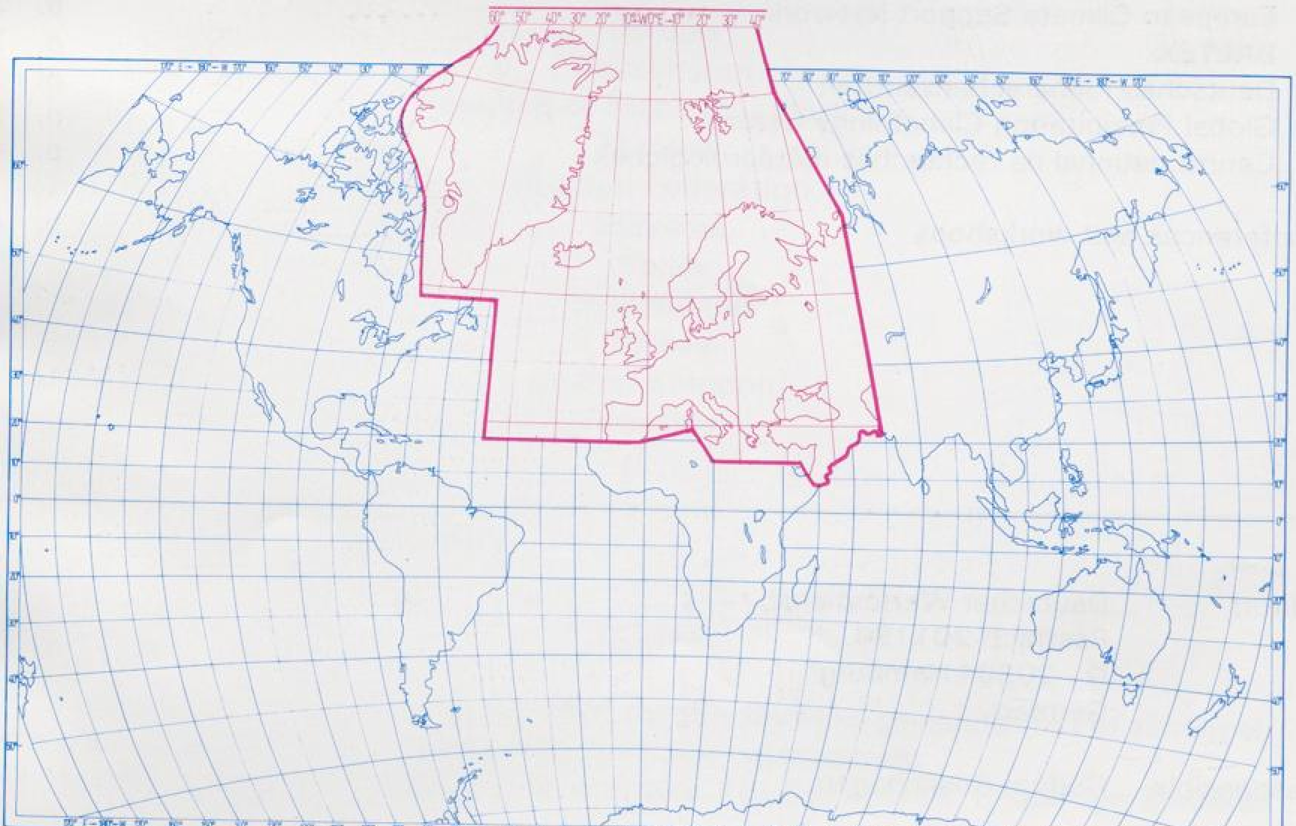
European
Climate Support
Network

World Meteorological
Organization
World Climate Data
and Monitoring Programme

Deutscher
Wetterdienst

Annual Bulletin on the Climate in WMO Region VI
-Europe and Middle East-

1995



List of Contents:

Editor: Deutscher Wetterdienst
Postfach 301190
D - 20304 Hamburg
Germany

Responsible: Gudrun Rosenhagen

Annual Bulletin on the Climate in WMO Region VI -Europe and Middle East- 1995

The bulletin is a summary of the information co-ordinated by Deutscher Wetterdienst, Germany, with input from the national weather services in:

Armenia
Bulgaria
Cyprus
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Israel
Jordan
Kazakhstan
Republic of MacedoniaPortugal
Norway
Russian Federation
Slovenia
Spain
Switzerland
Turkey
United Kingdom
Yugoslavia

Furthermore, contributions to the WMO Bulletin article on consequences of abnormal weather in 1995 were referred from the following countries:
Austria, Azerbaijan, Croatia, Latvia, Lithuania, The Netherlands, Poland and Slovakia

Foreword

There is a continuing international concern about global warming and its potential to cause serious disruption to vulnerable social and economic sectors of society as well as to sustainable development efforts. As recently as December 1995, scientists of the World Meteorological Organization/United Nations Environment Programme (WMO/UNEP) Intergovernmental Panel on Climate Change stated that "the balance of evidence suggests a discernible human influence on global climate", through emissions of greenhouse gases. At the same time, there is a developing capability within national Meteorological and Hydrological Services (NMHSs) to provide comprehensive information on the past, present, and future (season to a year ahead) climate and its variations, to a wide spectrum of users.

Scientific interest is now focusing on the regional implications of a possible global warming. Routine monitoring of regional as well as global climate on shorter time scales is becoming more critical to detecting and determining the impacts of human-induced climate change. This was one of the reasons that WMO Regional Association VI supported the recommendation of the RA VI Implementation Co-ordination Meeting on Climate Monitoring to publish an annual climate system monitoring bulletin for the region and invite members to contribute.

It is intended that this second annual bulletin be again a comprehensive publication to include recent information on climate in the Region and on achievements in climate analysis and research during the past year. This bulletin will serve as a timely sequel to the European Climate Support Network's 1995 release of "Climate of Europe - First European Climate Assessment".

WMO is pleased to be a co-sponsor of this publication along with Germany and the European Climate Support Network (ECSN). The contributions of material from 24 WMO Member countries in the Region and the co-ordination and preparation of the document by Germany were greatly appreciated.

Prof. Dr. Peter Steinhauser
President RA VI

Summary

According to an estimation of the Hadley Centre, the globally averaged surface temperature for 1995 was the warmest ever since the beginning of instrumental measurements in the middle of the last century. This was especially true for the northern hemisphere.
For Region VI, too, 1995 was one of the warmest year's or even the warmest since regular observations started. This is clearly shown in the graph below, which compares the temperature anomalies of Central England and the global mean values between 1856 and 1995.
Only in the far northwest of the Region it was considerably colder than normal. For Iceland, it was the coldest year since 1983.

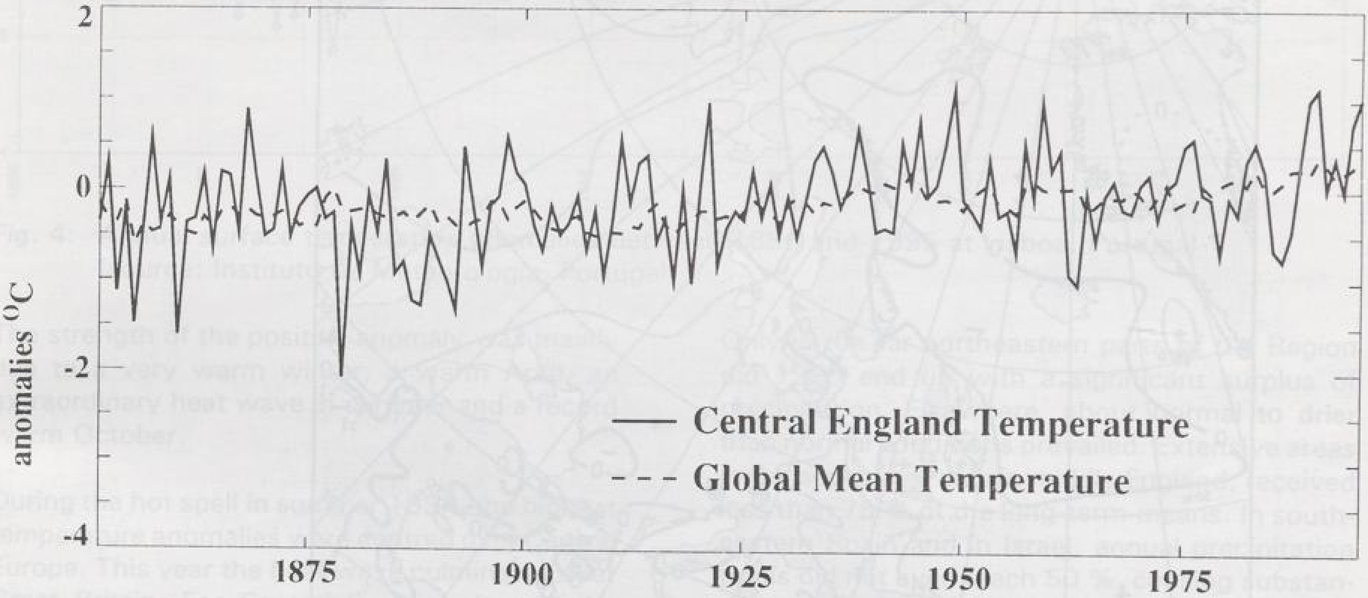


Fig. 1: Central England and global mean temperature anomalies between 1856 and 1995 reference period: 1961-1990 (source: U.K. Meteorological Office, land data provided by University of East Anglia)

The precipitation distribution was characterised by several record heavy precipitation events, causing flood catastrophes. Severe inundations afflicted the Rhine River basin at the end of January and the Glomma River region, southern Norway, in May/June. Furthermore, there were considerable losses when the Caspian Sea rose and flooded the Astrakhan region.
For the Mediterranean, which had suffered from wide-spread substantial drought conditions for more than four years, abundant rain, especially in December, brought relief. However, the dry soils in most parts were not able to easily recover from the extreme shortage of water.

In March, the European Climate Support Network (ECSN) issued its First European Climate Assessment. It was a joint compilation of contributions from the 16 National Meteorological Services which are associated in ECSN and should be seen as an important step towards European climatological co-operation.
Also, the publication "Changes in 'Normal' precipitation in the North Atlantic Region" should be appreciated. It was prepared as a co-operation of most participants in the NACD-project (North Atlantic Climatological Dataset) and published by Det Norske Meteorologiske Institutt, Oslo (DNMI-Report No. 7/96 Klima).

Annual survey

1995 turned out to be warmer than normal in most parts of the Region, as in the previous year. Unlike 1994, however, when the warmest area was centred over Central Europe, the record warmth culminated over the utmost northeast of Europe, where temperature anomalies surpassed +3 °C. A second maximum was situated over western Europe, though less pronounced (see Fig. 2).

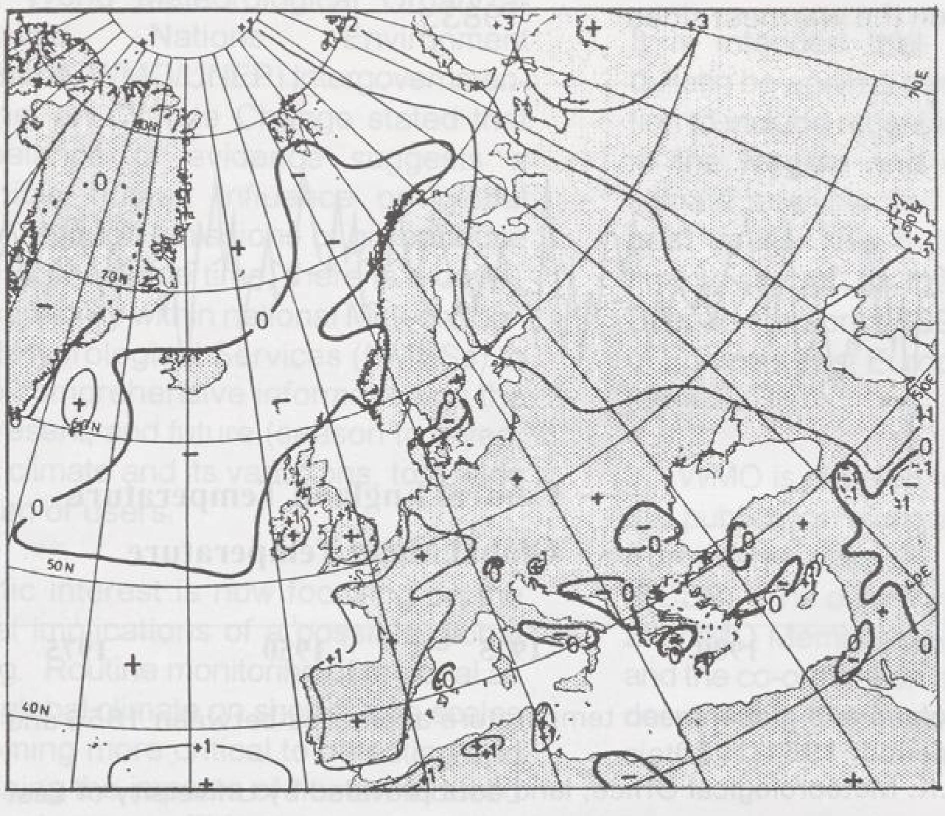


Fig. 2: Annual surface temperature anomalies in °C, reference period: 1961-1990 (source: Deutscher Wetterdienst, Germany)

Most of Russia and adjacent Central Asia experienced their warmest year on record (see Fig. 3). The extreme high annual mean temperatures mainly trace back to the first four months of the year, with anomalies up to 9 °C in February, at their height.

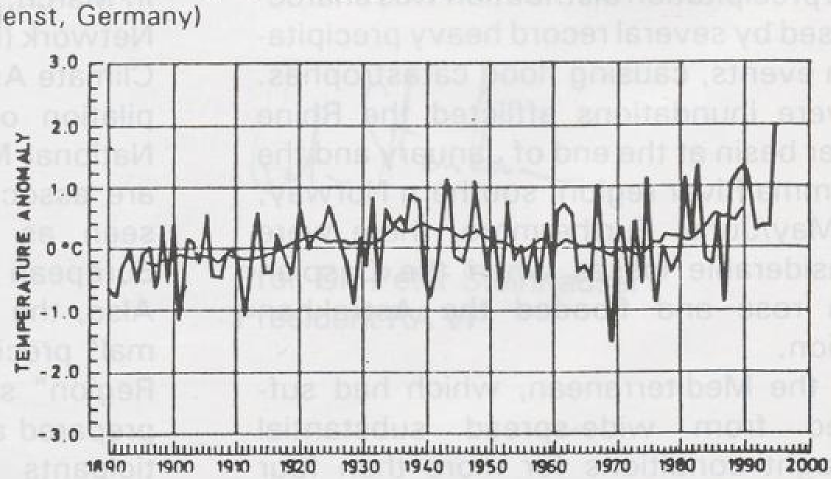


Fig. 3: Annual surface temperature anomalies for the former Soviet Union, smoothed curve is an 11-year running mean Reference period: 1951-1980 (source: Institute for Global Climate and Ecology, Russia)

But also for some regions in western Europe, the year turned out as the warmest ever.

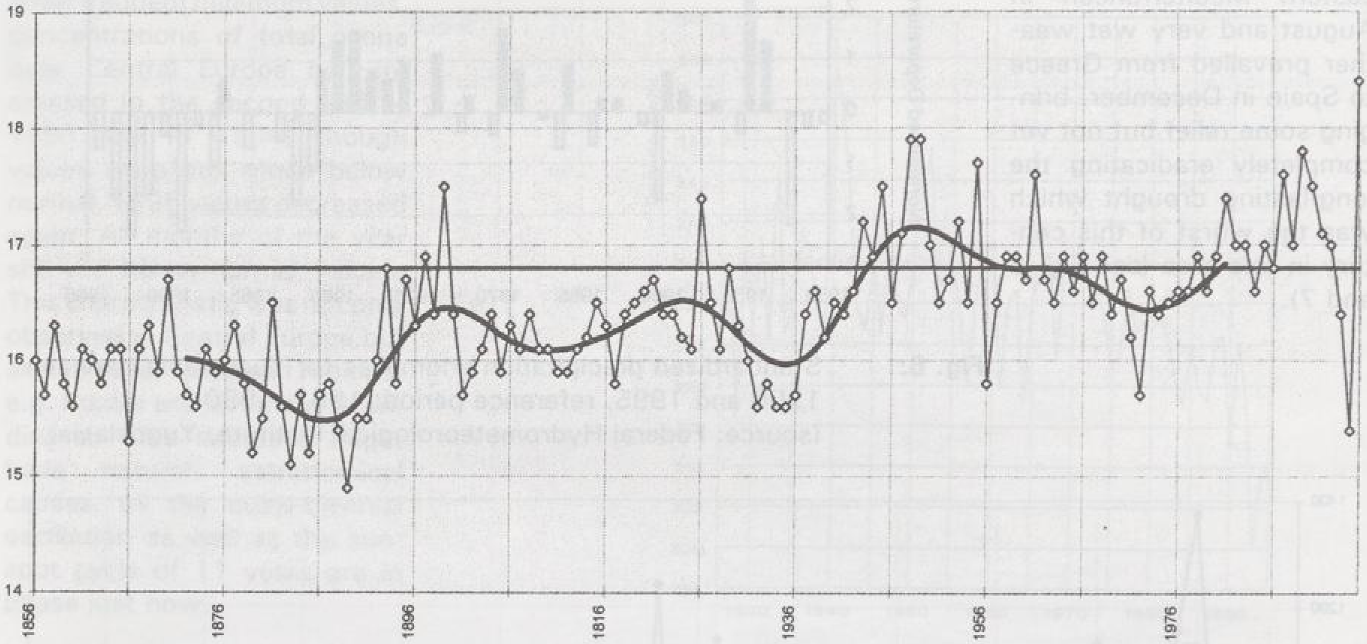


Fig. 4: Annual surface temperature anomalies between 1856 and 1995 at Lisboa, Portugal (source: Instituto de Meteorologia, Portugal)

The strength of the positive anomaly was mainly due to a very warm winter, a warm April, an extraordinary heat wave in summer and a record warm October.

During the hot spell in summer 1994, the highest temperature anomalies were centred over Central Europe. This year the heat wave culminated over Great Britain. For Central England, it was the hottest July/August period since records began more than 300 years ago.

Only in the far northeastern parts of the Region did 1995 end up with a significant surplus of precipitation. Elsewhere, about normal to drier than normal conditions prevailed. Extensive areas in the south, but also in middle England, received less than 75 % of the long-term-means. In south-eastern Spain and in Israel, annual precipitation totals did not even reach 50 %, causing substantial water shortages and high losses to the agricultural industry.

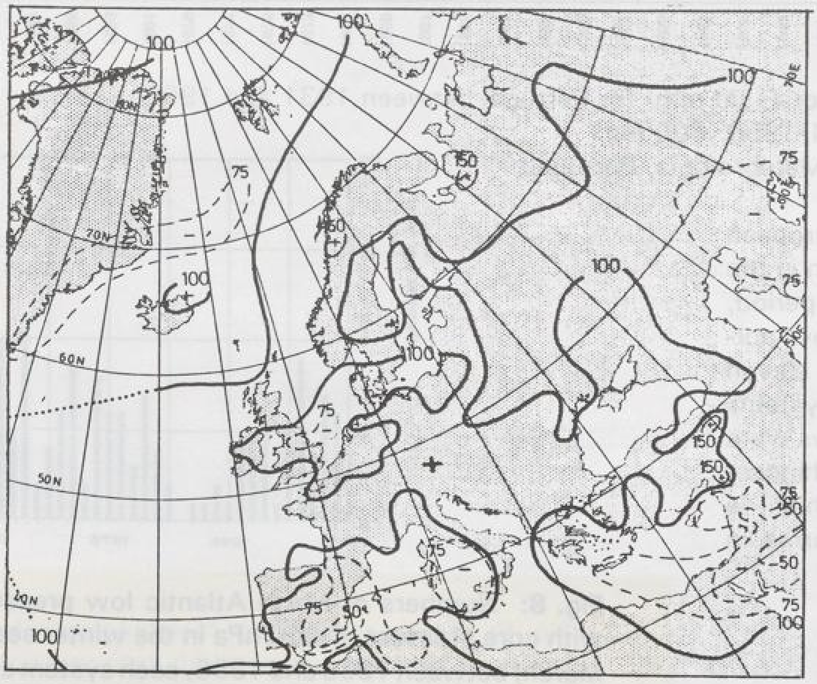


Fig. 5: Annual precipitation for 1995 in percentage of normal (1961-1990) (source: Deutscher Wetterdienst, Germany)

Heavy rain fell in the south-eastern Mediterranean in August and very wet weather prevailed from Greece to Spain in December, bringing some relief but not yet completely eradicating the long-lasting drought which was the worst of this century in this area (see Fig. 6 and 7).

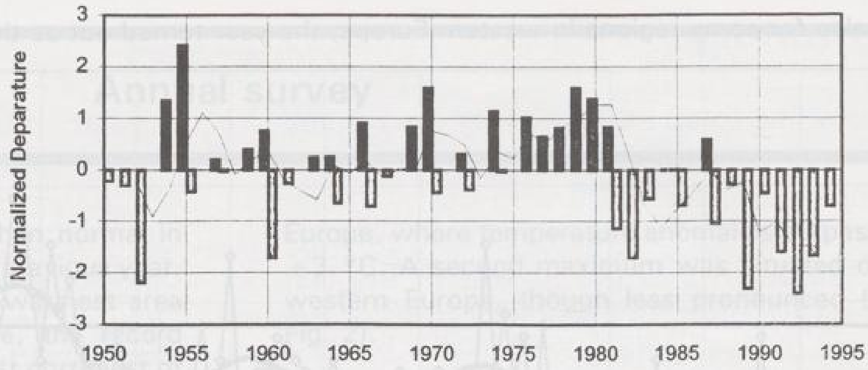


Fig. 6: Standardized precipitation anomalies for Yugoslavia between 1950 and 1995, reference period: 1961 -1990 (source: Federal Hydrometeorological Institute, Yugoslavia)

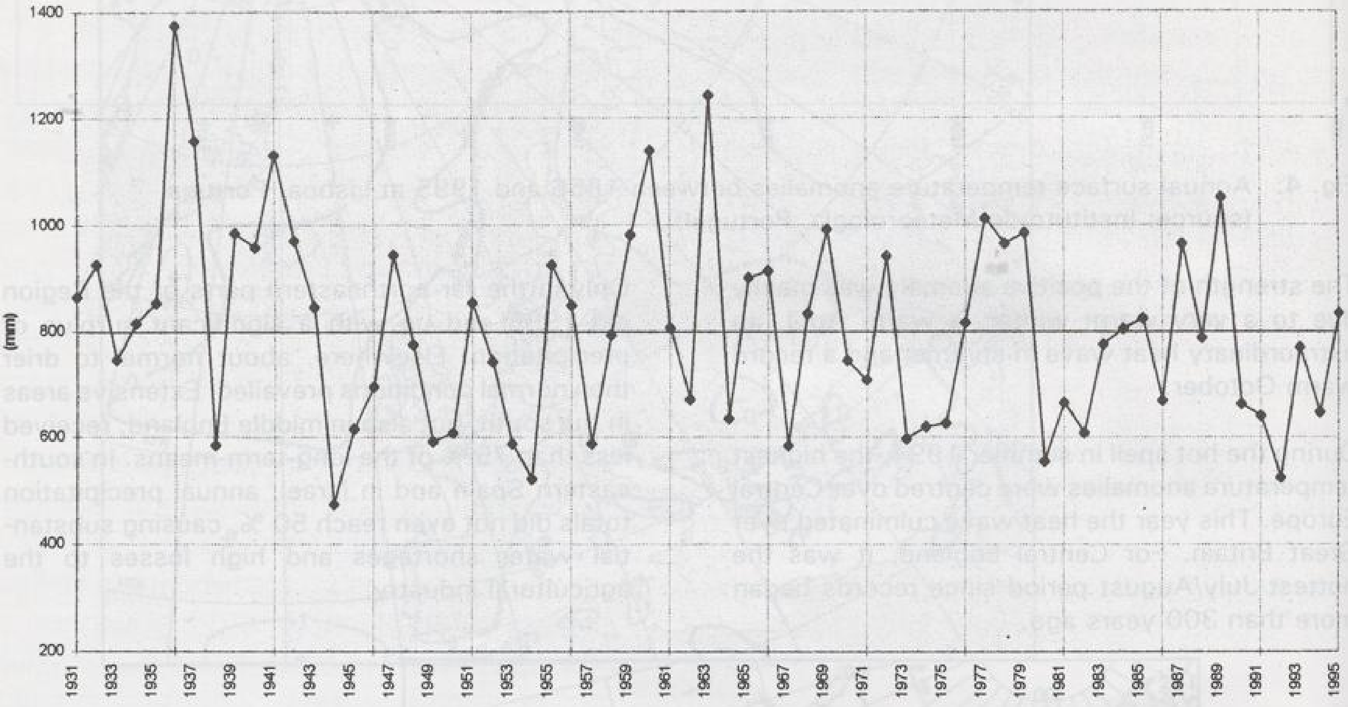


Fig. 7: Annual precipitation totals (in mm) for Portugal between 1931 and 1995
Long-term mean 1961-1990: 800 mm
(source: Instituto de Meteorologia, Portugal)

As to **storms**, the Atlantic-European region got off more lightly than in the very windy 1989 to 1993 period, though storminess was still above normal (see Fig. 8). Five of the eleven intense Atlantic low pressure systems occurred in February. Two lows were counted in September. The highest number for this month, which is usually free of such intense storms, in the 40-year time series.

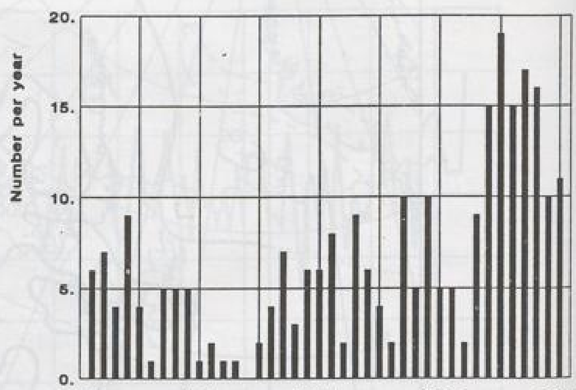


Fig. 8: Yearly numbers of North Atlantic low pressure systems with core pressure ≤950 hPa between 1956 and 1995 (source: Deutscher Wetterdienst, Germany)

After frequent minimum values, concentrations of **total ozone** over Central Europe had increased in the second half of 1993 and in 1994, though values were still much below normal. 1995 values decreased again. All months of the year showed below-normal values. This characteristic was not only observed in Central Europe but also in other European regions, e.g. Russia and southern Scandinavia. This decrease might have natural, astronomical causes, as the quasi-biennial oscillation as well as the sunspot cycle of 11 years are in phase just now.

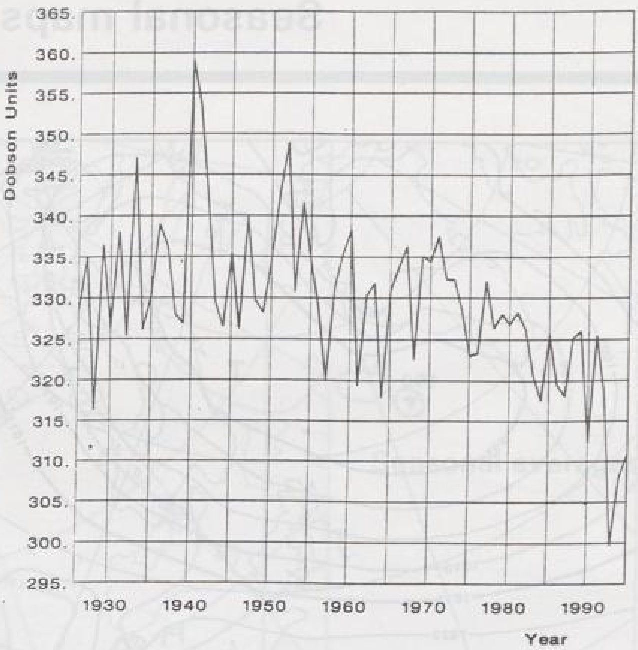
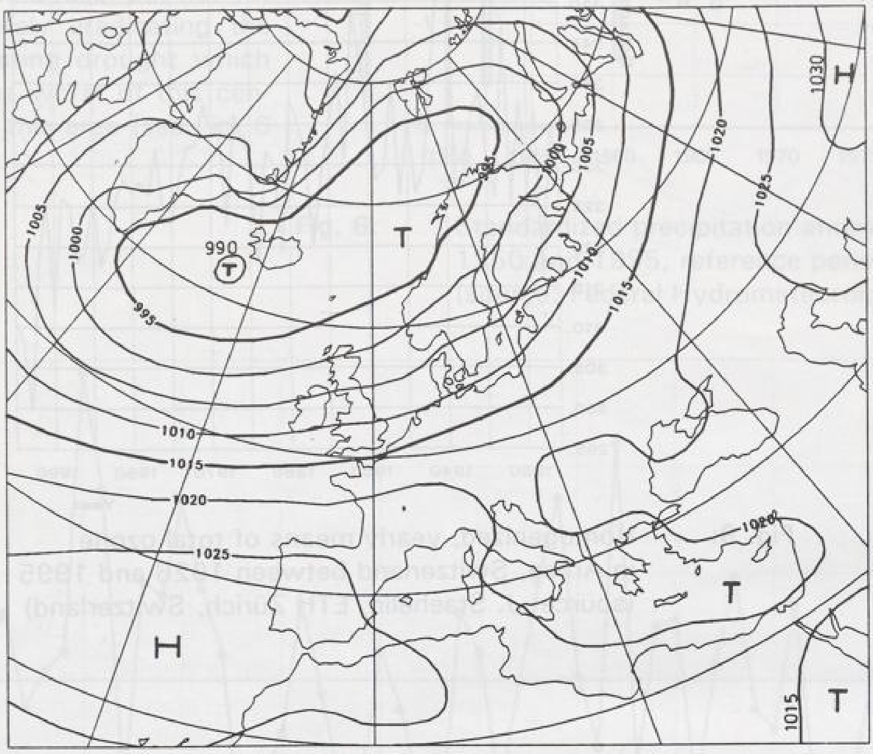


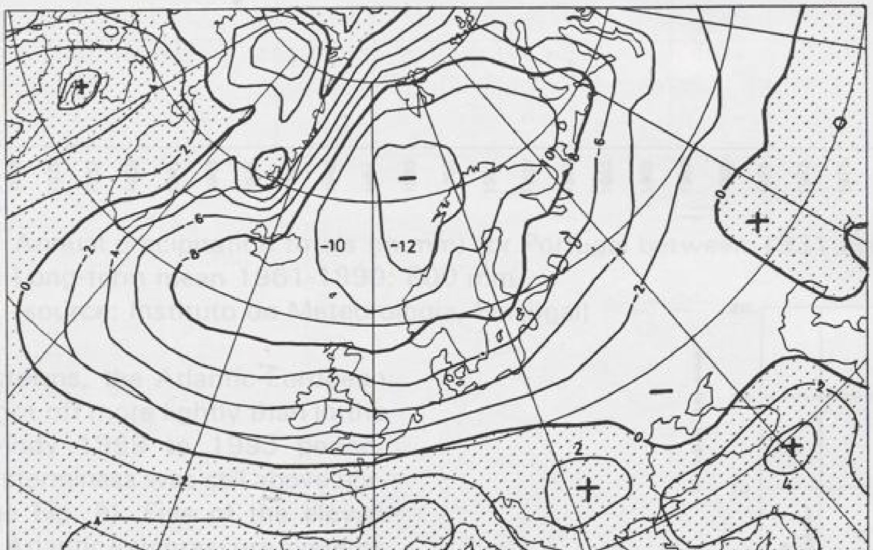
Fig. 9: Homogenized, yearly means of total ozone in Arosa, Switzerland between 1926 and 1995 (source: J. Staehelin, ETH Zürich, Switzerland)

Seasonal maps and tables



Seasonal averages in hPa

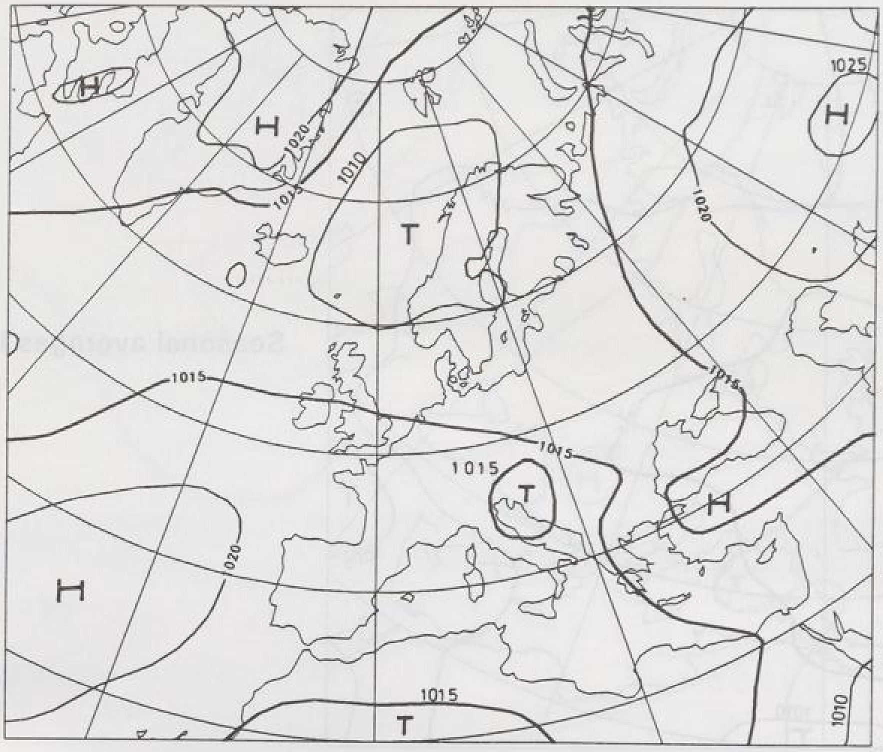
December 1994 - February 1995



Seasonal anomalies in hPa

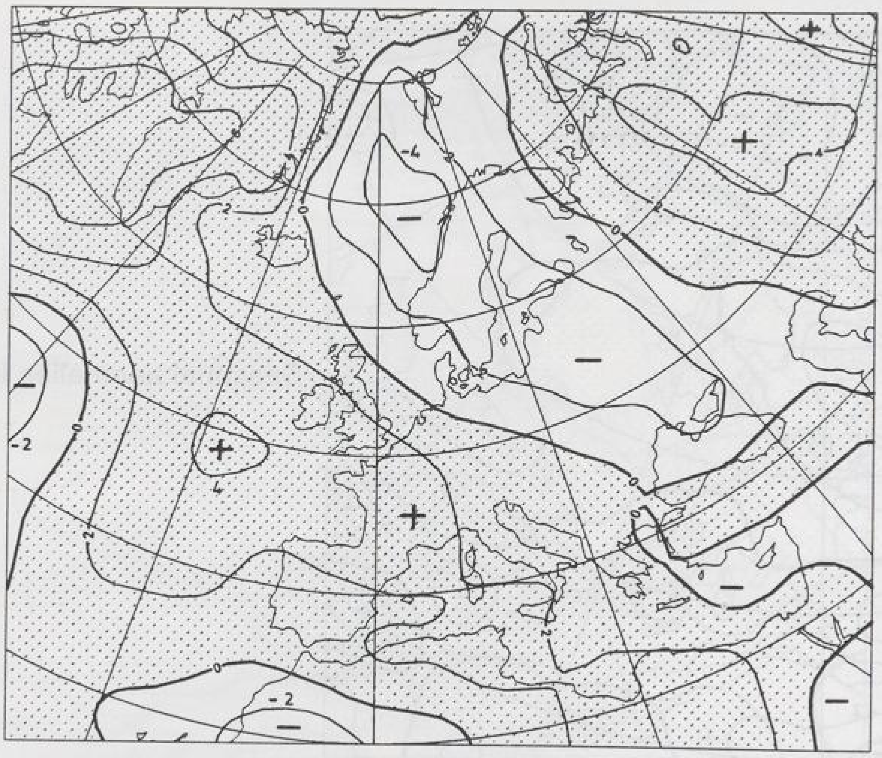
Sea level pressure

(source: Deutscher Wetterdienst, Germany)



Seasonal averages in hPa

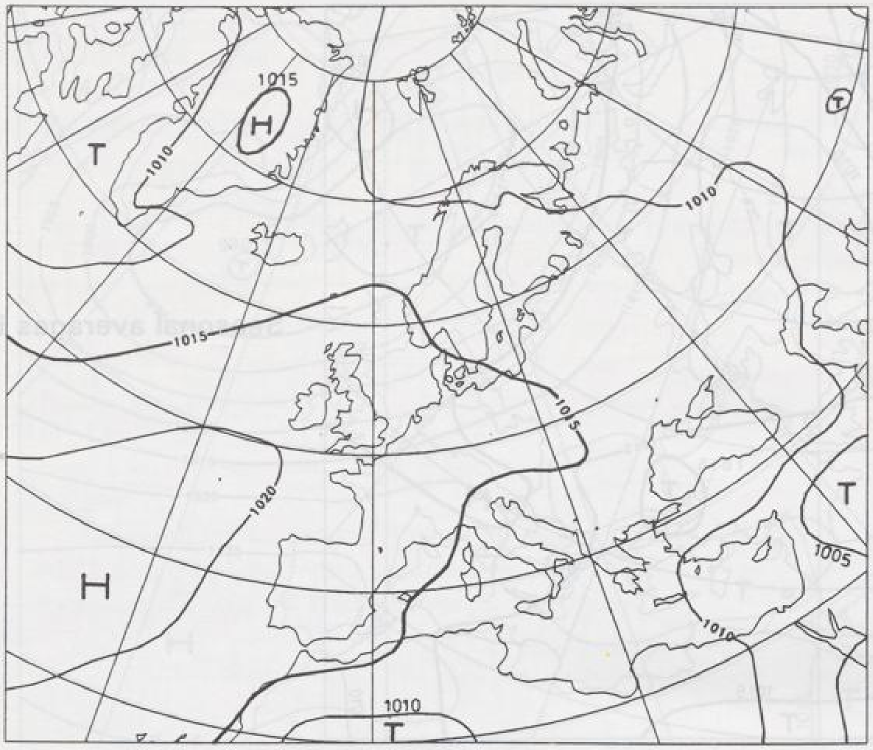
March 1995 - May 1995



Seasonal anomalies in hPa

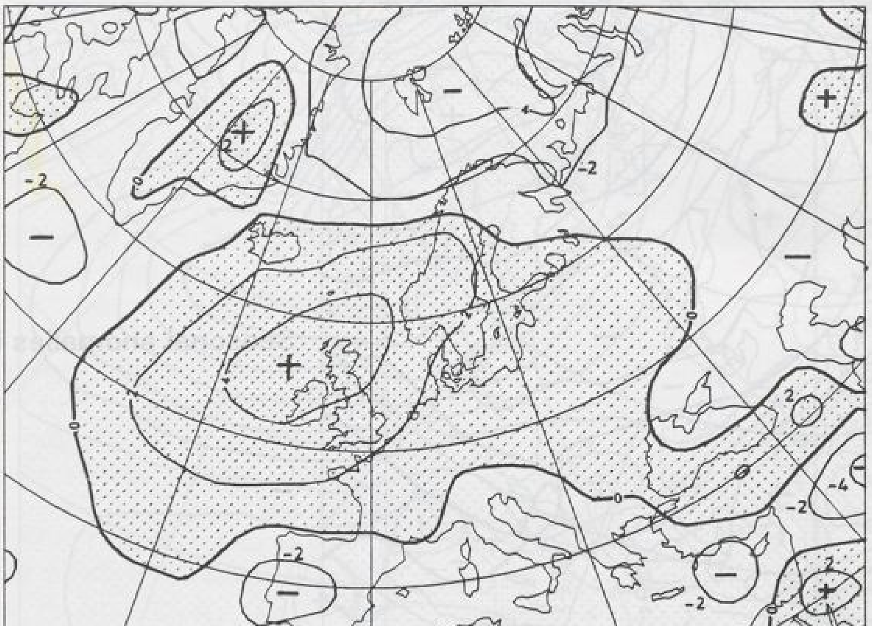
Sea level pressure

(source: Deutscher Wetterdienst, Germany)



Seasonal averages in hPa

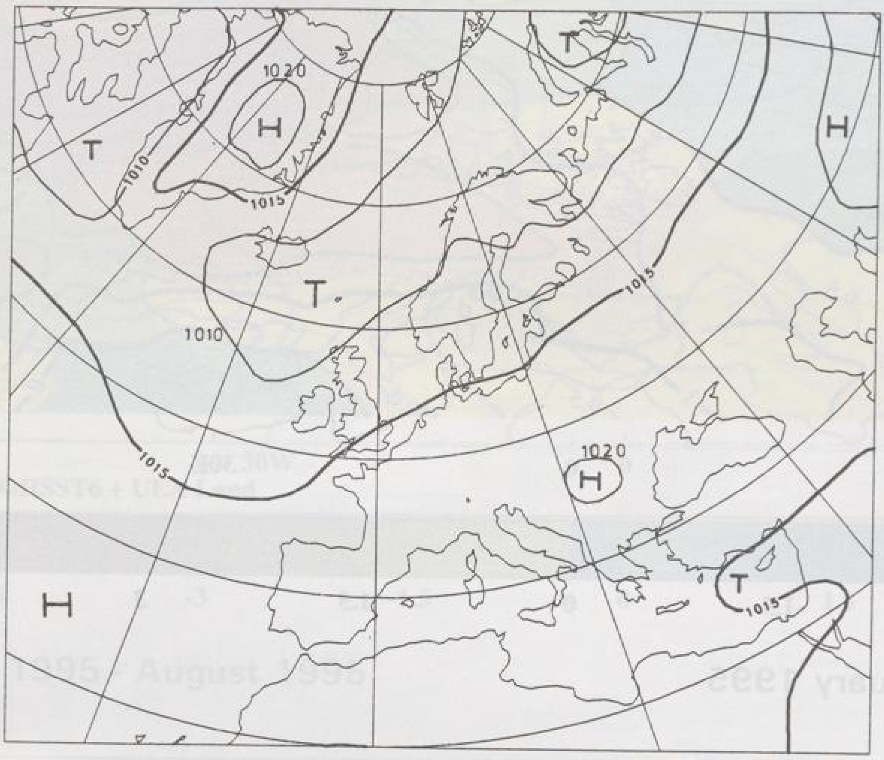
June 1995 - August 1995



Seasonal anomalies in hPa

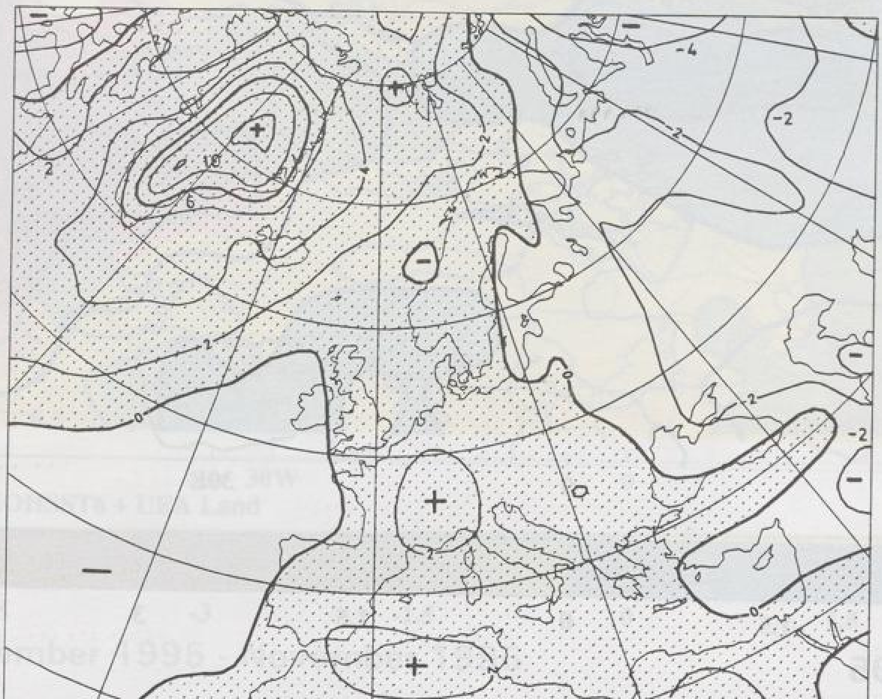
Sea level pressure

(source: Deutscher Wetterdienst, Germany)



Seasonal averages in hPa

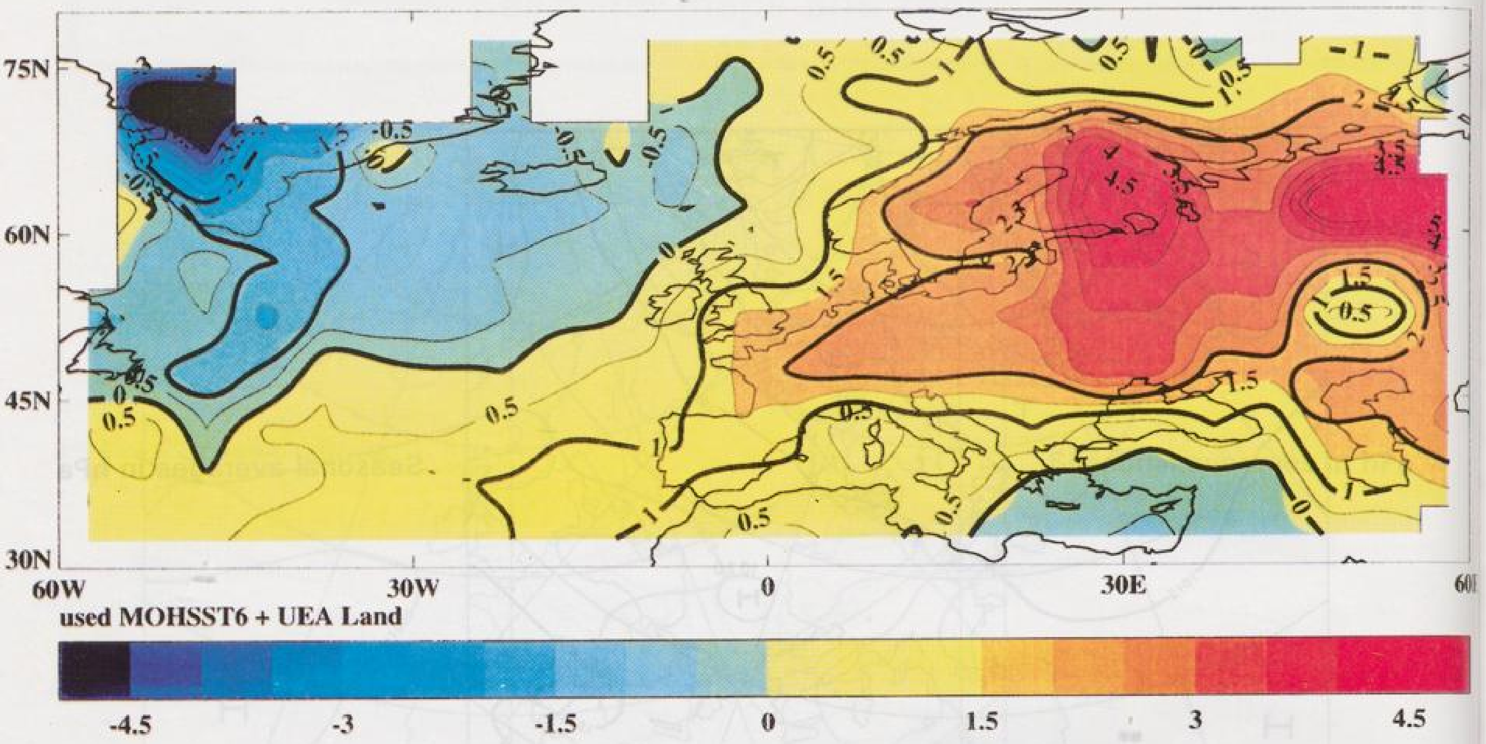
September 1995 - November 1995



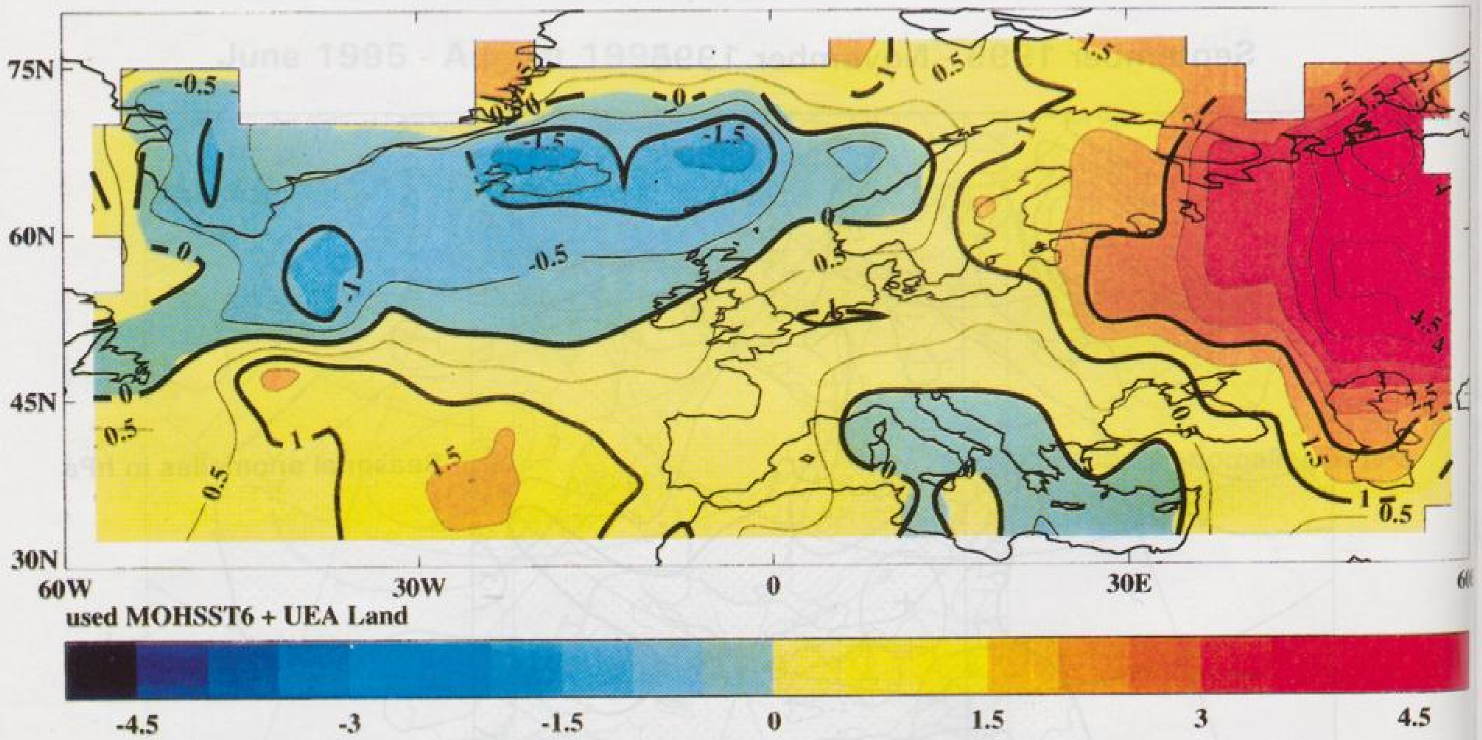
Seasonal anomalies in hPa

Sea level pressure

(source: Deutscher Wetterdienst, Germany)



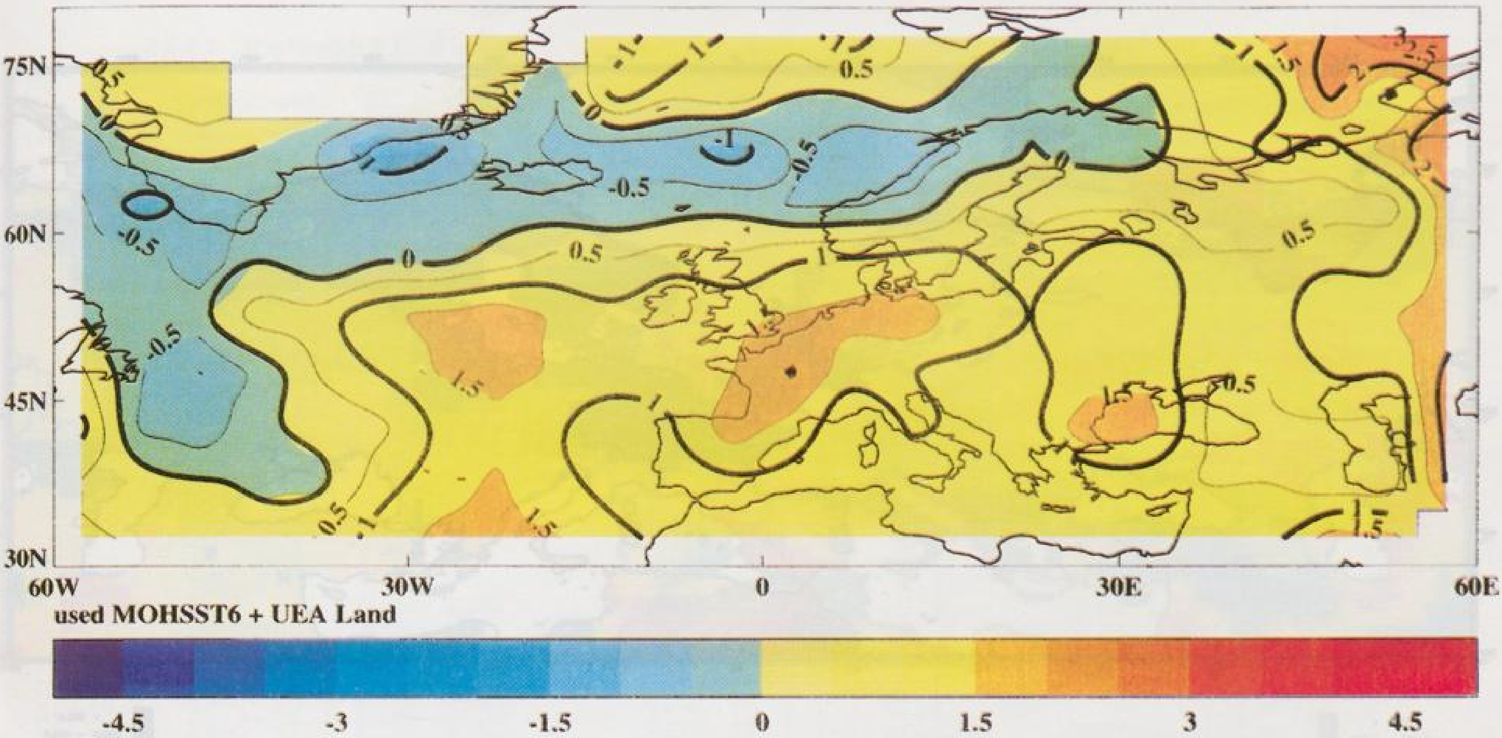
December 1994 - February 1995



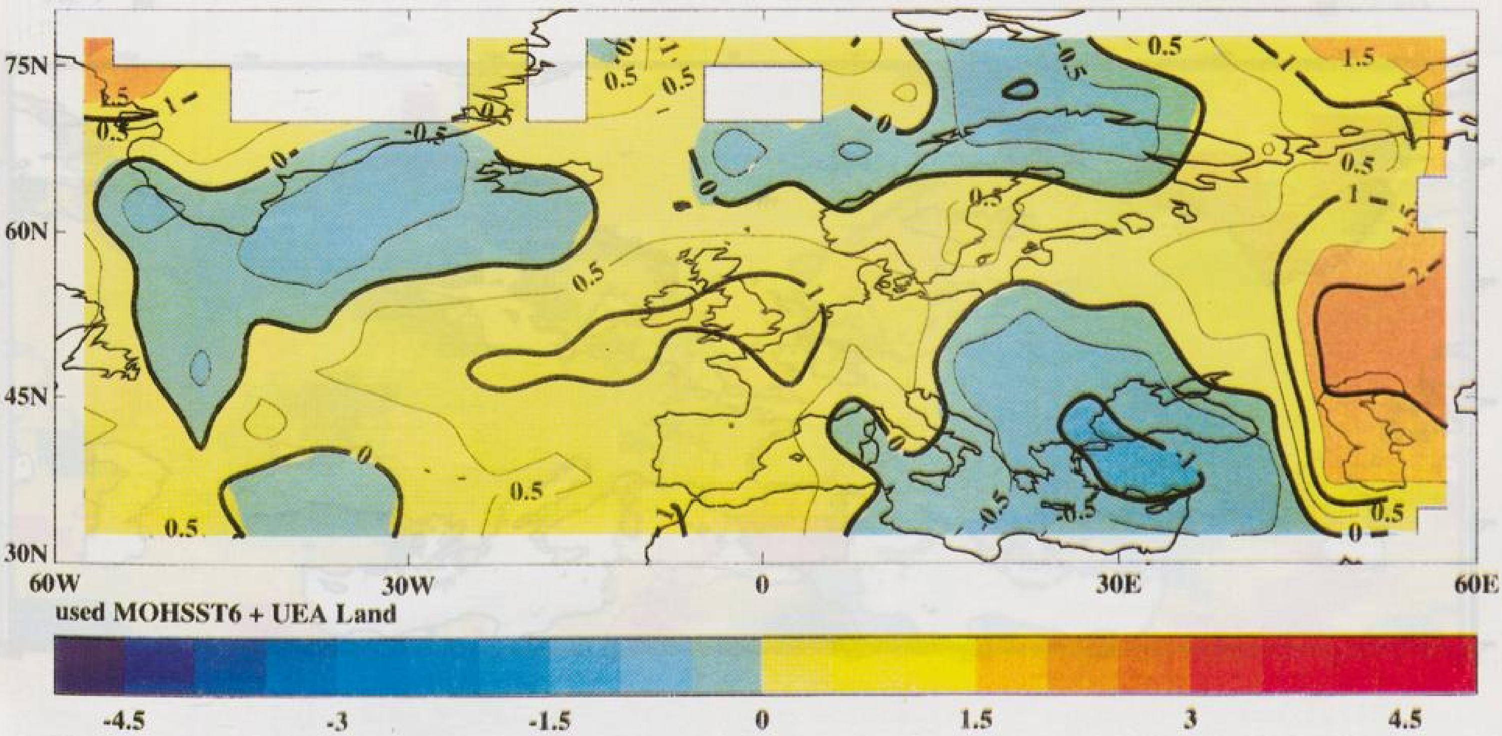
March 1995 - May 1995

Surface temperature anomalies in ° C

Reference period: 1961 - 1990
(source: U.K. Meteorological Office, land data provided by University of East Anglia)



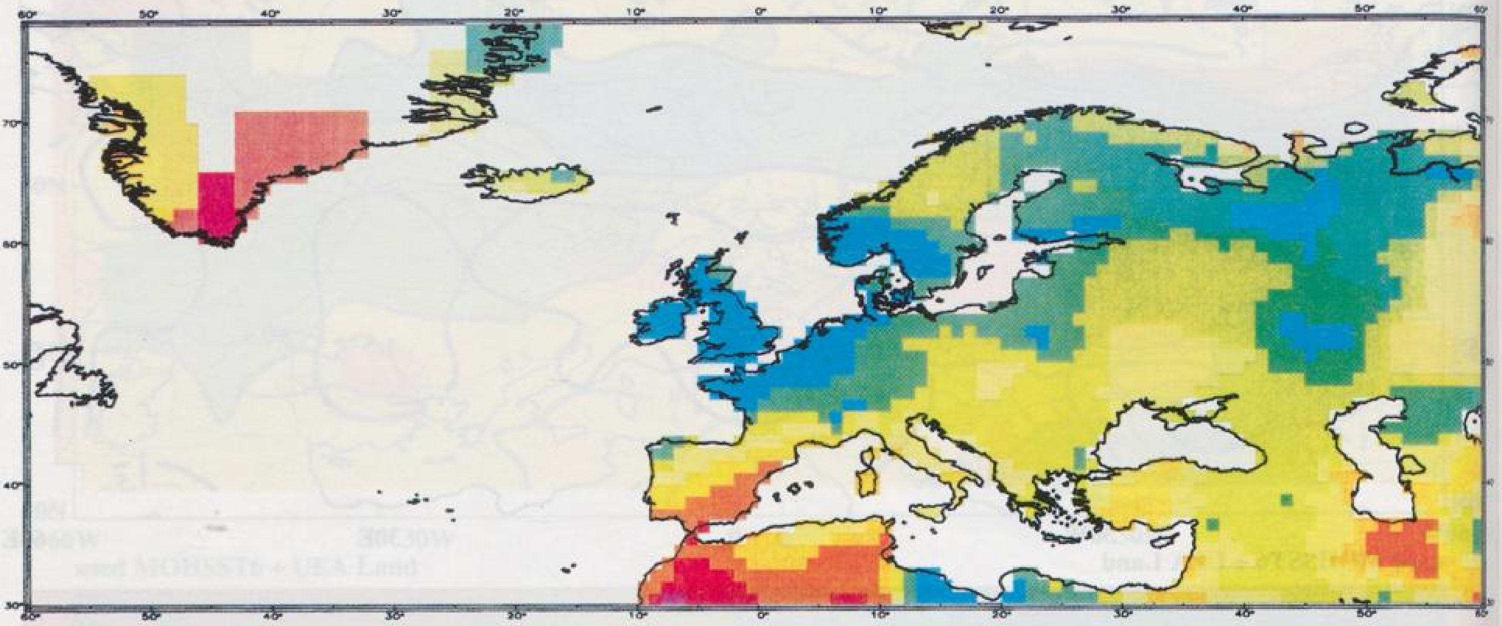
June 1995 - August 1995



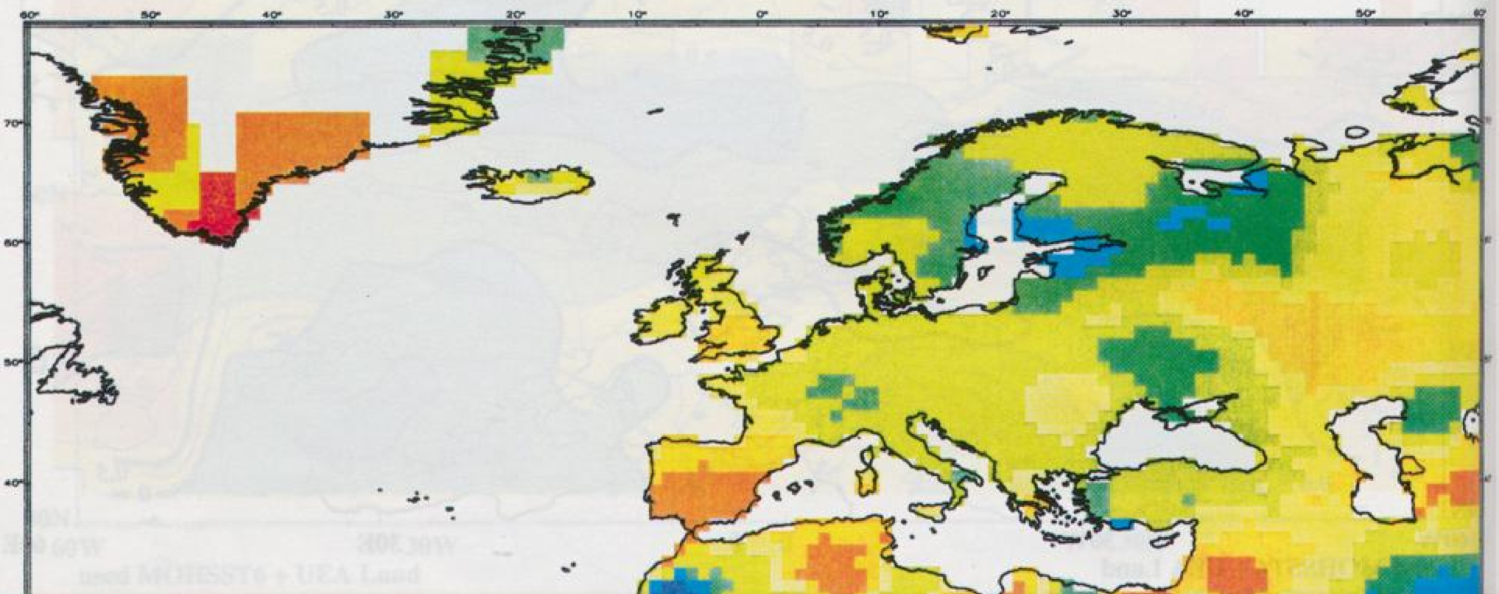
September 1995 - November 1995

Surface temperature anomalies in ° C

Reference period: 1961 - 1990
(source: U.K. Meteorological Office, land data provided by University of East Anglia)



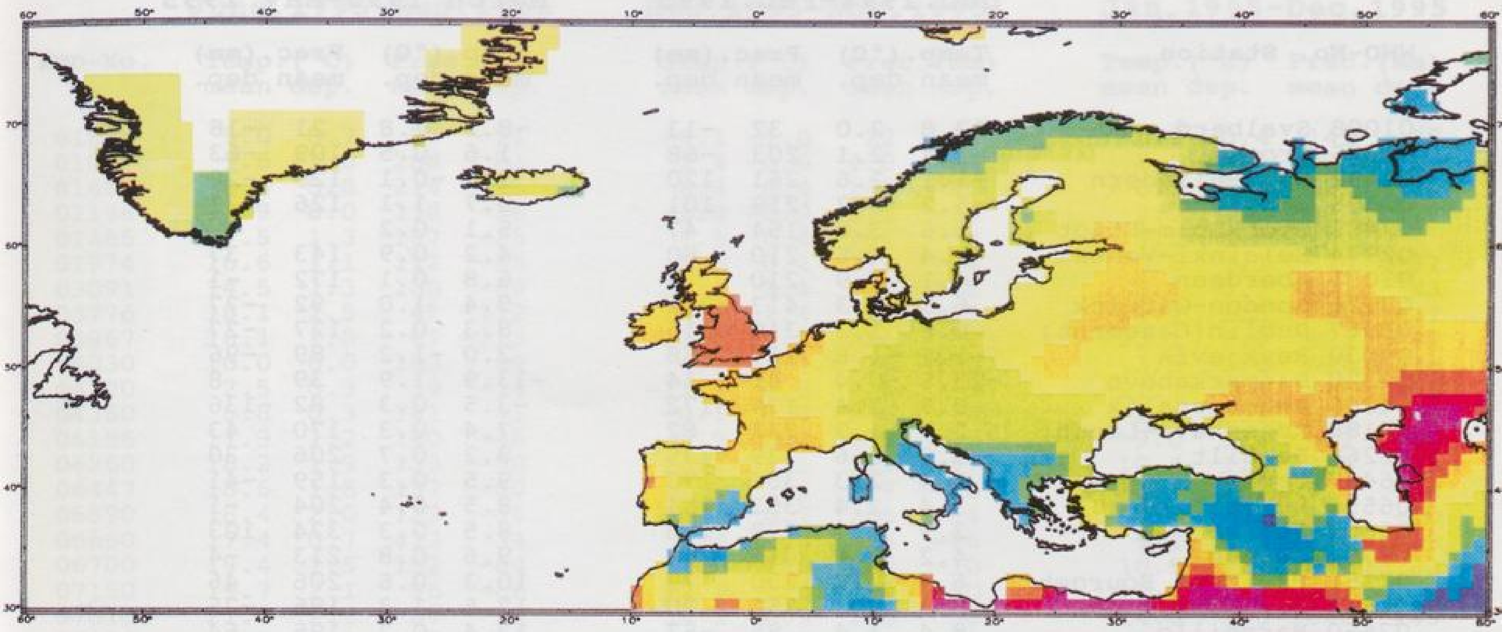
Dezember 1994 - February 1995

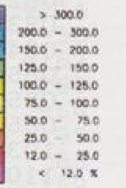


March 1995 - May 1995

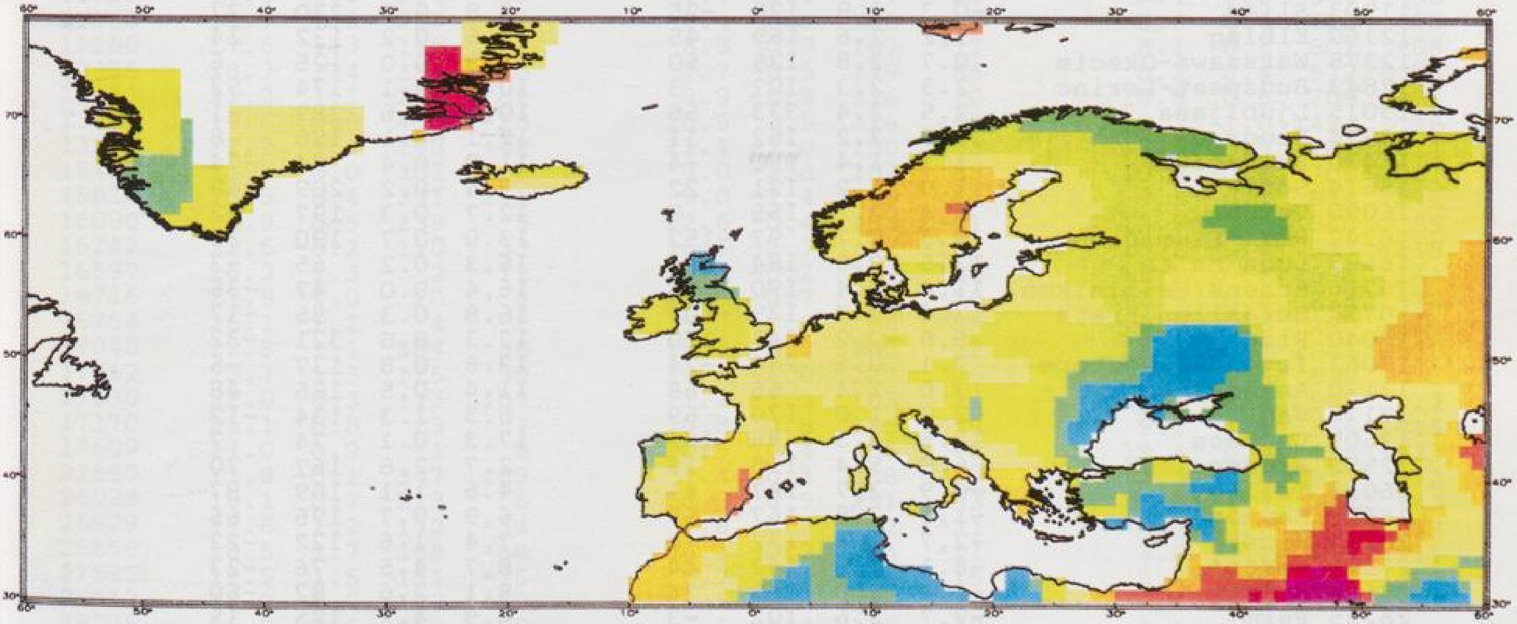
Precipitation in percentage of normal

Reference period: 1961 - 1990
(source: Deutscher Wetterdienst,Germany)





June 1995 - August 1995



September 1995 - November 1995

Precipitation in percentage of normal

Reference period: 1961 - 1990
(source: Deutscher Wetterdienst, Germany)

Seasonal and annual temperature means and precipitation sums and their anomalies* for selected stations

WMO-No.	Station	Dec.1994-Feb.1995 Temp.(°C) mean	dep.	Prec.(mm) mean	dep.	March 1995-May 1995 Temp.(°C) mean	dep.	Prec.(mm) mean	dep.
01008	Svalbard	-12.8	2.0	32	-13	-8.2	1.8	21	-18
01025	Tromsø	-1.4	2.1	203	-68	1.6	0.5	109	-63
01492	Oslo-Blindern	-1.1	2.6	261	120	5.0	-0.1	120	-20
02196	Haparanda	-5.2	5.7	219	101	0.7	1.1	126	31
02485	Stockholm-Stadt	0.6	3.0	154	47	5.1	0.2		
02974	Helsinki-Vantaa	-1.4	4.6	210	80	4.2	0.9	143	37
03091	Aberdeen	4.1	0.9	210	5	6.8	0.1	172	-1
03776	London-Gatwick	6.5	2.3	413	202	9.4	1.0	92	-77
03967	Dublin(Casement)	6.0	1.3	310	116	8.3	0.2	127	-27
04030	Reykjavik	-1.7	-1.6	167	-58	2.0	-1.2	89	-96
04320	Danmarkshavn	-23.5	-0.4	49	14	-13.9	1.9	39	8
04360	Angmagssalik	-8.9	-1.4	134	-172	-3.5	0.3	82	-136
06186	København-Landb.	2.8	1.7	222	82	7.4	0.3	170	43
06260	De Bilt	5.3	2.6	329	135	9.2	0.7	206	30
06447	Uccle	5.4	2.3	367	170	9.5	0.3	159	-41
06590	Luxembourg	3.4	2.4	363	154	8.5	0.4	204	-1
06660	Zürich	2.9	2.4	378	158	8.5	0.3	374	103
06700	Genève	4.2	2.6	416	168	9.6	0.8	213	-4
07150	Paris-Le Bourget	6.9	2.9	230	79	10.3	0.6	206	46
07510	Bordeaux	8.4	2.2	350	70	12.5	1.3	196	-25
07650	Marseille	8.4	1.4	95	-57	13.4	0.2	195	64
08222	Madrid	7.7	1.1	69	-72	15.0	2.2	61	-67
08314	Mahon/Menorca	12.1	1.1	72	-122	14.9	0.7	72	-55
08495	Gibraltar	14.9	1.1	68	-299	17.5	0.9	57	-113
08506	Horta/Acores	15.6	1.2	308	-17	16.8	1.6	242	44
08522	Funchal/Madeira	17.3	0.7	102	-121	18.4	1.2	75	-34
08535	Lisboa	13.0	1.1	166	-111	16.9	1.1	79	-78
10384	Berlin-Tempelhof	3.3	2.7	172	42	9.0	0.1	162	27
11035	Wien-Hohe Warte	2.7	2.2	99	-25	10.2	0.1	203	51
11518	Praha-Ruzyne	1.3	2.6	95	23	7.7	-0.1	168	25
11903	Sliac	-0.3	1.9	120	-25	8.8	0.4	230	77
12160	Elblag	1.2	2.6	169	45	7.5	0.2	132	14
12375	Warszawa-Okecie	0.7	2.8	125	50	7.8	0.0	125	6
12843	Budapest-Lorinc	2.3	2.3	107	3	10.8	-0.1	174	52
13015	Ljubljana	2.5	2.4	333	56	10.5	0.6	289	-1
13274	Beograd	3.9	2.2	162	11	12.1	-0.1	188	8
15420	Bucuresti	1.1	1.4	130	-4	11.0	-0.4	94	-74
15614	Sofia	1.0	1.2	121	22	9.4	-0.2	209	48
16090	Verona	4.6	2.2	155	9	12.7	0.3	197	-2
16242	Roma-Fiumicino	9.3	0.7	97	-152	13.0	-0.7	190	34
16597	Luqa/Malta	13.5	0.6	184	-76	16.3	0.2	65	-3
16716	Athens(Hellinikon)	11.4	0.4	190	32	16.4	0.0	47	-35
16754	Heraklion/Kreta	13.4	0.7	139	-102	16.8	0.3	85	-17
17040	Rize	6.8	-0.2	747	120	12.3	0.6	321	-32
17062	Istanbul-Goztepe	7.1	0.6	264	-24	12.8	0.8	137	-5
17130	Ankara/Central	3.0	1.4	66	-68	11.4	0.5	186	48
17170	Van	-2.0	1.0	170	69	8.3	1.3	134	-12
17609	Larnaca	12.5	0.3	96	-102	17.3	0.1	74	7
22550	Arcangel'sk	-6.9	5.4	118	19	2.7	2.6	167	70
26038	Tallina	-0.9	3.7	167	41	4.6	1.1	189	87
26629	Kaunas	-1.1	2.8	167	59	6.9	0.7	196	65
26850	Minsk	-2.7	2.8	132	6	7.4	1.6	122	-23
27595	Kazan'	-8.1	3.1	142	44	8.7	4.5	76	-23
27612	Moskva	-4.9	2.8	168	34	8.1	2.6	82	-50
28225	Perm	-9.7	3.6	102	-3	6.9	4.1	125	15
33345	Kiev	-1.7	2.2	123	-16	8.8	0.5	209	71
34731	Rostov-na-Donu	-1.8	1.4	170	5	10.7	0.8	143	4
34880	Astrahan'	-2.0	2.1	45	7	12.6	2.4	43	-13
40080	Damascus	6.7	-0.6	44	-69	15.5	-0.3	22	-19
40100	Beyrouth	14.7	0.7	355	-177	18.8	1.0	114	-77
40184	Jerusalem	8.0	-1.2	371	-34	14.8	-0.6	84	-60
40270	Amman	8.6	-0.1	138	-20	16.7	0.9	32	-42
60030	Las Palmas/Gr.Can	18.8	1.0	3	-71	20.1	1.2	72	53

* reference period: 1961-1990, derived from CLIMAT and SYNOP-data

WMO-No.	June 1995-Aug.1995 Temp.(°C) mean	dep.	Prec.(mm) mean	dep.	Sep.1995-Nov.1995 Temp.(°C) mean	dep.	Prec.(mm) mean	dep.	Jan.1995-Dec.1995 Temp.(°C) mean	dep.	Prec.(mm) mean	dep.
01008	5.0	0.7	27	-21	-6.1	-1.0	22	-29	-6.1	0.4	145	-38
01025	9.6	-1.0	288	81	2.4	-0.6	418	95	2.7	-0.1	1005	32
01492	16.4	0.8	214	-25	6.4	0.4	163	-86	6.1	0.4	699	-70
02196	13.9	0.0	118	-36	1.8	-0.3	172	-13	2.0	0.8	571	19
02485	17.5	1.3	157	-25	7.5	0.4	161	3	7.2	0.6		
02974	16.6	1.1	112	-85	5.6	0.4	214	-4	5.6	1.1	614	-37
03091	14.5	1.3	100	-89	10.1	1.4	367	146	8.6	0.7	871	83
03776	18.1	2.5	45	-112	11.9	1.4	197	-19	11.2	1.5	716	-37
03967	16.1	1.8	67	-113	11.0	1.0	216	9	10.1	0.9	693	-42
04030	10.0	0.0	183	19	4.5	0.1	126	-100	3.8	-0.6	624	-176
04320	2.5	0.3	19	-14	-11.5	0.8	28	-5	-11.7	0.5	128	-4
04360	5.8	0.3	161	-1	-0.1	0.7	230	-16	-1.6	0.1	688	-244
06186	17.9	1.2	140	-46	9.9	0.2	170	-13	9.0	0.4	622	-14
06260	18.2	1.9	133	-80	11.2	1.1	153	-67	10.4	1.1	730	-73
06447	18.6	1.8	137	-80	11.6	1.1	109	-96	10.9	1.0	724	-95
06590	18.4	2.0	122	-85	9.7	0.7	166	-54	9.6	1.1	831	-10
06660	17.4	0.7	413	34	9.4	0.2	155	-96	9.2	0.6	1324	203
06700	19.4	1.5	152	-84	11.0	1.0	238	-10	10.8	1.3	1031	82
07150	19.7	2.1	96	-66	12.3	1.1	106	-60	12.0	1.4	643	4
07510	21.3	2.3	87	-69	14.2	0.9	286	38	14.0	1.6	1048	143
07650	23.5	1.1	43	-26	15.9	0.5	187	5	15.3	0.8	617	83
08222	24.5	1.6	44	-5	15.8	0.9	85	-54	15.8	1.5	343	-114
08314	24.4	1.2	78	32	19.0	0.7	232	16	17.7	1.0	553	-30
08495	23.5	0.5	29	11	20.4	0.9	106	-114	19.1	0.9	613	-162
08506	21.2	0.5	230	94	18.6	-0.4	322	11	18.0	0.7	1153	183
08522	22.1	0.8	33	17	21.6	0.6	183	-62	19.8	0.8	539	-54
08535	22.2	0.1	9	-16	18.6	0.0	288	68	17.7	0.6	776	97
10384	19.5	1.4	246	55	9.8	-0.1	119	-12	9.8	0.4	670	83
11035	19.9	0.9	216	15	9.3	-0.8	213	77	10.3	0.4	772	159
11518	17.3	0.5	239	30	7.7	-0.4	77	-25	8.1	0.3	564	38
11903	18.7	1.3	223	7	7.4	-0.8	105	-70	8.5	0.6	712	23
12160	17.6	1.3	196	-73	8.0	0.0	167	-12	8.1	0.5	602	-88
12375	18.7	1.4	192	-10	7.7	-0.5	179	56	8.2	0.4	572	53
12843	21.2	1.1	248	82	9.9	-0.8	126	0	10.9	0.5	709	191
13015	19.6	0.8	430	-23	10.6	0.5	316	-62	10.7	1.0	1424	26
13274	22.2	1.3	168	-42	11.4	-1.0	150	1	12.3	0.5	701	11
15420	21.6	0.0	301	119	9.0	-2.8	202	58	10.5	-0.6	709	81
15614	19.5	0.4	331	151	9.0	-1.4	145	22	9.8	0.1	834	271
16090	22.9	0.5	238	5	12.6	-0.4	154	-61	13.0	0.5	848	55
16242	22.6	-0.2	110	33	16.1	-0.7	92	-181	15.3	-0.1	537	-218
16597	26.3	1.3	2	-11	20.4	-0.2	353	140	19.2	0.6	695	141
16716	27.8	1.0	20	3	19.0	-0.7	86	-26	18.8	0.3	295	-74
16754	26.1	1.2	4	-1	19.3	-0.5	94	-59	19.0	0.6	290	-211
17040	22.5	1.1	504	58	15.3	-0.2	767	22	14.4	0.5	2041	-130
17062	23.7	1.3	125	58	14.5	-1.0	227	26	14.6	0.5	699	1
17130	22.0	0.3	172	107	11.3	-1.3	103	24	12.1	0.4	528	112
17170	21.1	0.8	23	-7	10.8	0.5	163	59	9.7	1.1	366	-15
17609	27.0	0.9	1	0	20.5	-0.4	56	-8	19.4	0.3	196	-133
22550	13.8	-0.1	347	169	1.4	-0.1	188	17	2.3	1.5	817	272
26038	16.1	0.7	213	6	6.6	0.5	251	33	6.2	1.1	796	143
26629	17.6	1.2	172	-34	6.8	-0.2	142	-21	7.1	0.6	647	39
26850	18.5	1.7	168	-68	6.1	-0.2	144	-11	7.0	1.2	551	-111
27595	19.5	1.5	131	-75	5.7	1.9	154	15	6.1	2.4	517	-25
27612	18.0	1.0	192	-50	5.6	0.6	145	-35	6.6	1.6	577	-111
28225	16.9	0.6	250	40	3.1	1.4	133	-39	4.1	2.2		
33345	20.1	1.5	211	-12	7.4	-0.6	154	22	8.5	0.8	684	52
34731	22.7	0.6	107	-43	10.3	0.5	161	36	10.7	1.1	604	25
34880	24.7	0.9	44	-20	11.6	1.7	48	-14	11.9	1.9	191	-29
40080	26.1	0.3	0	-1	17.3	-0.7	10	-29	16.5	-0.2	57	-137
40100	27.0	1.8	4	2	22.3	0.2	230	67	20.7	1.0	554	-334
40184	23.0	0.4	0	0	17.8	-0.9	68	-25	16.1	-0.4	319	-323
40270	25.5	0.9	0	0	19.2	0.0	17	-17	17.7	0.6	97	-168
60030	24.1	1.3	3	0	23.2	0.9	26	-20	21.6	1.1	167	29

Monthly surveys

January: **Regionally severe floodings**
Avalanche catastophes in Iceland
Mostly dry in southern and eastern Europe
Extremely warm in the Northeast

Unusually large amounts of rainfall along with rapidly melting snow caused widespread flooding and dangerously high water levels in many parts of Europe.

This was particularly bad in The Netherlands, Belgium, France and Germany. By the end of the month, continuous rainfall resulted in extremely high water levels in the catchment basins of the rivers Rhine, Waal and Mosel.

In many of the places, the recorded rainfall reached two or three times the normal value for January. In particular, the period of January 21-30 was extremely wet (see fig. 10, page 21).

Copious rain, continuing into the New Year, gave much of Britain its wettest January in 47 years and put many rivers in England and Wales on flood alert. Some rivers recorded their highest ever levels.

On January 16, 14 people were killed in an avalanche that destroyed 19 houses in Sundavik, northwest Iceland.
On January 10-11, more than 100 cm depth of new snow caused chaotic traffic situations in Tyrol, Austria.

Whereas many regions suffered from copious amounts of precipitation, drought situations with rainfall amounts less than 50 % of normal plagged wide parts of the southern countries.

In Israel, January 1995 was nearly the driest of the last forthy years. In the southern parts of the country, there was no rain at all.
In Portugal and Spain, the water shortage, which had lasted for more than four years, still persisted, as precipitation anomalies remained far below normal. The Sierra Nevada in southern Spain was without snow cover for the first time since 25 years. Thus the World Ski Championship had to be cancelled.

There was a number of severe storm conditions that afflicted the Region in 1995.
Blizzards ravaged Italy and Romania on January 4,5. In the harbour of Constanza, Romania, two ships capsized, killing 54 people. On January 16, in the same storm that released the Sundavik avalanche, a new windspeed record, a gust of 74.1 m/s, was measured at Gagnheidi, Iceland.
January 23-27, was stormy in many European countries: In Hanko, in the western part of the Gulf of Finland, the highest wind speed of the year, 31 m/s, was recorded. Thunderstorms and record gusts between 70 to 90 m/s, (up to 115 m/s in the Jura) caused considerable damage in severals regions of Switzerland, Austria and Germany.

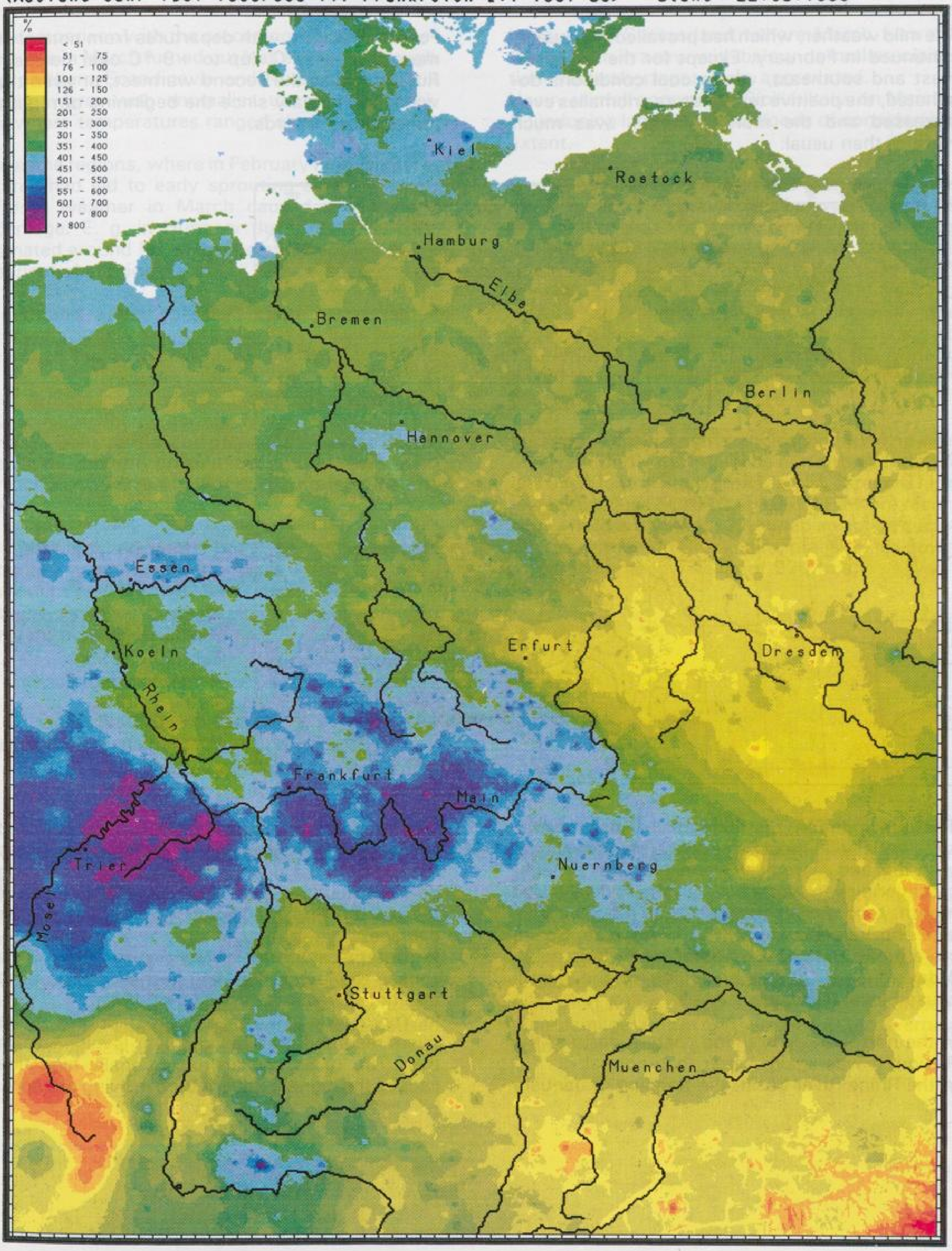
With prevailing westerly winds over the north of the Region, the month turned out to be mostly warmer than normal. In northern Russia, temperature anomalies surpassed +8°C.

Page 21, Fig. 10:

Precipitation anomalies over Central Europe between January, 21 and 31, 1995
Reference period:
1961 - 1990
(source:
Deutscher Wetterdienst, Germany)

Niederschlagshoehe (mm) 21.-31.Januar 1995
in Prozent des Normalwertes (Januar 1961-1990/31*11)
(Ausland Jahr 1961-1990/365*11, Frankreich z.T 1951-80)

Deutscher Wetterdienst
GB FE, Ref. FE 24
Stand: 22.08.1996



February: Record warm February
Persisting drought in the Mediterranean
Elsewhere mostly wet

The mild weather, which had prevailed in January, continued in February. Except for the far northwest and southeast, where cool conditions dominated, the positive temperature anomalies even increased and the month, overall, was much warmer than usual.

For many places, with departures from normal of more than +4 °C, (up to +9 °C over northern Russia) it was the second warmest, or even the warmest February since the beginning of regular temperature records.

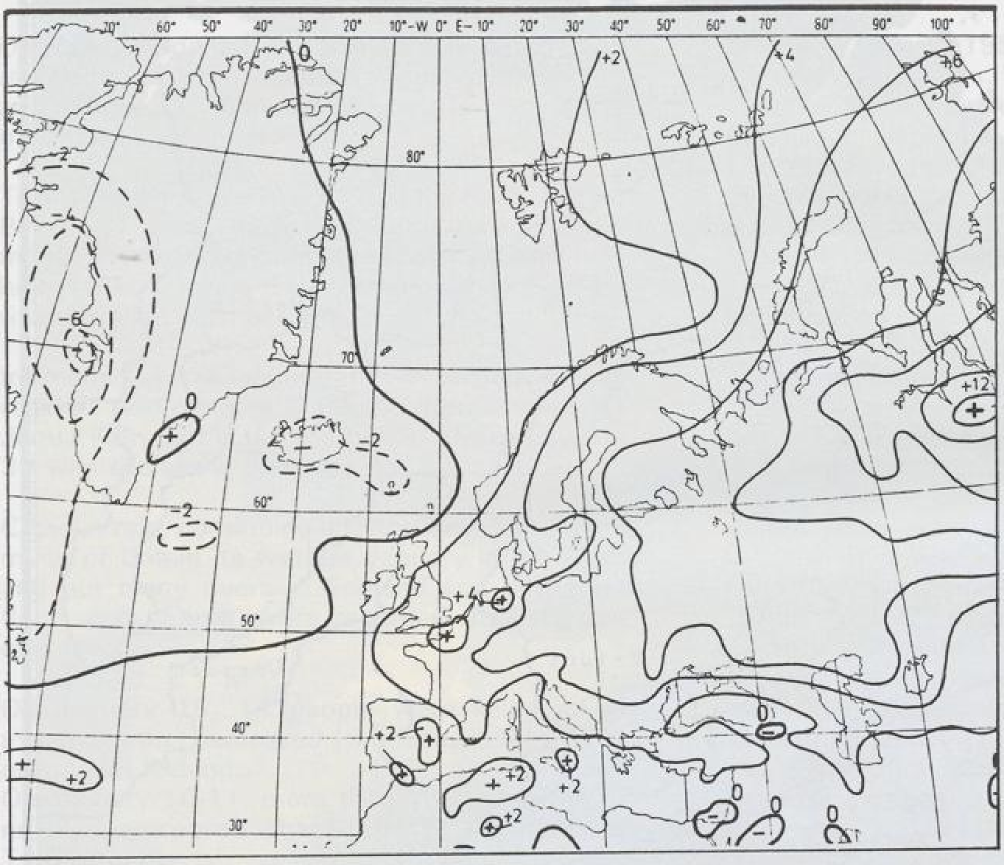


Fig. 11: Air temperature anomalies (°C) in February 1995
Reference period: 1961 - 1990,
(source: Deutscher Wetterdienst, Germany)

The precipitation distribution did not change substantially. In most parts of the Mediterranean, with dry and extremely warm weather, drought conditions even worsened. (In the middle of the month, record temperatures up to 25 °C in Malaga and Valencia and 29 °C in Alicante, Spain, were measured.) On the other hand, in Israel, a 4-day rainspell at the beginning of the month caused local floodings.

In the northern, central and eastern parts of the Region, it was again wetter than normal.
In the Rhine River basin, the flooding of January >continued into February. 250 000 people and thousands of cattle along the borders of the rivers were evacuated due to the threat of collapsing dikes. Fortunately, rainfall ceased in the course of the month, and the region was spared further damage.
In eastern Latvia, an ice dam of the River Orge caused the largest flooding in the history of the town of Ogre.
In Yorkshire and northeast Great Britain, some rivers recorded their highest ever levels. And on the 17th, gales and an exceptionally high tide caused the highest Severn Bore in living memory.

March: **Temperature near normal**
Dry weather still prevails in the Mediterranean
Severe flooding at the border of the Caspian Sea

In comparison with the preceding months, temperatures in March turned out less extreme. Though in northern Scandinavia and Russia, it was still quite warm with anomalies up to +4 °C, elsewhere temperatures ranged about normal.

In some regions, where in February high temperatures had led to early sprouting and flowering, frosty weather in March caused considerable damage. E. g. in Hungary the losses were estimated around 50 % for the apple and 70 % for apricot plantations.

In Iceland, a very cold period with below-normal temperatures, came to an end: Reykjavik passed through the coldest winter since 1920.

In Portugal, however, it was the 9th consequetive year with above normal March temperatures. Here, again, as in many parts of the Iberian Peninsula, the monthly precipitation totals did not even reach a quarter to a half of their long-term means, and dryness continued.

In Russia, where winter 94/95 had closed exceptionally warm, ice on the rivers in the western and northwestern regions thawed 25 to 31 days earlier than usual. This resulted in record high water levels in many rivers.

In southern Switzerland, where March was the third month in a row with below-normal precipitation, watershortages were aggravated.
Heavy rainfall occurred in Sicilia, Italy, on March 13 inducing landslides and floods of considerable extent.

Strong easterly winds caused a storm tide in the northwest of the Caspian Sea between March 12 and 16, flooding 1500 km², destroying hundreds of houses and killing more than 150 000 heads of cattle.

In Austria, Bulgaria and Croatia, unusually late heavy snowfall and strong winds (gusts up to 130 km/h in inland and 160 km/h at the Adriatic coast) brought down power lines and caused high economic losses.

In Latvia, a special meterological phenomena was reported. Under the influence of a strong anticyclone over Central Russia, on March 13, record high pressure values of 1046 to 1051 hPa were recorded, whereas on March 27, when an active cyclone was centred off Stockholm, pressure fell down to the extreme low value of 970 hPa.

April: **Very warm in the northeast**
Very dry in Spain, Greece and in the southeast
Elsewhere irregular precipitation conditions

This spring month showed its typical variability in extreme conditions.
On the high mountainous observatory Lomnický štít, 2635 m a.s.l., Slovakia, on April 15, a record snow depth of 370 cm was measured.
In Portugal, after an unusual warm period between April 1 and 18 (temperatures rose up to as high as 32.4 °C in Coimbra), temperatures dropped abruptly and regional frost and hail caused serious agricultural problems.

In Kazakhstan, monthly mean temperature anomalies surpassed +6 °C. At the same time it was extremely dry, though April normally has the highest monthly precipitation sums of the year.

Extremely dry conditions occurred in most parts of Slovenia. Elsewhere in Azerbaijan, after heavy rain, mud flows of some rivers caused considerable damage. And in northern Russia the Svernaja Dvina flooded the town of Kotlas.

May: **Again warmer than normal in the northeast and southwest**
Extreme flooding in southern Norway
Still mostly dry in the Mediterranean

The southeastern part of Norway experienced the biggest flood recorded since the devastating flood in 1789 (see Fig. 12). During the winter months, accumulated precipitation in the form of snow reached 120 to 140 % of the normal amount in the mountain areas. The weather in May was cold and the snow depth in the mountains even increased after snowfall during the first two weeks in May. From May 22 to 25, tempera-ture rose by 5 to 10 °C, triggering the snow melt process. The discharge of the rivers Glomma and Laagen started to increase on May 25 and after heavy precipitation at the end of the month, 150 km² of cultivated farmland were flooded and crops destroyed. More than 7000 people had to be evacuated from their homes.

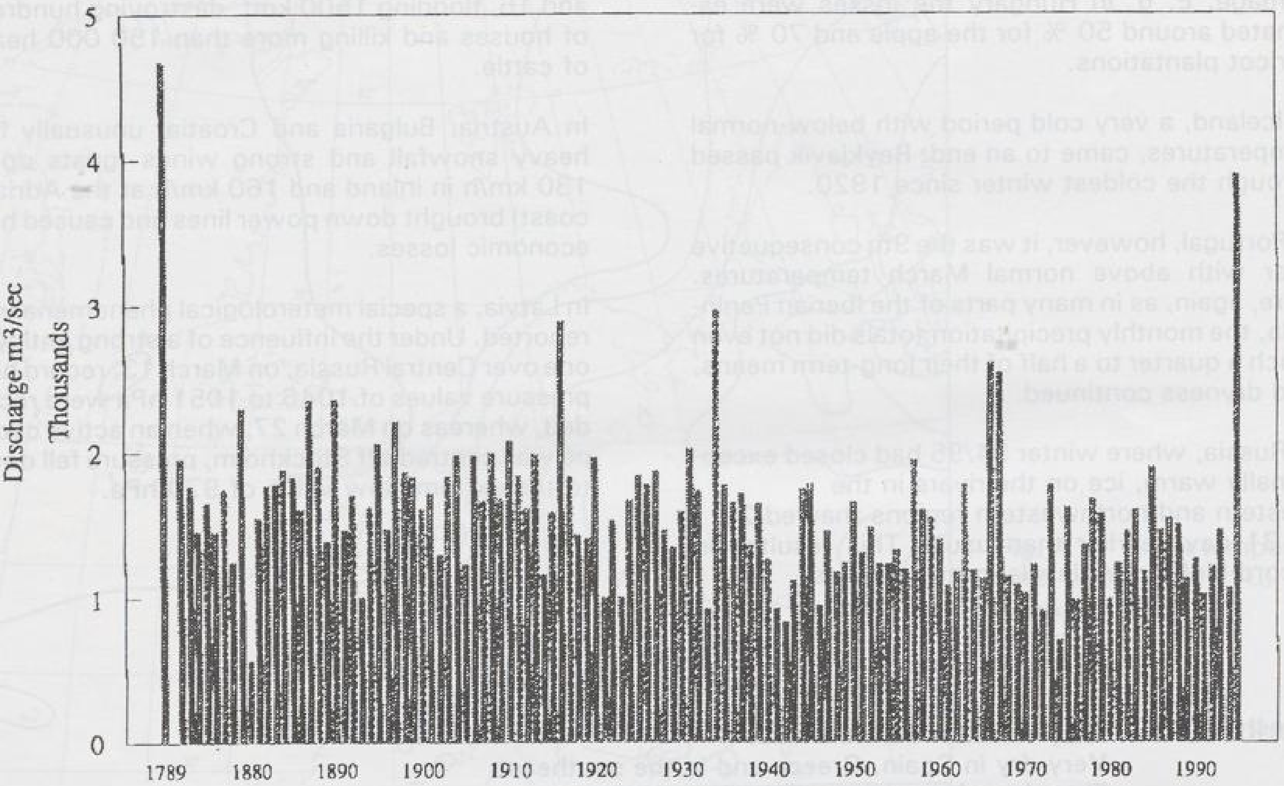


Fig. 12: Annual maximum daily discharge of river Glomma at Elverum, Norway (source: Norwegian Water resources and Energy Administration)

In Russia and Spain, May 1996 turned out warmer than normal. In the northeast with temperature anomalies up to +3 °C, deviations from normal were less than in the preceding months.

On May 14, there was an abnormal snowstorm in southern and southeastern Finland causing widespread snowdepths exceeding 20 cm, an unusually large amount to fall late in May. Only two weeks later, a hot spell occurred in the same region. In Lahti, on May 30, Finlands's highest ever temperature of 30.1 °C was measured.

From May 22 to 24, one of the most extreme "Sharavs" (very hot and dry weather) of the last 50 years, plagued Israel. Temperatures rose to between 37 to 44.5 °C while relative humidity was only 5 to 15 %.

Heavy rain caused high tides and floods in Slovakia. On May 31, 78.4 mm of rain fell, the highest daily total since 1951.

Between May 8 and 22, the river Volga overflowed its banks and flooded wide parts of the Volgograd - Astrakhan region.

June: **Heavy rain and hail in many parts of northern and Central Europe**
Again unsually warm in the east

Extreme weather events caused high economic losses in many parts of the Region. There were high rainfall intensities with lots of thunderstoms, tornadoes and hailstorms. In early June, southeastern Norway, passed through the most dramatic period of the flood which had started in May.

Heavy showers occurred in western and southwestern Finland and prevented the cultivation of fields. A new Finnish monthly precipitation record for June was set in Niinisalo, western Finland (242.9 mm).

At the beginning of the month, snow depths on the northern side of the Alps were three times higher than normal.
High water levels of the rivers in southern Germany, restricted shipping on rivers Rhine and Main.

In Sered, Slovakia, the maximum daily precipitation total since measurements started in 1901 was reported on June 1.

In Burgenland, Austria, torrential rain poured down (60 mm within 2 hours, more than 100 mm within 24 hours) and flooded villages on June 5. In the region of Klagenfurt, Austria, on June 21, a strong hail occurred, landslides blocked roads and the rail connection to Italy.

In southern Spain, after a long-lasting drought, extreme downpours caused considerable damage and cut villages off.

In middle-western Bohemia, Czech Republic on June 25, heavy rain gave rise to extreme local floods with recurrence intervals of 50 to 100 years (see Fig. 13).

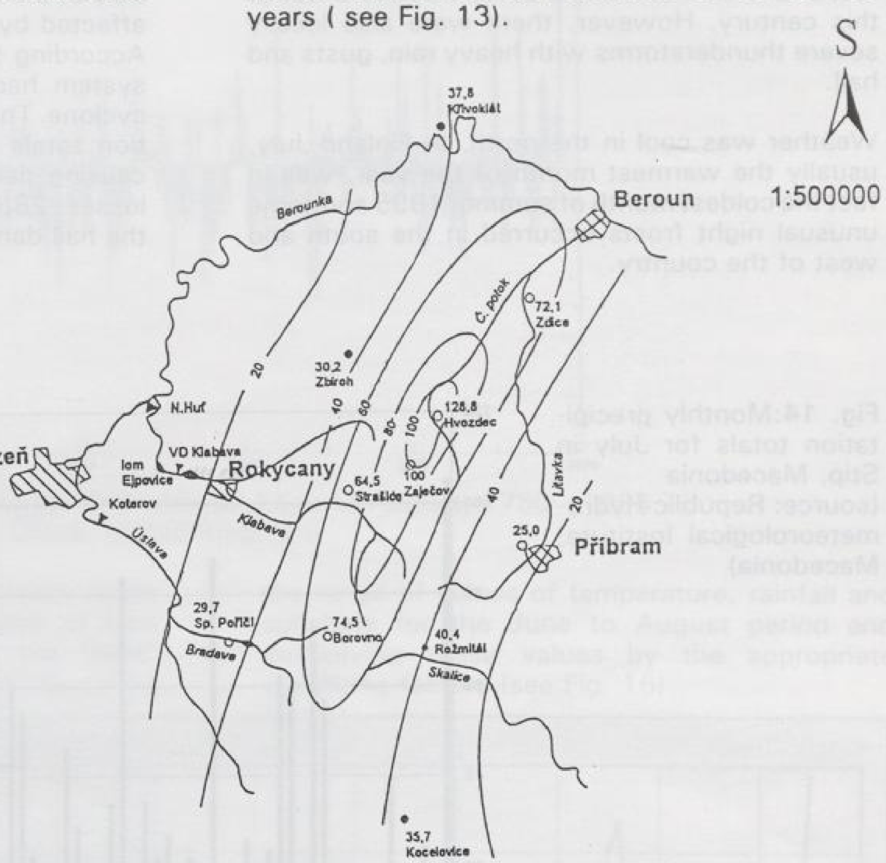


Fig. 13:
Precipitation totals in the middle-west Bohemia on June 25,1995
(source: Czech Hydrometeorological Institute)

A hot spell with maximum temperatures up to 32 °C plagued eastern Europe and was accompanied by thunderstroms and locally heavy rain. In Ghor Safi, Jordan, the annual extreme maximum temperature of 47 °C was measured.

In Azerbaijan, 56 - 144 mm of rain within only 2 to 4 days destroyed large parts of the winter cereal crops. 76 mm of rain within 38 minutes and gusts up to 28 m/s ravaged wide parts of Kislovodsk, Russia, on June 20.
Lithuania reported the extreme monthly number of 10 to 14 thunderstorms (normal 5-6).

In Latvia, thunderstorms occurred every day from June 3 to 13, going along with hail (diameters up to 6 cm), heavy showers and stormy gusts. In the southeastern and eastern parts of Yugoslavia, on June 16, hailstones with diameters of 25 mm and stormy gusts caused high economic losses.

Turkey suffered from drought conditions in many regions (esp. around in the vicinity of Konya). At the same time, horticultural losses of 70 to 100 % were reported from Isparta, after torrential rain and stormy gusts on June 30.

July: **Mostly hot and dry from Ireland to Russia**
Regionally heavy rain in the Mediterranean

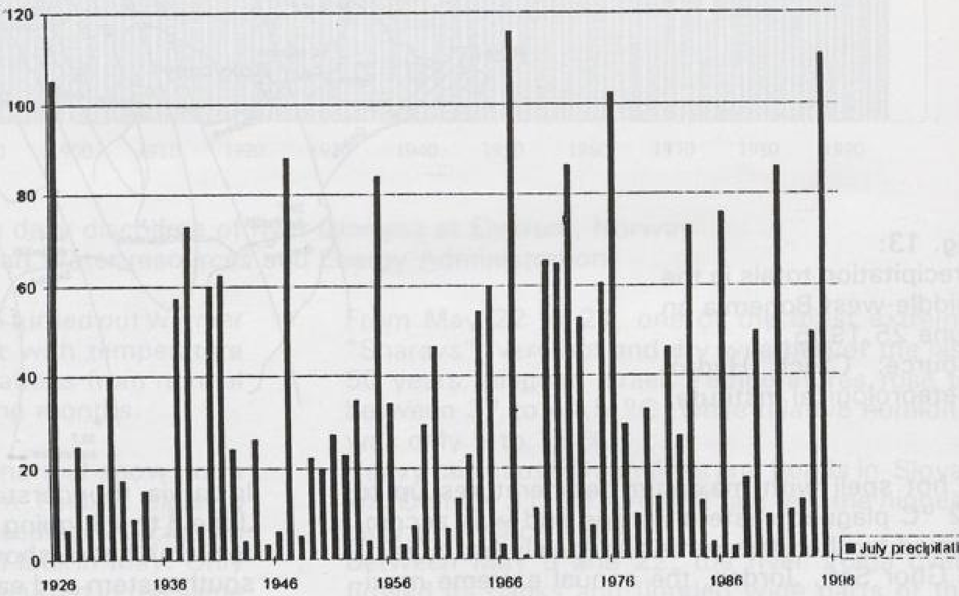
After June had been extraordinarily warm in the east, the heat wave slowly moved westward with temperature anomalies up to 4 °C over western and central Europe in July.
For several places, it turned out to be the second warmest month since the beginning of regular observations.
From July 15 to 25, an extreme hot spell affected southwestern Europe. Temperatures soared to new all time maximum values in Spain and Portugal (Cordoba: 46.6 °C, Amareleja: 46.5 °C) and daily minimum temperatures rarely dropped beneath 25 °C.
At the same time, dry conditons prevailed, causing water shortages affecting agriculture and causing forest fires.
In Slovakia, July 1995, with monthly precipitation totals ≤ 3 mm at many places, was the driest of this century. However, there were also locally severe thunderstorms with heavy rain, gusts and hail.

Weather was cool in the north. In Finland July, usually the warmest month of the year, was in fact the coldest month of summer 1995 and some unusual night frosts occurred in the south and west of the country.

In Russia, July also turned out colder than June. Thunderstorms, torrential downpours of rain and hail regionally caused high losses. In Lithuania, on July 10, a hailstorm occurred with hailstones reaching diameters up to 12 cm.

After longlasting below-normal precipitation conditions in the Mediterranean, July was wetter than usual. Severe floods were reported from Turkey, killing 67 people and causing high economic losses. In Israel, it rained on four days 10 to 26 mm. A number of four rainy days in July had never been recorded anywhere in the country before.
In Macedonia, too, it was very rainy (see Fig. 14, below and Fig. 22, p.31) and July turned out to be the second wettest in more than 70 years. On July 6, the region of Negotino and Kavadarol was affected by heavy rain and strong gusty winds. According to the radar reports, the cloud cover system had all the charcteristics of a tropical cyclone. The highest ever recorded daily precipitation totals of up to 180 mm were measured, causing devastating floods and great economic losses. 288 hail rockets were released to reduce the hail damage.

Fig. 14: Monthly precipitation totals for July in Stip, Macedonia (source: Republic Hydrometeorological Institute, Macedonia)



August: Hot and dry in western Europe
Heavy rain from Italy to the Balkans

The heat wave, which had slowly moved westward from Russia in June, reached the British Islands. Thus, the "Central England" temperature in August 1995 was 3.4 °C above the 1961 - 90 period. This was the warmest August in the record which extends back to 1659. As July had been 2.5 °C warmer than average, the period July and August together was the warmest in the series (see Fig. 15). The associated very dry conditions resulted in severe restrictions for water consumers over a wide area.
In The Netherlands, where hot, sunny and dry weather dominated since the end of June, August was the third warmest and sunniest of this century. At many places, no precipitation of any importance fell from middle of July to August 25.
In Brandenburg, northern Germany, 34 days without precipitation came to an end, the longest dry period during the main growing season in this century.
In southern and western Finland, as well, dry conditions prevailed and the period from July 6 to August 25 resulted in unprecedented dryness, reducing the crop yield considerably.

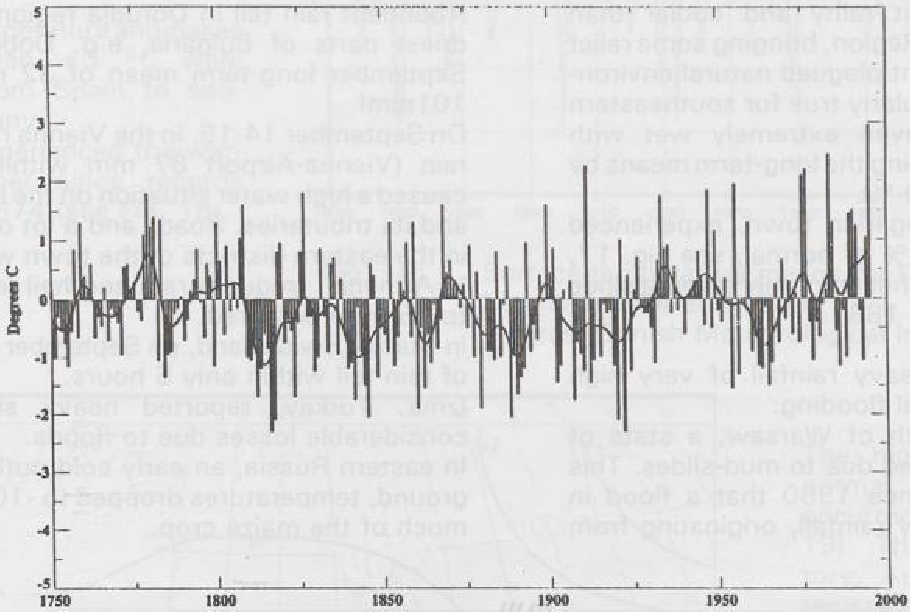


Fig. 15: Central England temperature anomalies of July and August, 1750 - 1995 (source: Meteorological Office, United Kingdom)

Ireland reported according to the Poulter Index which provides an objective measure of how "good" or "bad" a summer was, the "best" summer ever. The Poulter Index works by taking the range of values of temperature, rainfall and sunshine for the June to August period and multiplying these values by the appropriate weighting factors (see Fig. 16).

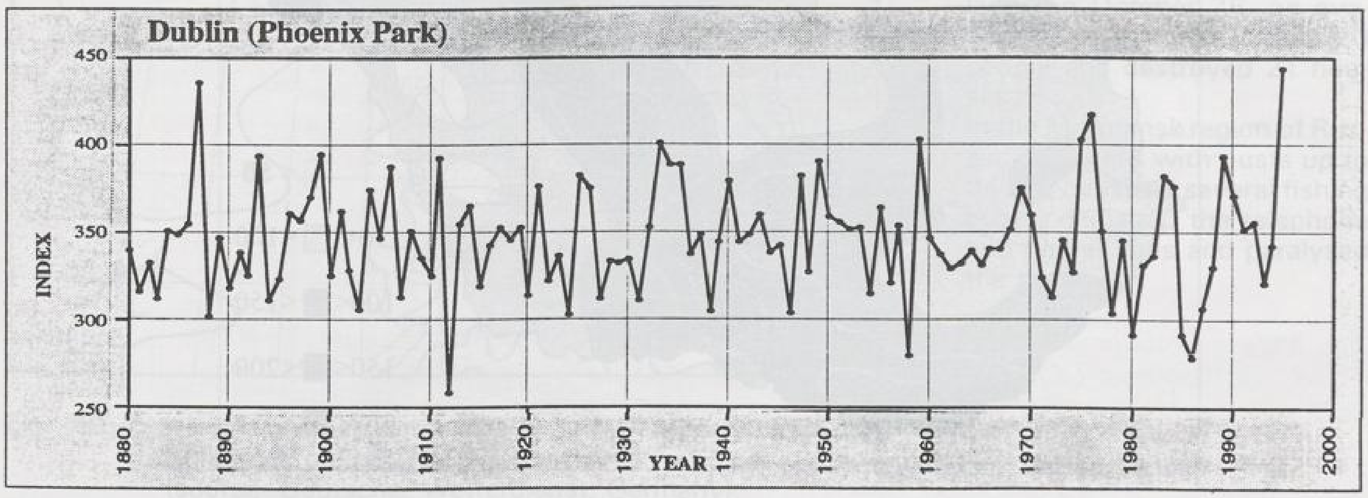


Fig. 16: Poulter Index for Dublin between 1880 and 1995 (source: Meteorological Service, Ireland)

Whereas warm and and dry weather persisted in Portugal and northwestern Spain, wide parts of the Mediterranean received heavy rain after months of drought. In a belt stretching from southern Italy and Montenegro to southwestern Turkey, monthly precipitation totals surpassed 300 to more than 400 % of their normals. Very high losses caused by floods and landslides were reported from northeastern Turkey, Albany and southern Italy.

Southern Norway had a warm and dry summer, but it was cold and wet in northern Norway. Tromsø (measurements since 1920) and Bodø (measurements since 1946) established new precipitation records for August with 203 mm and 237 mm respectively. On August 14, Tromsø enjoyed for the only time in the entire summer (for less than half an hour) a temperature above 20 °C.

September: Cold and wet in southwestern and central Europe / Warm in the northeast

September turned out rainy and cooler than normal in many of the Region, bringing some relief to the heat and drought plagued natural environment. This was particularly true for southeastern Europe which was even extremely wet with monthly totals surpassing the long-term means by more than 200 to 300 %.
Pécs, a southern Hungarian town, experienced 199 mm of rain (423 % of normal, see Fig. 17, below) which is the highest monthly amount since observations began in 1881.

In several regions, heavy rainfall. of very high intensities caused local flooding:
In Kielce region, south of Warsaw, a state of disaster was proclaimed due to mud-slides. This was the first time since 1980 that a flood in Poland was caused by rainfall, originating from the country itself.

Abundant rain fell in Dorudja region, one of the driest parts of Bulgaria, e.g. Dobrich, with a September long-term mean of 32 mm received 101mm!
On September 14-15, in the Vienna region, heavy rain (Vienna-Airport 87 mm within 12 hours) caused a high water situation on the Danube River and its tributaries. Roads and a lot of basements in the eastern districts of the town were flooded.
In Armenia, frequent rain and hail (diameters up tp 25 mm) occurred.
In Stabio, Switzerland, on September 13, 171 mm of rain fell within only 5 hours.
Izmir, Turkey, reported heavy showers and considerable losses due to floods.
In eastern Russia, an early cold outbreak (at the ground, temperatures dropped to -10 °C) spoiled much of the maize crop.

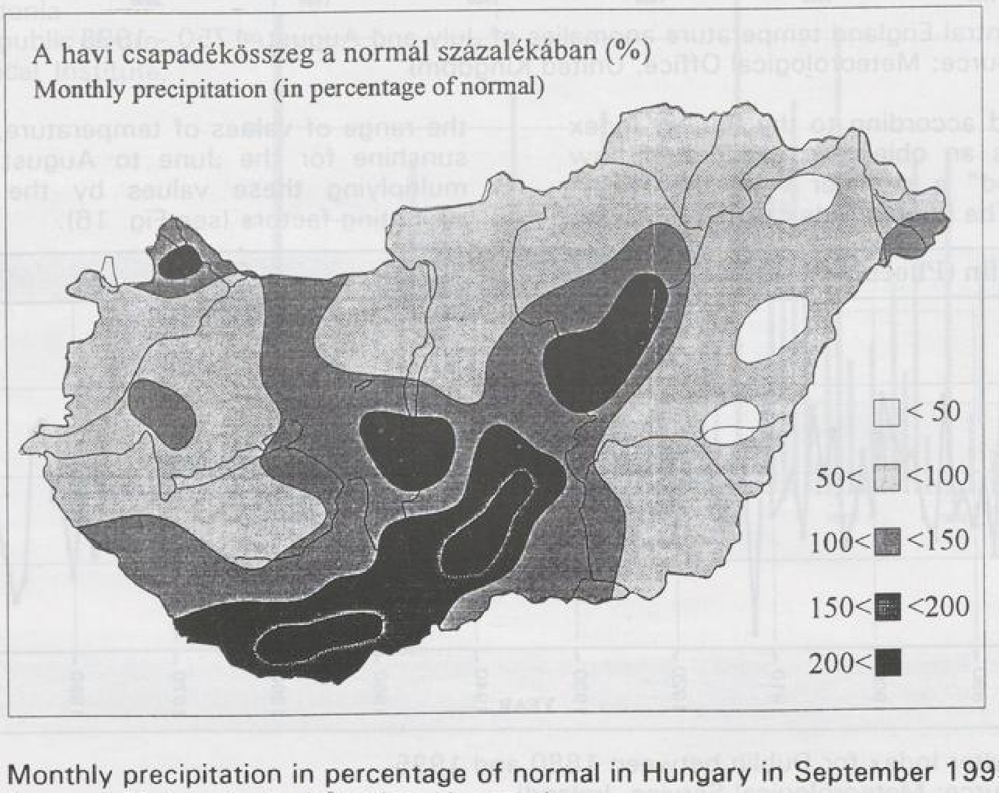


Fig. 17: Monthly precipitation in percentage of normal in Hungary in September 1995 (source: Meteorological Service, Hungary)

October: **Record warm and dry October**
Cool in the utmost north and southeast

Under prevailing high pressure influence, it was the warmest and sunniest October ever at many places, and, of course, the month turned out to be extremely dry, as well.

Some regions did not receive any rainfall at all.
In Hungary, mean monthly precipitation amounted only to 3 % of the average, which is the second driest this century.

Monthly temperature anomalies of more than +3 °C were recorded from Spain to southern Germany.
Denmark experienced the warmest October since records started in 1874 (see Fig. 18).

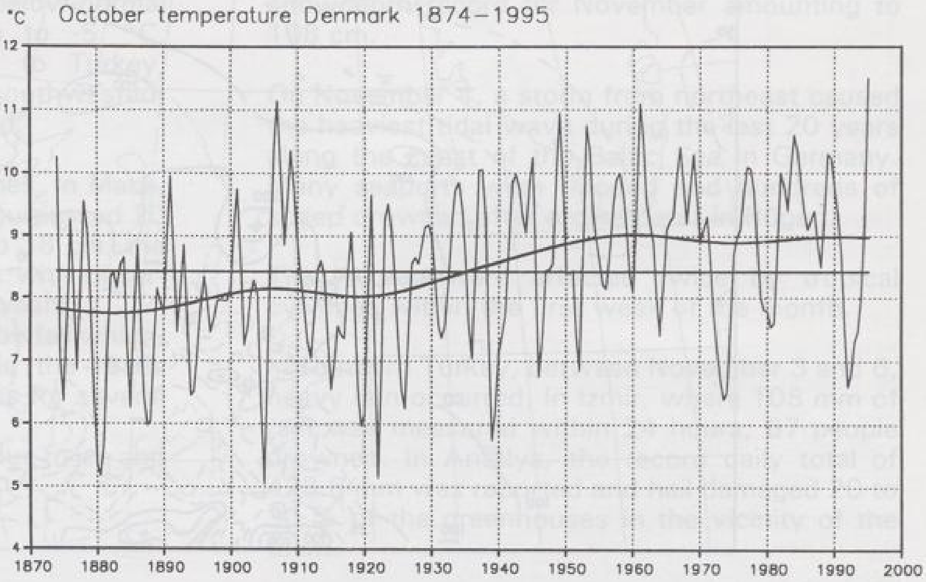
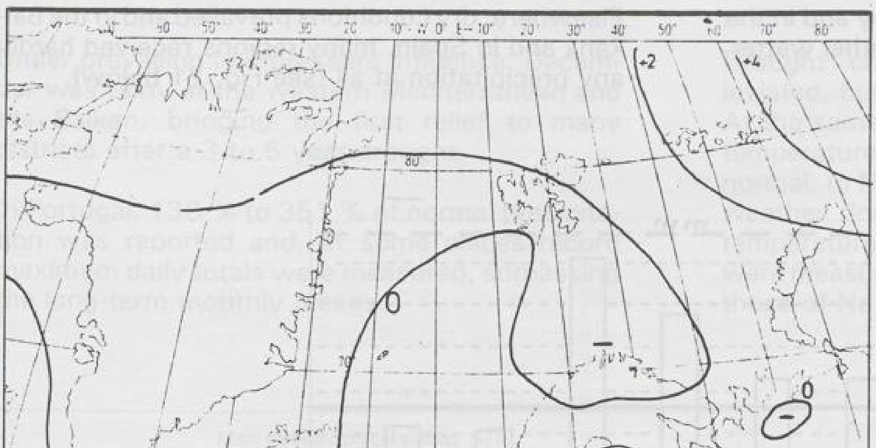


Fig. 18: Surface temperature means for Denmark in October between 1874 and 1995
(source: Danish Meteorological Institute)



The highest deviations from normal, surpassing +4 °C, occurred in the Alps (see Fig. 19). The Sonnblick Observatory, Austria, 3105 m a.s.l., registered its highest monthly mean (plus 0.3 °C) since the foundation of the station in 1885, surpassing the normal by 4.6 °C. Below-normal temperatures occurred in the far southeast and north, only.
In Flateyri, northwestern Iceland, on October 26, an avalanche catastrophe killed 20 people and destroyed 21 houses.
In the Murmansk region of Russia, a blizzard with gusts up to 34 m/s capsized several fishing boats, damaged the telephone and power lines and paralysed the traffic.

Fig.: 19: Air temperature anomalies (°C) in October 1995
Reference period: 1961-90
(source: Deutscher Wetterdienst, Germany)

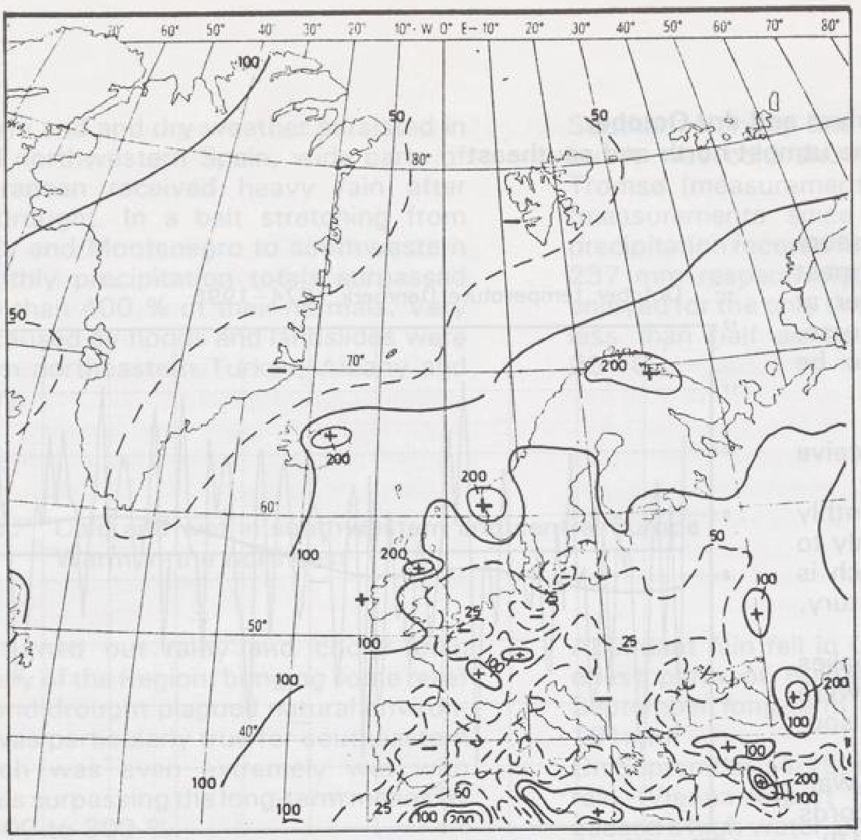


Fig. 20: Precipitation in percentage of normal in October 1995
Reference period: 1961 - 1990
(source: Deutscher Wetterdienst, Germany)

Only in the far north, in eastern Turkey and in the Caucasus, did October turn out altogether wetter than normal (see Fig. 20 above).

Elsewhere, dry conditions prevailed and in the Balkans and in Spain, many regions received hardly any precipitation at all (see Fig. 21 below).

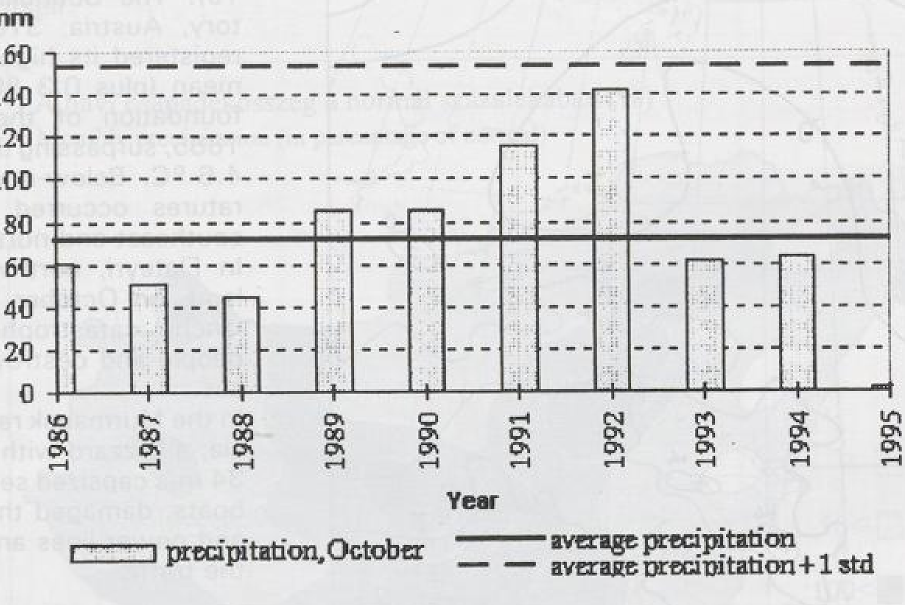


Fig. 21: October precipitation totals in Yugoslavia between 1986 and 1995
(source: Federal Hydrometeorological Institute, Yugoslavia)

November: **Cold from Scandinavia to the eastern Mediterranean, mild in the west**
Wet in eastern Europe, elsewhere mostly dry

November was the first month in 1995 to be cooler than normal. A vast area of below-normal temperatures, with anomalies up to -5 °C, stretched from the Barents Sea to Turkey, whereas in western and especially southwestern Europe the warm weather continued.

Winter arrived early in many countries. In Macedonia and Yugoslavia, snow depth surpassed 20 to 30 cm and in some places up to 38 cm, the highest on record even at stations with observations going back more than 100 years.
Hungary, as well, reported heavy snowfall which, together with strong winds, made the roads impassable and cut off some villages for several days.
Lots of accidents in Germany were due to ice and snow.

Tromsø in northern Norway, established a new snowdepth record for November amounting to 108 cm.

On November 4, a storm from northeast caused the heaviest tidal wave during the last 20 years along the coast of the Baltic Sea in Germany. Many seaports were flooded and hundreds of sheep drowned after a dike burst in Rügen.

The Azores were affected twice by tropical cyclones within the first week of the month.

In southern Turkey, between November 3 and 6, heavy rain occurred. In Izmir, where 108 mm of rain was measured within 24 hours, 67 people drowned. In Antalya, the record daily total of 428.6 mm was reported and hail damaged 20 to 30 % of the greenhouses in the vicinity of the town.

December: **Very cold in the north**
Wet and mild from Greece to Spain

Under prevailing low pressure influence, December was rainy in the western Mediterranean and the Balkan, bringing the first relief to many districts after a 3 to 5 year drought.

In Portugal, 136 % to 351 % of normal precipitation was reported and, at some places record maximum daily totals were measured, surpassing the long-term monthly means.

Drought conditions were not completely alleviated, but water shortages decreased.
At the same time, temperatures especially night temperatures, turned out to be warmer than normal. In Macedonia, wet (see Fig. 22) and mild weather dominated. Absolute record maximum temperatures for December of 20 °C to 22 °C were measured and the monthly means surpassed those of November (see Fig. 23, p. 32) .

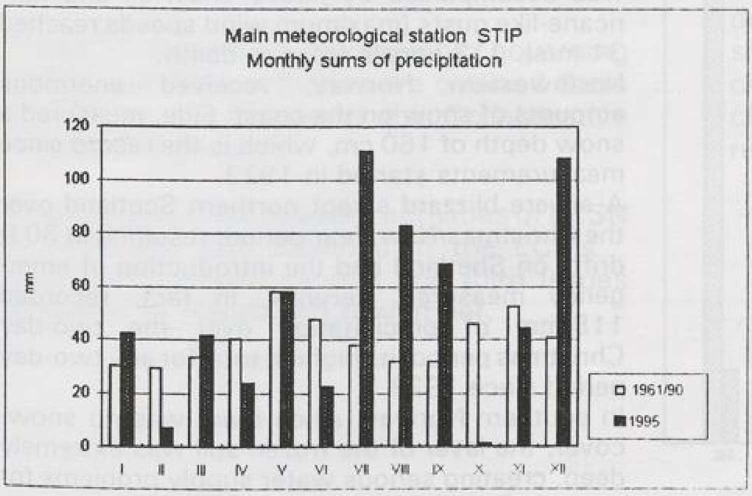


Fig. 22: Mean monthly precipitation at Stip, Macedonia (source: Republic Hydromet. Institute, Macedonia)

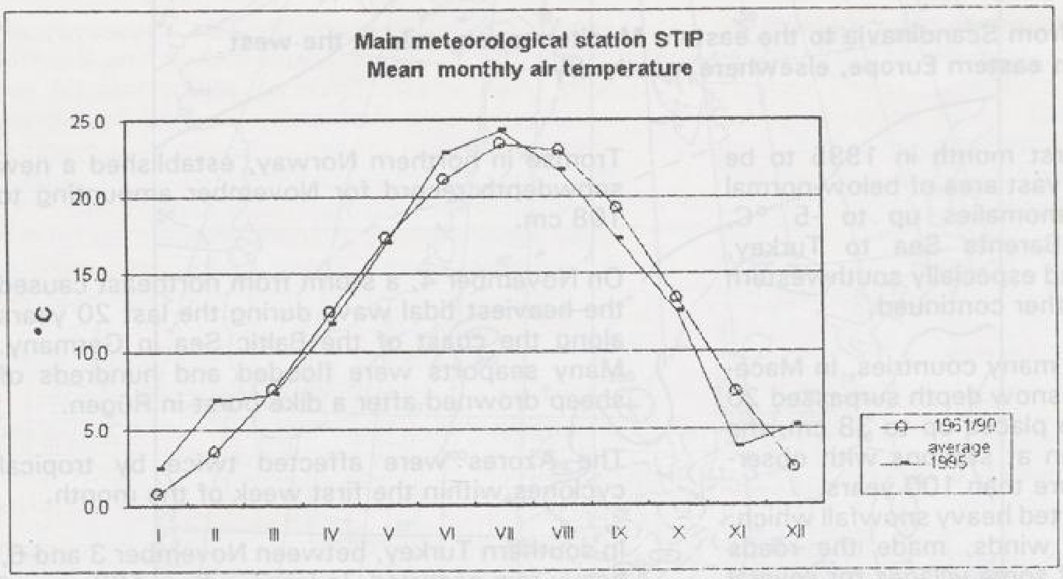


Fig. 23: Mean monthly temperatures at Stip, Macedonia (source: Republic Hydrometeorological Institute, Macedonia)

In Hungary, after copious precipitation in November and December, sudden warming before Christmas caused melting in the catchment areas of most rivers in the eastern parts of the country, causing serious floods, some of which exceeded the previous record levels. At some places, the monthly precipitation sums were highest in the 40-year time series.

In the Middle East, dry weather dominated. In Cyprus (see Fig. 24) it was the third driest December of the century which seriously affected water resources.

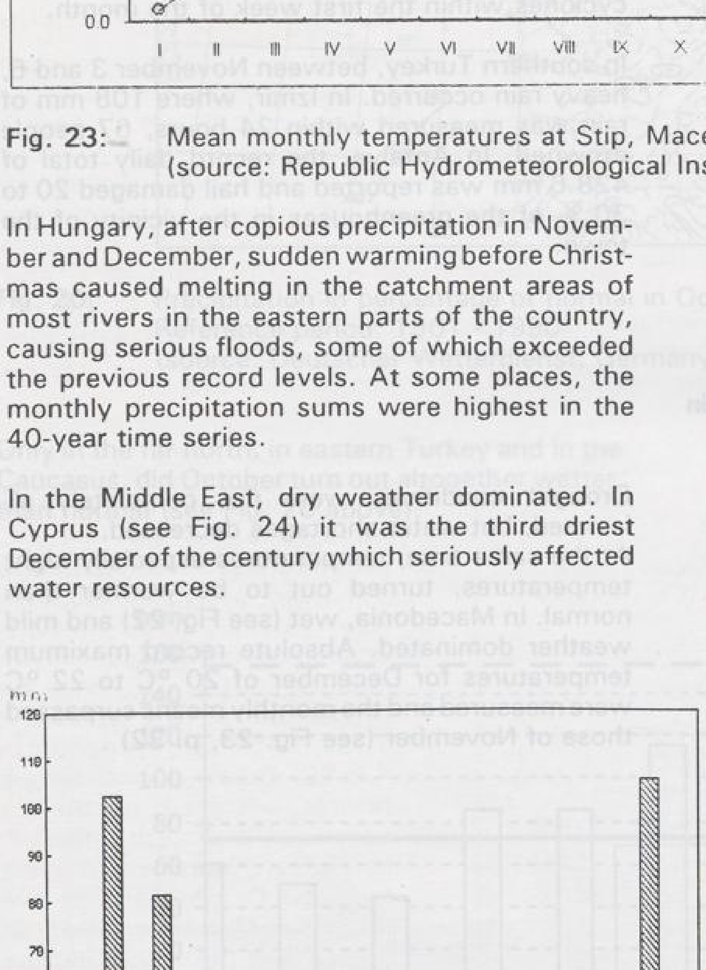


Fig. 24: Monthly precipitation sums of Cyprus in 1995 and long-term means 1961-1990 (source: Meteorological Service, Cyprus)

On December 30, in Samos island, a water sprout with severe thunderstorms and strong gales (up to 85-95 km/h), caused considerable losses.

In northern Europe, with temperature anomalies up to -5 °C, December was cold. An extreme cold snap affected this region in the third decade of the month and Christmas was the coldest of this century in Finland, southeastern Norway and Scotland. In Utsjoki, northern Finland, the lowest temperature of the year was measured on December 30. Glasgow, Scotland, recorded minus 20 °C, the coldest night ever.

The cold period was accompanied by heavy snowfalls in many regions, such as Scotland, parts of Scandinavia and the Baltic states.
Western Kasachstan was seriosly affected by an intense blizzard. A sudden fall in temperature by 20 °C within one day to reach -20 °C to -25 °C was accompanied by heavy snowfall and hurricane-like gusts (maximum wind speeds reached 34 m/s). 113 people froze to death.
Northwestern Norway, received enormous amounts of snow on the coast: Eide, measured a snow depth of 160 cm, which is the record since measurements started in 1923.
A severe blizzard swept northern Scotland over the Christmas/New Year period, resulting in 30 ft drifts on Shetland and the introduction of emergency measures. Lerwick, in fact, recorded 118 mm of precipitation over the two-day Christmas period, its highest total for any two-day period since 1922.
In southern Norway, since there was no snow-cover, the layer of the frozen soil was extremely deep, creating serious water supply problems for households and farmers.
In Bulgaria, where December was cool on average, mild air penetrated on December 26. (-22 °C was measured at many places, a new record December temperature.)

Activities of European Climatological Centres

The European Climate Support Network (ECSN)

The European Climate Support Network is an initiative by 16 National Meteorological Services (NMSs) in Europe to promote greater collaboration in climate data collection, data processing, modelling, exchanging personnel and developing recommendations. This followed the signature, in December 1992, of a Memorandum of Understanding (MoU) and the agreement on a programme of Collaborative Scientific and Technical projects which aims to contribute to the general scientific objective of understanding the mechanisms and assessing the predictability of the climate system on time scales from months to one hundred years.

The 16 National Meteorological Services which are the signatories of the MoU are those of:
Austria, Belgium, Denmark, Finland. France, Greece, Hungary, Iceland, Ireland, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

The ECSN World Wide Web Server, which started to operate in the second half of 1995 may be accessed through

http:\\aire.inm.es

The ECSN objectives, membership, governing bodies and main activities are outlined there as well as the scope of the Collaborative Programme projects.

Progress and most relevant activities of ECSN in 1995 are also included in the ECSN Newsletter whose second and third issues appeared in March and November.

In March, the ECSN issued its First European Climate Assessment (ECA) titled 'Climate of Europe. Recent variation, present state and future prospects'. ECA was first intended to inform the general public about climate variability and to increase its awareness of the climate change issue. Secondly, ECA constitutes a contribution of the European Meteorological Services of ECSN to the 1995 IPCC Assessment and may support decision-making at the political level by increasing the background knowledge of policy-makers and politicians. The ECA report was presented to the Framework Convention of Climate Change Intergovernmental Meeting held in spring 1995 in Berlin.

Specially relevant was the approval by the Board, in July, of the 'ECSN Recommendations for the availability of data for climate research within Members' states (ECSN data policy)'. The bulk of them are in agreement with the Resolution 40 of the XIII WMO Congress. To the extent possible, the Members of ECSN will undertake to make quality controlled and, if possible, homogenized data and products available for climate research within the Member's states at the most favourable terms and under conditions described in the corresponding model licensing agreement to entities involved in the climate research projects and those producing climate databases for noncommercial climate research, recognized by ECSN.

BALTEX - A European Contribution to GEWEX

The complex interactions of atmospheric, land surface, hydrological and oceanographic processes within the climate system are poorly understood. This is particularly the case for small-scale processes, which are generally not adequately resolved or represented in present models. Recognizing present deficits in our understanding of the thermodynamics of the atmosphere and earth surface the World Meteorological Organization, WMO, the International Council of Scientific Union, ICSU, and the Intergovernmental Oceanographic Commission, IOC, launched the Global Energy and Water Cycle Experiment, GEWEX, in the late 1980s, as part of the World Climate Research Programme, WCRP. A European contribution to GEWEX is BALTEX, the Baltic Sea Experiment, which constitutes one out of five continental-scale GEWEX experiments. The objectives of BALTEX include

- to explore and model the various mechanisms determining the space and time variability of energy and water budgets in the atmosphere and at the surface of the entire water catchment area of the Baltic Sea (the BALTEX region),
- to relate these mechanisms to the large-scale circulation systems in the atmosphere and oceans over the globe,
- to make improved models and other research tools applicable to other large water catchments on the Globe, for example the other GEWEX regions.

BALTEX is a physical research experiment including meteorological, hydrological and oceanographic research with additional links to other applications being kept open. The basic elements of the scientific programme include the collection of in situ and remote sensing data, the re-analysis of existing data sets, data assimilation, numerical experiments and coupled modelling, and process studies including extended field experiments.

The organizational structure of BALTEX is well developed on the European level. BALTEX is planned, guided and monitored by the BALTEX Science Steering Group (SSG, chaired at present by Prof L. Bengtsson, MPIfM Hamburg). The SSG is supported by permanent BALTEX Working Groups (three at present: Numerical Experimentation, Process Studies, Radar measurements), BALTEX sub-project co-ordinators, ad-hoc Working Groups and Panels, national BALTEX commissions and representatives, and an International BALTEX Secretariat implemented at GKSS Research Centre, Geesthacht.

The Baltic Sea catchment area extends over 14 European countries. National hydrometeorological services, operational data and modelling centres and other research institutions in 10 of these countries (i.e. Denmark, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Belarus, Poland, and Germany) are at present actively contributing to the BALTEX research programme. Also contributions from research groups in other countries (e.g. Great Britain and Austria) are included in the research strategy. In order to facilitate data preparation and exchange among BALTEX research groups three BALTEX Data Centers have been implemented at the Finnish Institute for Marine Research in Helsinki (oceanographic data), the Swedish Meteorological and Hydrological Institute in Norrköping (hydrological data), and the German Weather Service, DWD, in Offenbach (meteorological data), respectively.

An important outcome of the BALTEX research will be the establishment of comprehensive regional atmospheric models (REMO) for the BALTEX region coupled to models of the land surface, the Baltic Sea and the sea ice. Development of different versions of the BALTEX-REMO is presently being conducted at various institutions based on already existing weather prediction and climate models (e.g. the DM/EM model chain of DWD, HIRLAM of the Scandinavian Weather Services, and the ECHAM model at MPIfM, and others). The participation of the national operational meteorological and hydrological services of almost all of the 10 BALTEX countries constitutes a backbone of BALTEX. Improvements of models, assimilation procedures, and other analysis tools will thus be beneficial and available directly for operational purposes. On the other side, availability and exchange of observational data are expected to be facilitated with the data holders and producers being closely involved in the BALTEX research activities.

The time-schedule of BALTEX has seen its preparatory phase until about the end of 1993, with the scientific objectives being defined, the international co-operation started, the major organizational bodies established and the Science Plan written. The build-up phase is now on its way, with the initial implementation plan finalized in 1994, extended planning and preparational work being conducted for both the major BALTEX field experiments and for the establishment of data sets and management, and the preparation and test of models started. For a number of BALTEX-related research activities funding could be made available on both national and the European levels. Preparations made so far are aiming at the conduction of the major BALTEX research phase which is planned for the years 1998 to 2001, with a key observational period for the entire Baltic Sea catchment region planned for October 1999 through March 2001.

Much of the present BALTEX research is concentrated on BALTEX key periods and Intensive Observational Periods (IOP). The period August to November 1995 has been defined as the BALTEX Pilot Study for Intensive Data Collection and Analysis of Precipitation (PIDCAP). Through co-ordinated efforts of all national services in the BALTEX region daily precipitation sums from more than 3500 precipitation stations could be collected into one BALTEX data set, which will soon be available for e.g. model validation and other BALTEX investigations.

Various modelling groups have agreed to use PIDCAP as a first BALTEX model intercomparison period (Figure 1). BALTEX will be beneficial for a number of areas like short range weather prediction, medium and long term climate prediction, climate monitoring and impact studies, improvement of observational techniques and networks design, water resources assessment and management, as well as environmental aspects. BALTEX is expected to provide a solid physical background for environmental investigations and will enable more realistic environmental predictions and scenario calculations to be developed.

For further information contact
International BALTEX Secretariat
c/o Dr Hans-Joerg Isemer
GKSS Research Center, Geesthacht, Germany

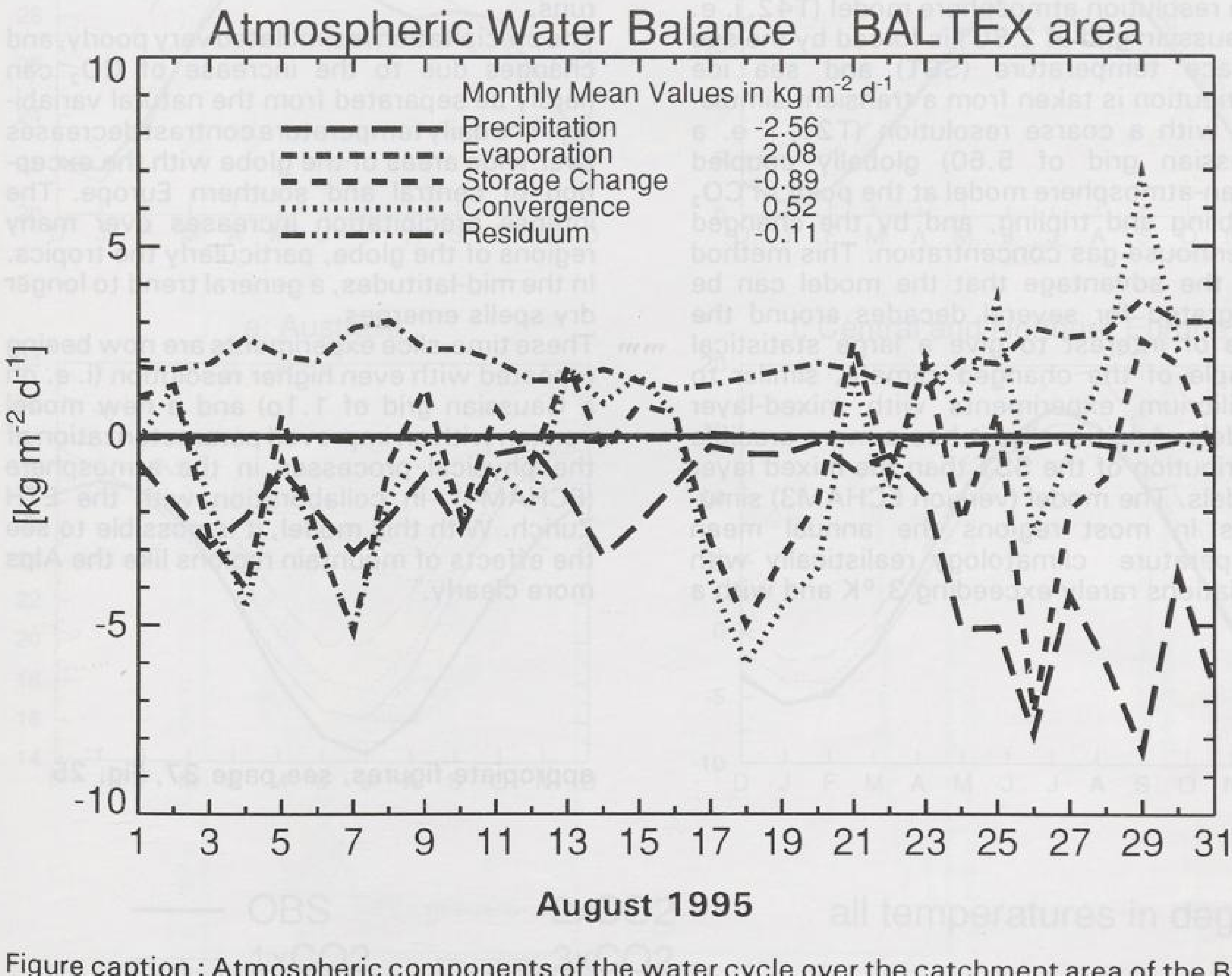


Figure caption : Atmospheric components of the water cycle over the catchment area of the Baltic Sea for August 1995. Daily values are taken from a specific version of the BALTEX REMO, which is based on the Deutschland Model (DM) of DWD. Note the wet period over the Baltic Sea catchment starting at August 24
(source : GKSS Research Center, Geesthacht, Germany).

Deutsches Klimarechenzentrum GmbH (DKRZ) - The German Climate Computing Centre

Time-slice climate change experiments, by U. Cubasch

A number of studies have been carried out to interpret model predicted climate changes on regional scales. However, these studies have attracted a lot of criticisms, since it was felt that the model resolution was too coarse and the model performance was too poor to allow for a regional interpretation of the results. Various techniques are currently been applied to overcome this problem. Besides statistical methods similar to model output statistics employed in weather forecasting, dynamical regional high resolution models have been nested into global models. These nested models have the disadvantage that they are expensive to run and that they are currently coupled only one way. An alternative strategy using dynamical models is the so called "time slice" method using high resolution global atmosphere models. In this technique, the high resolution atmosphere model (T42, i. e. a Gaussian grid of 2.80) is forced by the sea surface temperature (SST) and sea ice distribution is taken from a transient simulation with a coarse resolution (T21, i. e. a Gaussian grid of 5.60) globally coupled ocean-atmosphere model at the point of CO_2 doubling and tripling, and by the changed greenhouse gas concentration. This method has the advantage that the model can be integrated for several decades around the time of interest to give a large statistical sample of the changed climate, similar to equilibrium experiments with mixed-layer models. Additionally, it has a more credible distribution of the SST than the mixed layer models. The model (version ECHAM3) simulates in most regions the annual mean temperature climatology realistically with deviations rarely exceeding 3 °K and with a realistic phase of the seasonal cycle. In some regions, however, the model deviations are larger than the simulated change for the climate change scenarios (see Fig. 25).

The weaker forcing of the $2*CO_2$ experiment does not allow the changes to emerge as clearly as in the $3*CO_2$ experiment. A change in the seasonal cycle is frequently not yet visible in the $2*CO_2$ but it becomes distinct in the $3*CO_2$ experiment. The temperature change for the $2*CO_2$ experiment is only 30% to 40% of the change of the $3*CO_2$ experiment. This is caused not only by a non-linear response to the radiative forcing, but also by the experimental set-up ("cold start"). A comparison with mixed-layer model results shows that the $3*CO_2$ experiments resemble rather the results of the equilibrium $2*CO_2$ experiments than the $2*CO_2$ time-slice runs.

The precipitation is simulated very poorly, and changes due to the increase of CO_2 can hardly be separated from the natural variability. The daily temperature contrast decreases over wide areas of the globe with the exception of central and southern Europe. The intense precipitation increases over many regions of the globe, particularly the tropics. In the mid-latitudes, a general trend to longer dry spells emerges.

These time-slice experiments are now beeing repeated with even higher resolution (i. e. on a Gaussian grid of 1.1o) and a new model version with an improved parameterization of the physical processes in the atmosphere (ECHAM4), in collaboration with the ETH Zurich. With this model, it is possible to see the effects of mountain regions like the Alps more clearly.

appropiate figures, see page 37, Fig. 25

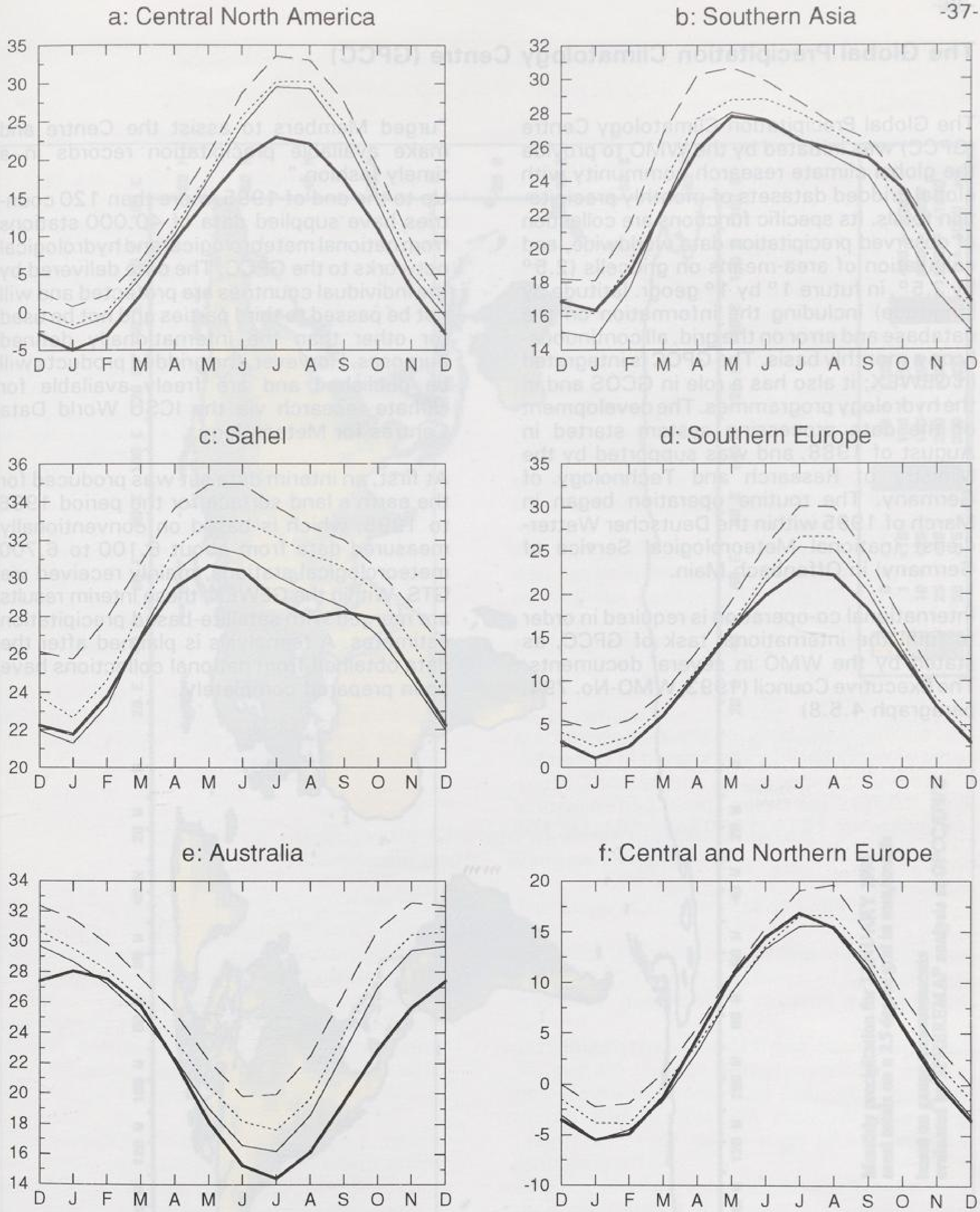


Fig. 25: The annual cycle of the near surface temperature (°C) for the observations, the control $2*CO_2$ and $3*CO_2$ integrations for five IPCC 1990 regions and central and northern Europe
(source: DKRZ, Germany)

The Global Precipitation Climatology Centre (GPCC)

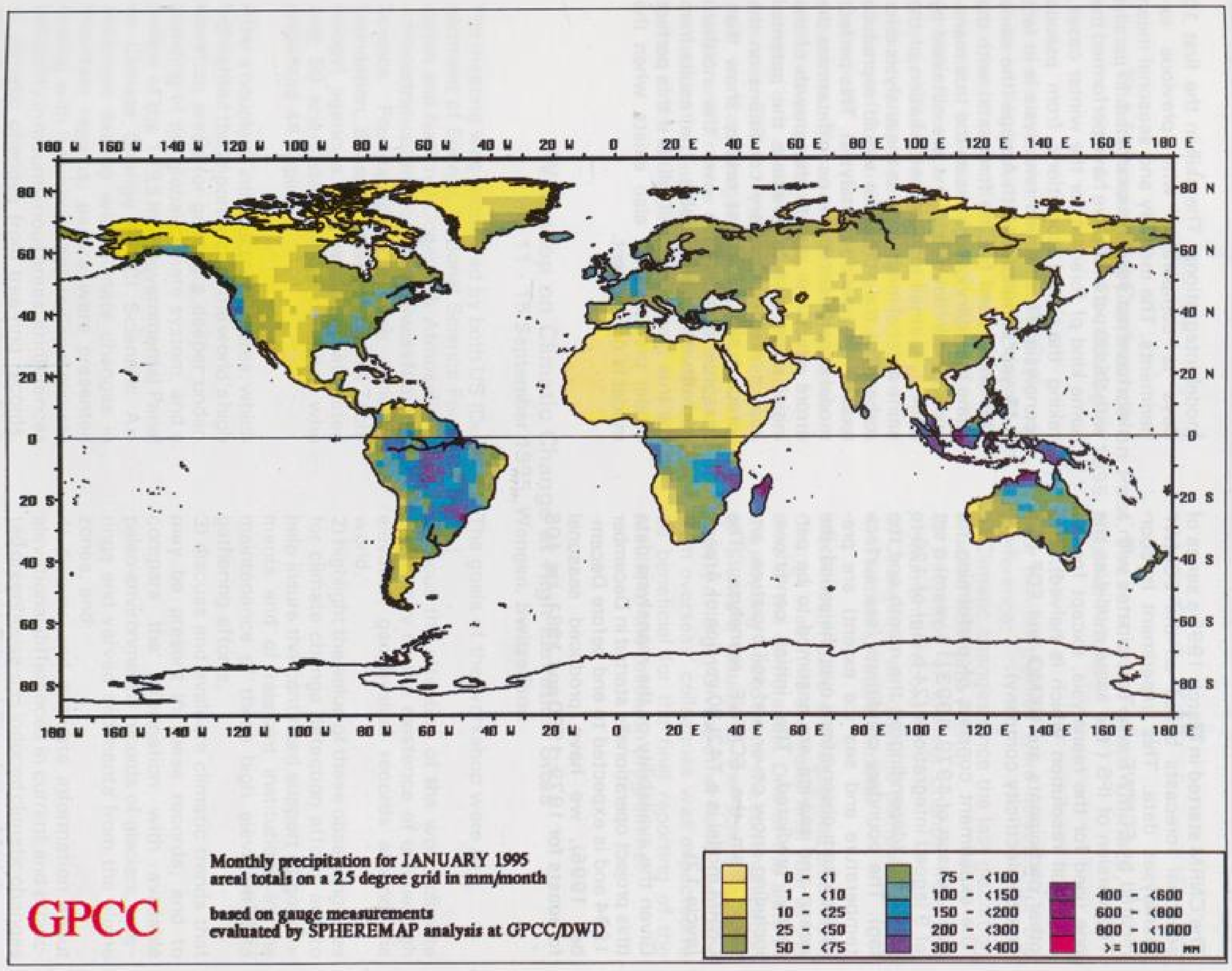
The Global Precipitation Climatology Centre (GPCC) was initiated by the WMO to provide the global climate research community with global gridded datasets of monthly precipitation totals. Its specific functions are collection of observed precipitation data worldwide, and calculation of area-means on gridcells (2.5° by 2.5°, in future 1° by 1° geogr. latitude by longitude) including the information on the database and error on the grid, all continuously on a monthly basis. The GPCC is integrated in GEWEX; it also has a role in GCOS and in the hydrology programmes. The development of the data processing system started in August of 1988, and was supported by the Ministry of Research and Technology. of Germany. The routine operation began in March of 1995 within the Deutscher Wetterdienst (national Meteorological Service of Germany) in Offenbach,Main.

International co-operation is required in order to fulfil the international task of GPCC, as stated by the WMO in several documents. The Executive Council (1993, WMO-No. 794, paragraph 4.5.8) "urged Members to assist the Centre and make available precipitation records in a timely fashion."
Up to the end of 1995, more than 120 countries have supplied data of 40,000 stations from national meteorological and hydrological networks to the GPCC. The data delivered by the individual countries are protected and will not be passed to third parties and not be used for other than the internationally defined purposes. However, the gridded products will be published and are freely available for climate research via the ICSU World Data Centres for Meteorology.

At first, an interim data set was produced for the earth's land surface for the period 1986 to 1995, which is based on conventionally measured data from about 6,100 to 6,700 meteorological stations, mainly received via GTS. Within the GEWEX, these interim results are merged with satellite-based precipitation estimates. A reanalysis is planned after the data obtained from national collections have been prepared completely.

Page 39, Fig. 26 :

Monthly precipitation for the earth's landsurface for January 1995 as analysed by the GPCC from ground based observations at 6,100 stations
(source: GPCC, Germany)


GPCC
Monthly precipitation for JANUARY 1995
areal totals on a 2.5 degree grid in mm/month
based on gauge measurements
evaluated by SPHEREMAP analysis at GPCC/DWD
0 - <1
1 - <10
10 - <25
25 - <50
50 - <75
75 - <100
100 - <150
150 - <200
200 - <300
300 - <400
400 - <600
600 - <800
800 - <1000
>= 1000 mm

METEO FRANCE CNRM: Centre national de recherches météorologique

Seasonal Forecast Experiment

The CNRM started in March 1995 a series of seasonal forecasts based on the ECMWF reanalyses data. This experiment is coordinated by ECMWF who participates with a T63 version of IFS (the same model as the one used for the reanalysis, except for the horzontal resolution which is halved). The other participants are UKMO and EDF (the French electricity company).

The experiment consists of performing for each season of 1979 -1993 (15 years) a set of 9 lagged integrations (24 h lag) of 120 to 130 days (depending on the month and the lag). The boundary conditions (sea surface temperature and sea ice extent) are prescribed from observations over the period: the ocean and sea-ice are assumed to be perfectly predicted. The initial conditions, including snow cover and soil moisture, are taken from the ECMWF reanalysis. The CNRM model is a T42L30 version of Arpège (cycle 12).

Given the availability of the reanalysis data (this project operationally started in December 1994 and is expected to end before December 1996), we have produced seasonal forecasts for 1979, 1980 and 1981, i.e. 108 model integrations. The skill in the first 10 days is comparable with previous experiments. The monthly and seasonal mean skills have not yet been examined. In parallel with this experiment, we have performed the same kind of forecast for the winter cases, taking the initial conditions from pseudo reanalysis. This pseudo reanalysis is in fact a 15-year simulation with Arpège (the same version as used for the forecasts) with the same boundary conditions as the true reanalysis. The initial conditions are obtained by adding a small random perturbation of the same order of magnitude as the analysis error (otherwise the forecasts would reproduce exactly the pseudo-reanalysis). This perfect model experiment allows us to determine the errors which are due to the growth of the initial error, and to evaluate the potential impact of the boundary conditions on the forecast skill. The first results show that, seasonal precipitation over the northern midlatitudes is predictable. The results from the true predictions will tell us if this perfect model predictability also exists when the model is not perfect.

Conferences and workshops

The International Conference on Past, Present and Future Climate, 22 - 25 August 1995, Helsinki, Finland

The conference was held in the Hotel Aurora, Helsinki. Altogether, 117 scientific contributions were submitted and more than 140 scientists attended the conference. The Finnish Research Programme on Climate Change (SILMU) hosted the conference, and additional support was received from the Ministry of Eduction and from the Research Council for the Environment and Natural Resources. This was organized to serve at least two purposes. Firstly, it was the fourth meeting in a series of Nordic climate conferences. Earlier Nordic meetings had been held in Copenhagen (1978), Stockholm (1983) and Tromsø (1990). Secondly, the conference formed part of the integration activities of the SILMU.

Four central themes were selected for the conference:
1) Climatic changes since the last glaciation inferred from proxy data,
2) Detection of climate change from the instrumental record,
3) Changes in atmospheric composition and
4) Predicting future climate.

The Finnish Research Programme on Climate Change was in its sixth and final year at the time of the conference. One of the aims of the meeting was to foster the communication of SILMU's results to the scientific community at large. On the other hand, feedback from overseas' colleagues was expected to be beneficial for the final reporting of the results of the research programme.

Workshop on Climatic Change at High Elevation Sites 11 - 15 September 1995, Wengen, Switzerland

The meeting was sponsored by both US (Department of Energy, National Science Foundation and National Oceanic & Atmospheric Administration) and European (Swiss National Science Foundation, European Science Foundation, Swiss Federal Institute of Technology) agencies. The workshop attracted over 50 scientists from 12 countries who presented 44 papers.

After a couple of introductory lectures, which highlighted the importance of the world's high elevation areas for gaining a deeper understanding of the global climate system, and a review of the 1995 Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment dealing with climate changes in mountain regions, papers were presented dealing with i) temporal and regional climate variability in mountainous areas, ii) inferences of climatic changes from tree-ring records, and iii) inferences of climatic changes from glacial, isotopic, and other proxy data.

The goals of the workshop were to

1) focus the attention of the world climate community on the existence of unique high elevation geophysical records around the world,
2) highlight the value of these observing sites for climate change detection efforts and to help insure the continued support of governments and of relevant institutions in the maintenance of these high elevation data gathering efforts,
3) discuss and evaluate climatic trends that may be present in these records, and to compare the information with available paleo-environmental records of glaciers, tree--rings and varved sediments from the alpine zones, and
4) discuss and evaluate information about elevational differences in current and projected greenhouse-gas induced climatic changes in coupled General Circulation Models.

Climate Dynamics and Global Change Perspective International Conference
17-20 October 1995, Cracow, Poland

The conference was sponsored by: the Jagiellinian University in Cracow - Institute of Geography; the Institute of Meteorology and Water Management - Cracow Branch; the University of Agriculture in Cracow - Department of Agricultural Meteorology and Climatology; the Polish Geographical Society; and the Polish National Committee for IGBP -Global Change. There were about 115 participants from 40 countries with the majority coming from Poland and countries of central Europe.

The conference was organized into sessions on: measurement methods and homogenization of the observation series; climate dynamics and its modelling; climate change detection; climate variability, tendencies and impact; and historical climatology.

The presentations covered a wide spectrum of the field of climatology including data sets, homogenization of time series data, statistical procedures, synoptic climatology, climate modelling, historical and proxy data sources, topoclimatology, and the human and economic impacts of climate. Many of the results presented were based on traditional climatological analysis techniques with only a few presentations using a modelling approach or trying to relate results of one parameter to other parameters or possible causati ve factors.