 406 mm (normal for March 63 mm). The average rainfall of Spain was calculated to 58 mm, which exceeded the average of the month (reference period: 1981-2010) by about 25%. In the east of Spain the precipitation amount reached values of more than 300% and led to new all-time record of precipitation for March at the observatories in Castellon de la Plana, Teruel and Almeria. Romania registered in the south-eastern part precipitation amounts of 150-200% of the long term means (1981-2010).

In **April 2015** precipitation was lowest at some places in the central and eastern Mediterranean such as Sicily, southern Greece, southern Turkey, parts of the Middle East, but also at few places in Hungary with less than 10 mm for the whole month of April 2015. In Austria at Klagenfurt the

second driest April since 1813 were registered, which led to forest fires (WMO 2015). Highest precipitation totals were measured in northwest Spain, southern France and near eastern coasts of the Black Sea with more than 100 mm in April, locally more than 150 mm. Northern and eastern Europe received more precipitation than normal, in some regions more than 250%. Some stations in Northern Norway received 2.5 to 3.5 times of the normal precipitation.

Precipitation anomalies for **May 2015** were heterogeneous distributed. Most parts of western Europe from Poland, Czech Republic, France, and Iberian Peninsula were drier than normal with values less than 20% of the long term mean in Spain. Most of Italy, Albania, and from Greece to eastern Romania and Moldova was also drier than normal. Scotland, Scandinavia, the Alpine region with western Balkan as well as Slovakia, eastern Poland, the Ukraine and parts of Belarus and Russia showed positive precipitation anomalies. In northern Europe precipitation was caused by cyclonic activities whereas in southern parts precipitation was mainly caused by thunderstorms.

Very wet May in Scandinavia

Precipitation in Finland ranged from below 100% in the south-east to more than 225% in the north and west parts of the country.

Monthly precipitation for Norway was 175% of the normal, and it was the second wettest **May** in a series that started in 1900, surpassed only by the May of the year 1949. Some stations in the north and the southeast received more than 3 times of the normal rainfall. It was relatively dry in parts of northern and central Norway with 50% to 75% of the normal precipitation. The wettest station was Hovlandsdal with 363.4 mm (265% of normal).

In Sweden May was very wet or extremely wet for almost the entire country. Several stations with more than 100-year long measurement series hit their old monthly record. In Stockholm it was the wettest May since 200 years.

Links/References:

Finland: [May 2015 Statistics](#)

Norway: [Klimatologisk månedsoversikt Mai 2015](#)

Monthly precipitation for **June 2015** showed high positive anomalies in Scandinavia and northern Russia of more than 70 mm. In the south-eastern part of Europe also high positive anomalies occurred with peaks over central Turkey and north of the Black Sea with values of more than 70 mm. A band of above normal precipitation extended from the Black Sea through Ukraine to northern Russia. Central and eastern Europe received partly below 25 mm or a deficit of up to 75 mm from Croatia through Austria and Hungary up to the Baltic States and northern Russia. While the Pyrenees recorded above normal precipitation, the rest of Spain and Portugal still had a precipitation deficit and drought.

Monthly precipitation for **July 2015** showed high positive anomalies of more than 70 mm in UK, Ireland, northern Germany, Scandinavia and northern Russia. Southern Europe (Serbia, Italy, Spain and Portugal) received partly below 25 mm or locally a relative anomaly of below 20%. While the north-eastern part of Spain measured above normal precipitation, the rest of Spain and Portugal, France, and a band from southern Germany up to the Ukraine still had a precipitation deficit and drought. On the 4th and 5th July severe thunderstorms with hail crossed the Netherlands, Belgium and northern Germany with 2 fatalities and a loss of 400 Million Euro (MunichRe). This low pressure system with storm (26.2 m/s at station Münster/Osnabrück, Germany), hail (9 cm in diameter) and heavy rain caused flash floods, and damage on numerous houses and vehicles.

Precipitation anomalies for **August 2015** were above normal in most parts of western and southern Europe while northern and eastern Europe were drier than normal. It rained less than normal in an area from Massif Central (France), Switzerland, Austria, southern Germany, Czech Republic, Poland to Scandinavia and from the Baltic Sea to the Black Sea with values less than 20% of the long term mean. Central Russia was wetter than normal with anomalies of more than 70 mm. While in southern Norway precipitation amount reached up to 341.9 mm (197% of normal) at station Sand i Ryfylke (Rogaland), central Norway received at station Skjomen–Stiberg (Nordland) only 18.1 mm or 26% of the normal. In France new records were set at station Gonneville (Brittany)

with 178.4 mm (more than three times of the normal amount) and Montpellier with 234.2 mm (nearly seven times of the normal amount)

In **September 2015** western Europe from Portugal to Norway was drier than normal. Eastwards of this band a second band of above normal precipitation was located from France to northern Finland. The next band with drier conditions followed from south Germany and Czech Republic, Poland, the Baltic States to northern Russia joined by a wetter zone from Greece and Turkey to Belarus and Russia. The southern part of Russia and eastern Ukraine were dominated by a precipitation deficit. Most of these precipitations were due to thunderstorms with severe rainfall. The precipitable water anomaly maps showed for the whole Mediterranean values of up to 8 mm or more than 3 standard deviations. Two peaks were remarkable one above Costa Brava/Gulf of Lions and the other western off the Spanish/French Atlantic coast. In Ireland, stations in Galway and Mayo saw September-record 24 hour rainfall totals over 100 mm on 11th and 13th September leading to flooding (WMO statement on the status of the global climate in 2015).

Scandinavia received in **October 2015** little precipitation, except central and northern Norway. The region of the deficit ranged from the Baltic States, northern Poland to Belarus, eastern Ukraine and western Russia with monthly totals below 10 mm. In southern Norway and Sweden new extreme low precipitation records were broken by many stations. Western Europe and eastern Spain received below normal precipitation, partly below 40%. In Ireland almost all stations reported their driest October in five to 12 years and also Estonia had its driest October since 1961. In contrast, south-eastern Europe the relative precipitation anomalies were partly above 250%. In mid-October, heavy rain in Bosnia-Herzegovina led to flooding in Mostar and Stolac city (WMO 2015).

In **November 2015** most of northern Europe received above normal precipitation. In Norway total precipitation of more than 700 mm/month was measured. Southern Europe showed a precipitation deficit below 40%, especially central and northern Italy as well as the western Balkan, Iberia and Turkey. Austria received only 50% of the precipitation amount, at some places even 2%.

In **December 2015** the precipitation pattern over Europe was divided in two parts of opposite precipitation anomalies.. The very dry part was extended from the Mediterranean to France, Germany, Poland and Ukraine with less than 20% precipitation. Austria noted its second driest December since 1858; Hungary its 3rd driest since 1901 The wetter part encompassed UK, Ireland, northern Greenland, Denmark, Norway, Finland, southeastern Caucasus and Russia with anomalies of more than 150%. In Ireland most stations across the country reported 2-3 times of their normal rainfall for December. Wettest conditions were in county Cork where nearly all stations measured more than 300% of normal. Roche's Point reported the highest percentage of average with 342 % (340.6 mm), and its highest measured value at this station for December since 1955. In Norway the monthly precipitation was 165% of its normal. It was the 4th wettest December since 1900. Some stations in southern and western Norway measured between 300% and 400% of normal precipitation.

Extreme precipitation and floods in northern UK in December 2015

December was a record-breaking month in the UK, dominated by unseasonably mild and moist tropical maritime air masses and a marked absence of frost, particularly in the south. Frequent deep depressions and frontal systems - including storms Desmond, Eva and Frank - brought strong winds and heavy rain to the north at regular intervals. In detail they brought record-breaking rainfall over much of Scotland, Wales and northern England. Severe flooding affected Cumbria for much of December, and became widespread across North Wales, northern England and Scotland after Christmas. With 198% of average rainfall, it was the wettest December, and calendar month, in the UK series. Rainfall reached 2 to 4 times the average in the west and north. 341.4 mm fell at Honister Pass (Cumbria) in 24 h on the 5th, a new UK record for any 24-hours. In fact of the storms and the high precipitation fallen trees and power cables leading to power cuts. Record-breaking rainfall totals brought widespread flooding of roads and rail routes, several bridges were washed away and many properties were flooded. In January, the Association of British Insurers (ABI) estimated the final bill for the flood damage caused by storms Desmond, Eva and Frank to homes, businesses and motor vehicles to be £1.3 billion.

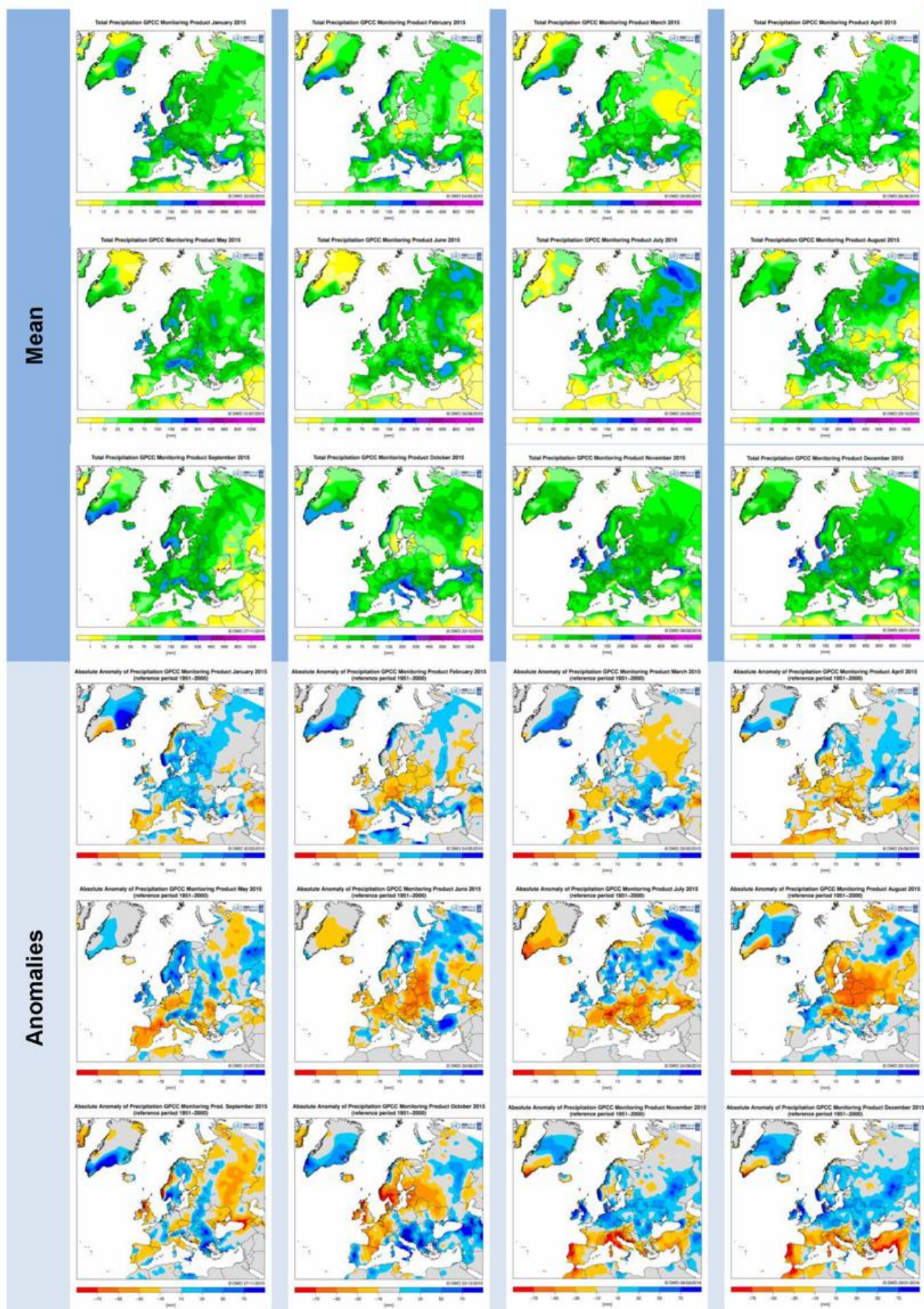


Figure 4.7: Mean and anomalies of precipitation (in mm/month) for each month of the year 2015. (First column January, February, March, April)

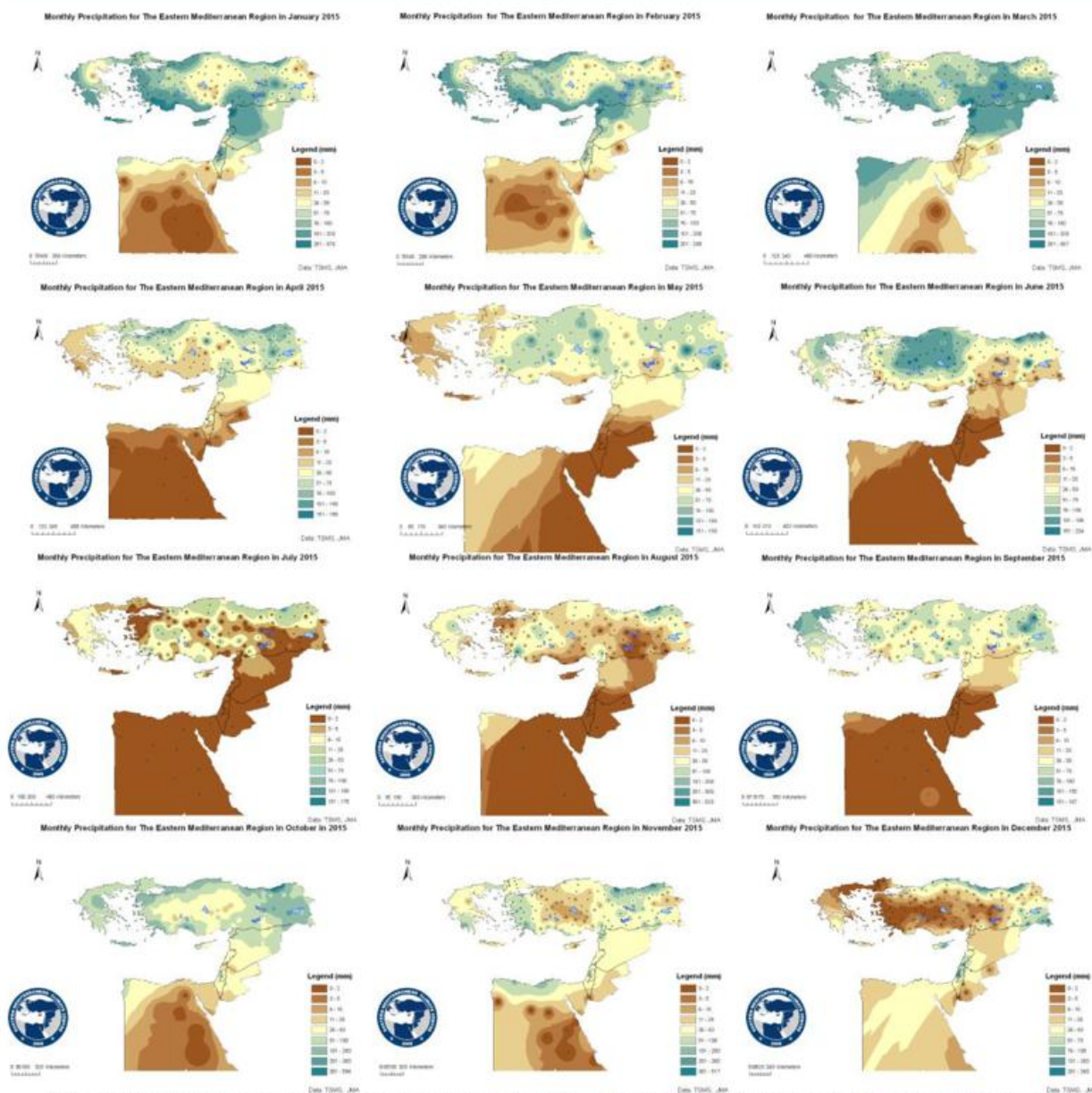


Figure 4.8: Monthly precipitation totals (mm) for the Eastern Mediterranean region as provided by the Eastern Mediterranean Climate Center (EMCC).

4.4. Sunshine duration

In **January 2015** most of central, eastern and northern Europe had lower than normal sunshine. The Mediterranean from Iberia to Turkey showed positive anomalies of the sunshine duration with values of more than 150% in Spain, Sardinia and Romania. In the United Kingdom the sunshine was well above normal in most places, especially eastern areas, and the UK received 126% of average sunshine hours. It was the UK's equal- 5th sunniest January in a series from 1929.

In **February 2015** more sunshine than normal showed central Europe with a maximum of more than +50% an area at the border between Germany and Poland. Austria reported at station Hohenau an der March (Hohenau upon March) a surplus of +44% while in the south-western part of Austria stations showed a deficit of -30% to -37%.

March 2015 was characterised by positive anomalies of sunshine duration over a large part of Europe except southern France and south-eastern Europe. South-western France had a deficit below 50% of normal and a surplus of 30% in the north-west. On 20 March 2015 there was a partial solar eclipse.

In **April 2015** the prevailed high pressure over western Europe determined positive anomalies of sunshine duration covered the western part of Region VI. UK received 143% of the average sunshine hours; that was the sunniest April since 1929. Germany received 134% of the normal sunshine hours. The north-eastern part of Europe had less sunshine than normal.

In **May 2015** positive anomalies of sunshine duration - accompanied by warmer and drier condition - covered mainly the eastern part of Region VI. For example, the highest reported sum of sunshine duration in Portugal was approximately 360 hours that is somewhat below the maximum value of northern Russian with 370 hours.

In **June 2015** the dry air from Africa induced positive sunshine anomalies in southwest and central Europe while Scandinavia and east Mediterranean obtained less sunshine than normal.

In **July 2015** southern and central Europe received more sunshine while northern (except Norway) and western Europe registered less than the average. The highest reported sum of sunshine duration in Greece was 418 hours.

In **August 2015** the high pressure over Scandinavia resulted in above normal sunshine duration over most of Scandinavia, the Baltic States, Poland and north-western Russia with values of more than 50% or 100 hours. This caused also above normal temperature and precipitation deficit in this region. For Stockholm results show that the current sunshine duration was only one hour below the record from 1955.

In **September 2015** in most parts of Europe the sunshine duration was below normal except the United Kingdom, Spain, western France, Poland, Scandinavia, east Ukraine and west Russia. In Wales obtained 170.2 hours or 137% of the 1961-1990 averages and West-Scotland 144.3 hours or 142% of the normal. In western Poland shone the sun more than 190 hours 60 hours (+25%) longer compared to the long term mean (1961-1990). Southern Sweden was also sunnier than normal with 235 hours at station Hoburg.

In **October 2015** the high pressure over Scandinavia together with the subsidence caused lower cloud amounts and more sunshine. This weather situation resulted in relative anomalies of more than 150% in Sweden and Finland. Sweden reported new records of sunshine duration for several stations like Umeå (162 h or 172%). These positive anomalies extended to the Black Sea, while the rest of Europe received less sunshine than normal in conjunction with above normal precipitation.

In **November 2015** most of southern Europe showed above normal sunshine. The Balkan received locally more than 150% of sunshine. In Austria it was the sunniest November since the nationwide sunshine measurements began in 1925.

In **December 2015** most parts of Europe recorded positive anomalies between 105% and more than 150% of normal sunshine duration. In Austria it was the sunniest December on record with 190% of normal. The station Villacher Alpe measured 233 h, which was 76% more than normal. Germany noted its second sunniest December on record since 1951. There were many other European countries which measured a record December. Sunshine deficit reported Ireland, UK, western Greenland, Portugal, parts of Spain, some places in the Mediterranean region, Denmark, and Hungary. Western Romania had a sunshine duration below 95%, parts of Russia and Finland actually below 25%.

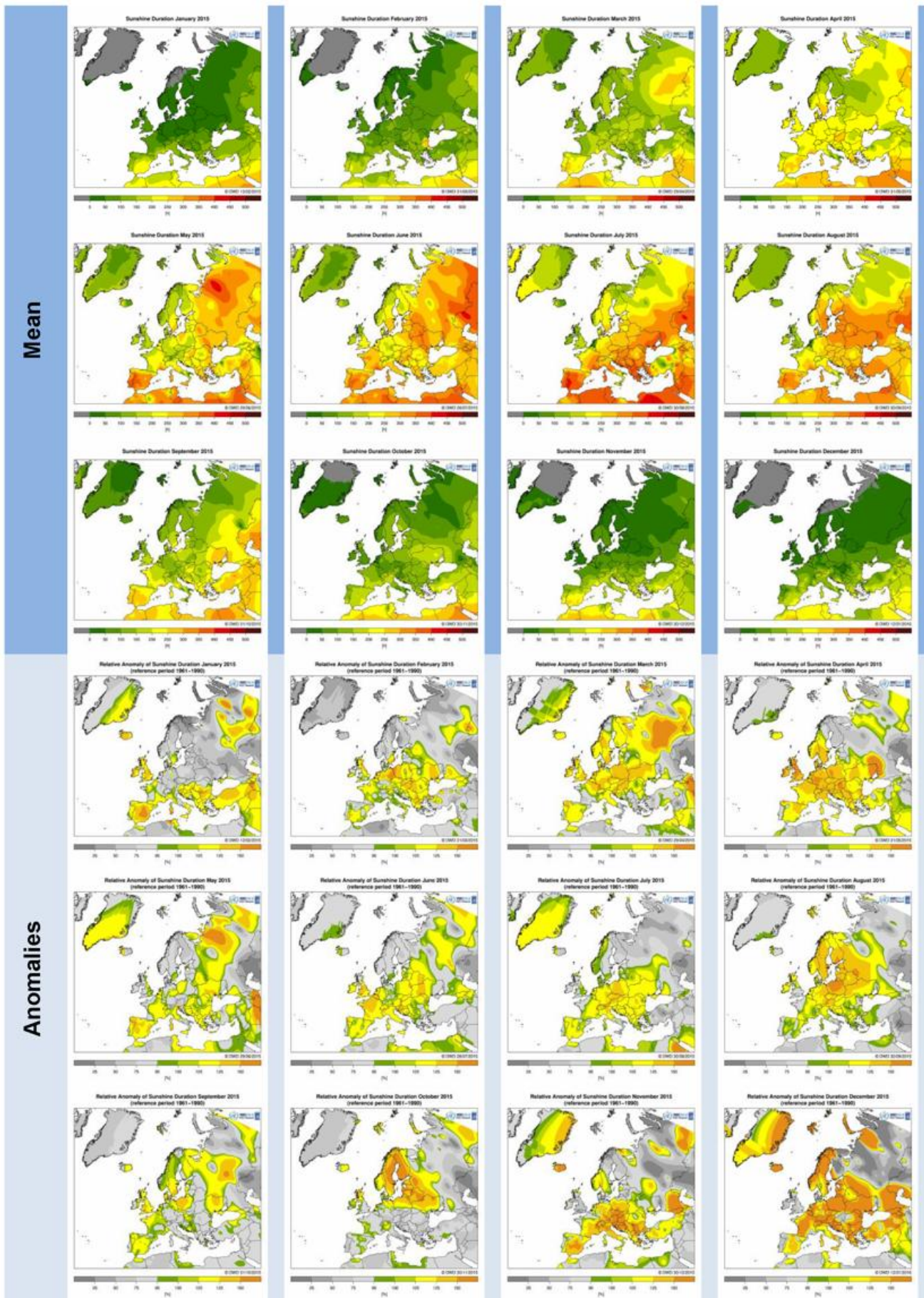


Figure 4.9: Mean of sunshine duration (in hours) and relative anomalies (in %) for each month of the year 2015. (First column January, February, March, April)

4.5. Maps of monthly climate extremes and events

The following maps are based on different data (as noted the legend in parentheses) and should summarize the weather conditions in each month of the year 2015.

From **January to March** 2015 in northern and eastern Europe the monthly temperature were 4°C warmer than normal and also the number of warm days were above normal. The areas at the Norwegian and Greenland coasts were affected by strong wind gusts. In **February** the Iberian and France had more colder days than normal.

In nearly whole Europe **April** had more warmer days than normal.

In **May** and **June** northern, central, western and southern Europe was wet and warm but had also a few colder days than normal.

In **July** it became warmer and dryer than normal in the south part of Europe while Scandinavia and the UK had more wetter and colder days as usual.

Whole Europe had more warm and wet days in **August** with anomalies above 4°C in Balkan, Poland and Ukraine.

In **September** western Europe was affected by more cold days while central and northern Europe showed again higher number of wet and warm days.

Central Europe showed in **October** more cold days than usual. The Balkan and southern Europe noted a higher number of very wet and sometimes warm days. While northern Europe had more warm days than normal with strong wind gusts at the Atlantic coast.

During **November** most parts of Europe showed a higher number of warm and wet days. Norway, the UK, Denmark, the Bretagne and in the Gulf of Lions were affected by strong wind gusts in November.

The **December** showed in whole Europe again more warm days than normal, but northern Europe was wetter and southern Europe dryer than normal. There were also strong wind gusts in Scandinavia, the UK and Greenland.

The Monthly Event Map contains information about the extreme anomalies of temperature, precipitation and wind gusts. Points are calculated from station data and represent the number of very warm or cold days, the locations of strong wind gusts (≥ 32 m/s) and days with precipitation. If more than one extreme anomaly occurs at the same location, the point is subdivided into several different colours. Coloured areas are based on interpolated gridded data for temperature (land and ocean) and precipitation (only land areas). If more than one extreme anomaly occurs at the same grid, the area is shaded.

Legend of Figure 4.10:

- | | |
|--|---|
| ● Anomaly of very wet days > 0 (ECAD) | ● Wind gusts (≥ 32 m/s) (SYNOP) |
| ● Anomaly of warm days > 0 (ECAD) | ● Anomaly of cold days > 0 (ECAD) |
| ■ Anomaly of TG ≤ -4 K (CLIMAT and ship obs.) | ■ Anomaly of TG ≥ 4 K (CLIMAT and ship obs.) |
| ■ Aridity index < -1.5 modified SPI (GPCC) | ■ RR $\geq 150\%$ of climatology (GPCC) |

Based on climatology 1961-1990 (GPCC climatology: 1951-2000)

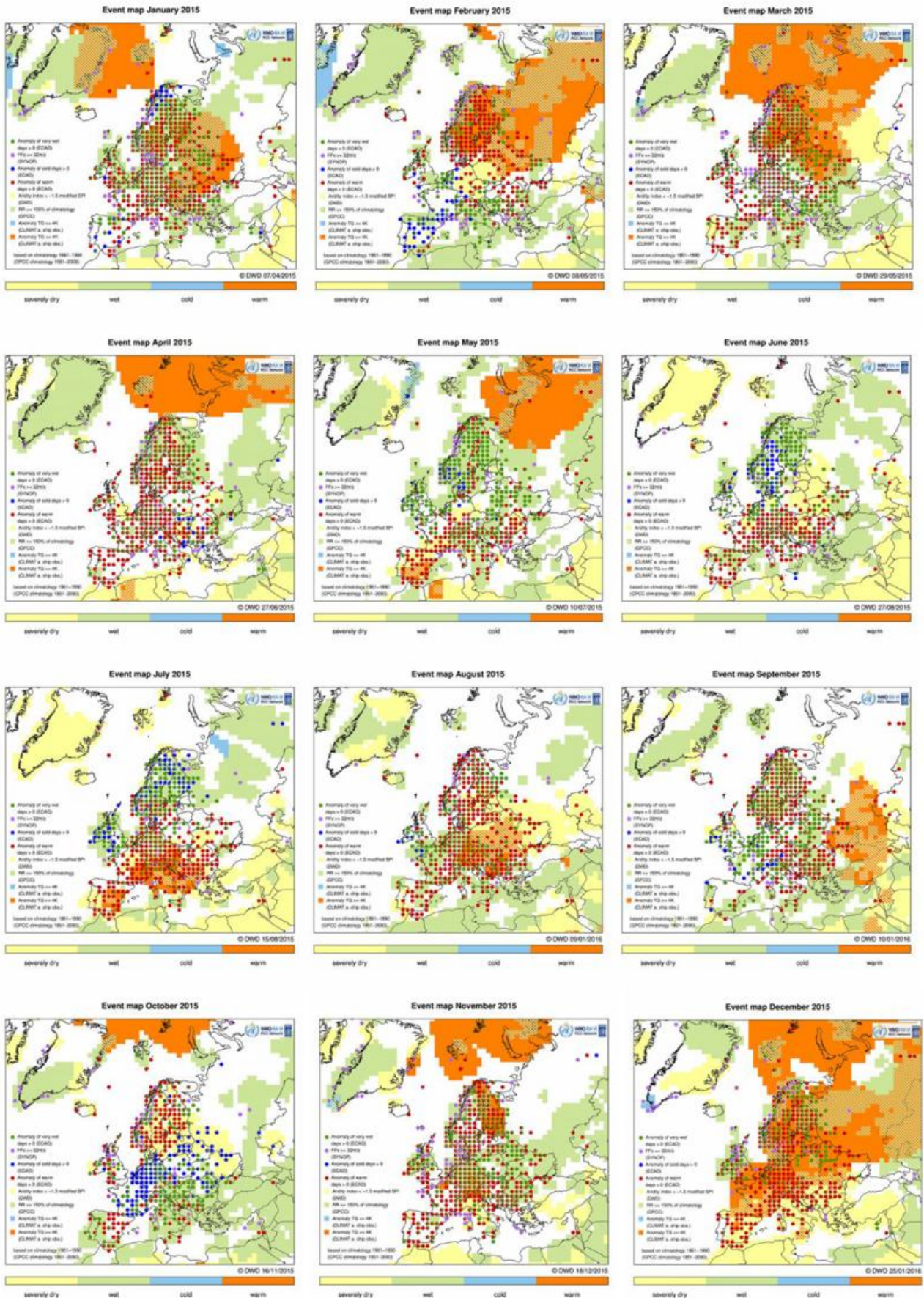


Figure 4.10: Maps of Climate Extremes for each month of the year 2015.

5. Long-term variability of the selected climate parameters - Regional examples

On the following pages graphs of long time series of temperature, precipitation and sunshine duration as provided by the national meteorological services (NMHSs) are presented to give an overview of the temporal development of the basic climate elements. The graphs are grouped with respect to the 6 sub-regions defined above (Figure 1.1). An overview about the contributed countries, the time series lengths and the area representativeness can be found in Table 5.1. Most are temperature time series. Each sub-region is at least represented by one country. Time series of precipitation totals are fewer but each sub-region is represented with at least one time series for precipitation. Diagrams of long-term annual sums of sunshine duration are provided by 4 countries and they belong to different sub-regions.

After this, we present examples of the temporal development of other temperature related phenomena, such as the sea surface temperature in the North Sea and sea level anomalies at the Polish station Władysławowo.

Table 5.1: Availability of the long-term records of temperature, precipitation and sunshine duration from some participant countries.

Sub-region	Country	Temperature		Precipitation		Sunshine Duration	
		Spatial Mean	Single Station	Spatial Mean	Single Station	Spatial Mean	Single Station
Central and Western Europe	Austria	1768					
	Belgium		1833				
	France	1900					
	Germany	1881		1881		1951	
	Hungary	1901		1901			
	Luxembourg	1947					
	Netherlands	1910					
	Poland	1951					
	Switzerland	1864		1864		1959	
	United Kingdom	1910		1910		1929	
Nordic and Baltic Countries	Denmark, Greenland, Faroer	1873		1874		1920	
	Estonia		1866		1866		1953
	Finland	1847			1900		
	Iceland		1871				
	Latvia	1924		1924			
	Lithuania	1961					
	Norway	1900		1900			
	Sweden	1860		1860			
Iberia	Portugal	1931		1931			
	Spain	1965					
Mediterranean, Italian and Balkan Peninsula	Bulgaria	1901					
	Croatia		1862				
	Italy	1961		1951			
	Slovenia		1951		1951		
	Turkey	1971		1971			
Eastern Europe	Belarus	1881		1891			
	Russia	1939		1966			
Middle East	Georgia	1961	1881	1961	1881		
	Israel	1951					
	Kazakhstan	1936					

5.1. Temperature

Central and Western Europe – annual temperature series

Austria, Belgium, France, Germany, Hungary, Luxembourg, the Netherlands, Poland, Switzerland

Austria

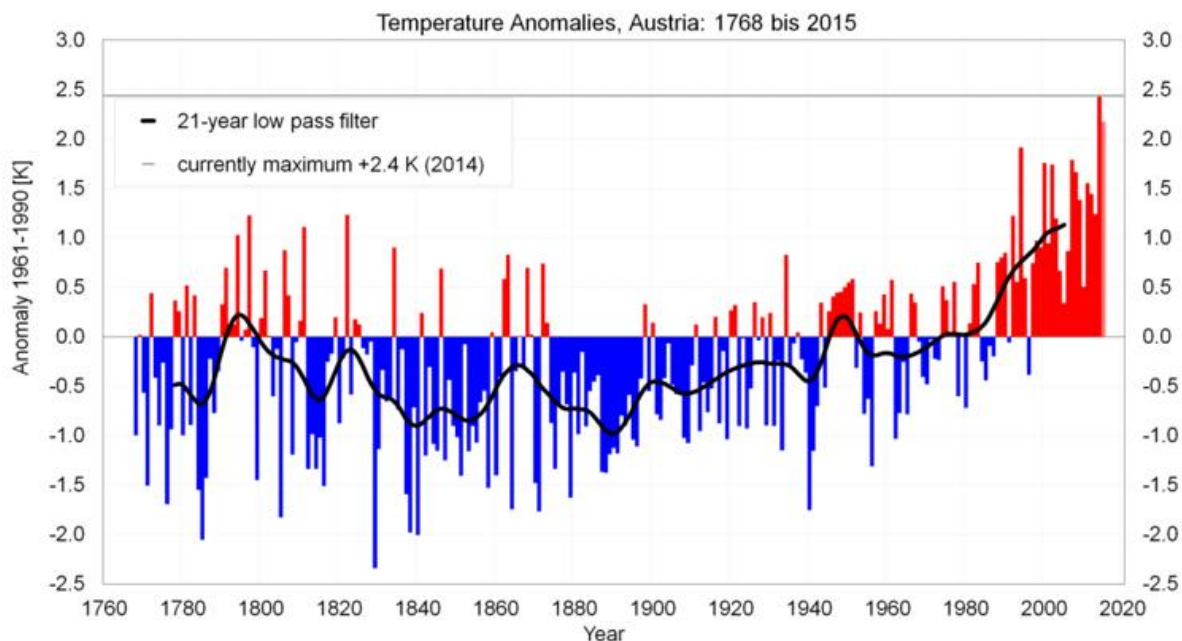


Figure 5.1: Time series of annual temperature anomalies for Austria (reference period 1961-1990, diagram as provided by the NHMS)

Belgium



Evolution de la température moyenne annuelle à Bruxelles - Uccle de 1833 à 2015

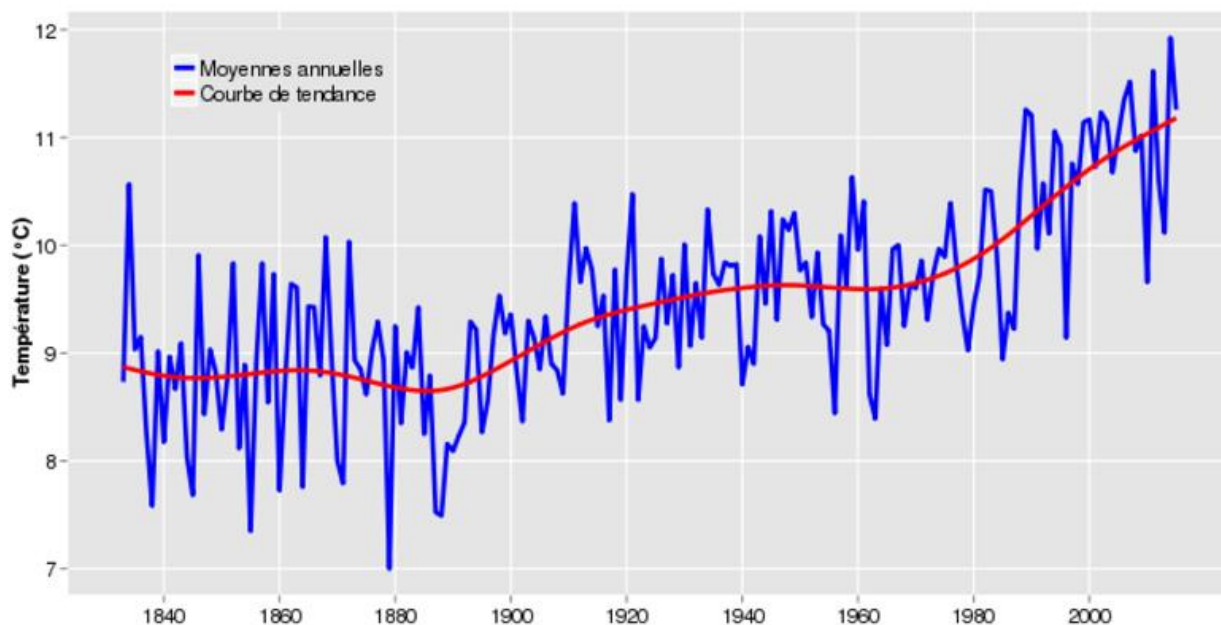


Figure 5.2: Time series of annual mean temperature for Uccle, Belgium (Diagram as provided by the NHMS)

Central and Western Europe – annual temperature series

France

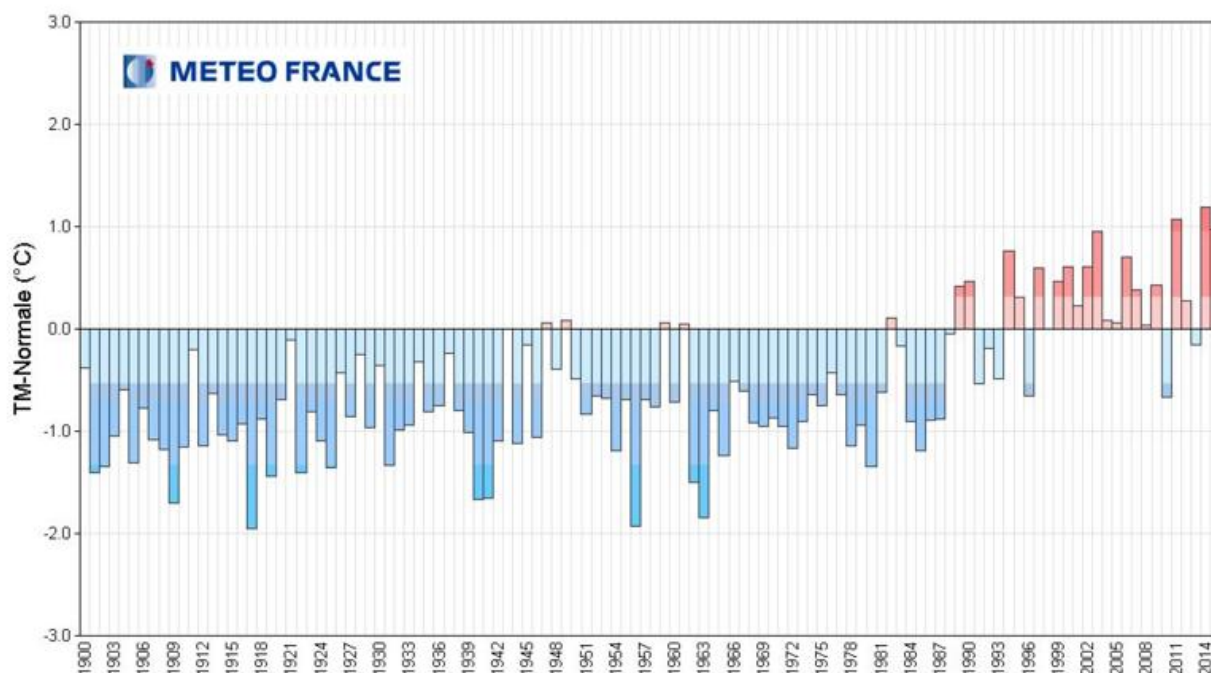


Figure 5.3: Time series of annual temperature anomalies for France for the period 1900-2015 (reference period 1981-2010; diagram as provided by the NHMS)

Germany

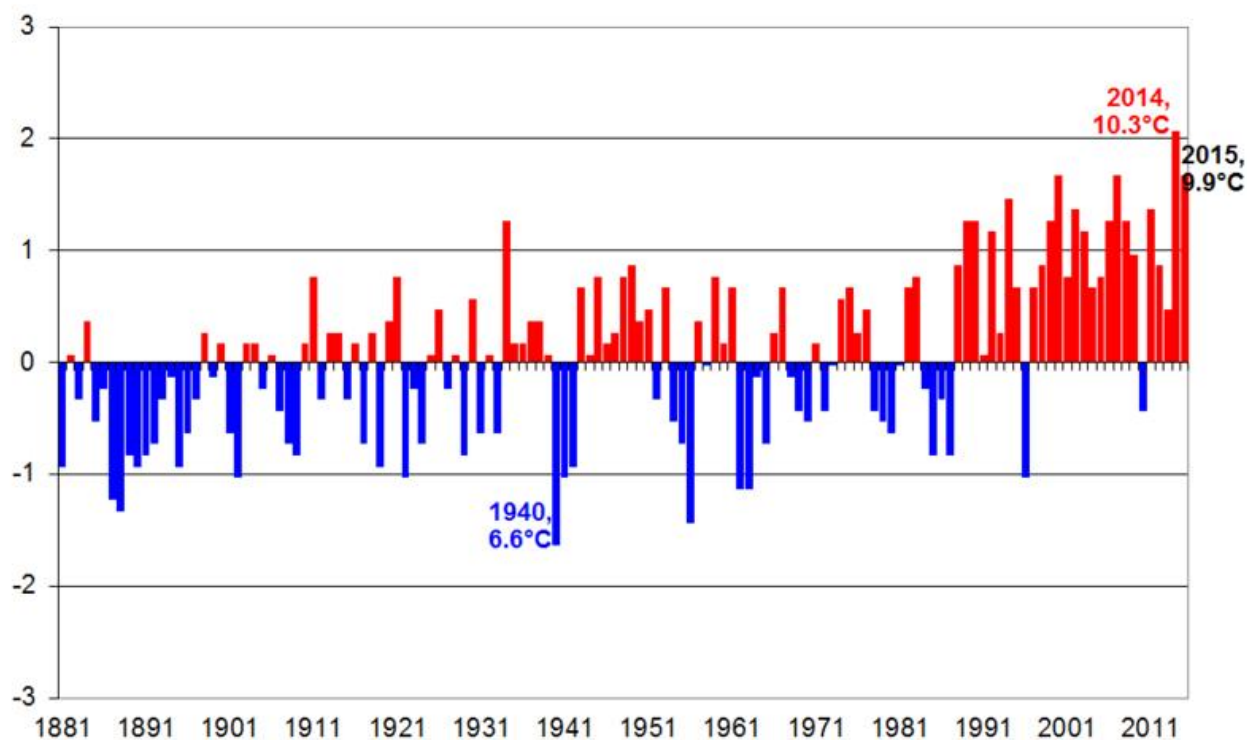


Figure 5.4: Time series of annual temperature anomalies for Germany for the period 1881-2015 (reference period 1961-1990, diagram as provided by the NHMS)

Central and Western Europe – annual temperature series

Hungary

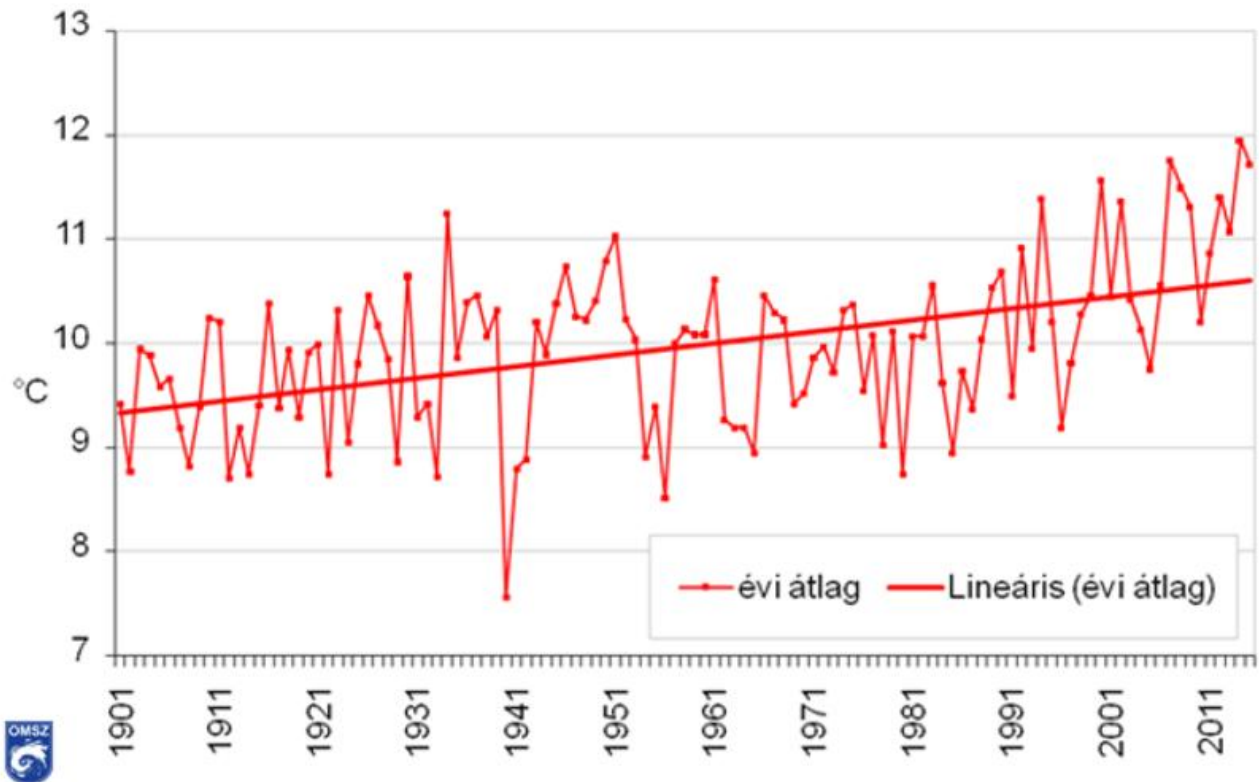


Figure 5.5: Time series of annual average temperature for the period 1901-2015 for Hungary (58 station based on data from homogenized, interpolated; Diagram as provided by the NHMS)

Luxembourg

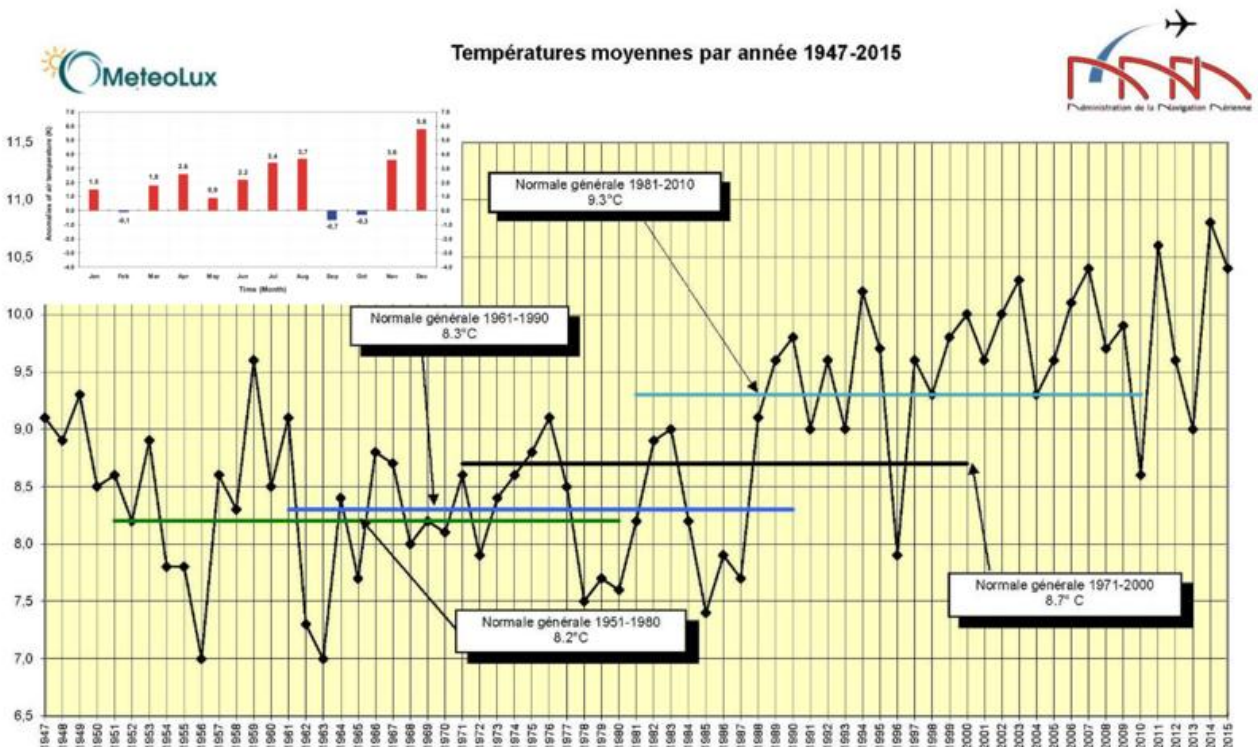


Figure 5.6: Time series of annual average temperature for the period 1947-2015 for Luxembourg (Diagram as provided by the NHMS)

Central and Western Europe – annual temperature series

The Netherlands

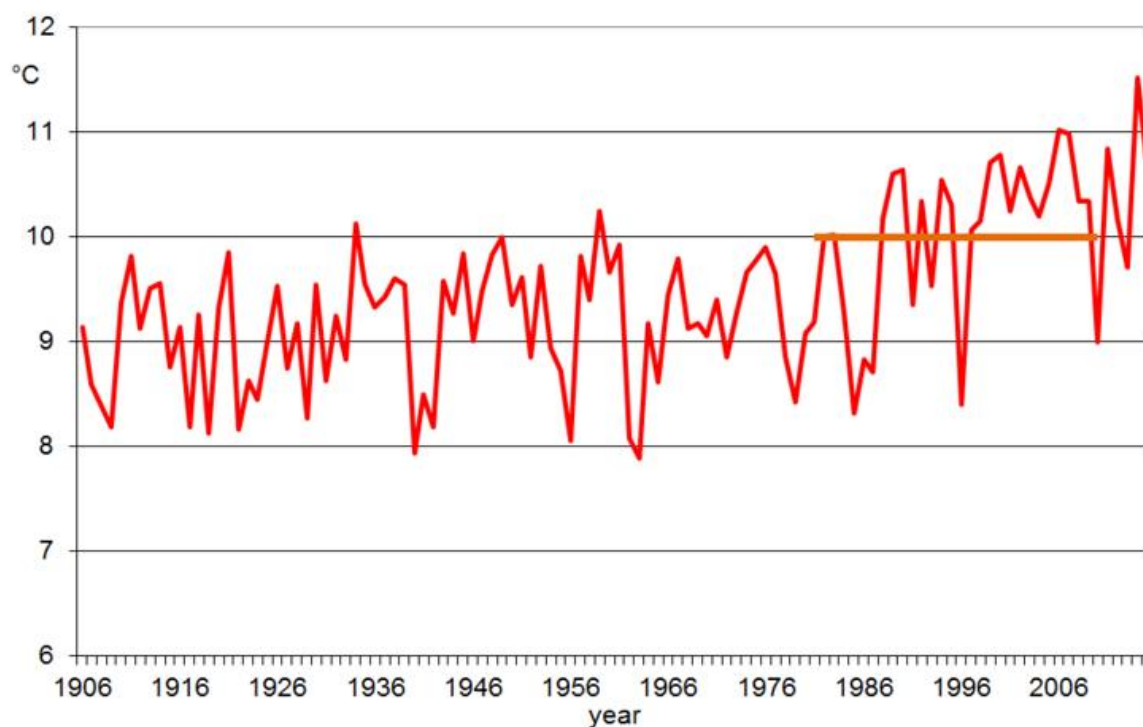
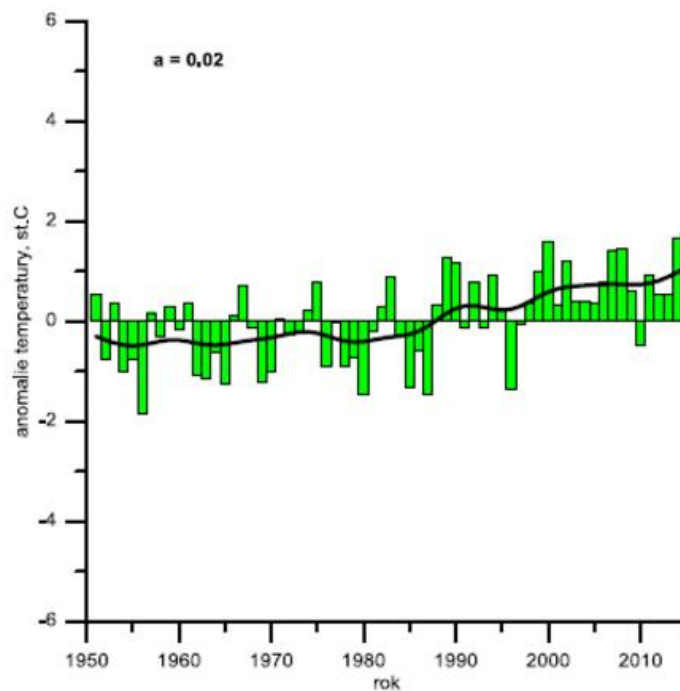


Figure 5.7: Time series of annual average temperature for the period 1906-2015 for the Netherlands (Central Netherlands Temperature v6, mean of 6 stations, data as provided by the NHMS)

Poland



Polska

Figure 5.8: Time series of annual temperature anomalies for the period 1951-2015 for Poland (base period: 1971-2000; smoothed by 10-years Gaussian filter (black line) and the values of linear trend ($^{\circ}\text{C}/\text{year}$; diagram as provided by the NHMS)

Central and Western Europe – annual temperature series

Switzerland

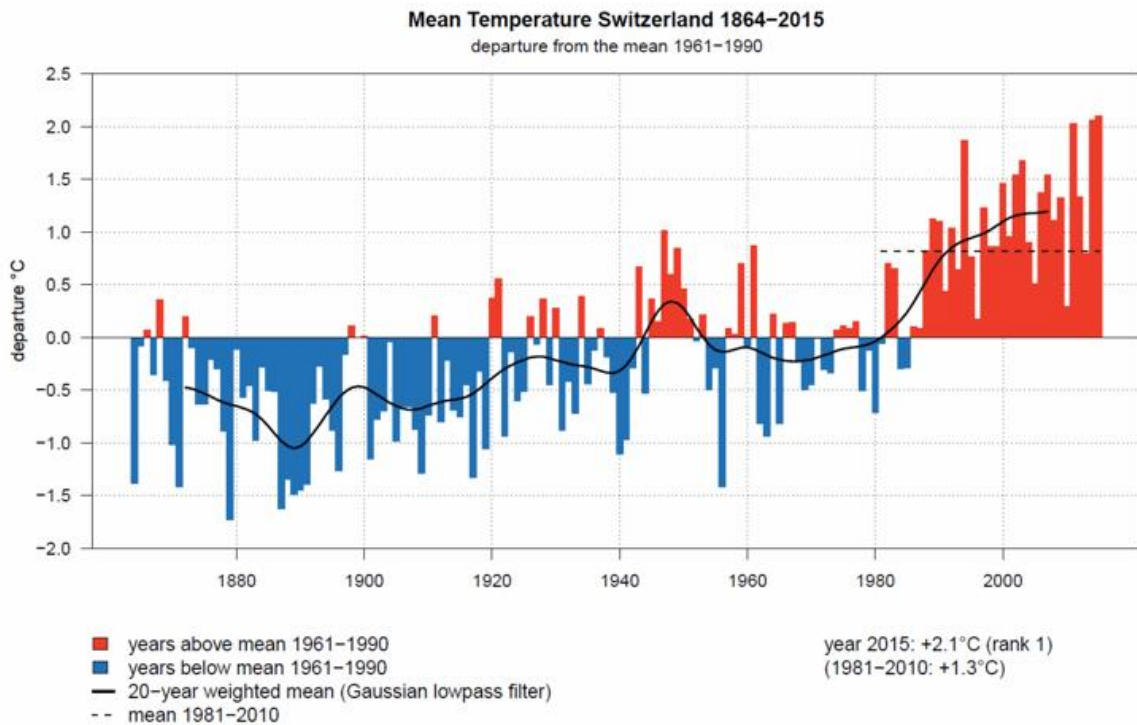


Figure 5.9: Time series of annual temperature anomalies for the period 1864–2015 for Switzerland (reference period 1961–1990, diagram as provided by the NHMS)

United Kingdom

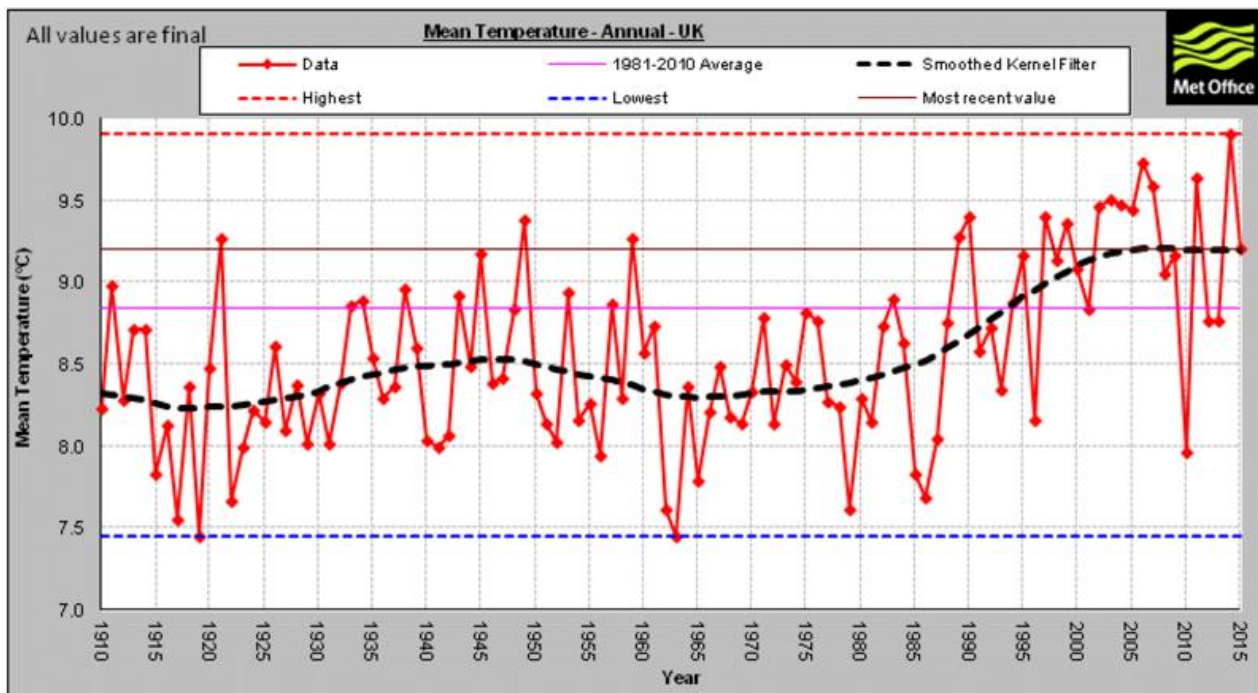


Figure 5.10: Time series of annual temperature for the period 1910–2015 for the United Kingdom (Diagram as provided by the NHMS)

Nordic and Baltic Countries – annual temperature series

Denmark, Estonia, Finland, Greenland, Iceland, Latvia, Lithuania, Norway, Sweden

Denmark, Greenland, the Faroe Islands

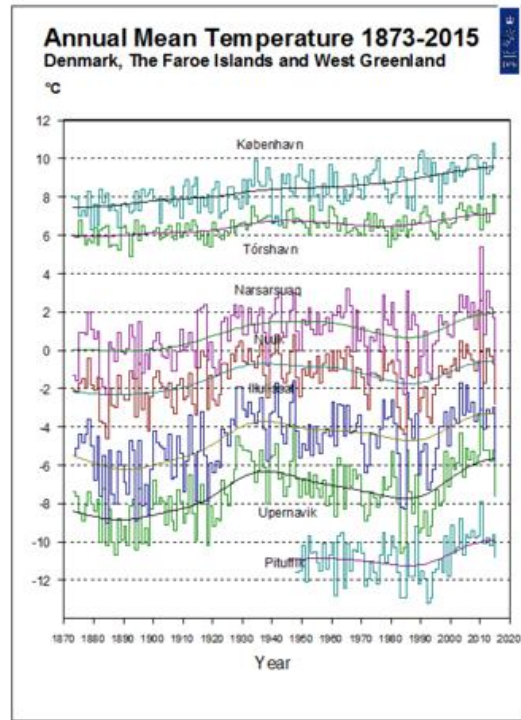
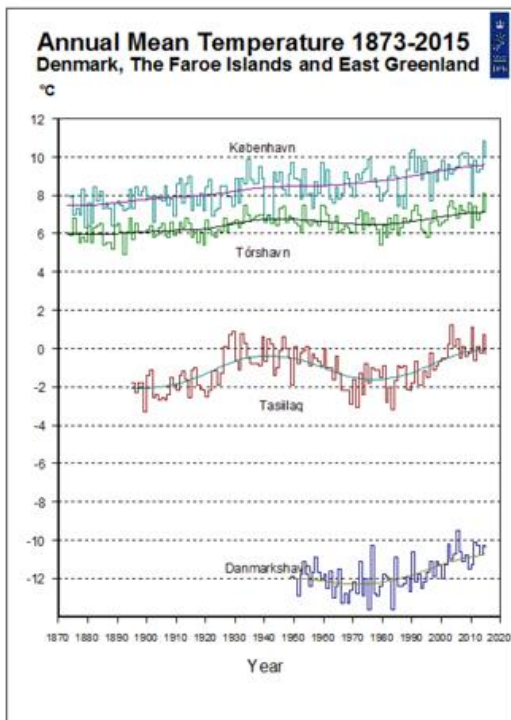
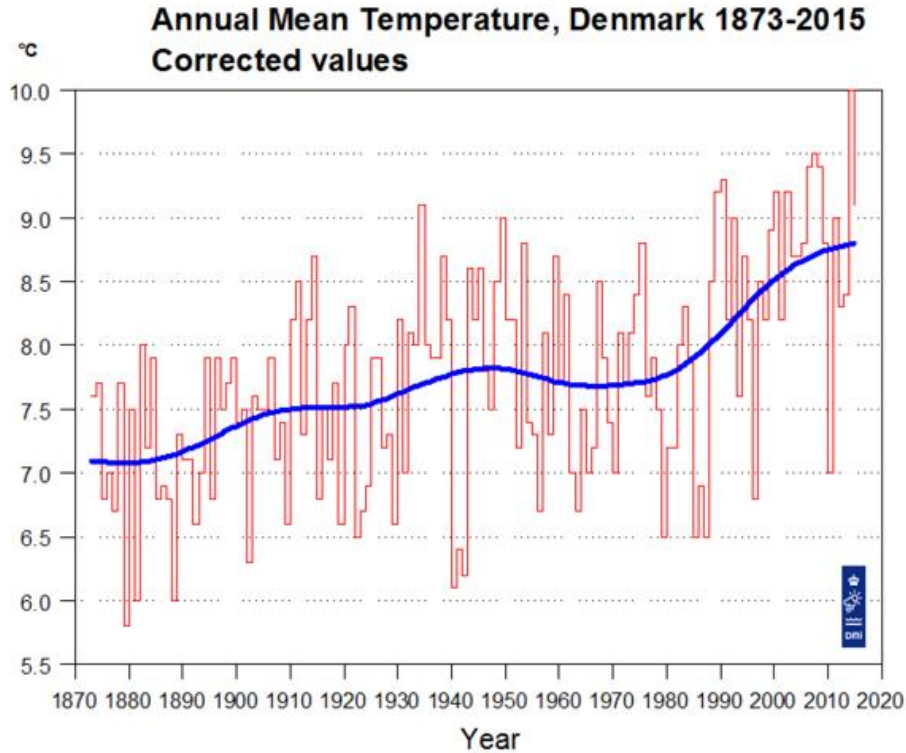


Figure 5.11: Time series of annual temperature for the period 1873-2015 for Denmark (top), the Faroe Islands and Greenland (bottom, diagram as provided by the NHMS)

Nordic and Baltic Countries – annual temperature series

Estonia

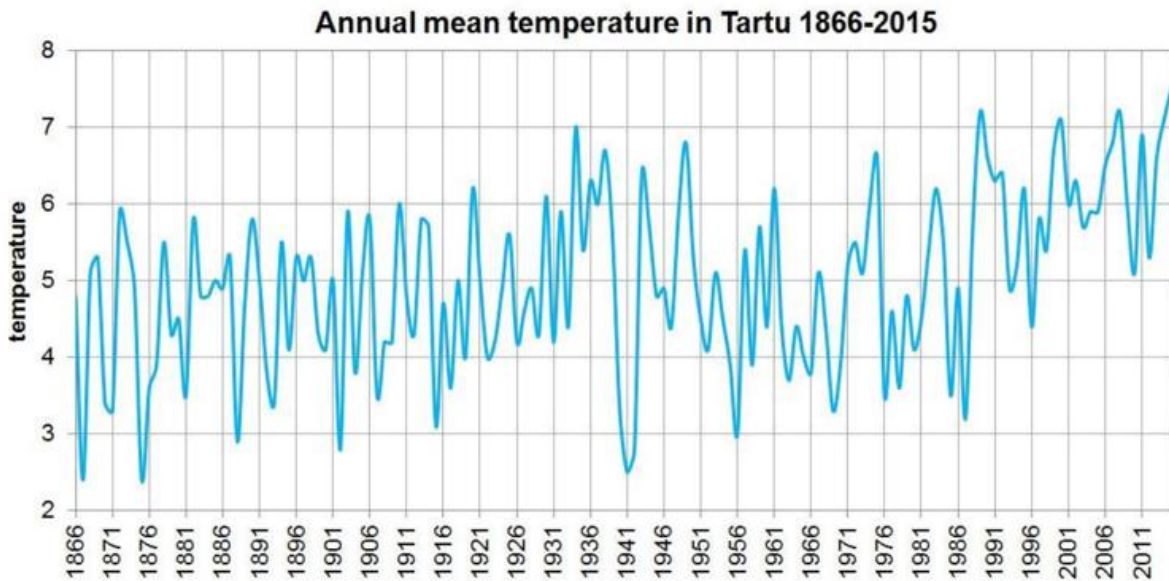


Figure 5.12: Time series of annual temperatures for the period 1866-2015 for station Tartu, Estonia (diagram as provided by the NHMS)

Finland

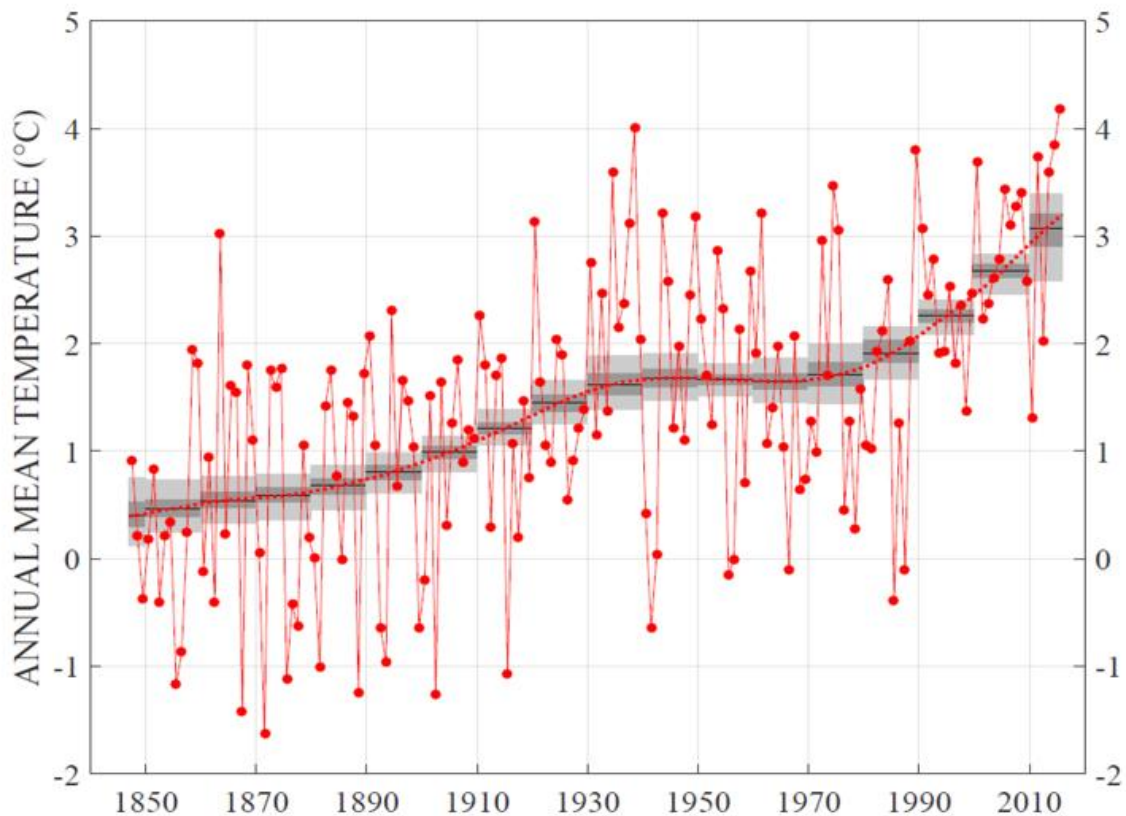


Figure 5.13: Time series of annual temperatures for the period 1848-2015 for Finland (in red and decadal averages (in black) with uncertainties in grey; diagram as provided by the NHMS)

Nordic and Baltic Countries – annual temperature series

Iceland

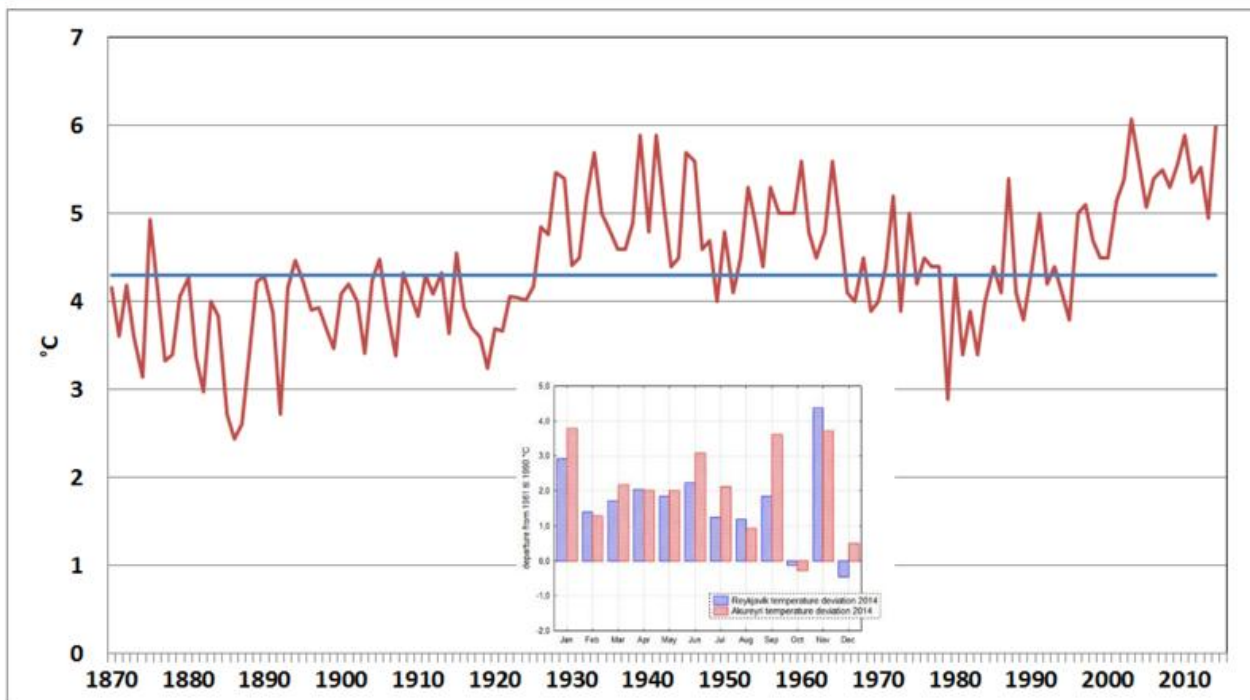


Figure 5.14: Time series of annual average temperature for the period 1870-2015 for station Reykjavik, Iceland (blue line: reference period 1961-1990; data as provided by the NHMS)

Nordic and Baltic Countries – annual temperature series

Latvia

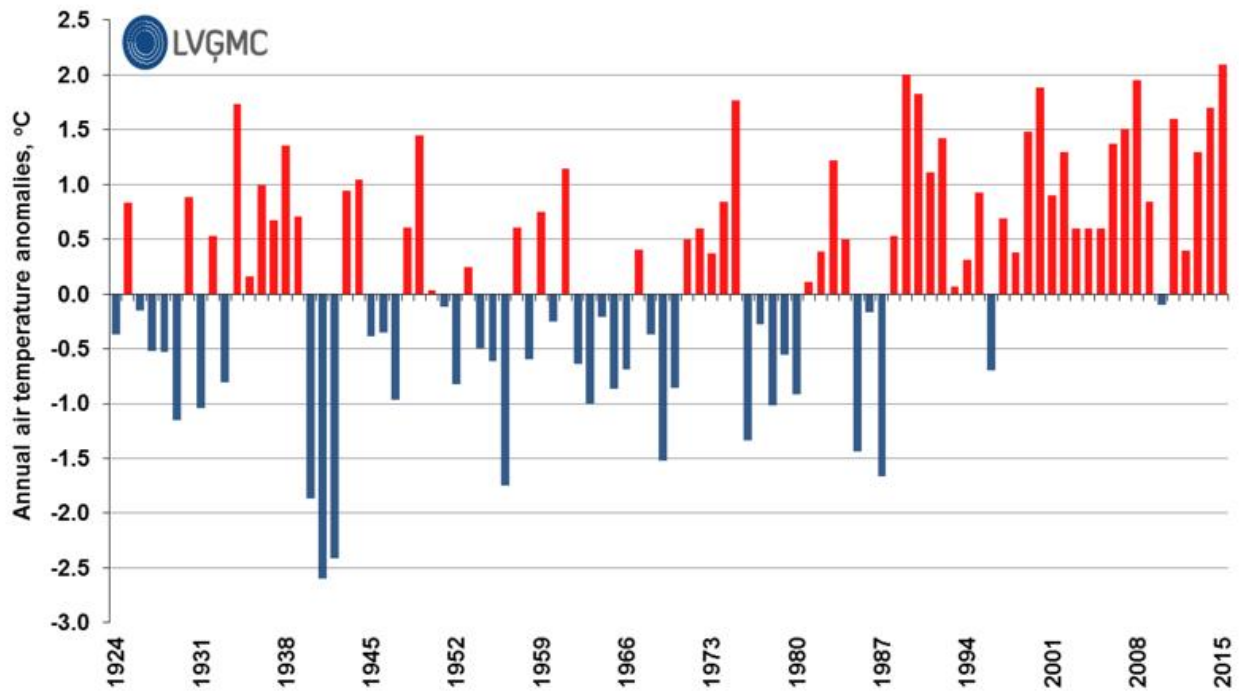


Figure 5.15: Time series of annual temperature anomalies for the period 1924-2015 for Latvia (reference period 1961-1990; diagram as provided by the NHMS)

Lithuania

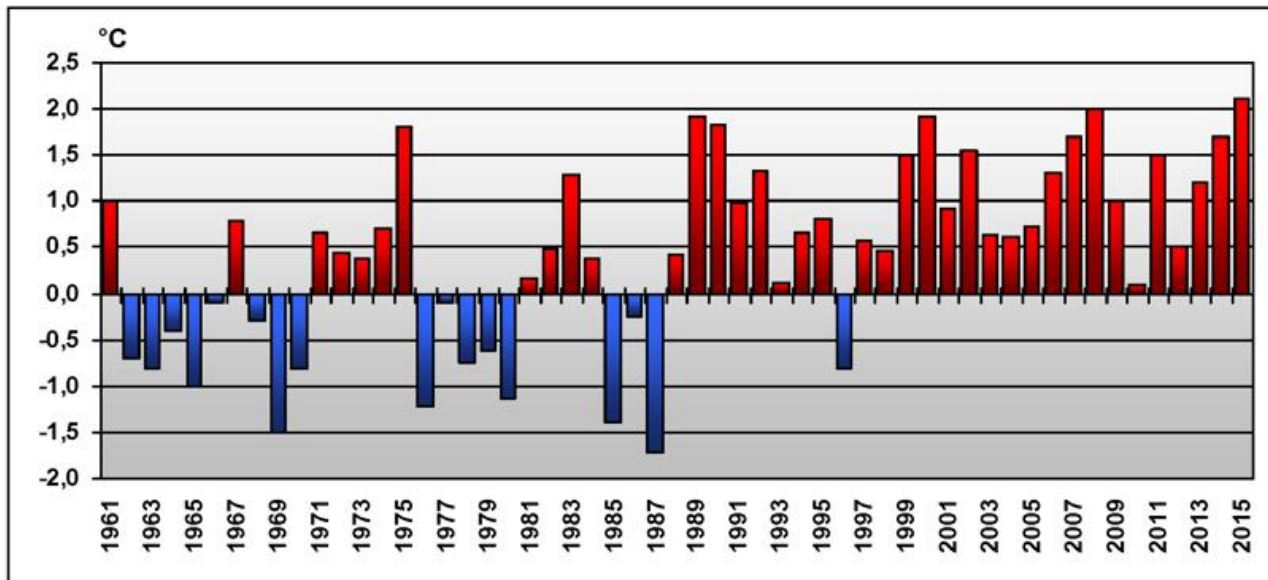


Figure 5.16: Time series of annual temperature anomalies for the period 1961-2015 for Lithuania (reference period 1961-1990; diagram as provided by the NHMS)

Nordic and Baltic Countries – annual temperature series

Norway

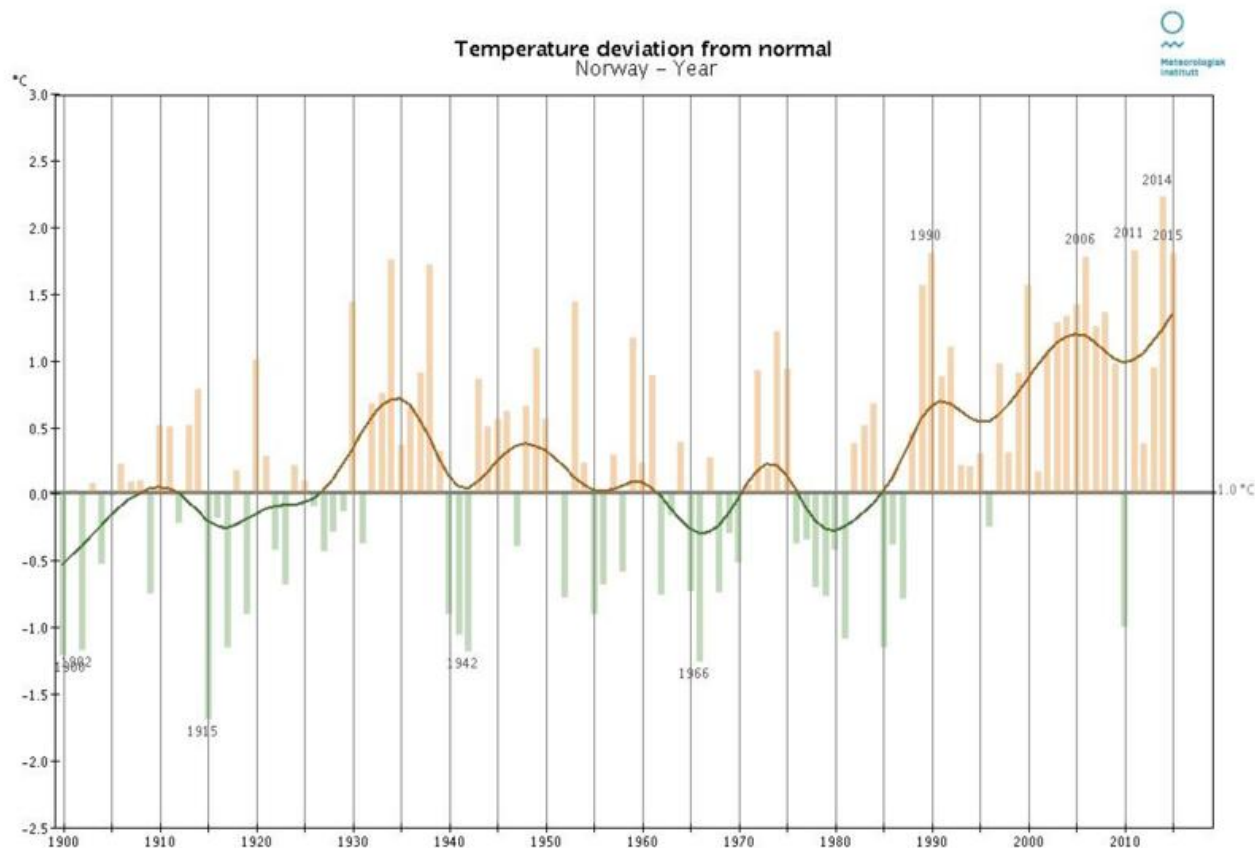


Figure 5.17: Time series of annual temperature anomalies for the period 1900-2015 for Norway (reference period 1961-1990; diagram as provided by the NHMS)

Sweden

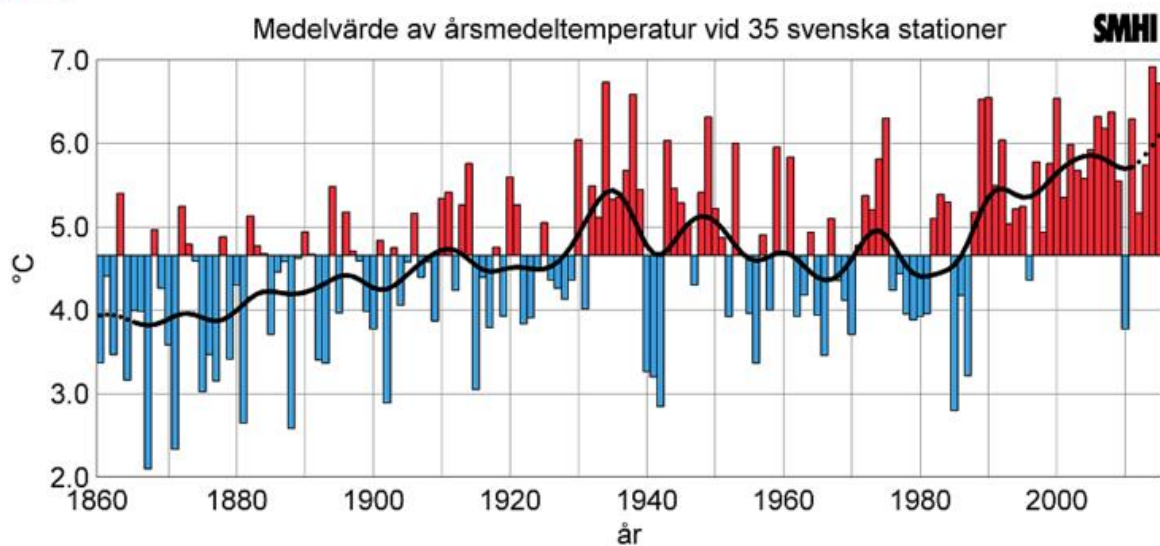


Figure 5.18: Time series of annual average temperature for the period 1900-2015 for Sweden (diagram as provided by the NHMS)

Iberia – annual temperature series

Portugal, Spain

Portugal

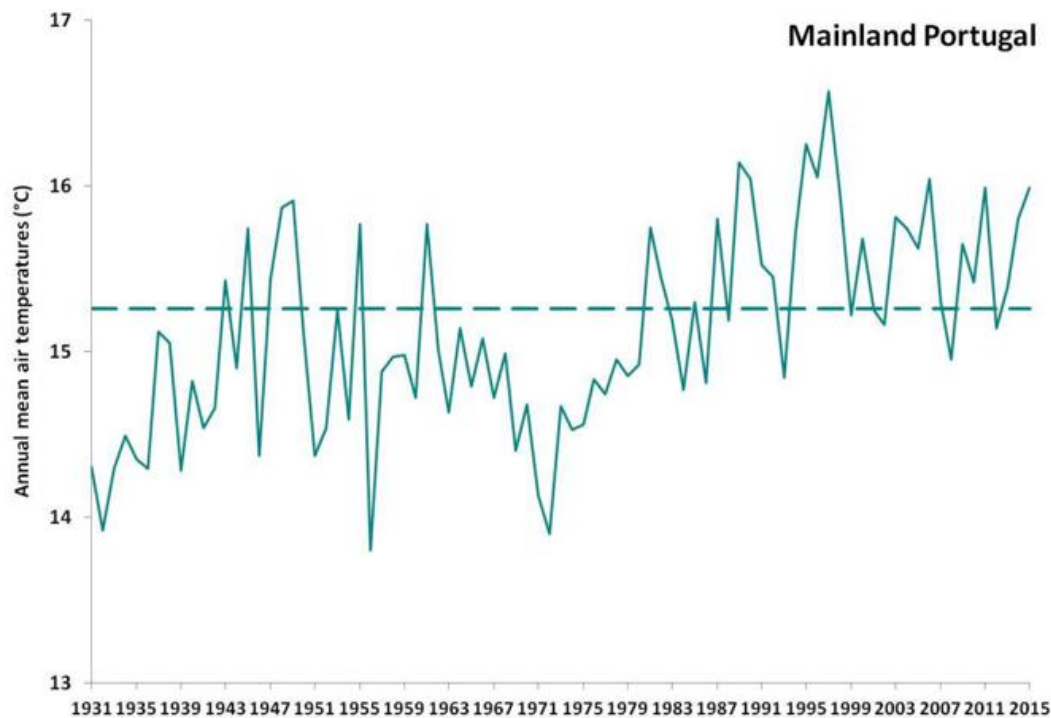


Figure 5.19: Time series of annual average temperature for the period 1931-2015 for Portugal (diagram as provided by the NHMS)

Spain

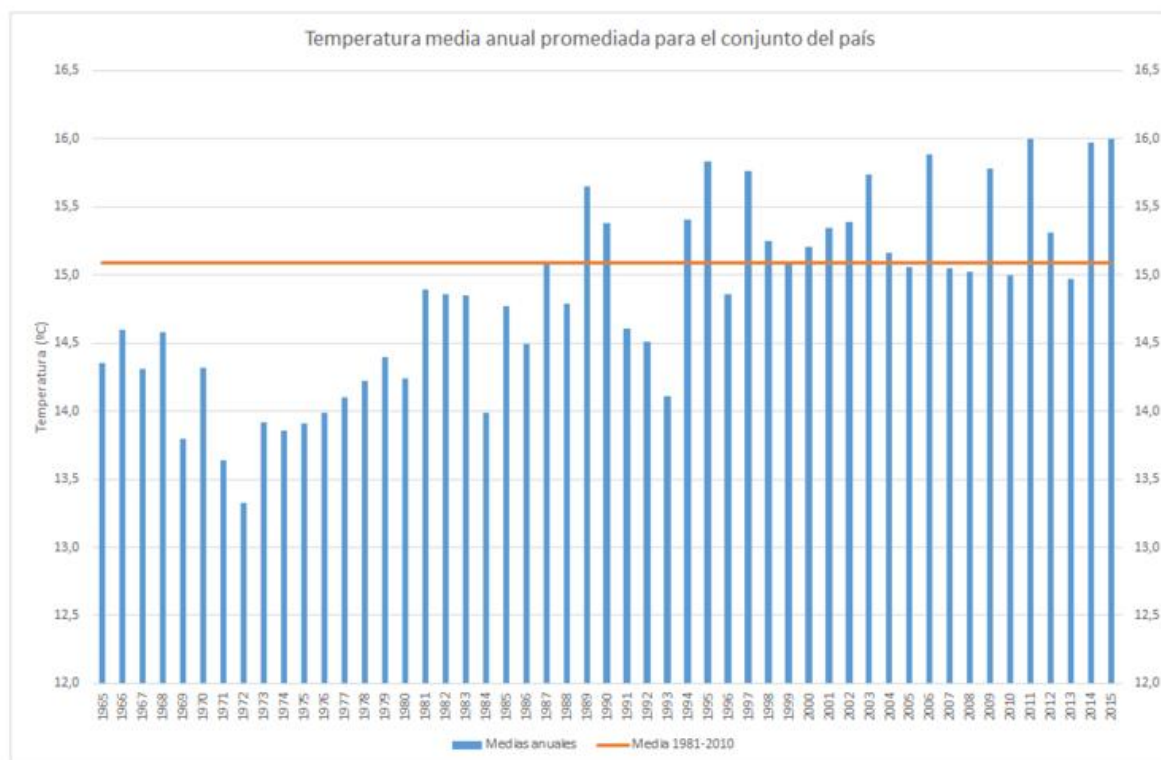


Figure 5.20: Time series of annual average temperature for the period 1965-2015 for Spain (diagram as provided by the NHMS)

Mediterranean, Italian and Balkan Peninsula – annual temperature series

Bulgaria, Croatia, Italy, Slovenia, Turkey

Bulgaria

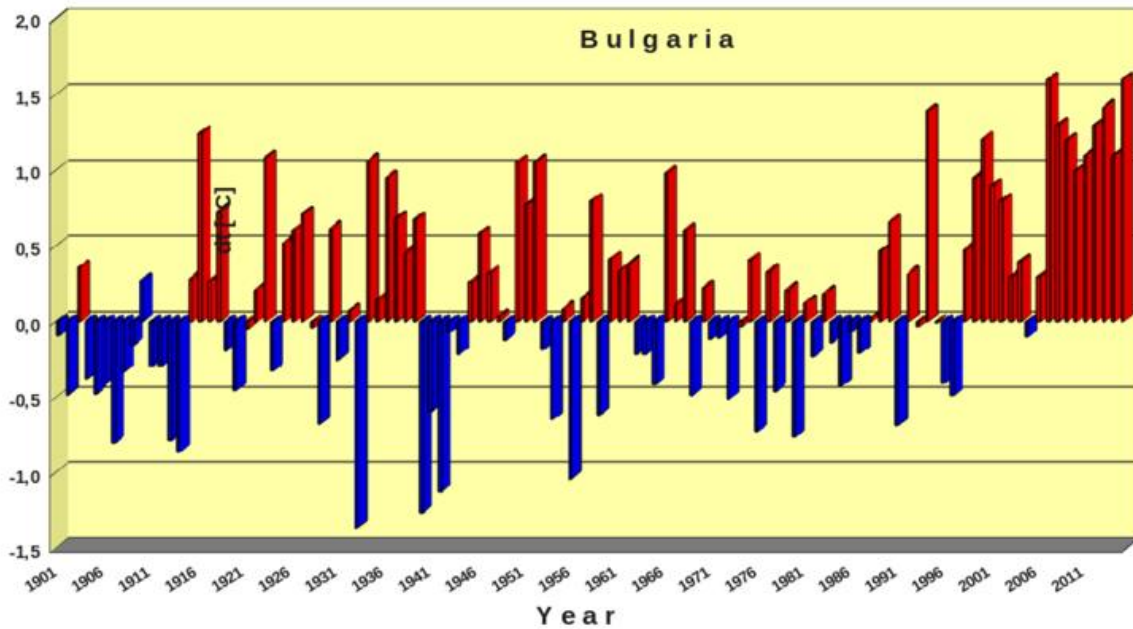


Figure 5.21: Time series of annual temperature anomalies for the period 1901-2015 for Bulgaria (reference period 1961-1990; diagram as provided by the NHMS)

Croatia

Average annual air temperature, ZAGREB-GRIČ (1862-2015)

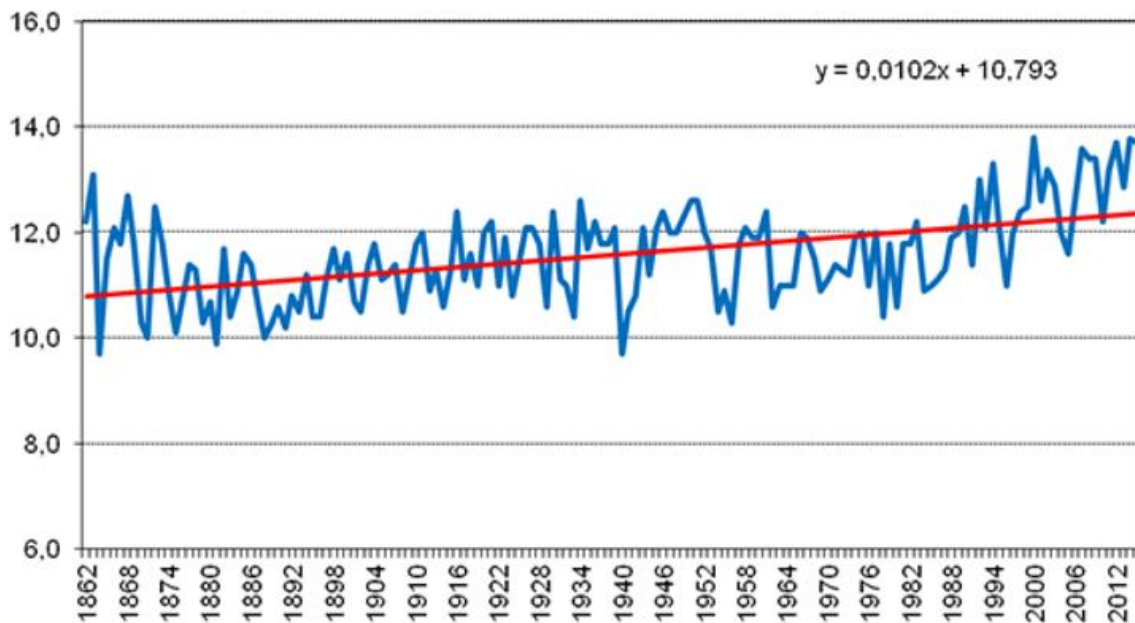


Figure 5.22: Time series of annual average temperature for Zagreb Grič (Croatia) for the period 1862-2015 (diagram as provided by the NHMS)

Mediterranean, Italian and Balkan Peninsula – annual temperature series

Italy

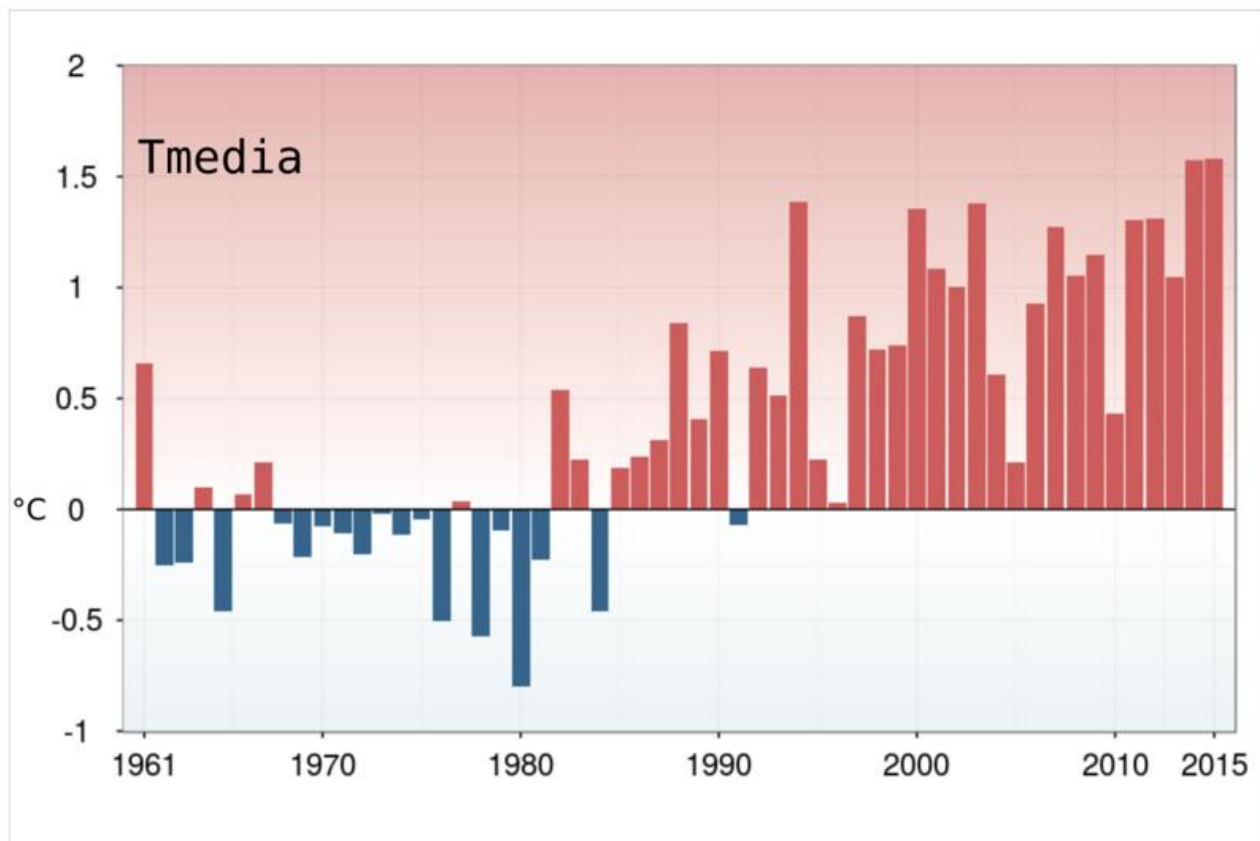


Figure 5.23: Time series of annual temperature anomalies for Italy for the period 1961-2015 (reference period 1961-1990; diagram as provided by the NHMS)

Slovenia

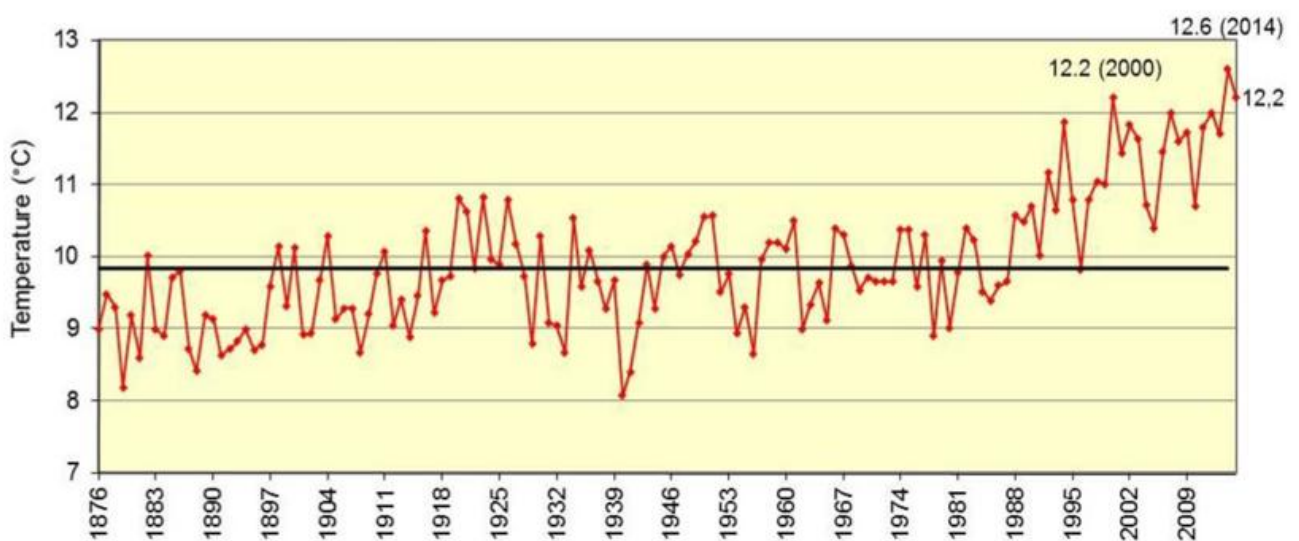


Figure 5.24: Time series of annual temperature anomalies for Ljubljana (Slovenia) for the period 1876-2015 (black line is the mean of the period 1961-1990; diagram as provided by the NHMS)

Mediterranean, Italian and Balkan Peninsula – annual temperature series

Turkey

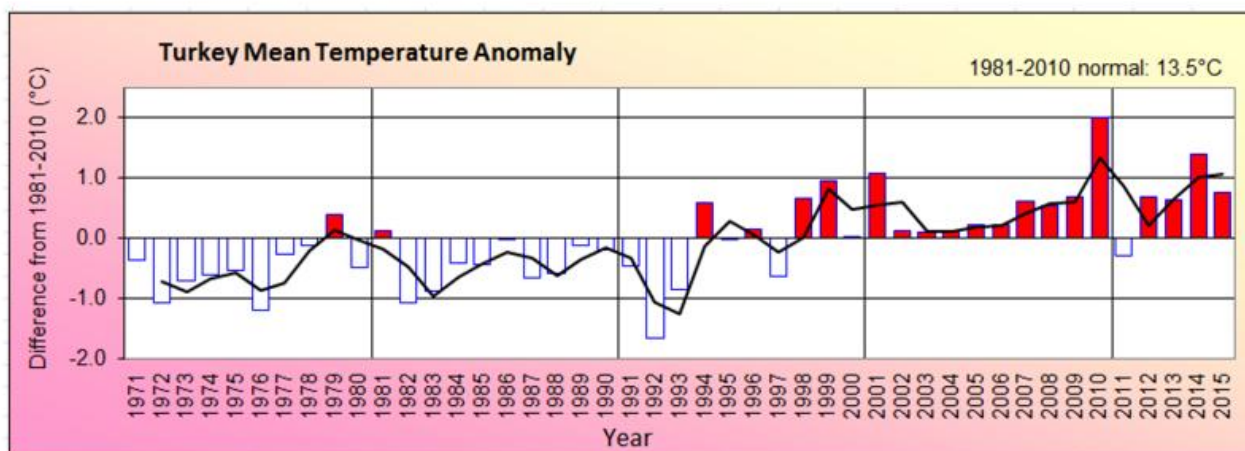


Figure 5.25: Time series of annual temperature anomalies for Turkey for the period 1971-2015 (reference period 1981-2010; diagram as provided by the NHMS)

Eastern Europe – annual temperature series

Belarus, Russia

Belarus

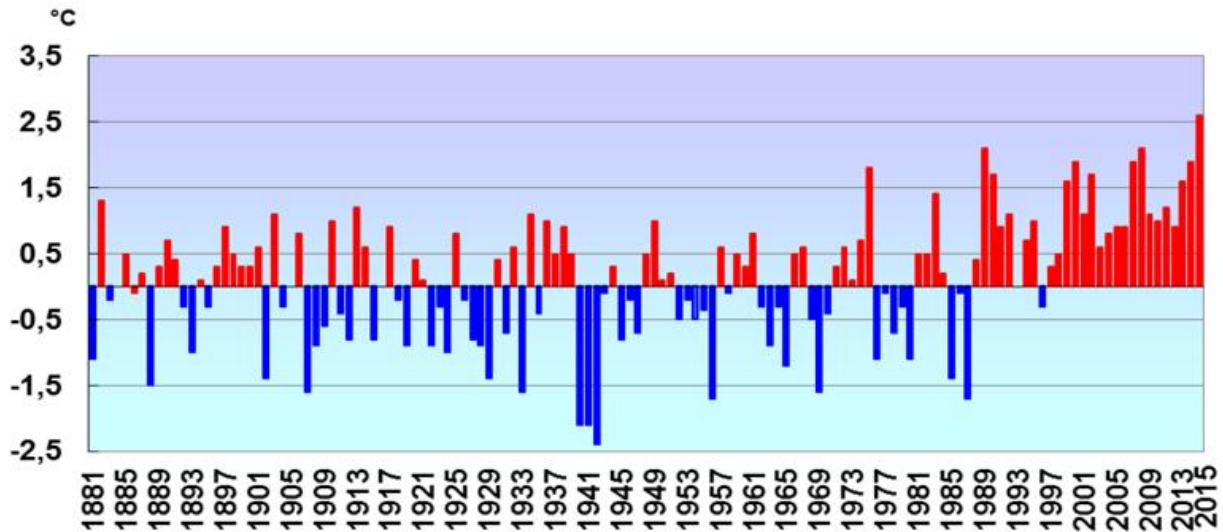


Figure 5.26: Time series of annual temperature anomalies for Belarus for the period 1881-2015 (reference period 1961-1990; diagram as provided by the NHMS)

European Russia

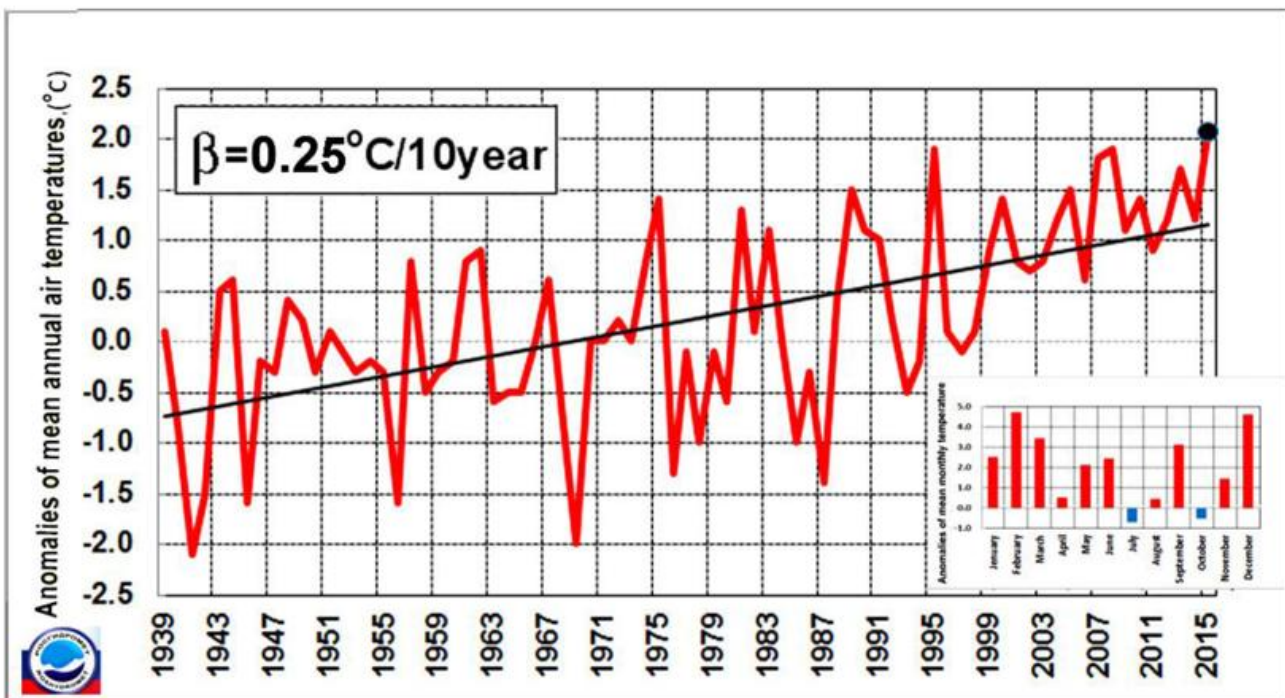


Figure 5.27: Time series of annual temperature anomalies for European Russia for the period 1939-2015 (reference period 1961-1990; diagram as provided by the NHMS)

Middle East – annual temperature series

Georgia, Israel, Kazakhstan

Georgia

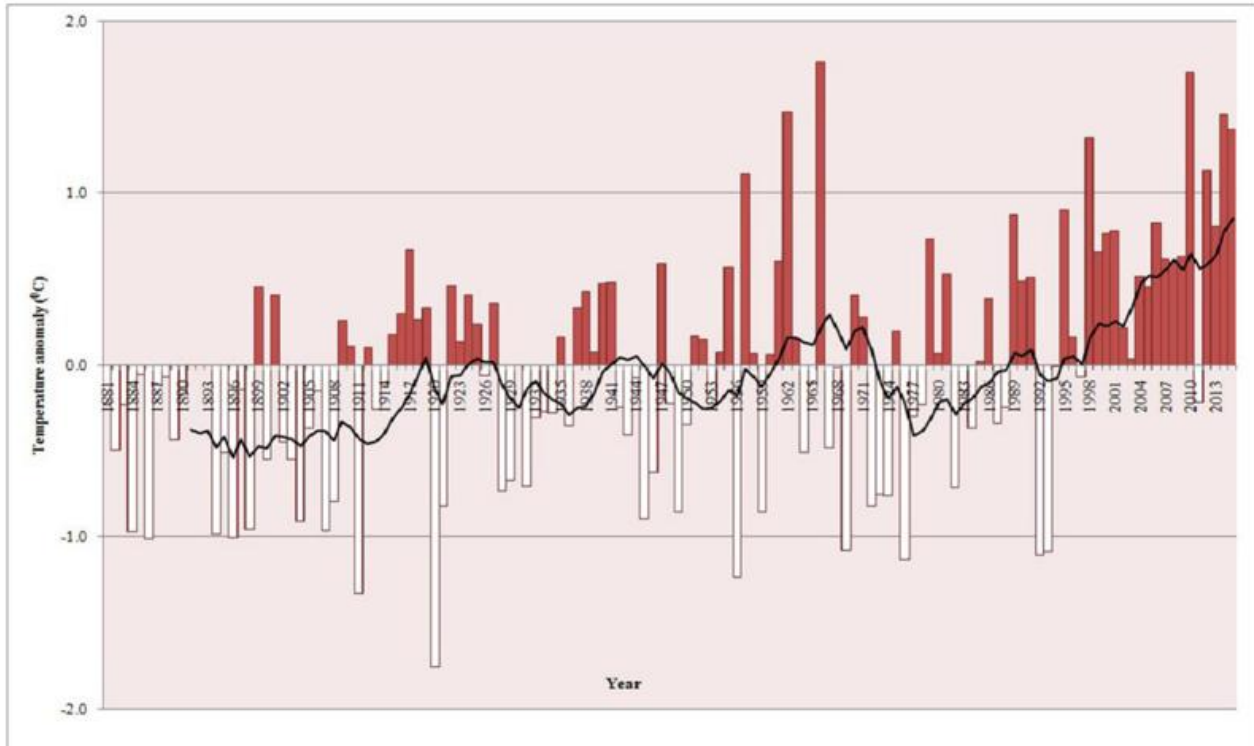


Figure 5.28: Time series of annual temperature anomalies and 11-yr moving averages for Tbilisi (Georgia) for the period 1881-2015 (reference period 1961-1990; diagram as provided by the NHMS)

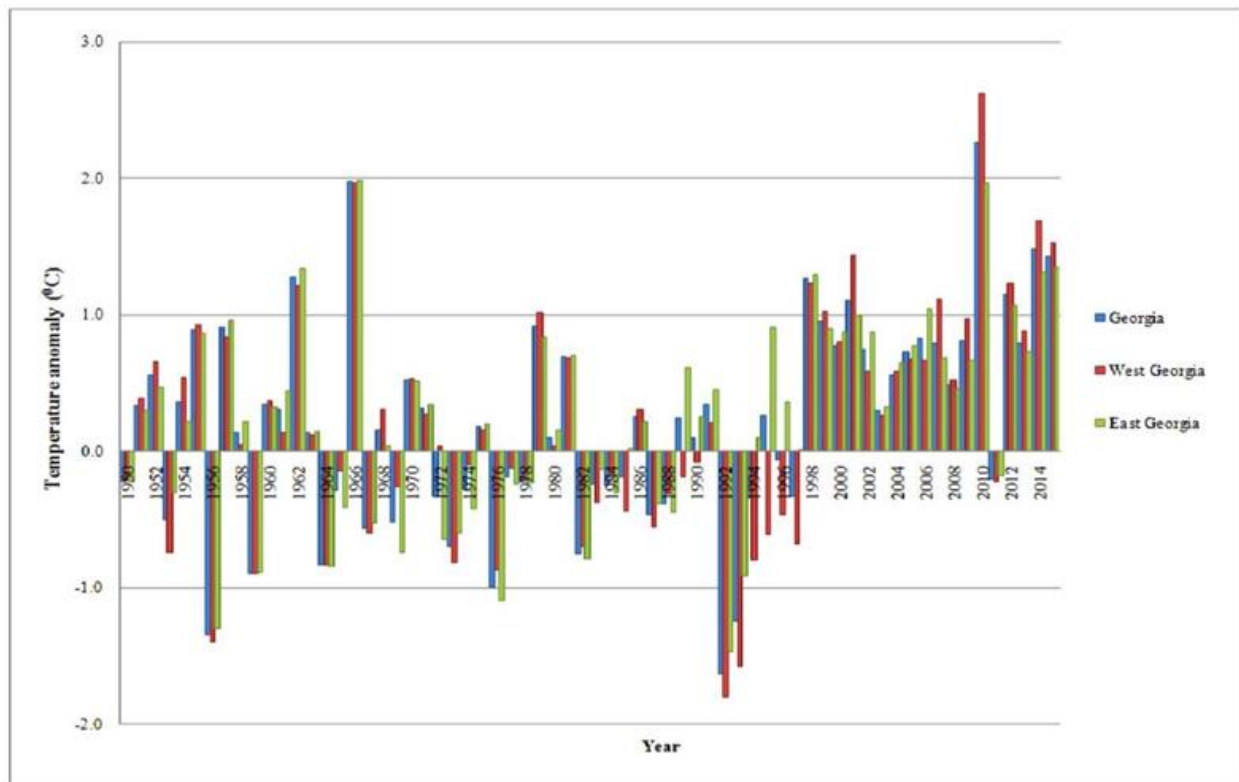


Figure 5.29: Time series of annual temperature anomalies for Georgia for the period 1961-2015 (reference period 1961-1990; diagram as provided by the NHMS)

Middle East – annual temperature series

Israel

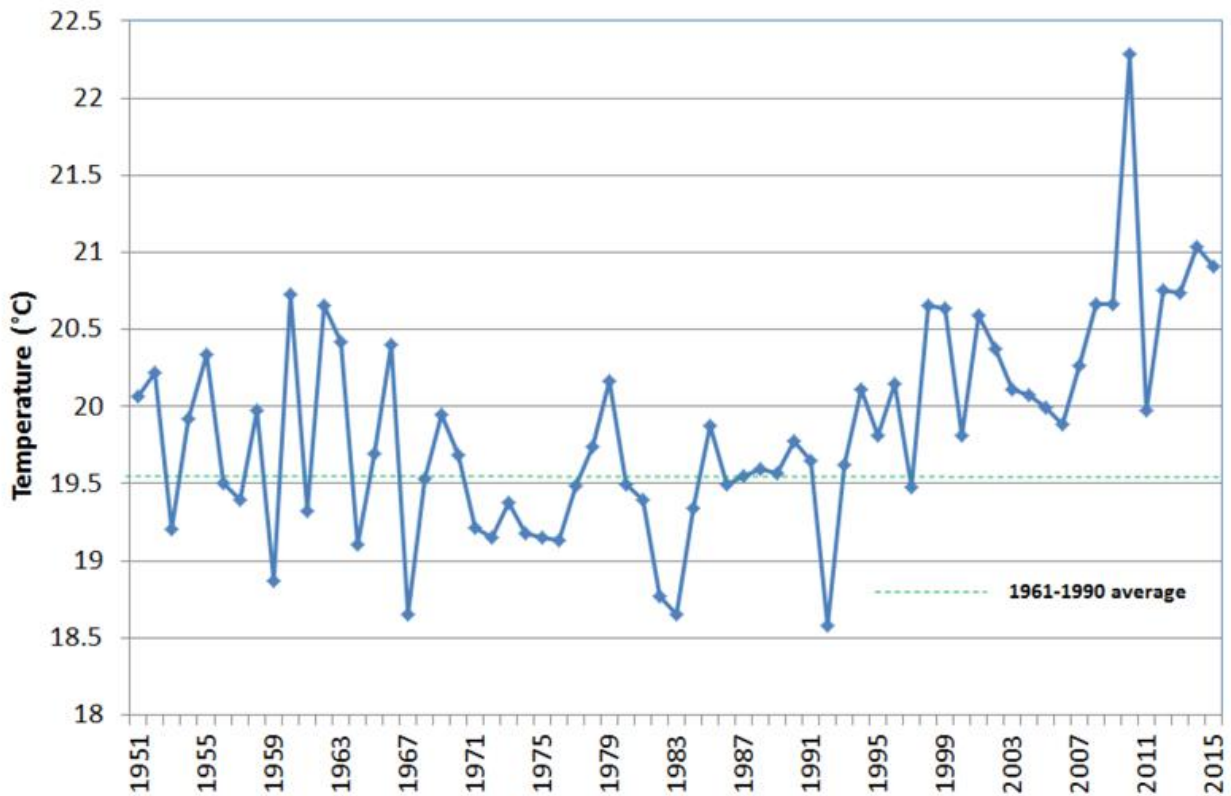


Figure 5.30: Time series of annual temperature for Israel (based on five stations) for the period 1951-2015 (diagram as provided by the NHMS)

Kazakhstan

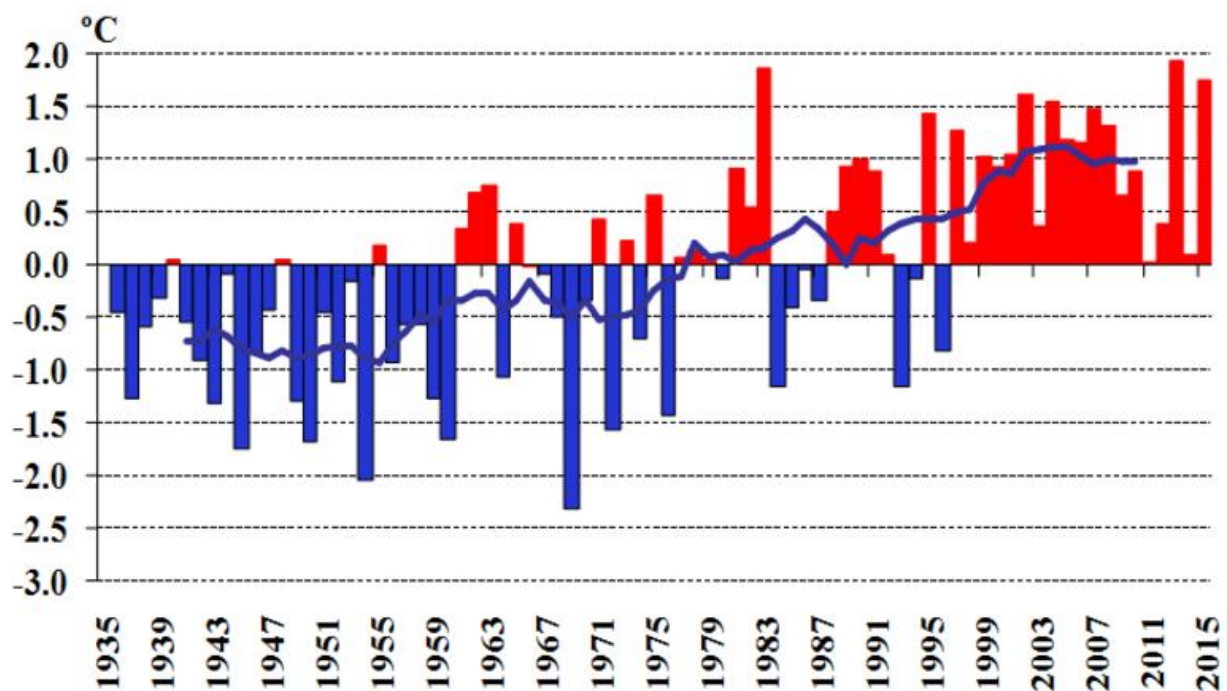


Figure 5.31: Annual average temperature anomalies for Kazakhstan for the period 1936-2015 with 11-year running mean (reference period 1961-1990, diagram as provided by the NHMS)

5.2. Precipitation

Central and Western Europe - precipitation totals and anomalies

Germany, Hungary, Switzerland, United Kingdom

Germany

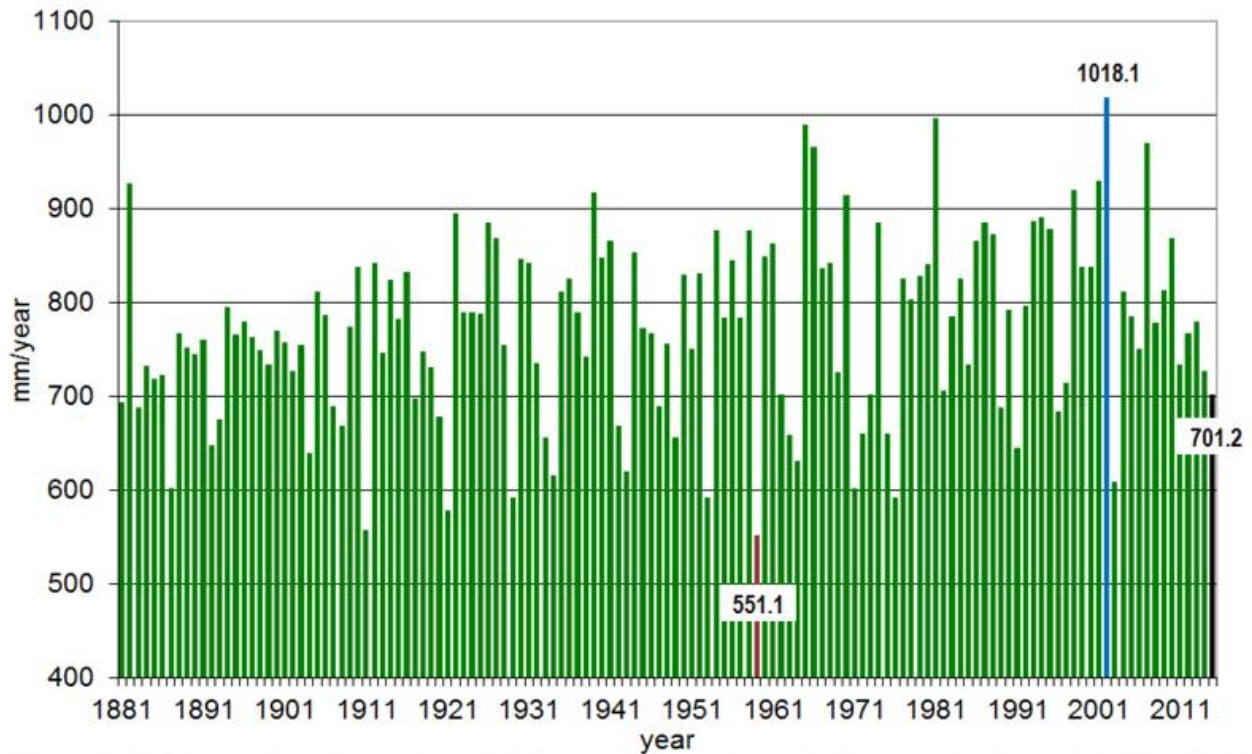


Figure 5.32: Time series of annual precipitation totals in mm/year for Germany for the period 1881-2015 (Diagram as provided by the NHMS)

Hungary

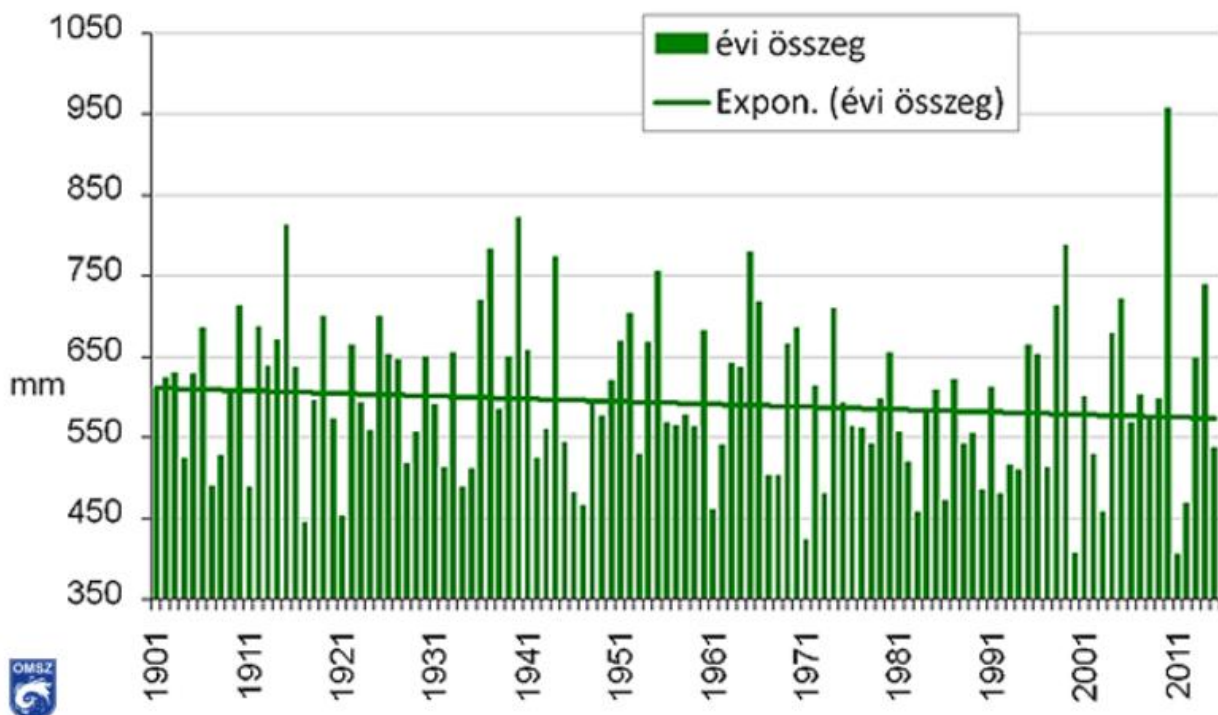


Figure 5.33: Time series of annual precipitation totals in mm/year for Hungary (Diagram as provided by the NHMS)

Central and Western Europe - precipitation totals and anomalies

Switzerland

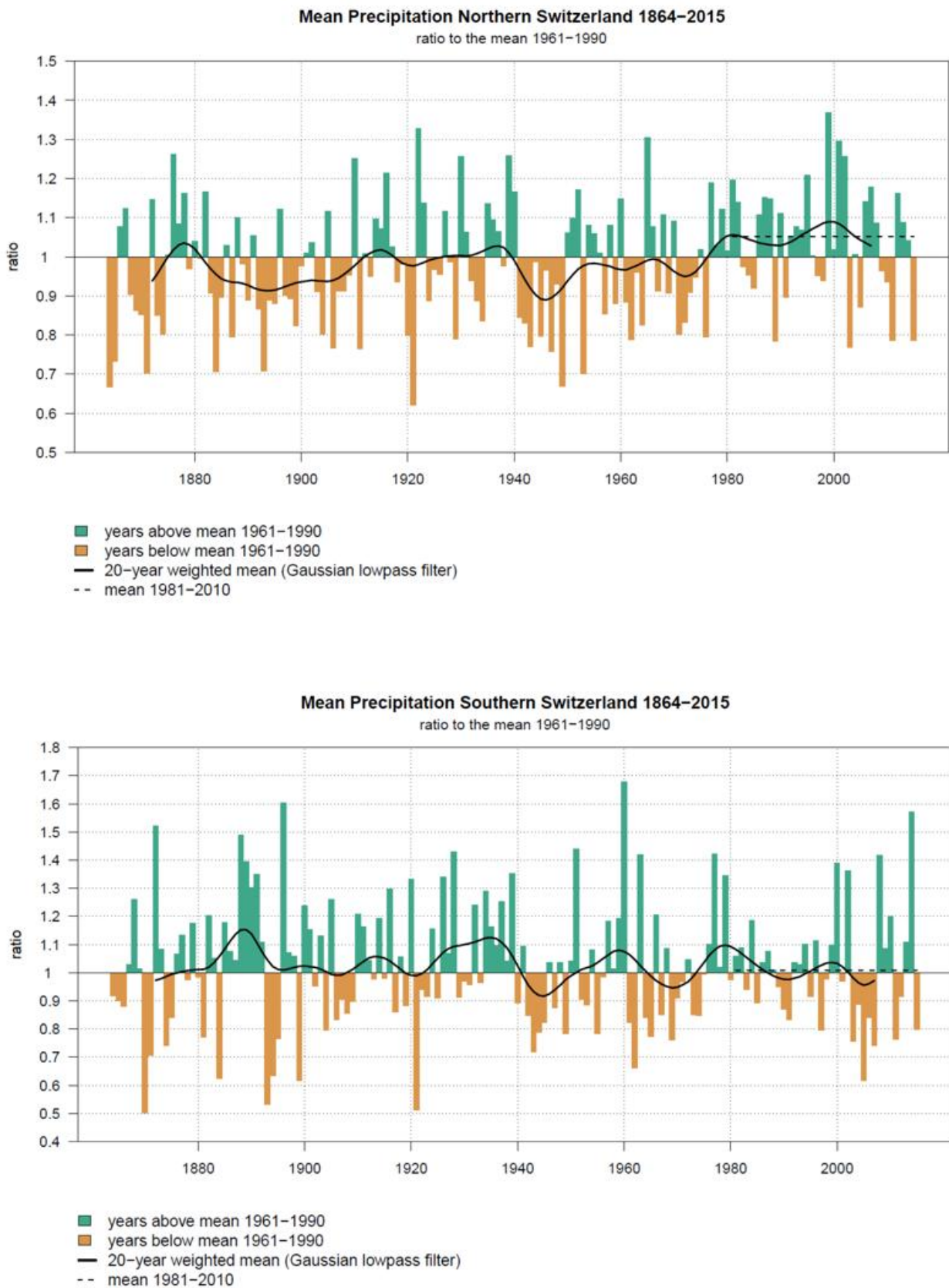


Figure 5.34: Time series of annual precipitation anomalies in relation to the mean of 1961–90 for northern (top) and southern (bottom) Switzerland (diagram as provided by the NHMS)

Central and Western Europe - precipitation totals and anomalies

United Kingdom

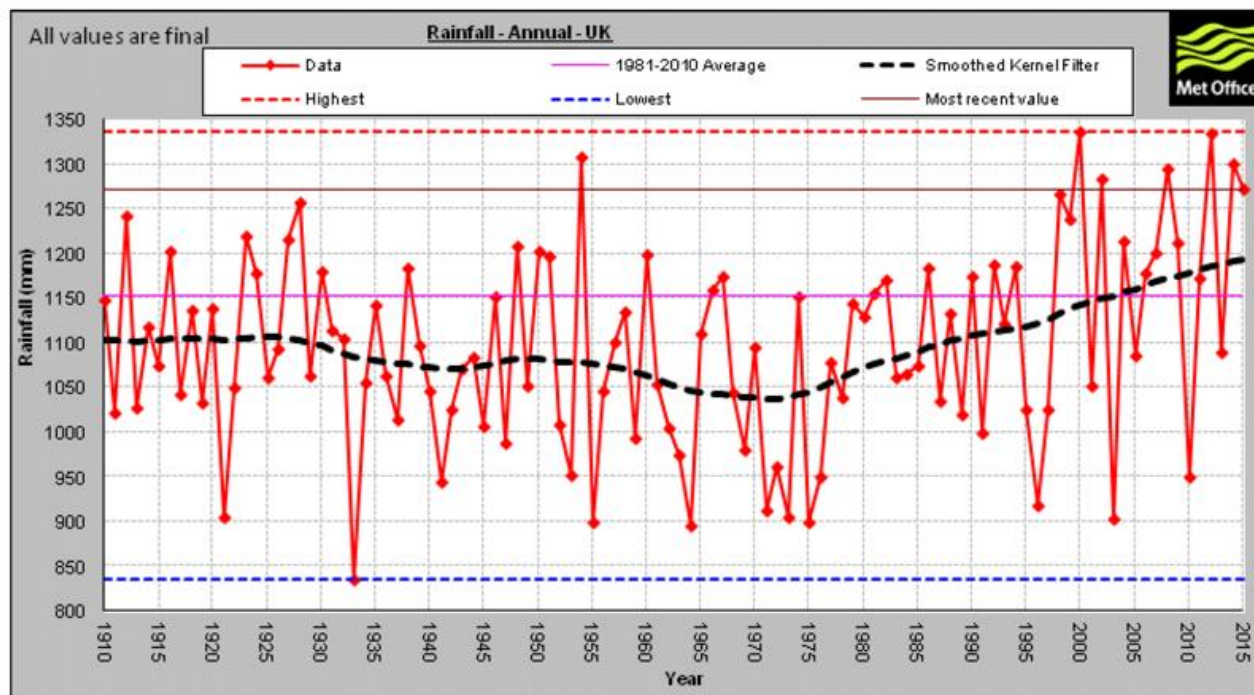


Figure 5.35: Time series of annual precipitation totals in mm/year for the United Kingdom (Diagram as provided by the NHMS)

Nordic and Baltic Countries - precipitation totals and anomalies

Denmark, Finland, Latvia, Norway, Sweden

Denmark

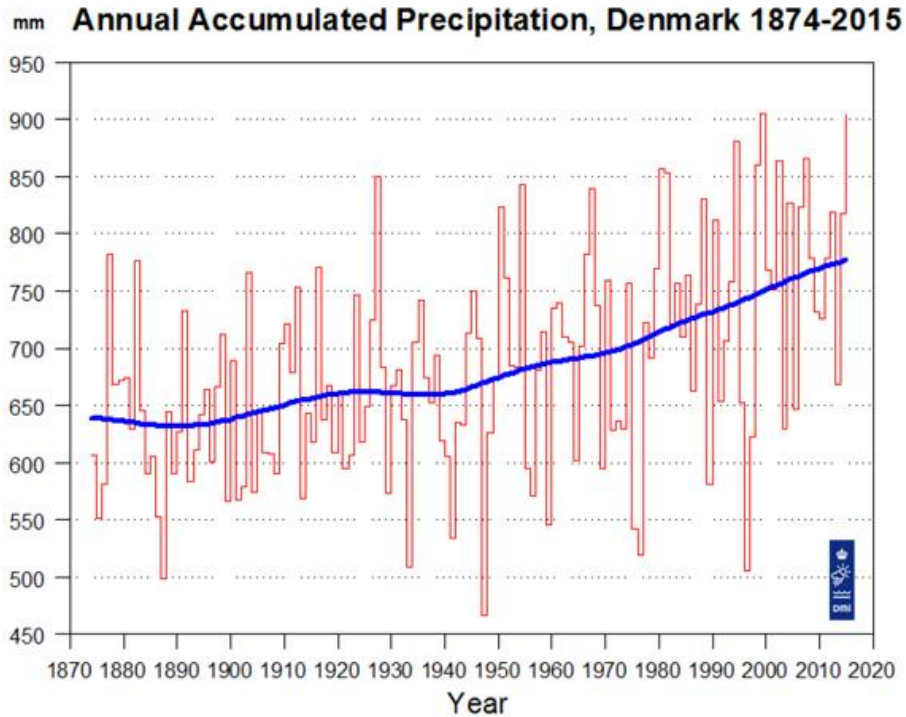


Figure 5.36: Time series of annual precipitation totals in mm/year for Denmark (Diagram as provided by the NHMS)

Finland

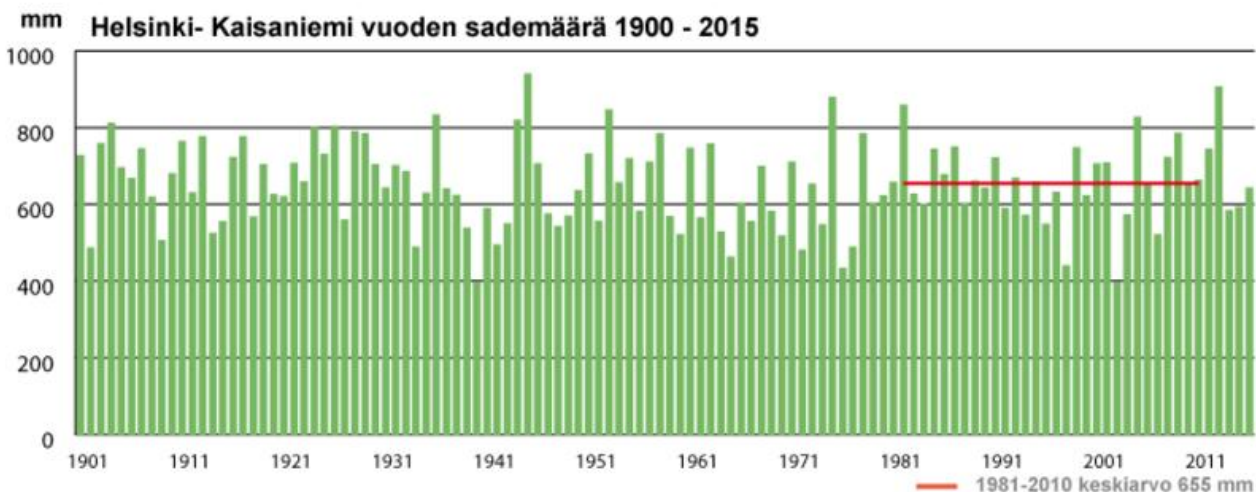


Figure 5.37: Time series of annual precipitation totals in mm/year at station Helsinki, Finland (Diagram as provided by the NHMS)

Nordic and Baltic Countries - precipitation totals and anomalies

Latvia

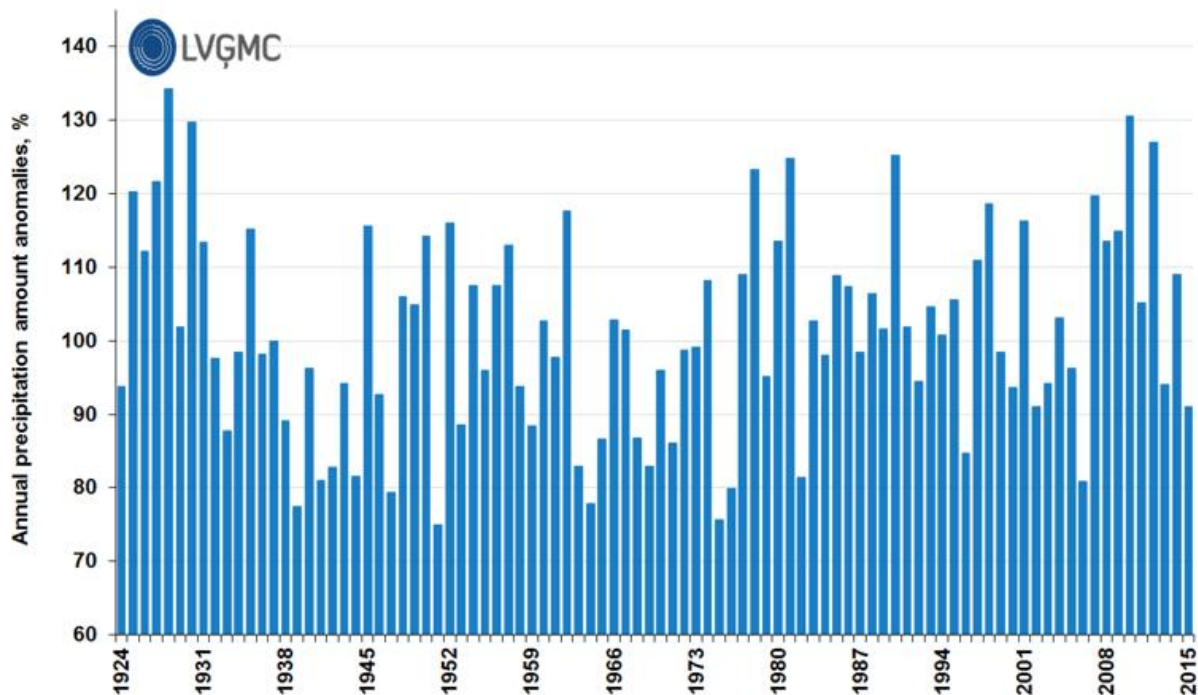


Figure 5.38: Time series of annual precipitation totals in relation to the mean of 1961-90 for Latvia (Diagram as provided by the NHMS)

Nordic and Baltic Countries - precipitation totals and anomalies

Norway

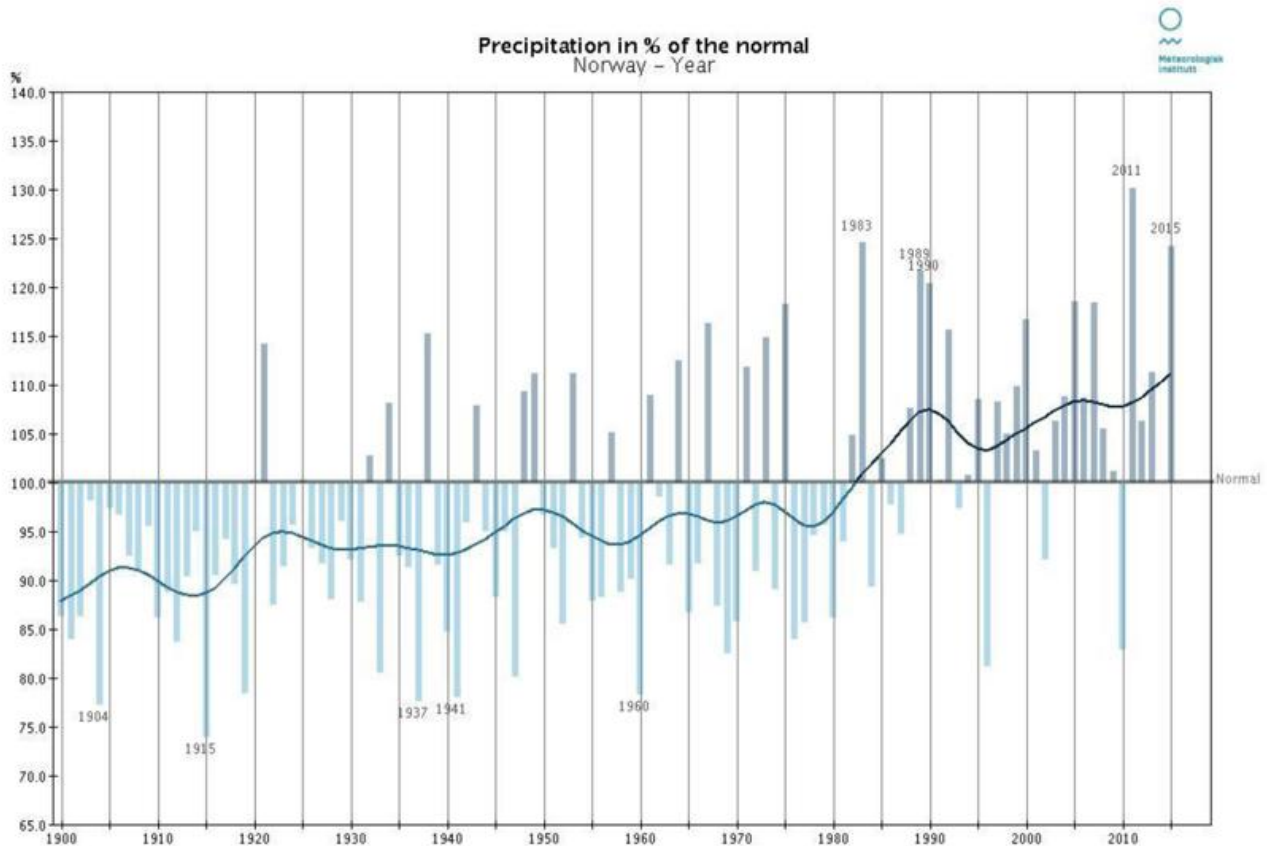


Figure 5.39: Time series of annual precipitation totals in relation to the mean of 1961-90 for Norway (Diagram as provided by the NHMS)

Sweden

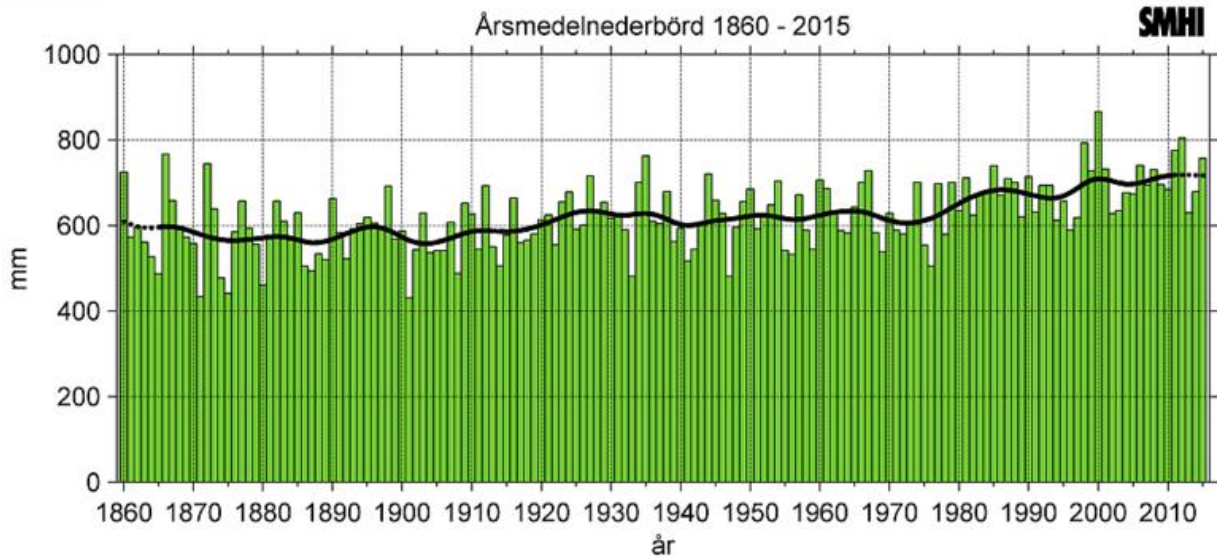


Figure 5.40: Time series of annual precipitation totals in mm/year for Sweden (Diagram as provided by the NHMS)

Iberia - precipitation anomalies

Portugal

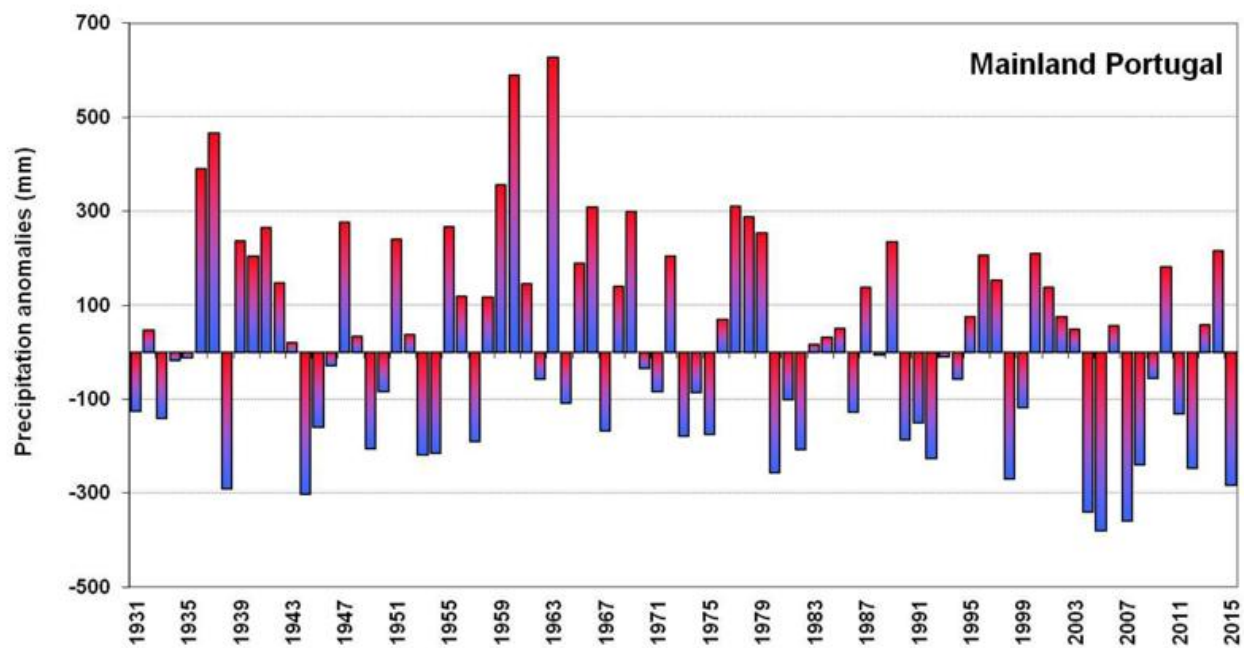


Figure 5.41: Time series of annual precipitation totals in mm/year (deviations from the mean of 1971-2000) for Portugal (Diagram as provided by the NHMS)

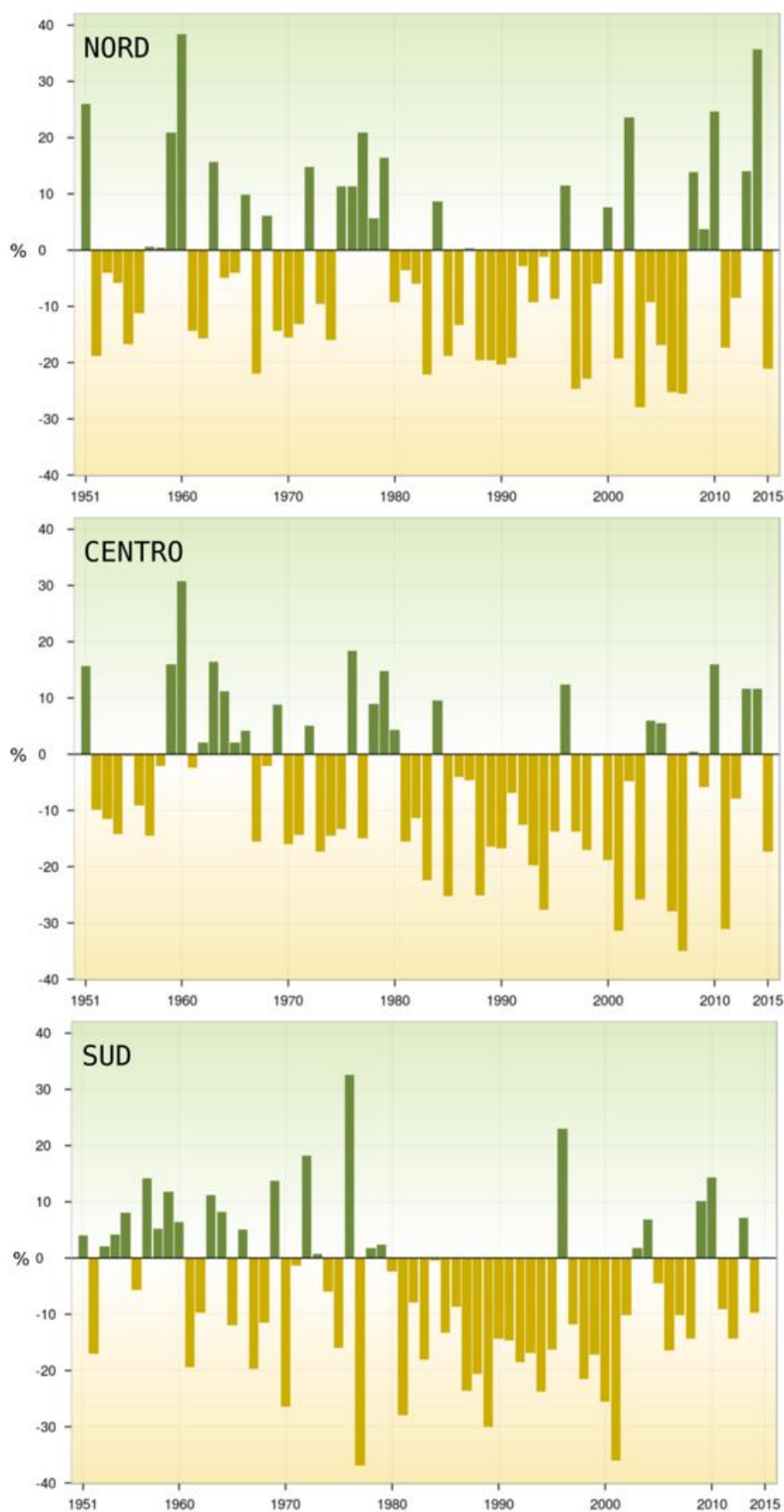
Mediterranean, Italian and Balkan Peninsula - precipitation anomalies*Italy, Slovenia, Turkey***Italy**

Figure 5.42: Time series of annual precipitation anomalies in relation to the mean of 1961-90 for north (top), Central (middle) and southern Italy (bottom, diagram as provided by the NHMS)

Mediterranean, Italian and Balkan Peninsula - precipitation anomalies

Slovenia

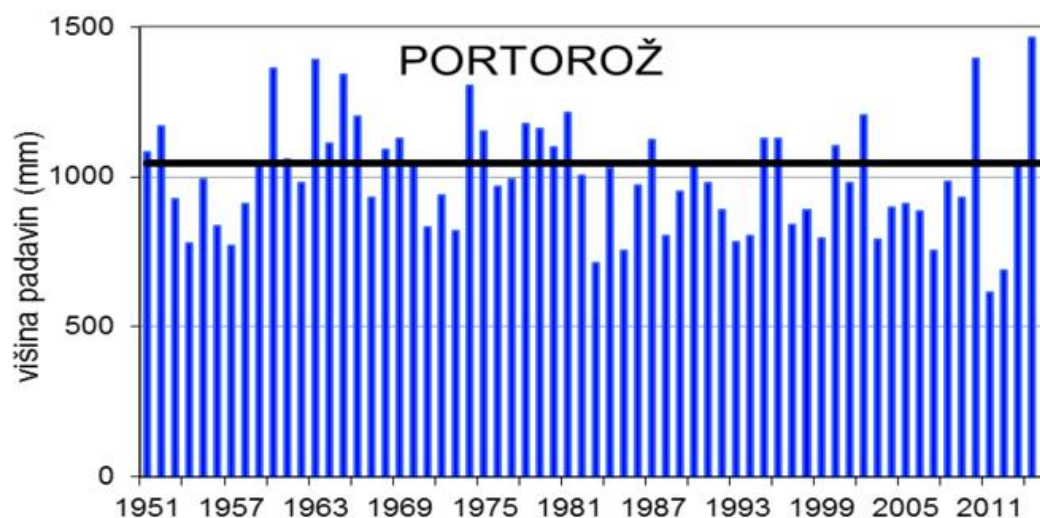


Figure 5.43: Time series of annual precipitation totals in mm/year for station Portorož (diagram as provided by the NHMS)

Turkey

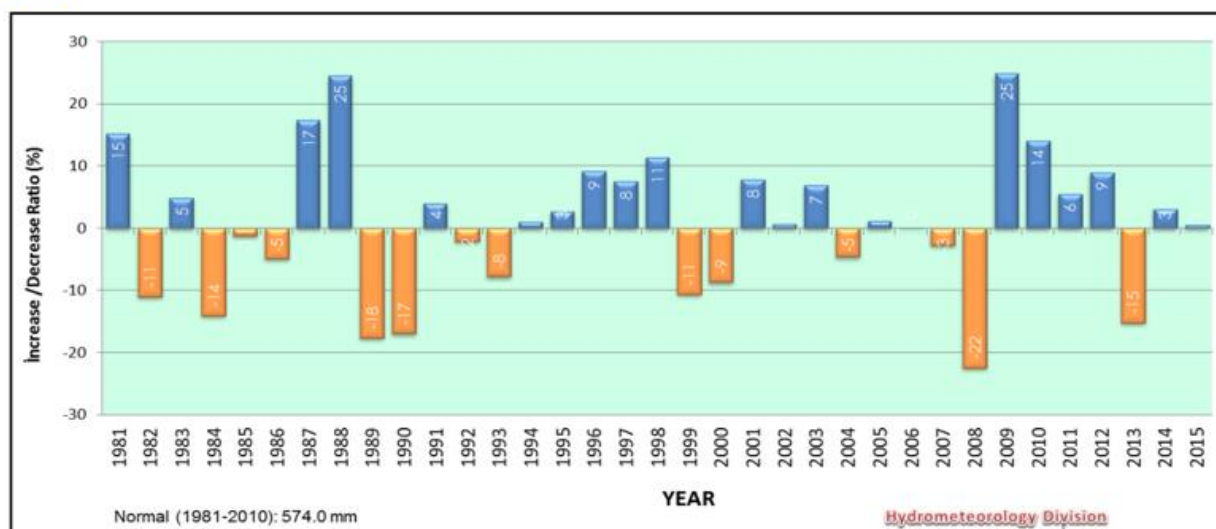


Figure 5.44: Time series of annual precipitation anomalies in relation to the mean of 1981-2010 for Turkey (Diagram as provided by the NHMS)

Eastern Europe - precipitation anomalies

Belarus, European Russia

Belarus

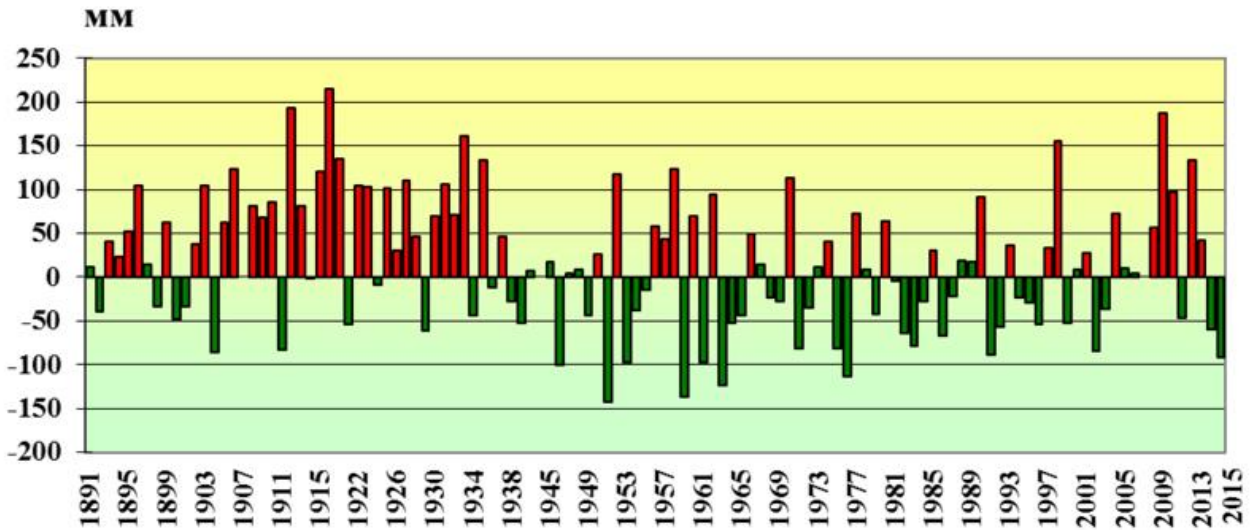


Figure 5.45: Anomalies of annual precipitation totals for Belarus (base period: 1961-1990; Diagram as provided by the NHMS)

European Russia

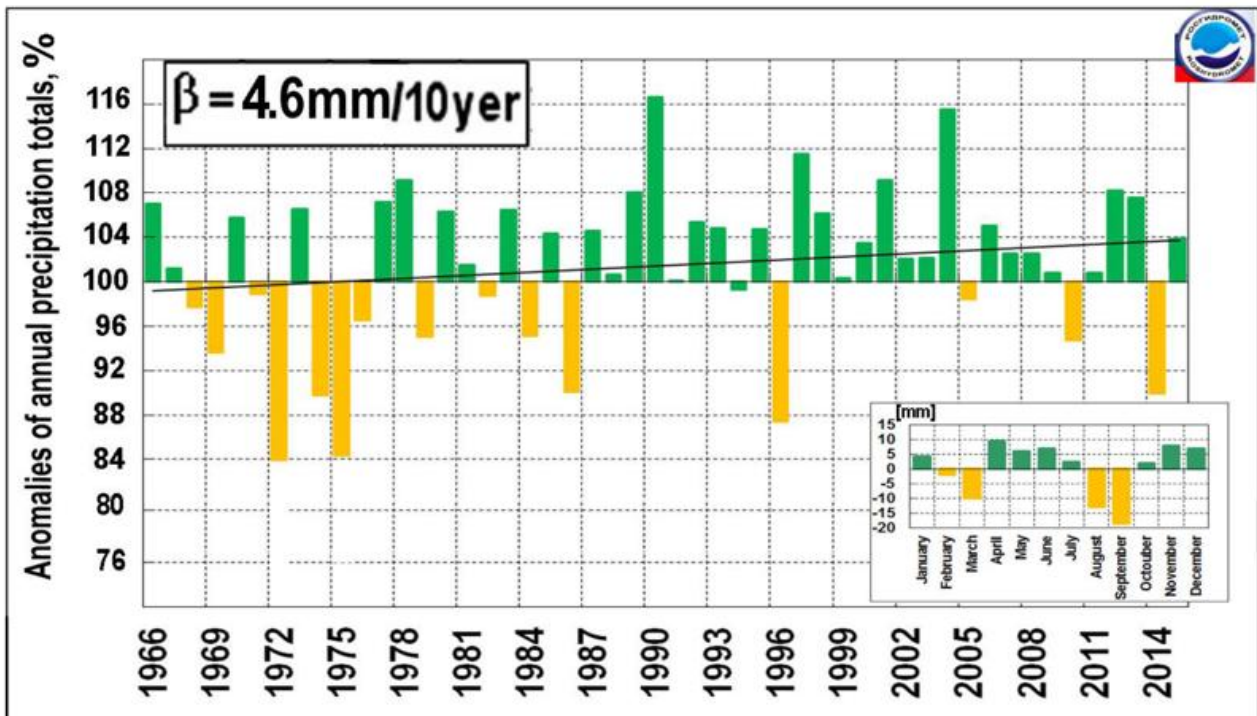


Figure 5.46: Time series of annual precipitation totals in relation to the mean of 1961-1990 for European Russia (Diagram as provided by the NHMS)

Middle East - precipitation anomalies

Georgia

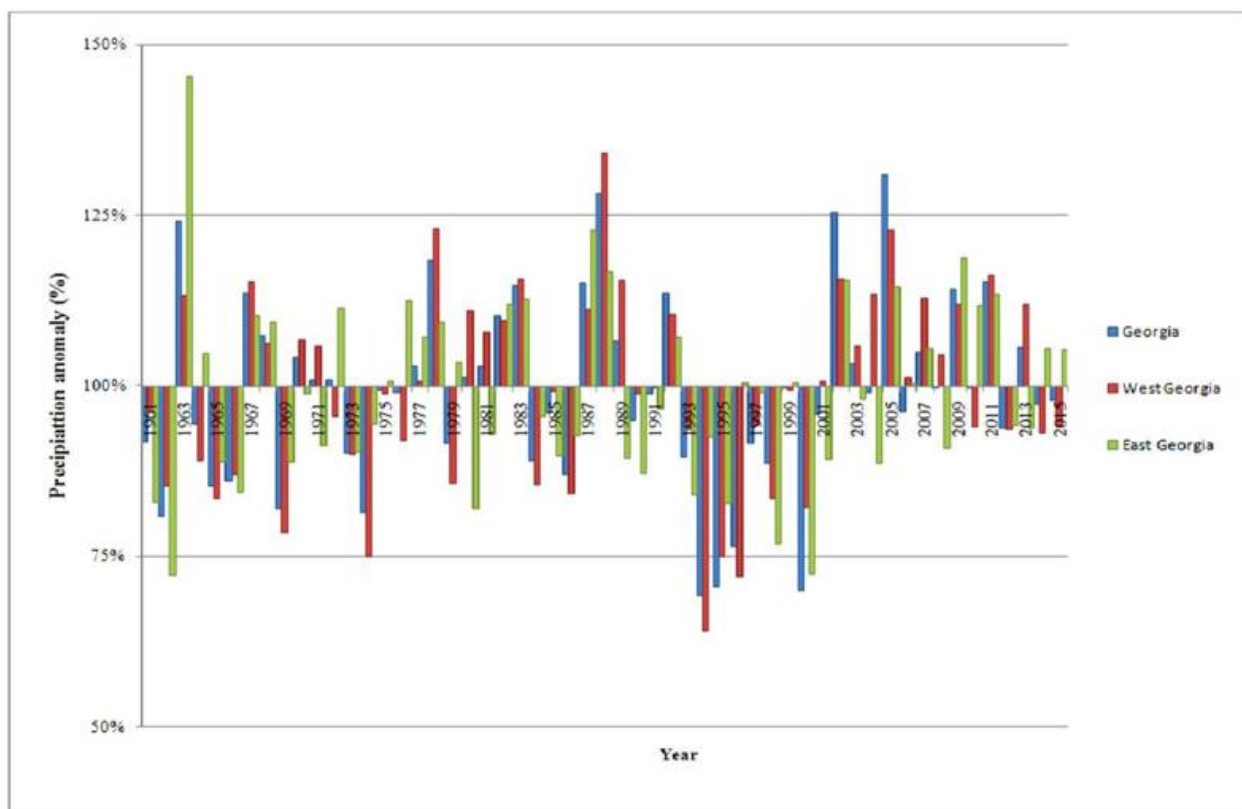


Figure 5.47: Time series of annual precipitation totals in relation to the mean of 1961-1990 for Georgia (Diagram as provided by the NHMS)

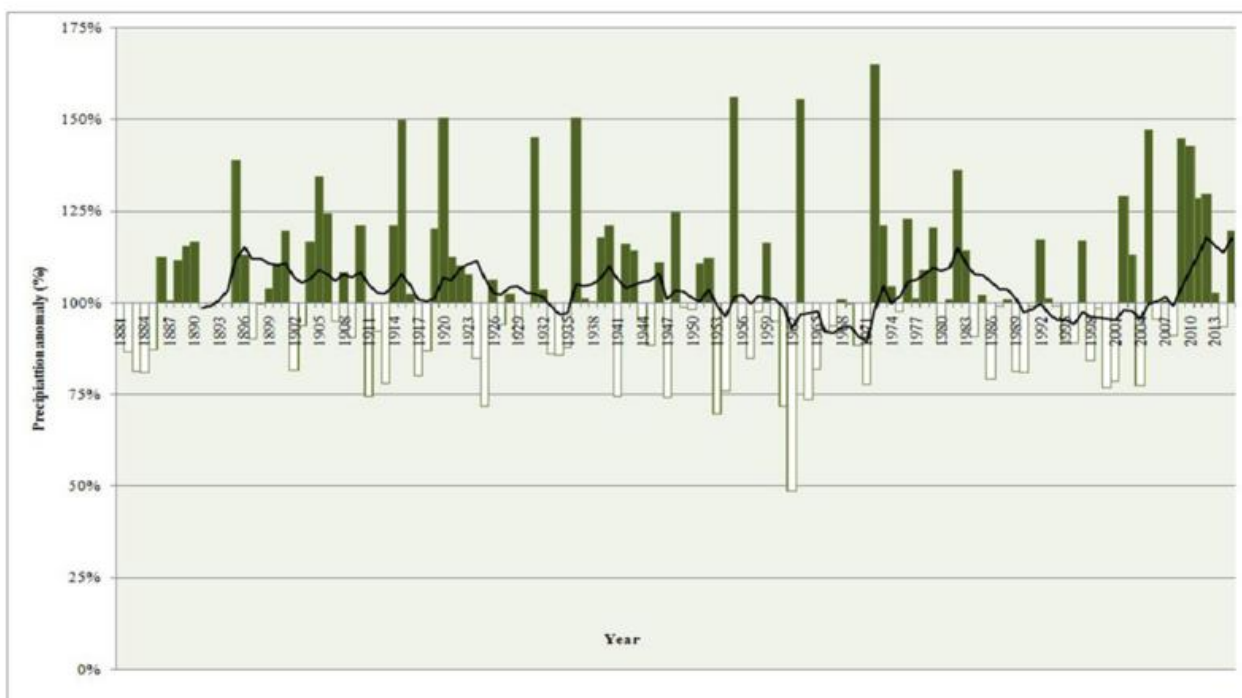


Figure 5.48: Time series of annual precipitation totals in relation to the mean of 1961-1990 for Tbilisi, Georgia (Diagram as provided by the NHMS)

5.3. Sunshine duration

Central and Western Europe - sunshine duration anomalies

Germany, Switzerland, United Kingdom

Germany

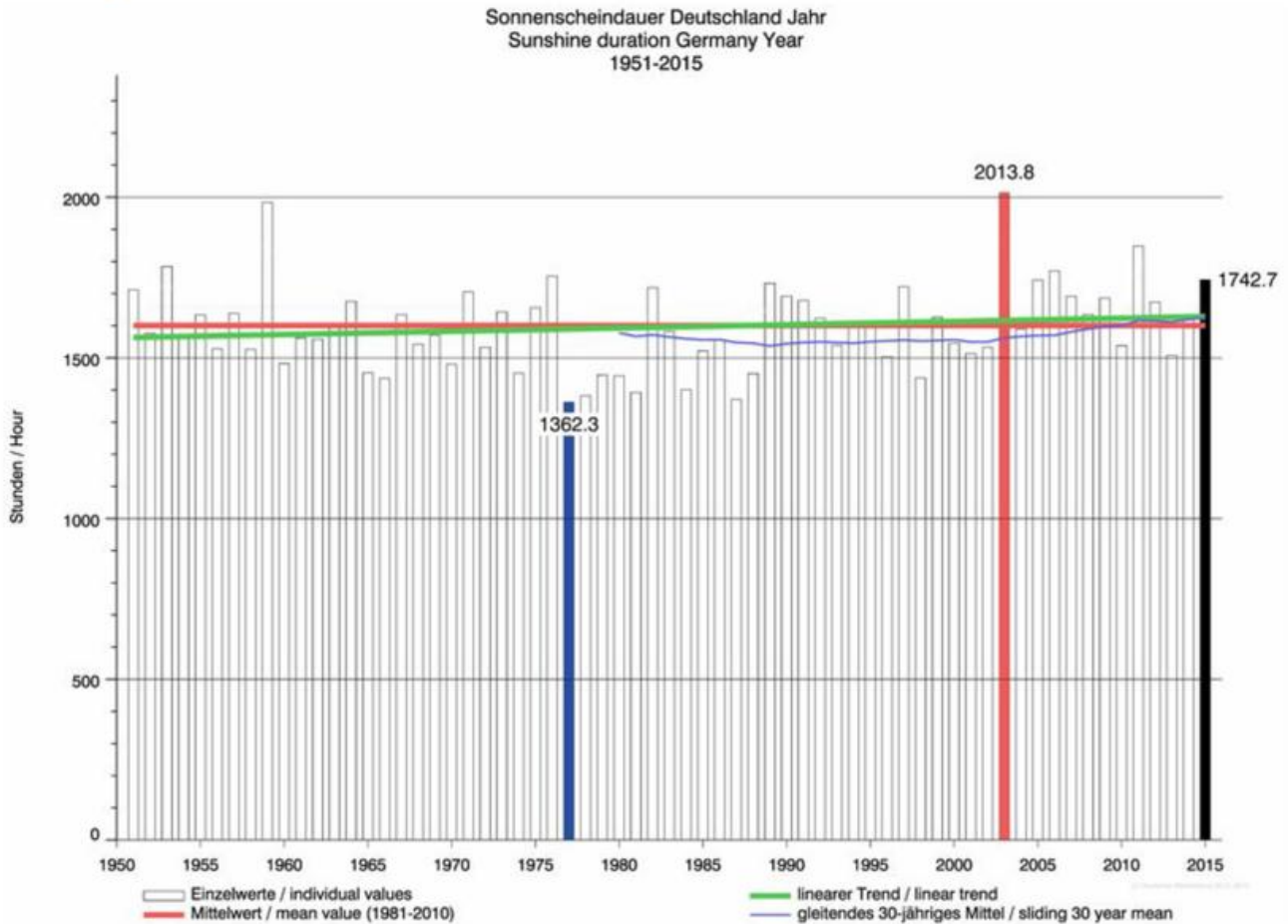


Figure 5.49: Time series of annual sum of the sunshine duration in hours for Germany (Diagram as provided by the NHMS)

Northern and Southern Switzerland

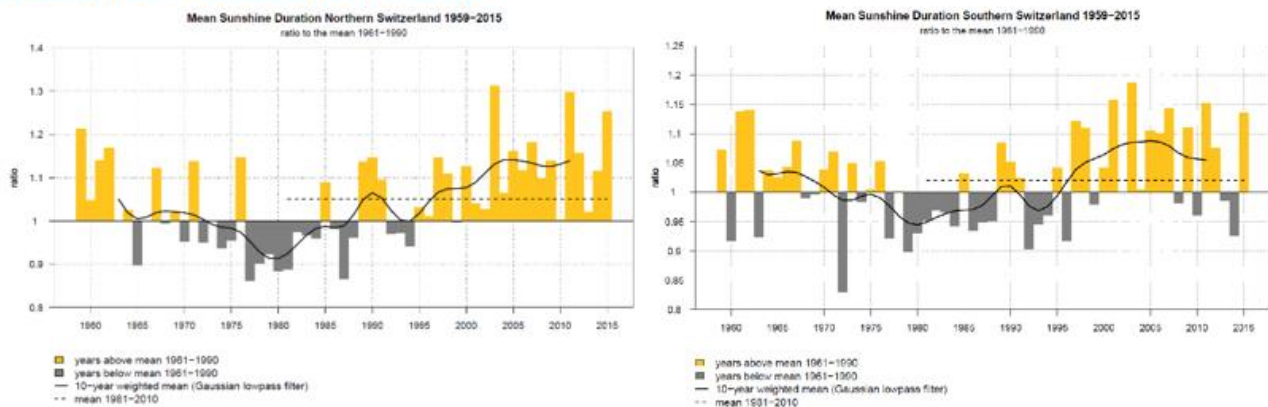


Figure 5.50: Time series of annual sunshine duration anomalies as ratio of the mean 1961-1990 for Northern (left) and Southern (right) Switzerland (reference period: 1961-1990; diagram as provided by the NHMS)

Central and Western Europe - sunshine duration anomalies

United Kingdom

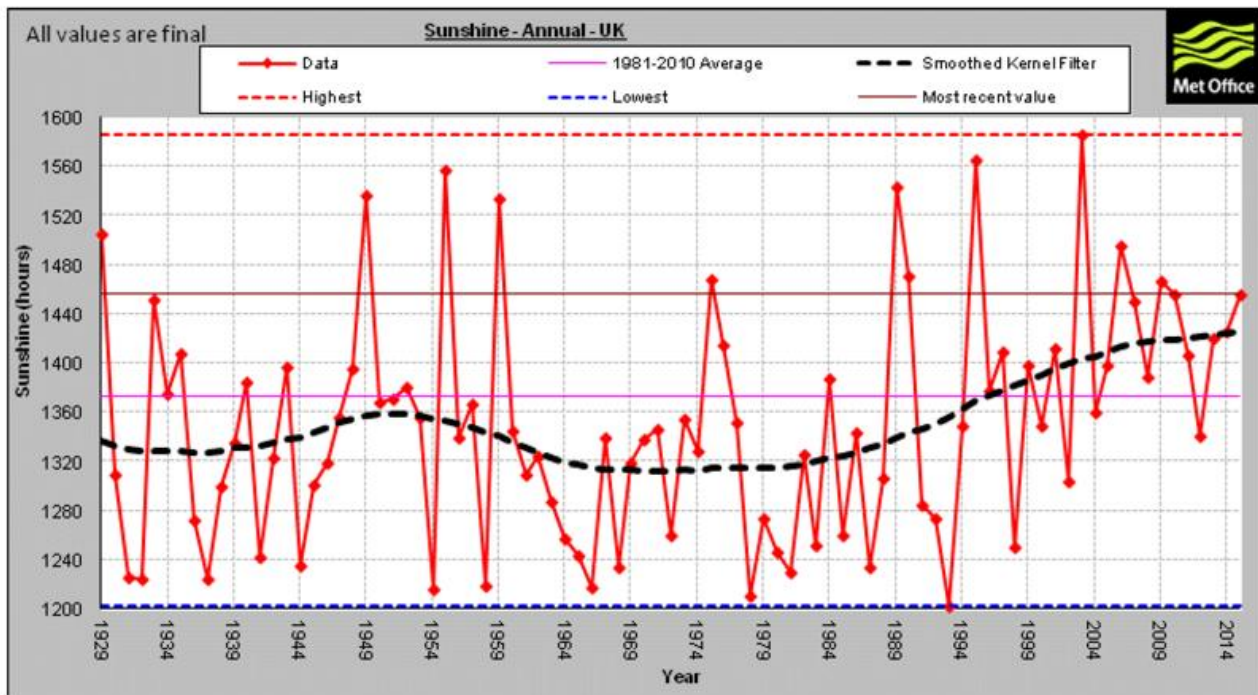


Figure 5.51: Time series of annual sum of the sunshine duration in hours for United Kingdom (Diagram as provided by the NHMS)

Nordic and Baltic Countries - sunshine duration

Denmark

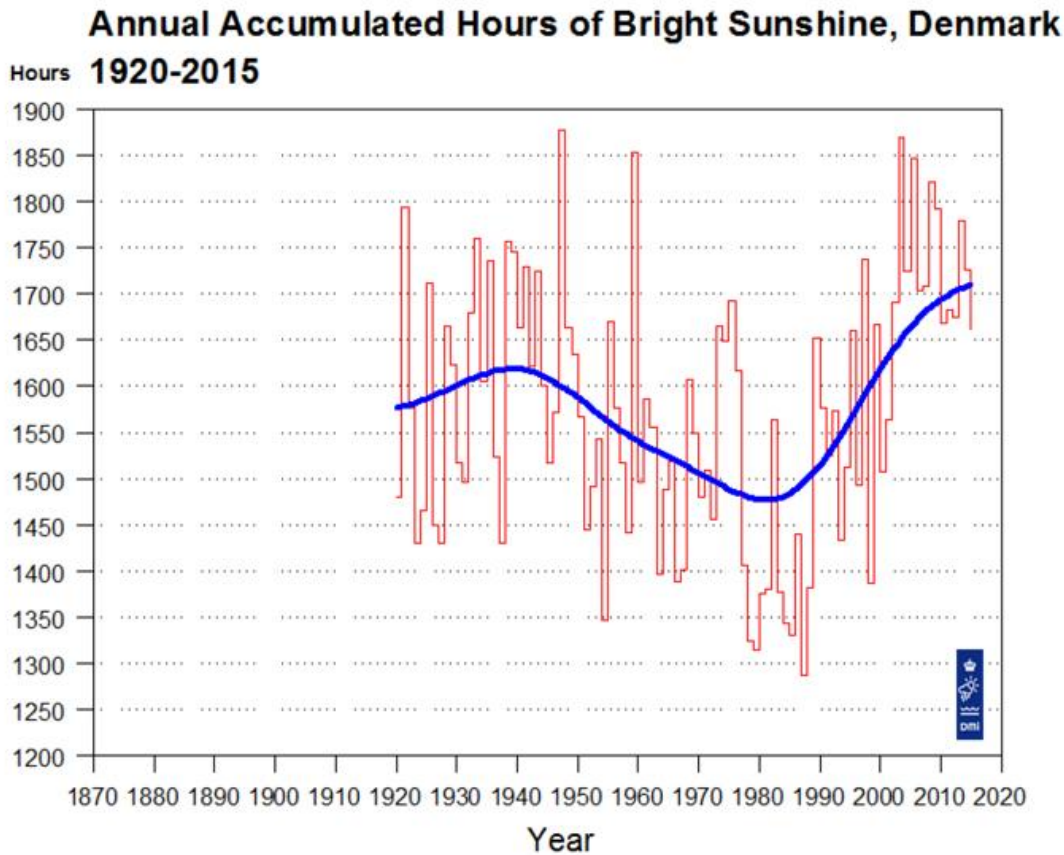


Figure 5.52: Time series of annual sunshine duration in hours for Denmark (Diagram as provided by the NHMS)

Note: DMI observed since 2002 the hours of bright sunshine using measurements of global radiation instead of measurements from a traditional Campbell-Stokes sunshine recorder. For that reason "new" and "old" hours of bright sunshine cannot directly be compared. It should also be noted that all values before 2002 are adjusted in the best way possible ensuring comparability to the new level. For details on that, see DMI Technical 02-25: Ellen Vaarby Laursen, Stig Rosenørn: New hours of bright sunshine normals for Denmark, 1961-1990.

http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/2002/tr02-25.pdf

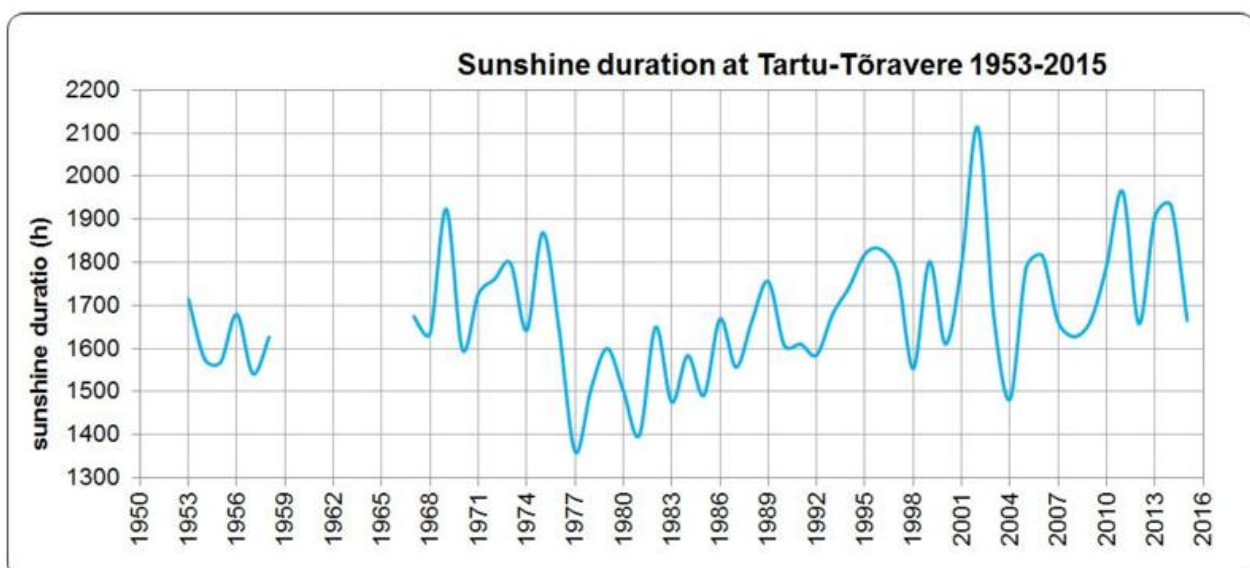


Figure 5.53: Time series of annual sunshine duration in hours for Estonia (station Tartu-Tõravere, diagram as provided by the NHMS)

5.4. Other climate related variables

Sea level of the Baltic Sea (Poland)

Sea level

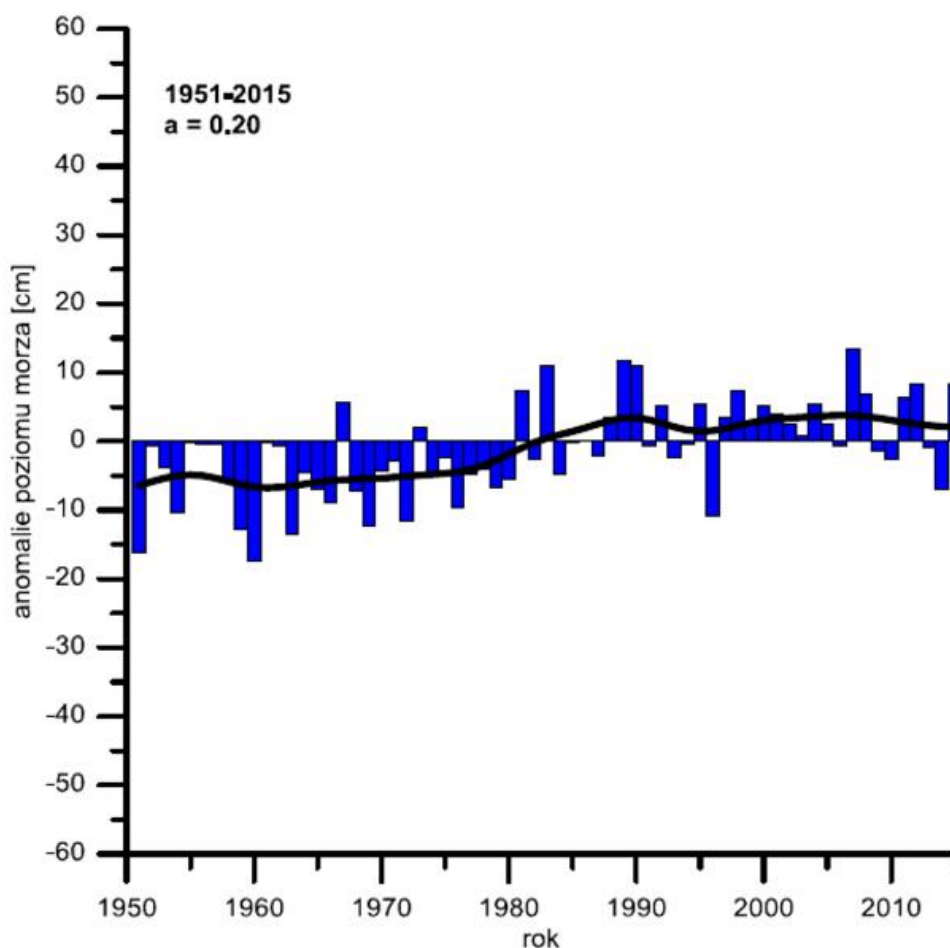


Figure 5.54: Mean annual sea level anomalies of the Baltic Sea in Władysławowo (1951-2015) in relation to the reference 1971-2000, smoothed by 10-years Gaussian filter (black line) and the value of the linear trend (cm/year, diagram as provided by the NHMS).

Recent decrease in the Caspian Sea level and consequences for the Kazakhstan's coastal zone

According to the observation data, the Caspian sea level has recently experienced wide fluctuations. During the last 35 years two periods can be singled out: 1) a sharp rise in the period 1978-1995; 2) a gradual fall in the period 1996-2015 (Figure 5.55). In 2015 the mean annual sea level was minus 27.96 m in the Baltic System of Elevations (BS), which is a decline of 1.34 m during the last twenty years.

This drop of the sea level can mainly be assigned to a change in the Volga River discharge, which results from the decrease in the precipitation over its catchment area due to climate change. In average for the period 1978-2005 the runoff of the Volga River during the first half of a year (phase of spring raising water and a high level of runoff) amounted to 165 km³. But in 2015 it was less than 103 km³.

Sea level reduced by more than 1 meter led to a change in the position of Caspian coastline in Kazakhstan's territory. In this Caspian region the sea bottom and the surrounding surface land have a very small slope, and even small changes in the sea level can lead to significant coastal flooding or drainage.

It should be noted that decrease in the sea level to a mark lower than minus 28.00 m will have a lot of negative consequences for its ecosystem. The shallowing of ducts, reduction of spawning areas, increase in salinization will lead to reduction of the areas of fish fodder grounds, and consequently to decrease in a fish crop, and as a result, to the problems for the fishing enterprises. Also decrease in sea level can significantly complicate economic activity in shallow coastal zones, especially as it concerns port constructions and shipping business.

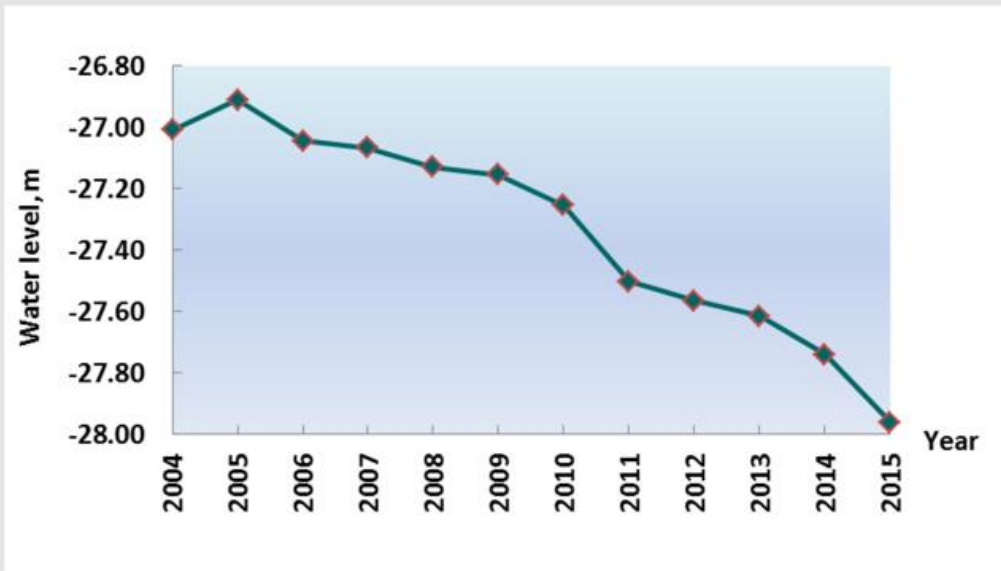


Figure 5.55: Annual Caspian Sea level from in situ observations during period 2004-2015 (m, Baltic System of Elevations)

6. Annex: Monthly and annual tables

Table 6.1: Statistical values of **annual** mean temperature and total precipitation and their deviations from the long term mean (1961-1990, CLIMAT Data) for several stations of the RA VI region.

WMO-No.	Station name	Country	Temperature (°C)		Precipitation (mm)	
			mean	dev.	total	dev.
1001	Jan Mayen	NOR	0.9	2.3	677	-16
1008	Svalbard/Spitzb.	NOR	-2.0	4.4	382	199
1025	Tromsø	NOR	4.2	1.5	1140	167
1492	Oslo	NOR	7.6	1.9	917	148
2196	Haparanda	SWE	4.0	2.9	813	261
2485	Stockholm	SWE	8.7	2.1	657	118
2836	Sodankylä	FIN	1.6	2.6	664	164
2974	Helsinki	FIN	7.2	2.7	643	-8
3091	Aberdeen	GBR	8.9	1.0	869	86
3772	London	GBR	12.2	1.6	562	-37
3967	Dublin	IRL	9.5	0.2	826	91
4030	Reykjavik	ISL	4.5	0.2	1025	227
4360	Angmagssalik	GRL	-0.4	1.2	1070	138
6186	Kopenhagen	DNK	10.0	1.3	786	150
6260	De Bilt	NLD	10.9	1.5	855	50
6447	Brüssel	BEL	11.3	1.4	741	-59
6590	Luxemburg	LUX	10.4	2.1	631	-244
6660	Zuerich	CHE	10.6	2.1	919	-167
6700	Genf	CHE	11.6	1.9	686	-268
7510	Bordeaux	FRA	14.1	1.4	596	-327
7650	Marseille	FRA	16.1	1.3	530	-16
8222	Madrid	ESP	16.6	2.2	281	-176
8314	Mahon/Menorca	ESP	17.6	1.0	607	9
8495	Gibraltar	GBR	19.0	0.8	462	-313
8515	Santa Maria/Azoren	PRT	18.0	0.5	730	-45
8535	Lissabon	PRT	17.5	0.6	433	-320
10384	Berlin-Tempelhof	DEU	11.2	1.8	508	-76
11035	Wien	AUT	12.1	2.3	519	-88
11518	Prag	CZE	10.1	2.2	382	-144
11903	Sliac	SVK	10.2	2.3	668	-18
12160	Elbing	POL	8.5	0.8	650	-40
12375	Warschau	POL	10.3	2.5	404	-115
12843	Budapest	HUN	12.2	1.8	575	57
13274	Belgrad	SRB	14.0	2.1	686	2
14015	Ljubljana	SVN	12.1	2.4	1090	-304
14445	Split	HRV	17.5	1.6	799	-26
14654	Sarajevo	BIH	10.7	1.2	766	-152
15420	Bukarest	ROU	11.9	1.3	688	93
15614	Sofia	BGR	11.4	1.7	728	165
16158	Pisa	ITA	15.5	1.4	863	-41
16597	Luqa	MLT	19.6	1.0	556	3
16716	Athen	GRC	19.2	0.7	353	-17
16754	Heraklion/Kreta	GRC	19.2	0.8	437	-65
22113	Murmansk	RUS	2.2	2.3	508	30
26038	Tallinn	EST	7.5	2.4	592	-75
26406	Liepaja	LVA	8.7	2.0	633	-57
26629	Kaunas	LTU	8.6	2.2	552	-56
26730	Vilnius	LTU	8.2	2.2	593	-90
26850	Minsk	BLR	8.7	2.9	562	-115
27612	Moskau	RUS	7.4	2.5	717	29
33345	Kiew	UKR	10.5	2.8	452	-197
33815	Kisinev	MDA	12.0	2.4	431	-116
34300	Kharkiv (Charkow)	UKR	9.7	2.2	528	9
34880	Astrachan	RUS	11.8	1.8	182	-39
37789	Yerevan	ARM	14.0	1.9	361	84
17030	Samsun	TUR	15.5	1.2	751	60
17062	Istanbul-Bölge	TUR	16.0	1.9	833	136
17130	Ankara	TUR	12.6	1.0	512	105
17170	Van	TUR	10.3	1.6	472	94
17300	Antalya	TUR	19.6	1.2	954	-112
17609	Larnaka	CYP	20.3	1.2	434	105
35108	Uralsk	KAZ	7.3	1.9	323	-1
37545	Tbilisi	GEO	14.3	1.3	553	55
40080	Damaskus	SYR	18.0	1.5	88	-58
40103	Tripoli	LBN	20.2	0.9	887	7
40180	Tel Aviv	ISR	21.1	1.6	593	26
40199	Eilat	ISR	26.2	1.4	16	-17
40265	Mafrq	JOR	17.8	1.3	163	4
60030	Las Palmas Canarias	ESP	21.8	1.3	166	49

Table 6.2: Statistical values of **monthly** mean temperature and total precipitation and their deviations from the long term mean (1961-1990, CLIMAT Data) for several stations of the RA VI region.

Country	Station name	January				February				March			
		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)	
		mean	dev.	total	dev.	mean	dev.	total	dev.	mean	dev.	total	dev.
NOR	Jan Mayen	-1.2	4.5	55	-5	-4.9	1.2	54	-2	-1.8	4.3	79	23
NOR	Svalbard Airport	-7.3	8.1	32	18	-13.9	1.8	40	21	-6.8	7.9	95	74
NOR	Tromso	-3.8	0.2	16	-65	-1.5	2.2	125	39	1.3	3.5	79	15
NOR	Oslo	-0.3	4.0	111	62	0.3	4.3	30	-6	3.5	3.7	59	13
SWE	Haparanda	-8.8	3.3	118	74	-3.2	8.1	29	-3	-1.0	5.8	57	22
SWE	Stockholm	0.9	3.7	68	29	1.3	4.3	39	12	3.9	3.8	58	32
FIN	Sodankylä	-14.1	1.0	50	19	-6.5	7.1	17	-8	-2.3	6.2	48	23
FIN	Helsinki	-2.0	4.9	57	16	-0.1	6.7	47	16	1.8	4.7	61	27
GBR	Aberdeen	3.7	1.0	83	2	4.3	1.4	25	-26	5.9	1.4	36	-22
GBR	London	5.7	1.5	63	11	5.0	0.5	39	4	7.9	1.4	24	-23
IRL	Dublin Aero.	4.7	0.3	63	-3	3.9	-0.5	31	-20	5.7	-0.3	48	-1
ISL	Reykjavik	-0.3	0.2	127	51	-0.1	-0.5	93	21	0.7	0.2	137	55
GRL	Angmagssalik	-5.3	2.2	66	-46	-8.8	-1.1	171	80	-3.7	4.5	143	55
DNK	Copenhagen	3.1	2.6	84	33	2.1	1.6	28	-3	5.2	2.6	52	10
NLD	De Bilt	4.0	1.8	116	50	3.5	1.0	61	12	6.2	1.2	60	-3
BEL	Brussels	3.5	0.9	124	57	3.3	-0.2	58	5	6.6	1.1	53	-1
LUX	Luxembourg	1.5	1.5	74	3	1.0	-0.1	45	-17	5.9	1.9	40	-30
CHE	Zurich	1.9	2.4	90	23	-0.5	-1.4	36	-34	6.4	2.2	82	13
CHE	Geneva	2.6	1.8	81	1	1.7	-0.6	52	-29	7.3	2.2	52	-27
FRA	Bordeaux	6.3	0.5	94	-6	6.0	-1.1	80	-6	9.9	1.1	40	-36
FRA	Marseilles	7.6	0.9	71	24	6.5	-1.4	78	24	11.2	1.0	55	11
ESP	Madrid	6.2	0.1	17	-29	7.0	-0.5	22	-22	11.8	1.8	37	4
ESP	Mahon/Menorca	10.8	0.3	60	-6	9.2	-1.5	129	72	12.3	0.7	92	37
GBR	Gibraltar	13.5	0.1	39	-82	12.5	-1.3	96	-4	15.3	0.3	65	-10
PRT	Santa Maria/Az.	14.4	0.0	14	-86	14.6	0.6	12	-74	15.0	0.4	26	-53
PRT	Lisbon	10.9	-0.5	91	-19	11.2	-1.1	15	-96	14.0	0.3	23	-46
DEU	Berlin-Tempelhof	3.3	3.5	78	35	2.1	1.3	7	-27	6.3	2.1	45	8
AUT	Vienna	3.0	4.0	73	35	2.3	1.3	37	-5	6.6	1.6	40	-1
CZE	Prague	1.7	4.1	18	-5	0.3	1.1	2	-21	5.0	2.0	31	3
SVK	Sliac	0.4	4.3	67	23	-1.3	-0.2	18	-26	5.1	2.1	56	14
POL	Elblag	0.2	2.6	58	11	0.3	2.5	4	-21	4.3	2.2	57	22
POL	Warsaw	1.4	4.7	39	17	1.1	3.1	6	-15	5.5	3.5	30	2
HUN	Budapest	2.0	3.6	71	39	2.7	1.6	28	-4	7.2	1.6	15	-14
SRB	Belgrade	3.8	3.4	49	0	4.0	1.3	52	8	8.1	0.9	133	83
SVN	Ljubljana	2.8	3.9	70	-12	2.4	1.0	64	-16	7.6	2.2	105	7
HRV	Split	8.6	1.2	60	-23	8.7	0.6	125	57	11.3	0.9	38	-37
BIH	Sarajevo	0.7	1.6	113	42	1.7	0.2	57	-10	5.2	0.1	80	10
ROU	București	-1.0	1.4	43	3	1.7	1.8	36	0	6.0	1.2	86	48
BGR	Sofia	0.6	2.2	32	5	1.5	1.0	52	19	4.4	-0.2	116	78
ITA	Pisa	7.8	1.7	80	5	8.0	0.9	77	4	11.0	1.5	62	-14
MLT	Luqa	12.9	0.7	50	-39	12.0	-0.4	113	52	13.6	0.2	64	23
GRC	Athens	10.5	0.3	38	-6	10.3	-0.3	41	-2	12.6	0.0	90	49
GRC	Heraklion/Crete	12.3	0.3	196	106	12.2	0.1	81	4	13.7	0.3	46	-10
RUS	Murmansk	-11.8	-0.1	43	10	-5.8	5.4	12	-10	-0.9	5.9	30	10
EST	Tallinn	-0.9	4.6	69	24	0.2	5.9	33	4	2.8	5.0	29	0
LVA	Liepaja	1.0	4.0	79	33	1.1	4.1	21	-10	4.1	4.3	43	7
LTU	Kaunas	-0.4	4.6	74	37	0.0	4.3	13	-14	4.6	4.8	46	14
LTU	Vilnius	-1.1	5.0	61	20	-0.4	4.4	16	-22	3.9	4.5	38	-1
BLR	Minsk	-1.3	5.6	62	22	-1.1	4.7	21	-13	4.0	5.4	27	-15
RUS	Moscow	-4.4	4.9	62	17	-2.2	5.5	40	3	2.0	4.2	14	-20
UKR	Kiev	-0.7	4.9	56	9	-0.7	3.5	35	-11	5.1	4.4	50	11
MDA	Kishinev	-0.5	2.8	27	-13	0.6	2.3	34	-4	5.2	2.3	58	23
UKR	Charkov/Kharkiv	-3.0	3.9	26	-18	-2.5	3.2	53	21	3.3	3.6	43	16
RUS	Astrachan	-4.1	1.3	9	-4	-2.5	2.4	15	5	3.6	2.3	7	-7
ARM	Yerevan	0.1	3.6	15	-6	4.4	5.4	7	-17	7.5	1.7	64	32
TUR	Samsun	7.7	0.8	129	68	9.0	1.8	84	34	8.8	0.8	72	16
TUR	Istanbul	7.4	1.8	138	39	7.7	1.8	139	72	9.2	1.7	31	-31
TUR	Ankara	1.4	1.4	54	13	3.4	1.7	29	-7	7.1	1.1	96	60
TUR	Van	-2.0	2.4	46	12	0.7	4.5	8	-25	3.5	2.6	58	16
TUR	Antalya	11.0	1.1	288	49	12.0	1.7	186	-10	14.2	1.5	147	44
CYP	Larnaca	11.9	0.4	147	82	12.3	0.6	55	-2	15.1	1.8	65	16
KAZ	Uralsk	-11.8	1.1	24	-1	-8.9	3.6	7	-11	-4.4	0.6	3	-17
GEO	Tbilisi (Tiflis)	3.5	1.8	0	-19	5.7	2.8	39	13	8.1	1.2	49	19
SYR	Damascus	6.3	0.4	32	3	8.4	0.5	23	-1	13.4	2.4	6	-11
LBN	Tripoli	11.7	-1.0	226	32	12.9	-0.3	187	60	15.6	0.9	43	-73
ISR	Tel Aviv	12.2	-0.1	205	56	13.9	1.0	85	-13	17.5	2.6	8	-54
ISR	Eilat	15.4	0.2	4	-1	17.7	0.8	<1	-5	22.8	2.8	<1	-4
JOR	Mafraq	7.7	0.5	52	18	9.3	0.6	28	-3	13.3	1.8	9	-20
ESP	Las Palmas Can.	18.6	1.1	2	-15	17.6	0.0	9	-13	18.8	0.4	18	8

Table 6.2: continued

Country	Station name	April				May				June			
		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)	
		mean	dev.	total	dev.	mean	dev.	total	dev.	mean	dev.	total	dev.
NOR	Jan Mayen	-1.8	2.1	50	9	0.1	0.8	14	-26	2.6	0.8	19	-17
NOR	Svalbard/Spitzb.	-5.3	6.4	32	20	-2.2	1.5	3	-3	4.6	2.4	8	-2
NOR	Tromsø	2.1	1.4	73	13	5.9	1.0	31	-17	7.6	-1.7	99	46
NOR	Oslo	7.1	2.5	17	-25	9.0	-1.8	111	59	14.2	-1.0	64	-1
SWE	Haparanda	2.5	3.0	14	-15	6.4	0.3	88	57	11.4	-1.4	95	54
SWE	Stockholm	7.4	2.8	11	-19	10.2	-0.5	107	77	14.5	-1.1	61	16
FIN	Sodankylä	0.9	3.0	10	-14	6.3	1.3	102	67	10.2	-1.4	71	15
FIN	Helsinki	5.1	2.2	56	19	9.6	-0.3	44	9	13.7	-1.2	67	23
GBR	Aberdeen	7.8	1.5	58	5	9.2	0.2	84	25	12.0	-0.1	49	-4
GBR	London	11.1	2.2	16	-29	13.2	0.7	42	-9	16.8	1.1	12	-39
IRL	Dublin	8.1	0.3	56	9	9.9	-0.6	95	37	13.3	0.0	17	-31
ISL	Reykjavik	2.4	-0.5	48	-10	4.6	-1.7	32	-12	9.1	0.1	21	-29
GRL	Angmagssalik	-3.1	1.0	114	41	0.8	0.2	91	34	4.7	0.6	28	-24
DNK	Kopenhagen	8.3	1.7	31	-11	11.2	-0.8	66	23	14.5	-1.6	60	6
NLD	De Bilt	9.0	1.0	21	-31	12.4	0.1	46	-15	15.6	0.4	33	-35
BEL	Brüssel	10.3	1.5	24	-33	13.1	0.2	63	-8	16.5	0.8	53	-26
LUX	Luxemburg	10.1	2.6	50	-11	12.7	0.9	26	-55	17.0	2.1	43	-39
CHE	Zuerich	10.1	2.3	146	59	13.8	1.7	161	58	17.9	2.7	141	17
CHE	Genf	11.2	2.4	64	-1	15.3	2.3	96	19	19.9	3.4	45	-44
FRA	Bordeaux	14.2	2.9	27	-45	16.1	1.5	34	-43	20.8	3.0	44	-12
FRA	Marseille	14.2	1.0	51	3	18.9	1.8	1	-41	23.7	2.8	84	56
ESP	Madrid	15.1	2.9	47	-7	20.3	4.3	<1	-41	24.7	4.0	45	19
ESP	Mahon/Menorca	14.8	1.5	2	-48	19.0	2.2	12	-25	23.3	2.5	37	23
GBR	Gibraltar	17.3	1.1	29	-31	20.5	2.0	2	-33	22.1	1.0	2	-9
PRT	Santa Maria/Azoren	15.6	0.4	59	4	17.1	0.4	42	12	19.3	0.6	25	3
PRT	Lissabon	16.7	1.6	73	9	20.1	2.7	3	-36	22.2	2.0	12	-9
DEU	Berlin-Tempelhof	9.7	1.1	28	-13	13.9	0.0	16	-40	17.2	-0.2	50	-25
AUT	Wien	11.2	1.3	22	-29	15.3	0.7	50	-11	20.0	2.1	25	-49
CZE	Prag	8.3	0.6	33	-5	12.9	0.2	41	-36	16.1	0.2	33	-40
SVK	Sliac	9.3	0.8	21	-26	14.8	1.1	88	24	19.1	2.5	26	-59
POL	Elbing	6.7	-0.1	68	26	10.9	-2.0	31	-10	14.0	-1.4	38	-56
POL	Warschau	8.6	0.8	35	3	13.4	0.0	39	-20	17.7	1.1	20	-52
HUN	Budapest	11.8	0.7	6	-32	16.6	0.6	60	5	20.8	1.7	32	-31
SRB	Belgrad	13.2	0.8	31	-28	18.8	1.6	81	10	21.8	1.7	39	-51
SVN	Ljubljana	11.8	1.9	47	-62	16.9	2.3	115	-7	20.6	2.8	150	-5
HRV	Split	14.4	0.5	62	-4	20.4	2.0	86	30	24.3	2.1	49	-2
BIH	Sarajevo	9.1	-0.3	44	-30	15.8	1.7	53	-29	17.6	0.7	91	0
ROU	Bukarest	11.1	-0.2	58	12	17.9	1.2	24	-46	20.5	0.3	48	-29
BGR	Sofia	9.8	-0.1	41	-9	17.0	2.7	39	-34	17.6	-0.1	104	32
ITA	Pisa	12.8	0.3	53	-26	17.1	0.8	20	-39	22.0	2.2	22	-22
MLT	Luqa	15.9	0.4	5	-18	20.7	1.6	21	14	23.6	0.6	<1	-3
GRC	Athen	16.3	0.2	12	-13	21.9	1.3	7	-9	24.8	-0.3	9	2
GRC	Heraklion/Kreta	16.4	0.1	20	-10	20.8	1.0	1	-15	23.4	-0.1	<1	-3
RUS	Murmansk	0.9	2.8	36	15	7.0	3.2	53	21	9.8	0.4	82	29
EST	Tallinn	5.1	1.7	51	15	9.8	0.1	36	-1	13.5	-1.0	54	1
LVA	Liepaja	5.9	1.3	58	23	9.9	-0.4	50	10	13.7	-0.6	14	-32
LTU	Kaunas	7.1	1.1	46	3	11.5	-1.2	44	-12	15.4	-0.6	18	-57
LTU	Vilnius	6.8	1.1	60	14	11.4	-1.1	80	18	15.6	-0.2	16	-61
BLR	Minsk	7.3	1.3	60	18	12.7	-0.2	66	4	17.6	1.5	13	-70
RUS	Moskau	6.1	0.3	44	4	14.2	1.3	120	62	17.9	1.3	93	17
UKR	Kiew	9.7	1.0	5	-44	16.0	0.9	79	26	20.4	2.2	13	-60
MDA	Kisinev	10.2	0.0	47	5	17.7	1.6	15	-36	21.5	2.1	36	-39
UKR	Kharkiv (Charkow)	9.0	0.1	61	25	16.1	0.5	34	-13	21.4	2.5	72	14
RUS	Astrachan	10.9	-0.2	36	18	18.5	0.2	36	12	27.0	4.1	2	-20
ARM	Yerevan	13.9	1.2	49	12	17.6	0.1	48	5	24.6	2.7	11	-10
TUR	Samsun	10.6	-0.8	96	34	16.1	0.6	30	-19	21.1	1.1	80	35
TUR	Istanbul-Bölge	11.1	-0.9	122	73	19.2	2.7	56	25	21.9	0.8	90	69
TUR	Ankara	9.1	-2.1	25	-23	16.8	1.2	67	12	18.3	-1.3	134	97
TUR	Van	8.8	1.5	52	-2	13.4	0.6	69	19	18.8	1.2	5	-16
TUR	Antalya	16.1	0.0	22	-24	21.3	1.0	19	-9	23.9	-1.1	8	0
CYP	Larnaka	16.8	-0.6	12	1	22.0	1.1	<1	-7	24.3	0.0	1	0
KAZ	Uralsk	7.5	-0.2	36	17	16.9	0.8	25	4	25.3	5.1	27	-10
GEO	Tbilisi	11.0	-1.8	90	39	17.7	0.3	50	-28	23.9	2.7	151	75
SYR	Damaskus	15.8	0.3	2	-9	22.5	2.3	0	-4	24.2	-0.2	0	0
LBN	Tripoli	17.3	-0.2	53	-3	21.8	1.9	28	11	24.3	1.0	0	-1
ISR	Tel Aviv	18.4	0.2	45	22	23.3	2.2	<1	-3	24.6	0.6	0	0
ISR	Eilat	24.5	0.3	<1	-4	29.9	1.5	0	-1	30.9	-0.8	0	0
JOR	Mafrag	15.0	-0.8	8	-2	21.4	1.6	0	-3	22.4	-0.3	0	0
ESP	Las Palmas Can.	19.1	0.4	0	-6	22.0	2.1	0	-2	22.2	0.8	<1	<1

Table 6.2: continued

Country	Station name	July				August				September			
		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)	
		mean	dev.	total	dev.	mean	dev.	total	dev.	mean	dev.	total	dev.
NOR	Jan Mayen	5.8	1.6	28	-19	7.1	2.1	85	24	5.9	3.0	108	26
NOR	Svalbard/Spitzb.	8.1	2.1	5	-8	7.3	2.5	37	12	2.8	2.3	38	15
NOR	Tromsø	11.1	-0.6	30	-42	12.7	1.8	49	-33	9.2	2.4	73	-21
NOR	Oslo	16.2	-0.2	89	5	16.5	1.3	131	41	12.5	1.7	158	68
SWE	Haparanda	14.4	-1.1	52	2	14.8	1.5	65	2	11.3	3.4	88	25
SWE	Stockholm	17.0	-0.2	92	20	18.3	2.1	17	-49	13.5	2.3	113	58
FIN	Sodankylä	12.0	-2.1	89	24	13.5	2.3	54	-9	9.5	3.6	72	17
FIN	Helsinki	16.3	-0.3	84	11	17.3	2.3	36	-44	12.7	2.7	49	-24
GBR	Aberdeen	13.7	-0.1	126	66	14.5	0.9	92	17	12.0	0.3	51	-17
GBR	London	18.8	1.0	72	26	18.2	0.8	117	66	14.4	-0.6	50	-1
IRL	Dublin	14.4	-0.5	63	9	14.3	-0.3	68	-10	12.0	-1.0	26	-43
ISL	Reykjavik	11.3	0.7	35	-17	10.9	0.6	66	4	9.1	1.7	77	11
GRL	Angmagssalik	7.0	0.6	9	-40	6.5	0.5	5	-56	4.8	1.7	211	143
DNK	Kopenhagen	17.4	0.2	54	-15	18.6	1.6	50	-13	14.3	0.7	75	13
NLD	De Bilt	18.4	1.6	92	17	18.5	1.8	114	43	13.4	-0.6	89	22
BEL	Brüssel	19.0	1.5	36	-39	19.4	2.1	69	6	13.5	-1.0	59	0
LUX	Luxemburg	20.3	3.4	30	-38	20.1	3.7	77	5	12.7	-0.7	122	52
CHE	Zuerich	22.2	4.6	40	-77	20.4	3.7	61	-72	13.2	-0.6	44	-48
CHE	Genf	24.2	5.1	29	-38	20.8	2.6	63	-16	14.8	-0.1	118	37
FRA	Bordeaux	22.4	2.2	35	-12	21.7	1.8	90	36	17.0	-0.9	35	-39
FRA	Marseille	27.0	3.2	<1	-14	24.6	1.4	55	26	20.1	-0.2	51	4
ESP	Madrid	29.7	5.3	4	-9	25.6	1.7	3	-6	20.7	0.2	9	-21
ESP	Mahon/Menorca	27.1	2.9	1	-3	25.8	1.3	14	-12	22.1	-0.1	181	127
GBR	Gibraltar	26.0	2.3	0	-1	24.8	0.6	0	-6	22.0	-0.8	2	-13
PRT	Santa Maria/Azoren	22.7	1.9	42	17	22.7	0.5	49	9	21.8	0.4	83	26
PRT	Lissabon	22.7	0.3	2	-3	22.8	0.0	2	-4	20.5	-1.2	4	-22
DEU	Berlin-Tempelhof	20.4	1.6	67	15	22.6	4.2	26	-35	14.8	0.2	32	-14
AUT	Wien	24.1	4.4	35	-28	23.6	4.7	45	-13	16.1	1.0	49	4
CZE	Prag	20.6	3.1	48	-18	22.0	5.0	63	-7	13.9	0.6	9	-31
SVK	Sliac	22.0	3.8	121	62	22.0	4.7	31	-38	15.9	2.5	59	3
POL	Elbing	16.5	-0.3	71	-23	19.8	3.1	12	-69	13.7	1.0	97	27
POL	Warschau	20.2	2.3	59	-8	23.1	5.8	8	-55	15.4	2.2	58	15
HUN	Budapest	24.1	3.2	63	11	23.9	3.6	95	44	17.7	1.3	83	43
SRB	Belgrad	26.5	4.8	11	-55	25.9	4.6	50	-2	20.1	2.4	101	50
SVN	Ljubljana	24.4	4.5	118	-4	22.3	3.2	96	-48	16.5	1.0	152	22
HRV	Split	29.5	4.1	14	-14	27.7	2.5	52	2	22.8	1.4	63	2
BIH	Sarajevo	23.0	4.1	9	-70	21.7	3.2	57	-14	17.6	2.5	60	-10
ROU	Bukarest	24.4	2.4	64	0	22.8	1.6	46	-12	18.6	1.7	103	61
BGR	Sofia	23.4	3.4	10	-46	22.4	3.0	63	11	18.7	2.9	86	47
ITA	Pisa	25.8	3.0	56	33	23.6	1.1	246	189	20.1	0.6	14	-75
MLT	Luqa	28.1	2.2	<1	<1	27.9	1.6	36	29	25.9	1.8	16	-24
GRC	Athen	29.3	1.5	14	9	29.2	1.6	1	-4	26.0	1.8	39	29
GRC	Heraklion/Kreta	26.3	0.6	0	-1	27.2	1.6	25	24	25.4	2.3	10	-8
RUS	Murmansk	9.9	-2.9	33	-27	12.5	1.5	76	11	9.6	2.9	40	-12
EST	Tallinn	15.9	-0.4	95	16	16.6	1.3	37	-47	13.0	2.2	48	-34
LVA	Liepaja	16.6	0.2	75	1	18.8	2.4	19	-61	14.4	1.5	93	15
LTU	Kaunas	17.4	0.3	72	4	20.2	3.9	7	-56	14.3	2.2	57	-2
LTU	Vilnius	17.3	0.4	68	-10	20.1	3.8	25	-47	13.7	2.1	55	-10
BLR	Minsk	18.7	1.4	52	-36	21.2	4.7	6	-66	14.5	2.8	100	40
RUS	Moskau	18.3	0.2	119	27	17.6	1.2	14	-60	13.8	2.9	88	24
UKR	Kiew	21.9	2.6	52	-36	22.6	4.0	3	-66	17.8	3.9	25	-22
MDA	Kisinev	24.4	3.5	41	-28	24.7	4.2	9	-36	20.0	3.8	26	-22
UKR	Kharkiv (Charkow)	21.4	1.1	106	46	21.6	2.1	2	-48	18.7	4.6	8	-33
RUS	Astrachan	26.5	1.2	10	-13	24.9	1.6	<1	-19	20.8	3.5	3	-23
ARM	Yerevan	27.7	1.7	0	-10	27.1	1.9	18	11	24.1	3.4	4	-6
TUR	Samsun	23.7	1.0	<1	-29	25.6	2.9	16	-17	23.2	3.6	40	-10
TUR	Istanbul-Bölge	25.5	2.3	<1	-19	26.7	3.7	8	-18	23.9	4.2	99	58
TUR	Ankara	24.3	1.4	5	-9	24.6	2.0	26	14	23.3	5.0	6	-13
TUR	Van	22.5	0.6	<1	-4	21.7	0.5	29	25	19.6	2.8	2	-8
TUR	Antalya	28.3	0.2	<1	-3	29.5	1.8	<1	<1	26.4	1.9	74	63
CYP	Larnaka	27.4	0.5	1	1	29.5	2.4	0	0	27.6	2.5	<1	<1
KAZ	Uralsk	22.7	0.2	24	-14	20.3	-0.1	10	-15	17.4	3.3	32	5
GEO	Tbilisi	25.4	1.0	6	-39	26.1	2.4	47	-1	22.8	3.2	0	-36
SYR	Damaskus	27.9	1.6	0	0	28.9	2.9	0	0	27.4	4.2	0	-1
LBN	Tripoli	26.6	1.6	0	0	28.8	3.2	0	-1	27.8	3.0	<1	-4
ISR	Tel Aviv	27.1	1.4	0	0	29.3	3.2	0	0	28.5	3.7	0	0
ISR	Eilat	34.2	1.3	0	0	35.8	3.0	0	0	33.7	3.3	0	0
JOR	Mafraq	25.7	1.6	0	0	27.7	3.5	0	0	26.6	3.9	0	-1
ESP	Las Palmas Can.	25.5	2.2	0	0	25.7	1.6	5	5	25.2	1.4	8	0

Table 6.2: continued

Country	Station name	October				November				December			
		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)		Temp. (°C)		Precip. (mm)	
		mean	dev.	total	dev.	mean	dev.	total	dev.	mean	dev.	total	dev.
NOR	Jan Mayen	2.6	2.5	75	-8	-0.6	2.6	70	4	-2.9	2.3	40	-25
NOR	Svalbard/Spitzb.	-1.8	3.7	31	16	-3.4	7.1	13	0	-6.0	7.3	48	36
NOR	Tromsøe	4.4	1.5	213	88	1.9	2.7	171	67	0.0	3.0	181	77
NOR	Oslo	7.2	0.8	8	-76	3.2	2.5	76	1	2.1	4.9	63	7
SWE	Haparanda	3.0	0.5	27	-37	1.2	5.3	131	73	-3.5	6.0	49	7
SWE	Stockholm	8.1	0.6	3	-47	5.0	2.4	65	12	4.1	5.1	23	-23
FIN	Sodankylä	0.6	0.9	38	-13	-2.5	4.9	72	33	-8.9	4.2	41	10
FIN	Helsinki	5.4	0.0	21	-52	4.6	4.5	64	-8	2.1	6.2	57	-1
GBR	Aberdeen	9.8	-0.1	93	16	6.9	1.9	67	-8	6.7	3.2	105	32
GBR	London	12.6	0.9	40	-18	10.9	3.7	48	-7	11.5	6.4	39	-18
IRL	Dublin	10.3	0.0	39	-29	8.6	1.9	114	44	8.6	3.3	206	129
ISL	Reykjavik	5.2	0.8	160	74	1.8	0.7	129	57	-0.2	0.0	100	21
GRL	Angmagssalik	0.2	1.0	115	33	-3.3	1.4	65	-31	-4.9	2.3	52	-51
DNK	Kopenhagen	10.2	0.3	22	-37	7.8	2.3	162	100	6.9	4.7	102	44
NLD	De Bilt	9.9	-0.6	33	-39	9.9	4.0	148	67	9.6	6.4	42	-38
BEL	Brüssel	10.2	-0.7	41	-29	10.1	4.0	104	28	9.7	6.2	57	-19
LUX	Luxemburg	8.8	-0.3	26	-49	7.5	3.7	68	-15	6.9	5.9	30	-50
CHE	Zuerich	9.2	-0.1	44	-25	7.8	3.9	64	-18	4.4	3.8	10	-63
CHE	Genf	10.1	0.0	36	-41	7.1	2.1	37	-55	3.9	2.1	13	-74
FRA	Bordeaux	13.3	-0.7	52	-36	12.3	3.2	52	-42	9.7	3.3	13	-86
FRA	Marseille	15.2	-0.9	53	-25	12.3	1.6	24	-34	11.8	4.5	6	-50
ESP	Madrid	15.8	1.0	61	16	12.1	2.7	31	-33	9.8	3.4	4	-47
ESP	Mahon/Menorca	18.6	0.1	43	-41	14.7	0.3	35	-42	13.2	1.4	1	-73
GBR	Gibraltar	20.5	1.0	139	75	17.7	1.6	79	-62	16.2	2.1	9	-137
PRT	Santa Maria/Azoren	19.0	-0.3	162	78	17.7	0.3	58	-44	15.9	0.5	158	63
PRT	Lissabon	18.5	0.0	141	61	16.0	1.5	29	-85	13.9	2.1	38	-70
DEU	Berlin-Tempelhof	9.0	-1.0	60	24	8.1	3.2	75	26	7.4	6.0	24	-29
AUT	Wien	9.9	0.0	80	39	8.4	3.8	38	-12	4.2	3.3	25	-18
CZE	Prag	8.2	-0.1	51	21	6.6	3.8	44	12	5.1	5.7	9	-17
SVK	Sliac	9.0	0.7	118	68	4.7	1.7	54	-15	1.7	3.4	9	-48
POL	Elbing	6.8	-2.1	23	-30	4.8	1.5	109	53	3.4	3.1	82	30
POL	Warschau	7.5	-0.8	40	2	5.3	2.1	53	11	4.7	5.6	17	-15
HUN	Budapest	10.2	-0.7	99	65	7.1	2.3	20	-32	2.7	2.3	3	-37
SRB	Belgrad	12.3	-0.1	72	32	9.1	2.1	63	9	4.2	1.9	4	-54
SVN	Ljubljana	11.0	0.6	127	12	6.8	2.2	45	-90	2.6	2.6	<1	-101
HRV	Split	17.3	0.4	208	129	13.6	1.4	42	-66	11.0	2.3	0	-100
BIH	Sarajevo	11.0	0.6	125	37	5.7	0.9	75	-16	-0.6	-0.4	2	-62
ROU	Bukarest	10.4	-0.4	70	38	7.1	1.9	108	59	2.9	2.7	2	-41
BGR	Sofia	10.3	-0.1	124	87	8.7	3.7	60	13	2.1	1.6	1	-38
ITA	Pisa	15.7	0.4	208	88	12.2	1.8	12	-112	9.3	2.5	13	-72
MLT	Luqa	22.5	1.8	102	12	18.0	1.0	102	22	14.4	0.6	46	-66
GRC	Athen	20.0	0.7	79	27	17.4	1.9	22	-28	11.9	-0.3	<1	-71
GRC	Heraklion/Kreta	21.6	1.9	29	-47	17.6	1.0	20	-39	14.0	0.2	8	-66
RUS	Murmansk	2.6	1.6	34	-8	-2.1	3.0	22	-18	-5.8	3.5	47	9
EST	Tallinn	5.9	-0.4	10	-60	4.8	3.6	57	-11	3.3	6.2	73	18
LVA	Liepaja	7.2	-1.3	6	-68	6.8	3.1	121	38	4.8	5.1	54	-13
LTU	Kaunas	6.2	-0.7	18	-33	4.9	2.8	96	43	2.5	4.9	61	17
LTU	Vilnius	5.6	-1.0	14	-39	3.9	2.7	98	41	1.6	4.5	62	7
BLR	Minsk	5.4	-0.9	32	-17	3.8	3.0	82	30	1.6	5.4	41	-12
RUS	Moskau	4.4	-0.6	21	-37	0.8	1.9	41	-17	0.2	6.3	61	9
UKR	Kiew	7.3	-0.8	40	5	4.7	2.6	69	18	1.9	4.2	25	-27
MDA	Kisinev	9.9	-0.2	63	36	7.1	2.7	73	34	3.0	3.3	2	-36
UKR	Kharkiv (Charkow)	5.8	-1.5	5	-30	4.0	2.7	62	18	0.4	3.8	56	11
RUS	Astrachan	8.8	-0.3	5	-12	4.9	1.6	17	-2	2.1	4.0	41	26
ARM	Yerevan	14.5	1.3	103	76	7.2	0.7	13	-9	-0.2	-0.4	29	6
TUR	Samsun	17.4	1.8	72	-13	14.5	2.0	31	-58	8.4	-0.8	100	18
TUR	Istanbul-Bölge	17.1	1.8	92	21	14.5	2.9	24	-65	8.2	0.1	33	-89
TUR	Ankara	14.5	1.9	42	15	8.7	1.6	22	-11	0.0	-2.5	6	-43
TUR	Van	12.6	2.5	113	65	5.4	1.4	48	4	-1.9	-0.8	41	7
TUR	Antalya	22.5	2.9	66	-4	16.2	1.4	128	-6	13.2	1.8	15	-212
CYP	Larnaka	23.5	2.2	34	15	18.9	2.5	<1	-44	13.8	0.6	117	41
KAZ	Uralsk	4.5	-0.6	26	-4	0.3	2.4	77	42	-2.4	6.0	32	3
GEO	Tbilisi	14.1	0.6	76	38	8.3	0.2	42	12	5.1	1.3	3	-18
SYR	Damaskus	21.0	2.9	9	-3	13.0	1.2	14	-8	6.8	-0.4	2	-24
LBN	Tripoli	23.9	1.7	129	58	18.2	-0.1	99	-14	13.0	-1.1	121	-59
ISR	Tel Aviv	24.5	2.5	76	50	20.2	2.2	63	-5	14.0	0.2	110	-28
ISR	Eilat	29.0	2.3	8	4	23.7	2.2	2	-1	16.3	-0.3	0	-6
JOR	Mafrq	21.9	2.8	16	9	14.6	1.1	20	3	8.5	-0.3	30	2
ESP	Las Palmas Can.	24.2	1.7	114	104	22.5	2.1	5	-16	20.6	2.3	4	-17

7. References to national reports

Note: Primary information sources are the annual reports of RA VI Members, which are kindly provided by RA VI NMHSs. The names of Members, which contributed to the 2015 edition of the Bulletin, are listed on page 3 above. Many contributions or also additional information may as well be found on the web, see below.

Austria: Zentralanstalt für Meteorologie und Geodynamik (ZAMG), Wien, [Wetterrückblick](#)

Belgium: The Royal Meteorological Institute of Belgium (KMI), [Klimatologisch overzicht](#)

Bosnia and Herzegovina: Federal Meteorological Institute (METEOBIH), [Bilten 2015](#).

Croatia: Meteorological and Hydrological Service (DMHZ) [Annual reports](#)

Czech Hydrometeorological Institute (ČHMÚ) [News](#)

Denmark: Danish Meteorological Institute (DMI), [Vejret i Danmark](#)

Estonian Weather Service: [Estonian weather events in 2015](#)

Finnish Meteorological Institute (FMI) [Press release](#)

France: Météo-France, Toulouse, [Bilan climatiques](#)

Germany: Deutscher Wetterdienst (DWD), [Klimatologische Jahresübersicht](#)

Greece: Hellenic National Meteorological Service, [Climatic bulletin](#)

Greece: National Observatory of Athens, [Meteorological bulletin](#)

Hungarian Meteorological Service (OMSZ), [Climate retrospective](#)

Icelandic Met Office: [The weather in Iceland 2015- Climate summary](#)

Ireland: The Irish Meteorological Service (MET Éireann), [Weather Summary](#)

Israel Meteorological Service (IMS): [Weather summary in Israel](#)

Italy: Servizio **Meteo AM**, [Bollettino annuale - Report Italy](#)

Italy: Agenzia Regionale per la Protezione Ambientale (ARPA), [Rapporti annuali](#)

Latvian Environment, Geology and Meteorology Centre [Monthly bulletins](#)

Luxembourg: MeteoLux, Bilans climatologiques annuels (<http://meteolux.lu/fr/produits-et-services/bilans-climatologiques/bilans-climatologiques-annuels/>)

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Moldova: State Hydrometeorological Service (SHS), [Caracterizarea conditiilor meteorologice si agrometeorologice din anul](#)

Montenegro: Hydrological and Meteorological Service of Montenegro [Annual reports](#)

Netherlands: Royal Netherlands Meteorological Institute (KNMI), DeBilt, [Jaaroverzicht van het weer in Nederland](#)

Norway: Det Norske Meteorologiske institutt (DNMI), [Klimatologisk månedsoversikt](#)

Poland: Institute of Meteorology and Water Management National Research Institute (IMGW), [Monthly climate monitoring bulletin](#) (supplement)

Portugal: Instituto portuguesa do mar e da atmosfera (ipma), [Bolletim Climatológico Anual](#)

Romania: Administrația Națională de Meteorologie, [Monitorizare climatica](#)

Russia: Hydrometeorological Centre of Russia (Roshydromet) [Annual bulletin](#)

Serbia: Republic Hydrometeorological Service of Serbia (RHMZ) [Annual Bulletin for Serbia](#)

Slovak hydrometeorological institute (SHMU Slovenský hydrometeorologický ústav) [Bulletin Meteorológia a Klimatológia](#)

Slovenian Environment Agency (ARSO, Agencija Republike Slovenije za okolje): [Mesečni bilten ARSO](#)

Spain: Agencia Estatal de Meteorología (AEMET), [Resumen anual climatologico](#)

Swedish Meteorological and Hydrological Institute (SMHI), [Året \(year\)](#)

Switzerland: Federal Office of Meteorology and Climatology **MeteoSwiss**, [Klimabulletin](#)

Turkish State Meteorological Service (TSMS), [2015 Yılı İklim Değerlendirmesi](#)

United Kingdom: **Met Office** [Climate summaries](#)

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9. Abbreviations

AO	Arctic Oscillation (circulation indices)
BAMS	Bulletin of the American Meteorological Society
CLIMAT	monthly climatological data provided by the NMHSs via GTS
DWD	Deutscher Wetterdienst (German Meteorological Service)
EA	East Atlantic Pattern (circulation indices)
EAWR	East Atlantic/West Russia Pattern (circulation indices)
ECA&D	European Climate Assessment & Dataset, located at Royal Netherlands Meteorological Institute (KNMI)
EMCC	Eastern Mediterranean Climate Centre
E-OBS	daily gridded observational dataset for precipitation, temperature and sea level pressure in Europe based on ECA&D information
GCC	Global Collection Centre operated by the Deutscher Wetterdienst
GPCC	Global Precipitation Climatology Centre located at the Deutscher Wetterdienst
GTS	Global Telecommunication System
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale (Italian National Institute for Environmental Protection and Research)
m a.s.l.	Meter above sea level
NAO	North Atlantic Oscillation (circulation indices)
NMHSs	National Hydro-Meteorological Services
POL	Polar/Eurasia Pattern (circulation indices)
PDSI	Palmer Drought Severity Index
RCC-CM	WMO Regional Climate Centre Network (RA VI) Offenbach Node on Climate Monitoring
SCA	Scandinavia Pattern (circulation indices)
SCE	Annual snow cover extent
SYNOP	surface synoptic or weather observations provided by the NMHSs via GTS
WCDMP	World Climate Data and Monitoring Programme
WMO RA VI	WMO Regional Association VI (Europe and Middle East)
WMO	World Meteorological Organization