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Observed Precipitation in Denmark, 1961-90

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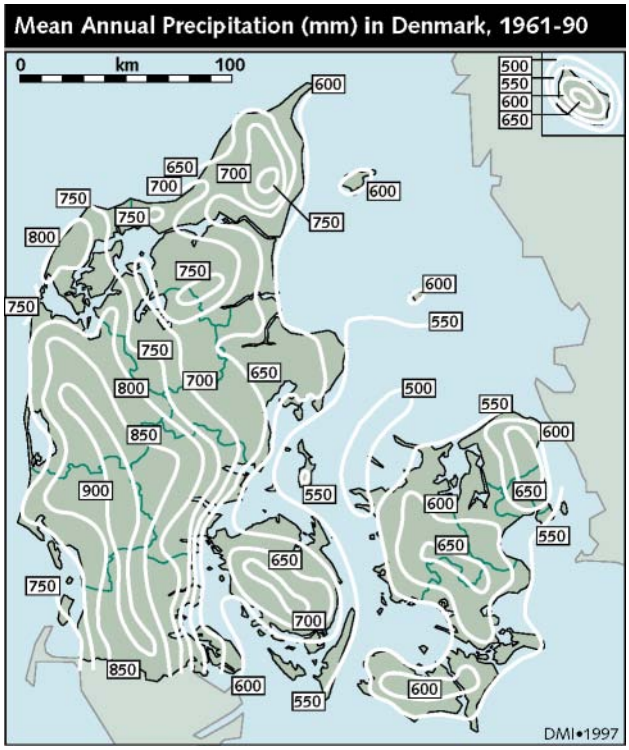

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ACKNOWLEDGEMENTS

We would like to express our gratitude to the countless observers and other employees at the Danish Meteorological Institute (DMI) who have provided more than 3 million observations of precipitation during this 30-year period. We appreciate the fruitful discussions with our former colleagues Peter Allerup, Knud Frydendahl and Peter Steffensen

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1. INTRODUCTION

Standard normal periods are defined by the World Meteorological Organisation (WMO) as consecutive 30-year periods beginning with 1901, 1931 and 1961. Standard normal values are based on complete and homogeneous series of climatic variables. They are used for describing the average climate of a particular site. Standard normal values can thus be inter-compared from site to site and across national borders. Not all series fulfil the requirements put forward by WMO. Averages of series which are either inhomogeneous or shorter than 30 years are therefore referred to as provisory normal values.

After the termination of the standard normal period 1961-90 it was possible to calculate the 30-year average precipitation for Denmark as a whole (Frich, 1990). Previous values for Denmark, covering the standard normal period 1931-60, have been published by Lysgaard (1969) and maps of temperature and precipitation were also published (Anonymous, 1975). Our neighbouring countries have published their standard normals of precipitation for the period 1961-90 (Alexandersson et al.,1991 Aune, 1993). A comparison of the latest normal period with the previous one was published by Førland et al. (1996a). It was found that the coastal areas of northwestern Europe had experienced an increase in precipitation, which was confined mainly to the cold part of the year from October through March (Frich, 1994).

This report is based on data from a network of 300 Danish stations, which have an almost complete record of monthly values during the normal period. One major task, however, was the interpolation of missing values. Nearly 3,800 (~3.5 %) monthly values were missing. They have been visually estimated and manually included in order to make the data set complete. The following procedure was used: A subset of stations that had complete series or series lacking less than 5 months was selected and plotted on a map to get an overview of the spatial distribution. Then stations were selected which had gaps of up to three years. Missing data were interpolated by visual inspection of values from neighbouring stations, taking into account the inter-station distance, topography and the character of the month (showers/frontal rain). Remaining gaps were filled by combining several shorter series within the datasparse region to form one provisory series.

Most of the Danish stations have been relocated one or several times during the standard normal period. In addition there have been gradual changes in the local environment around the precipitation gauges. As the measured precipitation is influenced by local wind conditions and other factors, it is necessary to test individual series for these artificial changes in catch efficiency. The methods of homogenisation have also been developed over the past six years. Reference is made to Alexandersson (1986), Steffensen et al. (1993), Hanssen-Bauer & Førland (1994) and Steffensen (1996) for further details.

Traditionally, the precipitation climate is not only described by the totals for each month but also by the number of days with precipitation exceeding certain limits, and the maximum daily precipitation values are used to describe the climate of a particular site. A subset of 40 stations which were homogeneous and had a complete series of daily values was extracted from the database at DMI. These series were used for calculating the statistics describing the extreme part of the precipitation climate.

In addition to the precipitation normals for each of the 300 stations, we have also calculated standard normals for the Danish counties, the Kattegat Region and Denmark as a whole.

The geographic distribution is illustrated by annual and seasonal maps. Annual maps are also given for the number of days with precipitation exceeding 0.1, 1 and 10 mm. Maximum daily precipitation has been plotted on a map.

Finally, the standard normals of precipitation for the period 1961-90 are discussed with reference to previous standard normals in Denmark.

2. OBSERVATIONS

The Danish network of precipitation gauges now constitutes around 500 manual stations. Over the years the network has grown from about 300 stations in 1931 to a maximum of about 600 stations in 1990. The network of 300 stations used in this report is shown in figure 1.

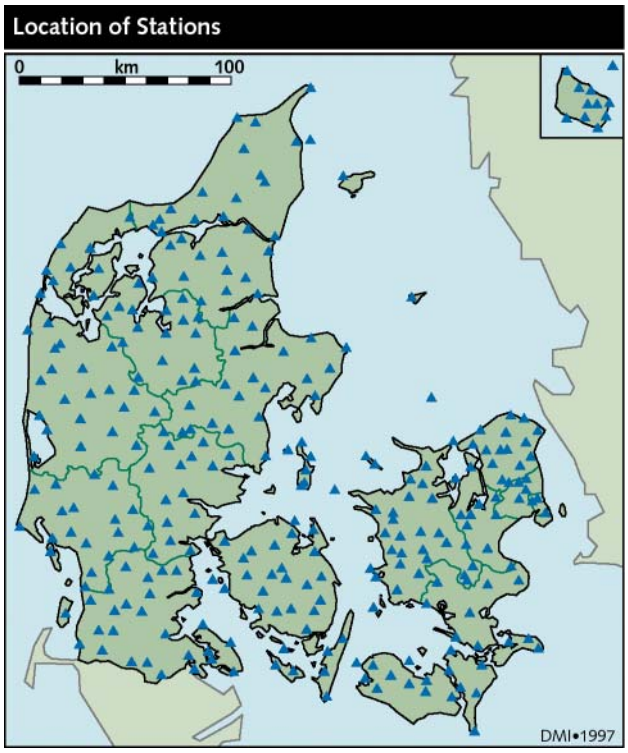

Figure 1. Map showing the location of Danish stations with an unbroken series of monthly precipitation totals during the standard normal period 1961-90. Extracted from Appendix 1.

The network consists of three kinds of manual stations. The main part of the network (89 %) is pure precipitation stations, which observe daily totals only at 8 AM local time every morning. The remaining stations are either climatological stations (4 %), which observe precipitation at 8 AM and a number of other climatic elements three times a day, or weather observing stations (7 %), which observe precipitation four times a day. The precipitation from the four daily observations has been summed to daily totals beginning at 6 UTC (Universal Time Coordinated) on the previous day. The discrepancy in time between synoptic observations and the other observations is therefore one hour. This has no influence on the statistics presented in this report. However, the synoptic stations tend to be located on more exposed sites, such as airports, lighthouses etc., leading in some places to a significant undercatch.

All observations have been made using a Danish version of the Hellmann gauge with an orifice of 200 cm^2. During the winter season from October through March the gauges are equipped with snow crosses, to prevent the snow from being blown out during strong winds. Solid precipitation was always melted before measurements took place.

The height of the gauge orifice is generally 150 cm above ground level but some gauges are either higher (max. 200 cm) or lower (min. 70 cm). The gauges have been inspected by DMI once every 5-6 years on average.

Erroneous observations, due to leaking gauges and other problems, have been corrected at the end of every month by manual quality control at DMI. However, the systematic errors from relocations and changing environment have remained unadjusted.

3. STATION HISTORY AND METADATA

The importance of metadata was highlighted through the NACD Project (Frich et al., 1996). The work of organising the station history information and converting this into metadata is a tedious and timeconsuming task.

At DMI, a station history file is kept for each station. An extract of the station catalogue for the 300 stations selected is enclosed as Appendix 1. This extract gives the name and position of each station at the end of 1990.

In addition to this digital station catalogue there are typewritten reports and photos from many of the inspections during the years. The photographic documentation in particular is needed when it comes to documenting changes in measuring conditions.

The inspection reports have gradually improved over the years, as has the frequency of inspections. Generally, there is only very scarce photographic documentation prior to 1970, and in such cases, it is necessary to rely on the station catalogue, which includes all relocations of 20 m or more. Topographic maps can also be of some help when changes in the local environment (i.e. growth or cutting of forest, or new buildings near the gauge) are suspected.

It is important to realise that the information contained in Appendix 1 represents the status for each station by the end of the standard normal period. Nearly all stations have undergone several changes during the 30-year period, which may have influenced the amount of precipitation observed.

4. STANDARD NORMAL HOMOGENEITY TEST

Homogeneity in time and space is critical to any kind of analysis. The homogeneity of a series requires the local environment around the gauge to remain unchanged over time. For spatial homogeneity individual gauges are also required to be exposed to the wind in a similar manner. Gauges located in the middle of a forest are known to catch more precipitation than gauges located on treeless promontories.

Inhomogeneity occurs when one or several factors change during the observation period. The relocation of a station will most often change the inter-station distance, the altitude and the surface characteristics. This change will normally lead to abrupt inhomogeneity.

When one or several factors change slowly, the series will show a non-natural trend in observed precipitation. One example could be the growth of a forest around a station. Another example could be the growth of a city around a station. Both cases would normally lead to a linear or non-linear increase in measured precipitation.

Since 1961 there have been a number of changes in the Danish network of precipitation gauges. Both abrupt and gradual changes have occurred but not all of these changes have had a significant influence on the homogeneity of the series. Therefore a method is needed which can separate significant changes from insignificant ones. The method must also be able to detect both abrupt and gradual inhomogeneities. Furthermore, the existence of multiple breaks must be considered.

The problem of homogeneity; testing existing precipitation series has been solved by using software developed at DMI (Steffensen et al., 1993). The Standard Normal Homogeneity Test is a statistical test which compares the ratio between a test series and several reference series. The test is performed on both annual and seasonal precipitation totals. The program output will give the year(s) of possible break(s) or trend and the size and significance of the break(s) or trend.

Once all inhomogeneous series have been tested and breaks detected, there was the option of either rejecting these inhomogeneous series or adjusting the series for documented changes in the physical environment. In this report, we have chosen to keep the series as observed and label these according to the test results (Appendix 1). Series are either homogeneous (label H), in which case the series can be used for all kinds of spatial and temporal analysis.

Inhomogeneous series are labelled I and great care should be taken when using these series for further analysis. A third group of series is labelled T, meaning they have been tested but are not perfectly homogeneous. This can be caused by either breaks or trends near the end of the series or by multiple breaks, which cancel out over the 30-year period. Finally, T may also indicate that one season shows an inhomogeneity but this cannot be explained by any known physical changes at the station.

However, we have tested the distribution of adjustment factors for smaller subsets of the network, and it turned out that inhomogeneities cancelled out when sample size exceeded a certain limit. For larger areas, such as counties and Denmark as a whole, the average values thus remained unchanged whether adjustments were applied or not.

5. RESULTS

Appendix 1 contains an overview of the present quality of each time series used for calculating standard normal values (label H or T) or provisory normals (label I). Of the original 300 series about 56 % tested to be homogeneous on an annual and seasonal basis. It was necessary to label 57 (~19 %) series, which were inhomogeneous. These 57 series should therefore only be considered in the following tables and figures as provisory normals. Approximately 25 % of the series had either multiple breaks or breaks near the end of a series, or had unexplained inhomogeneities in one season only. These series are labelled T, because they have been tested and found to be less than perfectly homogeneous.

A total of 243 Danish precipitation series are considered either homogeneous (H) or nearly homogeneous (T) according to the homogeneity test described in Section 4. The remaining 57 series (labelled I) have been included as provisory normals in order to obtain reasonable spatial coverage.

5.1 Correction of Observed Precipitation

It is well-known that observed precipitation is nearly always an underestimate of the precipitation falling on the ground (Førland et al., 1996b; Vejen, 1997). This is due to the fact that rain gauges installed at some height above the ground cause disturbances in the surrounding airflow, giving rise to a deflection of the trajectories of the precipitation particles. The result is that the gauge does not catch all of the precipitation falling. Thus the normally exposed Hellmann gauge only catches about 85 % of the true precipitation owing to this aerodynamic effect (Allerup & Madsen, 1980).

Another systematic error in the measurements is the wetting effect, where adhesion from the bottom and inner walls of the rain gauge will influence the amount of precipitation measured. The wetting loss amounts to 4 % of the annual precipitation, ranging from 3 % in winter to 6 % in summer (Allerup & Madsen, 1980).

Correction of observed precipitation is therefore very important for hydrological and climatological purposes, since corrected data used in studies of water balance and climatic change give more realistic results.

A statistical model for describing the aerodynamic effect on liquid precipitation has been developed by Allerup & Madsen (1980). The aerodynamic effect on solid and mixed precipitation has also been modelled in a more recent study (Allerup et al., 1997).

The various models have been developed on the basis of measurements from unsheltered sites. Since the Hellmann gauge is normally located in more protected sites in order to improve the catch efficiency, a number of supplemental experiments have been carried out. As a consequence of these experiments, it was decided to divide the stations into three classes describing their shelter towards the prevailing wind. Table 1 describes the definition used in classifying the Danish site exposures.

Shelter Class	Angle to horizon (α)	Description	Frequency (%)
A	$19° < \alpha \leq 30°$	Well sheltered	26
B	$5° < \alpha \leq 19°$	Moderately sheltered	63
C	$0° \leq \alpha \leq 5°$	Unsheltered	8
D	$\alpha > 30°$	Overprotected	3

Table 1 Definition of shelter classes for Danish Hellmann gauges. The frequencies have been extracted from Appendix 1.

Most of the sites are classified as moderately sheltered (class B) while well sheltered (class A) and unsheltered (class C) sites amount to 26 % and 8 %, respectively. A small number of stations (3%) have been classified as class D at the end of 1990. This means the gauge is surrounded by tall trees or other obstacles to the airflow, and the angles from the gauge orifice to the horizon generally exceed 30 degrees towards the prevailing wind. This may lead to a severe undercatch, especially when falling precipitation is intercepted by vegetation. No correction values can be recommended for these sites. Efforts are constantly made to keep the stations from being overgrown but apparently it is difficult to maintain a balance between extremely well protected A sites and overgrown D sites with the present frequency of station inspections.

Table 2 contains the correction factors for aerodynamic loss and wetting loss to be applied to the standard normal values of monthly precipitation. The large corrections during winter are mainly due to snow and the relatively large corrections in spring and early summer are mainly due to wetting loss. Since most of the stations have moderate shelter (with a slight bias towards the well sheltered A stations), the national average correction amounts to more than 15 %, corresponding to 50-150 mm per year for individual stations.

Shelter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
A	18	19	20	14	12	11	9	9	10	10	12	15	12
B	21	22	22	18	15	14	12	11	13	14	16	19	16
C	29	31	31	22	18	17	14	13	16	18	20	25	20

Table 2 Corrections (%) to be added to observed standard normals of precipitation 1961-90 due to aerodynamic and wetting effects. Based on Allerup & Madsen (1980).

These correction factors have not been applied in the present report, thus all standard normal values given are as observed. It is possible, however, to apply the corrections to get a more realistic picture of the geographical distribution of precipitation at ground level.

It should also be noted that class C stations span a narrow range of sheltering conditions but as the environment surrounding these stations is constantly changing, it has been decided to keep the number of shelter classes to a minimum, allowing a wider range for the B class.

5. 2 Annual and Seasonal Precipitation Maps

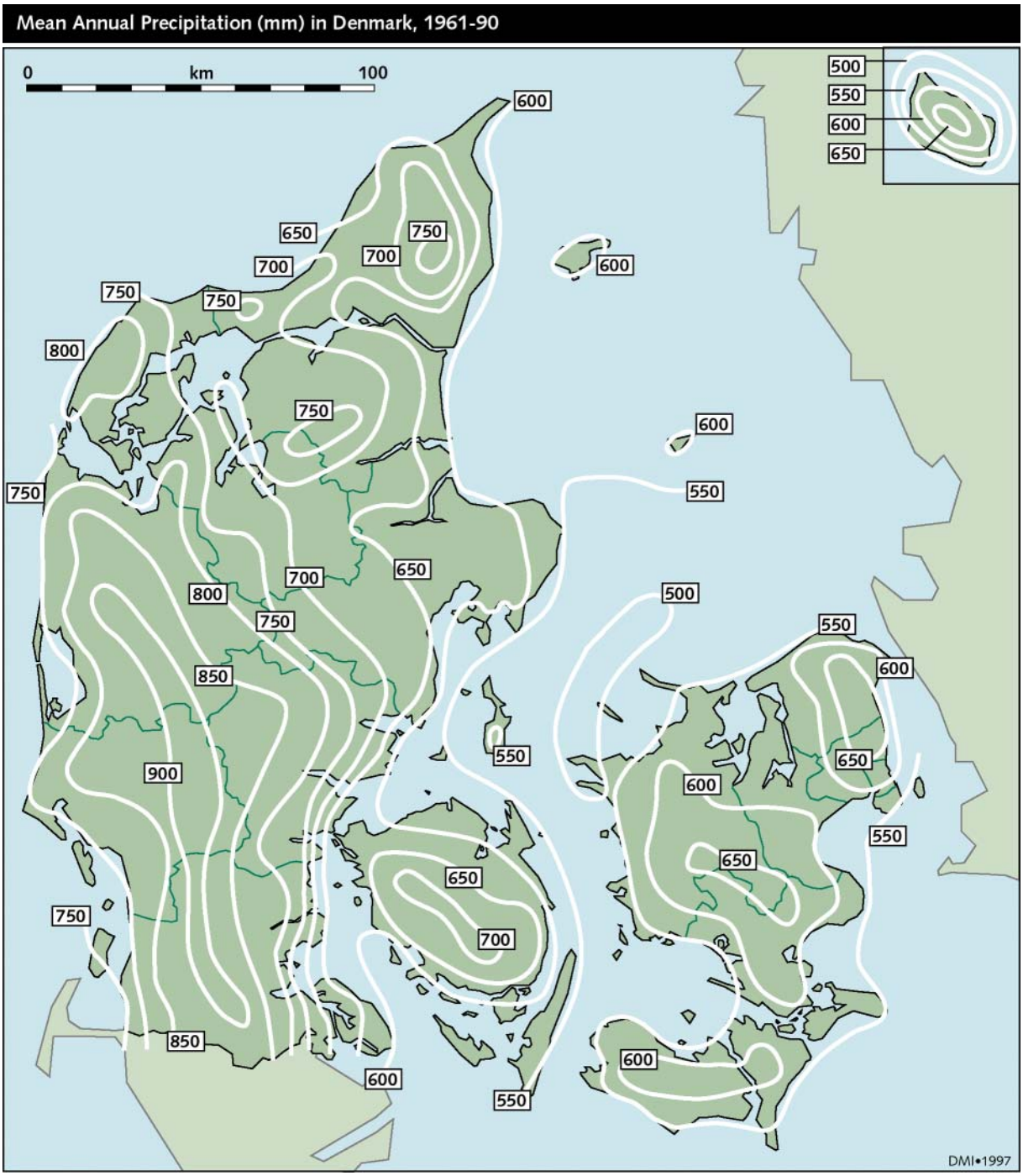

Figure 2. Mean annual precipitation in Denmark, 1961-90. The map is based on observed data from 300 stations. It has been produced by visual interpolation, taking into account the topography of the country and the shelter conditions of individual stations.

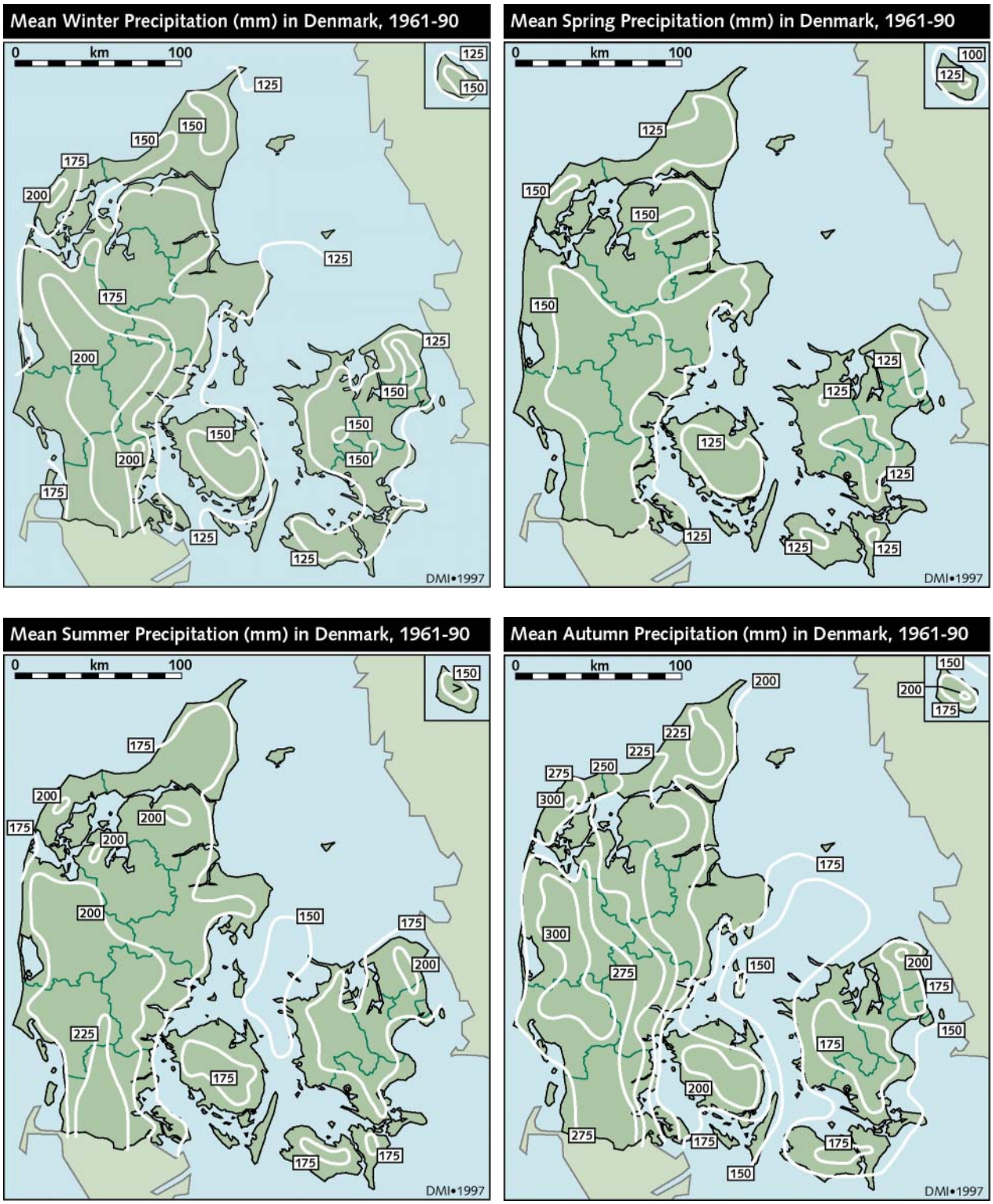

Figure 3. Mean seasonal precipitation in Denmark, 1961-90. The map is based on observed data from 300 stations. It has been produced by visual interpolation, taking into account the topography of the country and the shelter conditions of individual stations.

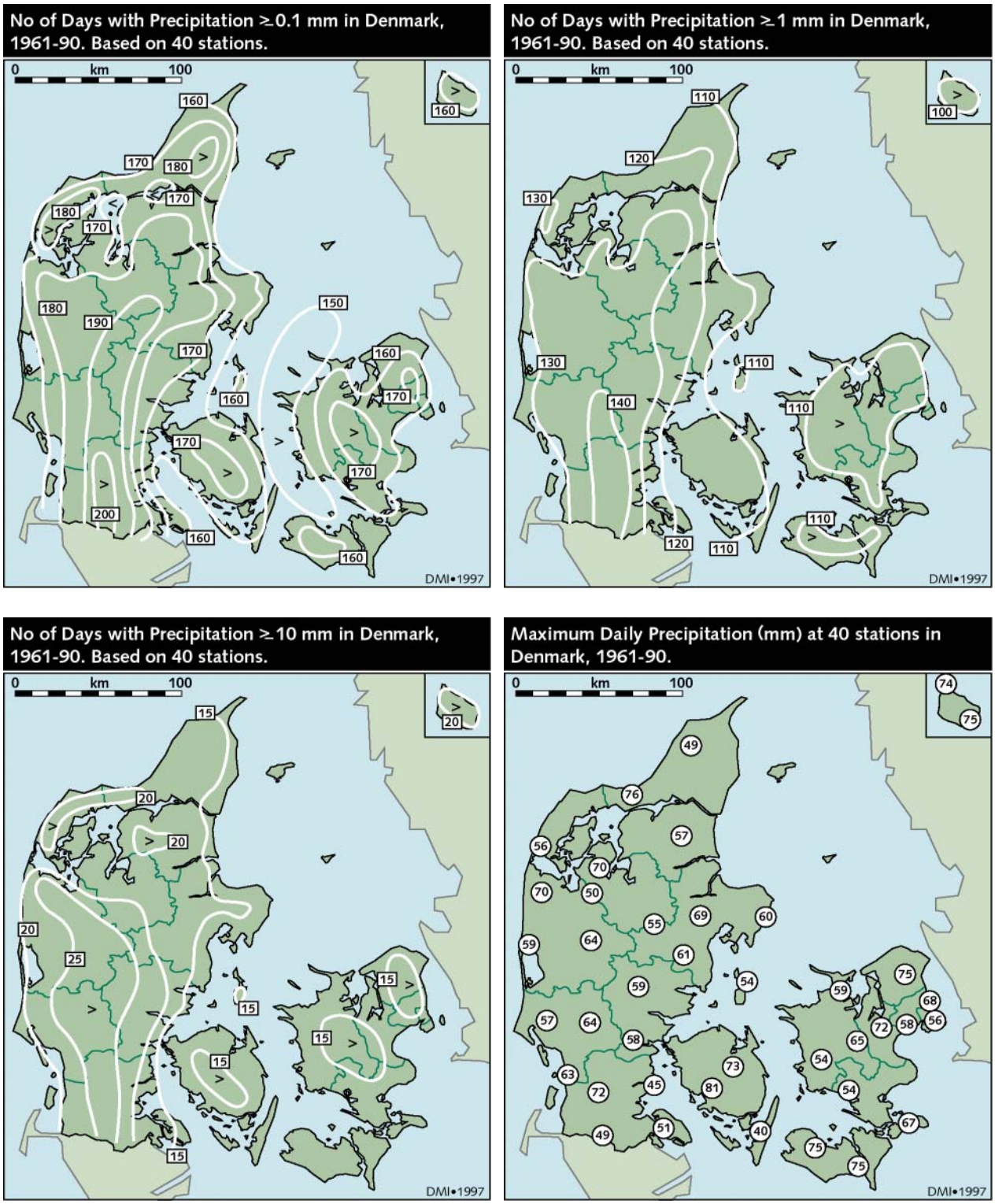

Figure 4. Mean annual number of days with precipitation exceeding 0.1, 1 and 10 mm per day, and maximum daily precipitation in Denmark, 1961-90. Maps are based on data from the 40 stations listed in sections 5.3 through 5.6, and produced by visual interpolation.

5.3 No. of Days with Precipitation ≥ 0.1 mm, Denmark 1961-90

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
20060 Hjørring v/v	17	11	13	11	11	11	11	12	15	17	18	17	**166**
20360 Fjerritslev	18	12	14	11	12	11	11	13	16	17	20	18	**172**
20590 Skørping	17	13	15	13	13	13	14	14	16	17	19	18	**181**
21100 Vestervig	20	15	17	13	12	11	13	14	17	18	20	20	**190**
21180 Øster Lyby	16	11	13	11	11	11	12	13	15	16	17	17	**165**
21430 Grønbæk	20	14	16	13	13	13	14	15	16	17	20	19	**189**
22140 Lyngdal	15	12	13	12	11	11	12	12	13	14	16	15	**156**
22230 Ødum	20	14	16	13	13	11	13	13	15	16	19	18	**182**
22540 Skanderborg	16	12	14	13	13	12	14	14	16	16	18	15	**173**
23180 Tørring	16	12	14	12	12	11	13	14	15	15	17	17	**168**
23320 Harte	18	13	15	13	12	12	14	14	15	16	19	17	**180**
24070 Mogenstrup	18	13	16	13	13	13	14	14	16	18	20	19	**185**
24110 Fruerhøj	18	13	15	12	12	12	13	14	16	17	19	18	**179**
24290 Herning	19	14	16	13	13	13	12	15	19	18	20	19	**187**
24330 Ringkøbing v/v	17	12	14	11	11	10	13	14	16	17	18	17	**170**
25180 Varde	15	11	13	11	11	11	13	14	15	16	18	17	**164**
25220 Hovborg	18	13	16	13	13	13	15	15	17	17	20	19	**189**
25350 Hviding	17	12	15	13	12	12	14	14	17	18	19	18	**181**
26080 Hajstrup	15	11	13	11	11	10	12	13	13	14	17	14	**155**
26190 Toftlund	21	14	17	15	14	13	16	15	18	18	21	20	**203**
26400 Store Jyndevad	19	14	16	15	14	14	16	16	18	19	21	19	**200**
26470 Rønhave	17	12	15	14	13	12	14	14	15	17	19	18	**180**
27070 Langør*	16	13	14	12	12	11	12	13	14	15	17	16	**165**
28280 Årslev	16	13	14	13	13	11	14	12	13	16	18	16	**169**
28390 Håstrup	16	12	14	12	11	10	13	12	13	13	16	16	**158**
28590 Rudkøbing	17	13	15	13	12	12	14	13	14	15	18	17	**172**
29020 Kollekolle	16	13	14	13	12	12	14	13	14	15	17	16	**168**
29210 Allindelille	17	14	16	14	13	13	14	14	15	15	18	17	**178**
29360 Antvorskov	15	11	12	11	11	10	12	12	13	13	15	14	**148**
30170 Ll. Dyrehavegård	16	11	13	12	12	11	13	14	14	14	17	16	**162**
30320 Thinghøj	17	13	15	13	11	11	13	13	14	15	18	17	**170**
30370 The Botanical Garden*	17	13	14	13	13	11	13	13	14	14	17	16	**168**
30390 Torsbro	16	13	13	12	12	11	13	13	14	14	17	16	**162**
30430 Lejre*	15	12	13	12	12	11	13	13	14	14	16	15	**160**
31170 Karrebæksminde	16	13	14	12	12	11	13	13	13	14	17	15	**163**
31270 Stege	16	12	13	13	11	11	13	13	12	13	16	15	**159**
31350 Abed	17	13	14	13	12	12	14	13	14	14	17	17	**170**
31530 Fuglsang	16	12	13	12	10	11	12	12	12	13	16	15	**154**
06193 Hammerodde Lighthouse*	16	13	13	11	10	9	11	10	13	13	17	17	**153**
32210 Elisegård*	18	14	15	12	10	10	11	11	13	14	18	19	**165**
National average	**17**	**13**	**14**	**12**	**12**	**11**	**13**	**13**	**15**	**16**	**18**	**17**	**172**

* Not included in national average.

The highest number of days with precipitation ≥ 0.1 mm occurs in south central Jutland with more than 200 days per year. During all seasons of the year this maximum prevails. The highest frequency of wet days occurs in November. The lowest number of days with precipitation ≥ 0.1 mm occurs along the coasts of Zealand with about 150 days per year. Late spring through early summer is the driest period of the year.

5.4 No. of Days with Precipitation ≥ 1 mm, Denmark 1961-90

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
20060 Hjørring v/v	10	7	9	8	8	8	8	10	11	12	13	10	**114**
20360 Fjerritslev	12	9	10	8	8	8	9	10	12	13	15	13	**126**
20590 Skørping	12	9	10	9	10	9	10	11	12	13	14	13	**131**
21100 Vestervig	13	9	10	8	8	8	8	10	12	14	15	13	**129**
21180 Øster Lyby	12	8	10	9	9	9	10	11	12	13	14	12	**129**
21430 Grønbæk	12	9	11	9	9	9	10	11	11	12	14	13	**128**
22140 Lyngdal	10	7	9	8	8	8	9	9	10	10	11	10	**108**
22230 Ødum	11	8	9	9	9	8	10	9	10	11	13	11	**118**
22540 Skanderborg	10	8	9	9	8	9	10	10	11	11	13	11	**120**
23180 Tørring	13	9	11	9	9	9	10	11	12	12	14	14	**132**
23320 Harte	12	9	10	9	9	9	11	11	12	12	14	12	**130**
24070 Mogenstrup	12	9	10	8	9	9	10	11	13	13	15	13	**130**
24110 Fruerhøj	13	9	11	8	9	9	10	11	13	14	16	14	**137**
24290 Herning	13	9	11	9	9	9	9	11	13	13	15	13	**131**
24330 Ringkøbing v/v	13	9	11	8	8	8	10	11	12	14	15	13	**130**
25180 Varde	13	8	11	9	9	9	11	12	13	13	16	14	**136**
25220 Hovborg	13	9	11	9	9	10	11	11	13	13	15	14	**139**
25350 Hviding	13	8	11	9	8	9	11	11	12	13	15	13	**132**
26080 Hajstrup	12	9	11	9	9	9	10	11	10	11	13	11	**124**
26190 Toftlund	13	9	11	10	10	10	12	12	12	13	16	14	**143**
26400 Store Jyndevad	13	9	11	10	9	10	12	12	12	13	15	13	**141**
26470 Rønhave	12	8	10	9	9	9	11	10	10	11	13	11	**123**
27070 Langør*	10	8	10	9	8	8	9	9	10	10	12	10	**113**
28280 Årslev	11	9	9	8	8	8	9	9	10	10	12	10	**114**
28390 Håstrup	11	8	10	8	8	8	10	9	9	10	12	11	**114**
28590 Rudkøbing	10	8	9	8	8	8	10	9	9	10	12	9	**110**
29020 Kollekolle	10	7	9	8	8	9	10	10	10	9	12	11	**112**
29210 Allindelille	11	8	10	8	8	8	10	9	10	10	12	11	**115**
29360 Antvorskov	11	8	9	8	8	8	10	10	10	10	12	11	**116**
30170 Ll. Dyrehavegård	11	8	9	9	8	8	10	10	11	10	12	11	**116**
30320 Thinghøj	11	8	9	8	8	8	10	10	10	9	12	11	**115**
30370 The Botanical Garden*	10	8	9	9	8	8	9	9	10	9	12	11	**112**
30390 Torsbro	9	8	9	8	8	8	9	10	10	9	11	10	**109**
30430 Lejre*	9	7	9	8	9	8	10	10	10	10	11	10	**111**
31170 Karrebæksminde	10	8	9	8	8	8	9	9	9	9	11	10	**107**
31270 Stege	10	8	9	8	8	9	9	9	9	9	12	11	**109**
31350 Abed	11	9	10	10	9	9	10	9	9	10	12	11	**119**
31530 Fuglsang	11	8	9	8	8	8	9	8	9	9	12	11	**110**
06193 Hammerodde Lighthouse*	10	7	9	7	6	6	7	7	9	9	11	11	**99**
32210 Elisegård*	11	7	9	7	7	6	8	8	9	10	12	12	**106**
National average	**11**	**8**	**10**	**9**	**8**	**9**	**10**	**10**	**11**	**11**	**13**	**12**	**121**

* Not included in national average.

The highest number of days with precipitation ≥ 1 mm occurs in south central Jutland with more than 140 days per year. During all seasons of the year this maximum prevails. The wettest months are November through January. The lowest number of days with precipitation ≥ 1 mm occurs on the island of Bornholm with less than 100 days per year. The driest period of the year occurs from late winter through early summer.

5.5 No. of Days with Precipitation ≥ 10 mm, Denmark 1961-90

Station	Jan	Feb	Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
20060 Hjørring v/v	1	0	1	0	1	2	2	2	2	2	2	1	**16**
20360 Fjerritslev	1	1	1	1	1	2	2	2	3	2	2	2	**21**
20590 Skørping	2	1	1	1	1	2	2	2	2	2	2	2	**19**
21100 Vestervig	1	1	1	1	1	2	2	2	3	3	3	2	**22**
21180 Øster Lyby	1	1	1	1	1	2	2	2	3	2	2	2	**18**
21430 Grønbæk	1	1	1	0	1	1	2	2	2	2	2	2	**16**
22140 Lyngdal	1	0	0	0	1	1	2	2	2	2	1	1	**14**
22230 Ødum	1	1	0	1	1	1	2	2	2	2	1	1	**14**
22540 Skanderborg	1	1	1	0	1	2	2	2	2	2	2	1	**16**
23180 Tørring	2	1	1	1	1	2	2	2	3	3	3	3	**24**
23320 Harte	1	1	1	1	1	2	2	2	3	3	2	2	**21**
24070 Mogenstrup	1	1	1	1	1	2	2	2	2	2	2	2	**19**
24110 Fruerhøj	2	1	1	1	1	2	2	3	3	4	4	3	**26**
24290 Herning	2	1	1	1	1	2	2	2	3	3	3	2	**24**
24330 Ringkøbing v/v	1	1	1	1	1	2	2	2	3	3	3	2	**23**
25180 Varde	2	1	1	1	1	2	2	3	3	4	3	3	**25**
25220 Hovborg	2	1	2	1	2	2	2	2	3	4	4	3	**28**
25350 Hviding	2	1	1	1	1	2	2	2	3	4	3	2	**22**
26080 Hajstrup	1	1	1	1	1	2	2	2	2	2	2	2	**18**
26190 Toftlund	2	1	2	1	2	2	3	3	3	3	3	3	**27**
26400 Store Jyndevad	2	1	1	1	2	2	2	3	3	3	3	2	**24**
26470 Rønhave	1	1	1	1	1	2	2	2	2	2	2	2	**18**
27070 Langør*	2	1	1	1	1	2	2	2	2	2	2	1	**19**
28280 Årslev	1	1	0	1	1	1	1	2	1	2	2	1	**14**
28390 Håstrup	1	1	1	1	1	2	2	2	2	2	2	1	**17**
28590 Rudkøbing	1	0	0	0	1	1	2	1	2	2	2	1	**13**
29020 Kollekolle	1	0	0	1	1	1	2	2	1	1	1	1	**13**
29210 Allindelille	1	0	1	1	1	1	2	1	1	2	2	1	**15**
29360 Antvorskov	1	0	1	1	1	1	2	2	2	2	2	1	**14**
30170 Ll. Dyrehavegård	1	0	1	1	1	2	2	2	2	2	1	2	**16**
30320 Thinghøj	1	0	1	1	1	2	2	2	2	2	2	1	**17**
30370 The Botanical Garden*	2	1	1	2	2	2	2	2	2	2	2	2	**22**
30390 Torsbro	1	0	0	1	1	1	2	2	2	1	1	1	**14**
30430 Lejre*	2	1	1	1	2	2	2	2	2	2	2	2	**21**
31170 Karrebæksminde	1	0	0	1	1	1	2	1	1	1	1	1	**11**
31270 Stege	1	0	0	1	1	1	2	2	1	1	2	1	**12**
31350 Abed	1	1	0	1	1	1	2	2	1	1	2	1	**13**
31530 Fuglsang	1	0	1	1	1	1	2	2	2	1	2	1	**14**
06193 Hammerodde Lighthouse*	1	1	1	2	1	2	2	2	2	2	2	2	**20**
32210 Elisegård*	2	1	1	2	2	2	2	2	2	3	3	2	**24**
National average	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**18**

* Not included in national average.

The highest number of days with precipitation ≥ 10 mm occurs in south central Jutland with more than 25 days per year. The maximum is most pronounced during autumn, with October and November having the highest number of heavy rainfall events. The lowest number of days with precipitation ≥ 10 mm occurs in the coastal areas of eastern Denmark with less than 15 days per year on average.

5.6 Maximum Daily Precipitation (mm), Denmark 1961-90

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
20060 Hjørring v/v	31	19	23	22	49	44	39	41	41	31	39	23	**49**
20360 Fjerritslev	20	28	35	25	58	39	76	45	35	38	28	30	**76**
20590 Skørping	23	40	25	23	36	45	57	43	37	49	38	34	**57**
21100 Vestervig	25	33	28	25	32	44	37	47	56	39	32	33	**56**
21180 Øster Lyby	19	34	33	24	51	36	70	47	34	48	34	27	**70**
21430 Grønbæk	34	40	21	24	47	55	37	49	42	32	29	29	**55**
22140 Lyngdal	20	22	15	30	38	32	43	60	36	31	26	24	**60**
22230 Ødum	24	34	30	25	55	29	49	69	50	34	33	32	**69**
22540 Skanderborg	27	30	35	28	43	35	35	56	61	39	31	33	**61**
23180 Tørring	25	40	28	31	46	39	59	43	44	53	39	29	**59**
23320 Harte	21	35	30	27	33	58	41	45	49	32	30	28	**58**
24070 Mogenstrup	24	33	32	25	40	42	50	49	34	40	33	29	**50**
24110 Fruerhøj	24	38	35	32	29	35	49	70	50	44	34	32	**70**
24290 Herning	22	38	32	27	31	64	52	52	39	37	34	33	**64**
24330 Ringkøbing v/v	24	28	31	19	30	40	53	59	50	37	30	33	**59**
25180 Varde	20	34	27	20	39	40	48	42	57	34	51	41	**57**
25220 Hovborg	23	50	35	26	36	64	58	36	55	38	45	38	**64**
25350 Hviding	28	26	27	25	28	63	36	42	56	39	37	29	**63**
26080 Hajstrup	30	30	27	23	34	38	45	39	30	32	29	31	**45**
26190 Toftlund	37	33	39	37	28	56	72	42	46	36	43	35	**72**
26400 Store Jyndevad	29	25	32	35	31	35	38	45	49	48	33	24	**49**
26470 Rønhave	30	18	24	37	46	37	51	39	47	31	28	27	**51**
27070 Langør	19	33	18	28	37	43	49	54	43	26	31	26	**54**
28280 Årslev	26	29	17	25	49	53	73	57	33	26	37	24	**73**
28390 Håstrup	25	21	16	21	49	49	38	81	43	29	28	27	**81**
28590 Rudkøbing	26	16	20	26	37	33	36	40	39	37	29	22	**40**
29020 Kollekolle	24	30	22	30	41	59	52	51	49	33	18	42	**59**
29210 Allindelille	31	25	23	31	42	65	46	48	39	37	28	28	**65**
29360 Antvorskov	26	17	16	24	47	44	39	45	54	31	23	27	**54**
30170 Ll. Dyrehavegård	27	19	23	30	27	51	47	53	75	24	21	31	**75**
30320 Thinghøj	21	21	19	28	32	38	60	42	68	31	28	41	**68**
30370 The Botanical Garden*	26	18	19	27	27	38	48	36	56	30	28	32	**56**
30390 Torsbro	21	18	19	17	36	58	50	58	44	30	27	27	**58**
30430 Lejre*	22	15	18	20	30	72	50	44	41	25	25	32	**72**
31170 Karrebæksminde	20	12	18	29	39	30	54	50	33	28	23	25	**54**
31270 Stege	29	16	17	16	46	41	56	67	35	33	47	28	**67**
31350 Abed	32	15	17	24	50	36	75	58	41	29	32	23	**75**
31530 Fuglsang	28	14	22	26	43	40	56	75	40	33	49	25	**75**
06193 Hammerodde Lighthouse	24	14	19	21	42	53	55	74	28	40	26	27	**74**
32210 Elisegård	29	15	23	28	38	75	51	41	41	37	36	35	**75**
Maximum 1961-1990	**37**	**50**	**39**	**37**	**58**	**75**	**76**	**81**	**75**	**53**	**51**	**42**	**81**
Maximum 1874-1996	**52**	**62**	**55**	**67**	**77**	**153**	**169**	**151**	**133**	**101**	**62**	**49**	**169**

The maximum daily totals from this subset of stations are in the order of 80 mm per day. The highest maxima occur during summer and early autumn. The coastal areas of eastern Denmark seldom receive more than 50 mm per day. A pronounced winter and spring minimum prevails. It should be noted that this subset of 40 stations and the time period 1961-90 exhibits maxima which in all cases are lower than the national maxima, extracted from observations at several hundred stations over the period 1874-1996.

5.7 Precipitation (mm) by County, Denmark, 1961-90

County	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Nothern Jutland	54	35	44	38	49	54	64	67	72	76	75	62	**689**
Viborg	60	39	48	40	49	56	63	68	78	85	85	70	**743**
Århus	53	36	42	38	46	50	64	61	64	67	69	58	**648**
Vejle	66	45	53	45	53	60	69	69	79	87	91	77	**796**
Ringkøbing	66	43	53	43	51	58	66	75	91	96	98	80	**819**
Ribe	68	43	54	45	50	62	68	80	89	100	102	83	**846**
South Jutland	66	41	52	45	52	62	75	76	80	87	91	74	**800**
Funen	52	36	41	38	46	53	62	61	60	62	69	58	**639**
West Zealand	46	30	38	36	43	49	61	59	56	55	58	54	**584**
East Zealand**	46	30	39	39	42	52	68	64	60	56	61	56	**613**
Storstrøm	46	32	37	39	43	49	63	58	55	49	62	52	**584**
Bornholm*	51	32	40	37	37	42	55	55	63	60	76	62	**609**
Kattegat Region*	43	29	36	35	42	46	54	57	55	53	54	49	**552**
National average	**57**	**38**	**46**	**41**	**48**	**55**	**66**	**67**	**73**	**76**	**79**	**66**	**712**

* not included in national average.
** The Counties of Frederiksborg, Copenhagen and Roskilde.

The wettest county is County of Ribe whereas the driest part of the country is the Kattegat Region, which is traditionally excluded from the national average. November and October are the wettest months of the year in the western part of the country. In the eastern part July and August are the wettest months.

February and April are generally the driest months of the year in all parts of the country. Taking the length of the month into account, April is generally the driest.

The national average can be compared with similar values from the previous standard normal period 1931-60. This has been done in Table 3.

NORMAL	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1961-90	57	38	46	41	48	55	66	67	73	76	79	66	**712**
1931-60	55	39	34	39	38	48	74	81	72	70	60	55	**664**
Ratio	**1.04**	**0.97**	**1.35**	**1.05**	**1.26**	**1.15**	**0.89**	**0.83**	**1.01**	**1.09**	**1.32**	**1.20**	**1.07**

Table 3. National average precipitation (mm) for Denmark 1931-90. Ratios above 1 indicate an increase in observed precipitation from 1931-60 to 1961-90. According to Frich (1990).

The largest increase in precipitation from the previous standard normal period is seen during late autumn through early winter and during spring. The summer months of July and August have been generally drier during the most recent standard normal period.

5.7.1 Precipitation (mm), County of Northern Jutland, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06030	Aalborg Airport	43	28	36	33	44	51	64	60	65	67	60	49	**601**
06041	Skagen Lighthouse	42	30	36	34	45	49	56	64	66	71	70	52	**613**
20030	Uggerby	60	40	44	37	46	51	60	67	76	82	83	67	**713**
20050	Hirtshals Lighthouse	57	39	43	36	41	44	53	69	70	76	76	60	**664**
20060	Hjørring	45	30	37	32	44	52	58	67	74	74	71	54	**638**
20100	Frederikshavn	51	34	40	36	48	50	61	61	68	74	74	60	**658**
20110	Hirsholm Lighthouse	46	29	35	33	42	45	50	59	62	64	62	51	**577**
20140	Kirkholt	58	39	48	41	51	55	66	73	75	82	79	66	**733**
20150	Hellum	62	41	51	44	52	57	70	71	76	86	83	72	**764**
20195	Pandrup	58	38	45	40	50	56	63	65	75	78	79	66	**714**
20210	Tylstrup	49	33	41	36	49	54	63	67	71	73	71	58	**666**
20270	Hals	44	33	38	33	46	46	56	59	60	64	59	53	**592**
20280	Dokkedal	50	32	39	33	48	46	63	64	59	65	62	55	**615**
20300	Klarup	53	34	41	37	48	51	64	63	65	71	69	57	**653**
20320	Sønder Økse	49	32	40	37	48	55	65	67	67	73	71	57	**661**
20350	Hjortdal	55	38	45	37	49	58	68	69	79	82	79	61	**721**
20360	Fjerritslev	62	42	52	41	53	60	66	72	81	86	87	71	**773**
20390	Gøttrup	61	38	49	38	51	56	61	71	79	83	85	70	**740**
20400	Aggersund	52	35	45	39	53	54	65	70	75	82	81	62	**712**
20430	Skarp Salling	62	39	49	40	51	56	66	67	78	80	83	70	**740**
20440	Farstrup	56	38	47	40	51	57	66	67	75	78	78	64	**720**
20470	Støvring Hede	55	39	46	41	52	58	72	71	75	79	78	68	**734**
20480	Veggerby	55	36	45	40	53	59	72	70	75	75	76	63	**718**
20510	Myrhøj	56	34	47	41	55	58	67	69	78	80	82	65	**732**
20540	Års	56	35	44	38	51	59	71	67	72	75	78	63	**710**
20560	Nørager	51	31	43	37	49	55	68	66	71	74	71	60	**676**
20590	Skørping	64	42	52	45	56	54	68	69	73	80	82	70	**755**
20610	Terndrup	54	35	44	40	52	50	69	64	67	72	72	61	**681**
20630	Stenstrupgård	54	36	46	40	52	51	63	64	66	71	70	62	**674**
20670	Havnø	48	31	41	36	45	46	65	63	61	63	63	55	**615**

The highest-lying areas of Vendsyssel and Himmerland are also the wettest parts of the county. At several stations the annual amount of observed precipitation exceeds 750 mm.

The driest part of the county is found along the east coast, with station 20110 Hirsholm Lighthouse receiving less than 600 mm per year.

5.7.2 Precipitation (mm), County of Viborg, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06060	Karup Airbase	60	37	47	41	51	61	65	66	80	84	85	68	**745**
21030	Frøstrup	61	39	48	38	48	54	58	61	73	90	86	66	**721**
21060	Silstrup	70	49	58	45	55	61	64	75	92	109	107	81	**867**
21080	Vorupør	73	46	55	42	45	52	56	75	89	98	101	83	**815**
21090	Lodbjerg Lighthouse	65	42	49	41	48	52	55	76	89	102	98	79	**795**
21100	Vestervig	69	44	54	42	49	53	56	76	88	100	99	81	**812**
21110	Hørdum	63	42	52	39	45	54	58	76	85	98	97	74	**783**
21120	Erslev	61	40	50	40	46	59	62	68	82	95	90	72	**765**
21130	Øster Assels	59	37	51	38	45	60	63	68	80	90	89	71	**751**
21160	Junget	51	31	43	37	50	57	62	65	76	78	76	57	**682**
21170	Oddense	71	43	53	46	53	65	70	71	92	94	102	81	**842**
21180	Øster Lyby	54	34	44	40	49	60	65	70	83	82	82	66	**728**
21200	Søvang	58	35	47	39	49	58	65	67	74	80	79	66	**717**
21220	Løgstrup	56	36	46	38	48	59	64	66	70	74	73	63	**694**
21230	Ulbjerg	60	37	46	39	48	56	65	68	70	77	75	67	**709**
21240	Ålestrup	68	44	56	44	56	55	65	70	78	80	83	73	**774**
21260	Vester Bjerregrav	54	37	45	40	48	53	63	63	69	73	72	63	**679**
21270	Klejtrup	56	37	44	41	47	52	61	63	70	75	73	66	**684**
21280	Tjele	54	35	46	39	50	55	66	67	71	78	74	62	**696**
21310	Stanghede	61	40	49	41	54	59	72	66	78	86	88	73	**766**
21420	Astrup	57	39	45	38	47	56	64	63	71	74	76	65	**696**
21430	Grønbæk	60	41	47	39	49	56	63	65	67	73	77	66	**703**
21440	Tange	50	34	40	37	46	53	63	63	67	70	71	57	**651**

The wettest part of the county is found in Thy, where 21060 Silstrup receives more than 850 mm per year.

The eastern part of Limfjorden is normally the driest, with several stations receiving just under 700 mm per year.

5.7.3 Precipitation (mm), County of Århus, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06070	Tirstrup Airbase	51	34	43	37	45	52	65	63	63	66	67	56	**642**
06071	Fornæs Lighthouse	39	27	35	32	40	43	54	52	53	52	51	44	**523**
22020	Hald	59	41	45	41	48	46	67	61	67	69	74	66	**684**
22030	Svenstrup	53	34	41	39	46	48	65	63	64	68	66	56	**644**
22055	Stevnstrup	47	32	39	35	45	47	63	60	60	65	67	54	**615**
22070	Auning	53	34	42	40	44	50	63	58	58	64	66	58	**630**
22090	Meilgaard	50	32	42	38	45	49	62	57	60	61	64	54	**614**
22140	Lyngdal	41	29	35	35	44	47	61	54	59	60	56	47	**567**
22150	Ebeltoft	50	36	40	37	43	46	60	57	59	57	60	54	**599**
22230	Ødum	50	36	38	37	46	48	67	61	61	65	65	54	**631**
22260	Hammel	60	41	48	40	50	53	67	65	69	70	74	64	**699**
22280	Lading	56	37	42	40	50	50	70	63	70	69	72	60	**681**
22320	Elsted	56	39	43	36	46	51	66	59	62	65	67	59	**647**
22360	Viby J.	57	40	45	38	50	52	67	57	62	66	68	59	**659**
22421	Silkeborg V/V	62	41	46	40	48	52	66	66	68	76	83	72	**719**
22460	Velling Bryrup	73	51	58	47	52	58	74	75	82	88	95	85	**839**
22510	Ry	59	41	46	39	48	58	65	65	75	74	80	66	**714**
22540	Skanderborg	49	34	40	35	45	53	65	61	67	69	72	56	**646**
22600	Hov	49	35	42	40	46	47	60	59	60	58	61	52	**608**

The high-lying westernmost part of the county is also the wettest place, with 22460 Velling Bryrup well above the county average. The underlying series is inhomogeneous, however, (c.f. Appendix 1), owing to a relocation in 1984, so the absolute value is not reliable.

The eastern part of Djursland is normally the driest, with less than 550 mm at 06071 Fornæs Lighthouse.

5.7.4 Precipitation (mm), County of Vejle, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
23030	Hampen	69	48	55	47	58	64	74	73	88	92	99	84	**851**
23050	Nørre Snede	69	49	56	47	54	60	68	71	82	93	98	84	**831**
23090	Hårup	64	43	52	47	55	62	71	69	81	90	97	77	**807**
23095	Løndal	72	49	56	46	54	58	69	72	83	86	98	83	**826**
23100	Vestbirk	67	46	53	44	52	58	67	65	76	82	90	77	**776**
23120	Tvingstrup	57	40	48	38	49	54	65	61	71	74	74	63	**695**
23140	Bygholm	58	42	47	39	48	56	66	58	68	73	77	66	**697**
23180	Tørring	68	49	56	47	52	61	68	72	81	91	94	81	**820**
23220	Give	72	50	58	50	55	68	72	74	90	96	104	89	**877**
23250	Bredsten	70	45	55	46	56	64	72	72	83	93	94	82	**832**
23260	Vejle Grejsdal	71	47	56	45	52	59	67	64	76	87	92	80	**794**
23270	Børkop	63	43	50	42	50	56	70	65	72	78	83	68	**739**
23310	Brakker S	60	42	51	45	52	63	74	69	77	88	89	71	**781**
23320	Harte	58	40	48	45	52	58	71	70	78	86	85	70	**761**
23330	Sønder Stenderup	65	48	54	44	52	56	69	69	76	81	88	77	**781**
23340	Vamdrup	67	45	55	46	55	63	72	75	80	93	97	80	**829**

Several stations in the westernmost part of the county receive more than 850 mm per year, whereas the dry northeastern part is represented by 23120 Tvingstrup and 23140 Bygholm, which both receive less than 700 mm per year.

5.7.5 Precipitation (mm), County of Ringkøbing, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06052	Thyborøn	60	39	43	36	43	45	47	71	85	93	86	74	**721**
24020	Bovbjerg	62	41	49	38	47	48	53	72	84	95	94	76	**758**
24030	Nørmark	58	39	45	40	48	50	57	78	91	101	94	72	**773**
24060	Sevel	64	41	52	41	51	61	70	72	91	92	98	75	**810**
24070	Mogenstrup	60	37	48	40	49	61	66	68	81	83	85	70	**748**
24105	Nørre Felding	72	47	59	45	56	61	66	83	99	104	111	88	**890**
24110	Fruerhøj	71	47	55	46	55	59	68	83	100	107	111	87	**888**
24120	Møborg N.	64	39	50	42	51	57	63	81	96	103	102	78	**825**
24130	Nørre Vosborg	67	42	53	42	52	56	65	82	93	102	102	81	**837**
24140	Staby	63	39	53	42	52	55	67	78	97	105	105	83	**840**
24170	Grønbjerg	69	45	57	45	54	67	73	85	102	108	109	85	**900**
24180	Røddinglund	76	49	60	47	56	63	74	80	99	108	112	92	**916**
24200	Ørre	72	46	58	44	56	65	69	79	89	98	101	84	**861**
24240	Ilskov	62	40	51	44	52	58	69	67	82	86	91	72	**774**
24270	Bodholt	67	46	55	50	55	66	69	77	84	92	95	79	**836**
24290	Herning	69	46	56	43	52	58	72	71	88	90	94	79	**817**
24310	Videbæk	73	51	61	46	53	60	69	76	96	103	105	89	**880**
24320	Velling	60	38	47	38	48	50	63	74	87	93	94	75	**767**
24330	Ringkøbing v/v	66	41	50	38	46	53	64	76	94	99	100	82	**810**
24350	Tipperne	58	36	44	37	46	49	61	69	87	92	93	75	**747**
24380	Borris	67	44	55	44	53	57	69	77	96	99	101	83	**845**
24400	Harreskov	74	50	59	47	55	64	75	82	101	103	106	87	**902**
24470	Brande Power Station	70	49	56	46	55	61	70	73	89	92	98	82	**840**
24500	Påbøl	68	44	54	45	51	62	77	78	98	102	104	85	**869**

The central part of the county exhibits an annual maximum of more than 900 mm on average (stations 24180 Røddinglund and 24400 Harreskov).

Several stations along the west coast observe less than 750 mm per year.

5.7.6 Precipitation (mm), County of Ribe, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06080	Esbjerg Airport	63	42	51	44	49	60	65	78	87	102	101	80	**821**
06089	Sædenstrand Lighthouse	60	41	48	40	47	55	60	72	82	94	88	72	**759**
25030	Grindsted L/s	70	44	57	50	55	64	71	81	101	103	109	91	**894**
25040	Åsted	67	44	56	43	51	61	64	82	96	100	104	86	**855**
25060	Henne Kirkeby	66	42	52	42	46	54	66	80	95	100	105	83	**832**
25110	Blåvand	61	41	49	41	43	49	61	77	86	96	93	77	**773**
25140	Nordby	62	41	50	39	45	53	61	72	85	99	98	79	**783**
25180	Varde	66	43	53	46	52	57	64	85	91	104	104	86	**852**
25190	Karlsgårde	68	44	54	47	50	58	64	81	94	105	105	86	**855**
25200	Agerbæk	72	48	57	48	53	64	72	82	91	102	107	88	**883**
25220	Hovborg	74	51	61	51	55	68	73	81	94	104	110	92	**915**
25250	Slauggård	80	54	68	54	56	71	77	83	97	108	118	97	**964**
25260	Veerst	73	47	58	48	54	67	73	78	85	98	102	87	**868**
25270	Askov	69	43	56	47	55	67	74	82	85	100	101	83	**862**
25300	Stilde	78	51	63	51	55	66	74	84	91	104	112	95	**924**
25320	Bramming	66	39	52	47	50	62	67	79	90	98	106	81	**836**
25330	Tobøl	67	43	53	46	50	66	70	80	88	97	100	82	**841**
25339	Ribe R/A	66	41	51	43	48	62	69	79	83	97	95	77	**812**
25350	Hviding	65	39	50	42	46	61	65	76	84	97	93	73	**790**
25360	Spandet	69	43	55	48	54	74	77	84	89	102	102	82	**879**

The eastern part of the county holds the national station record with 964 mm per year at 25250 Slauggård. The station is extremely well protected but the underlying series is not perfectly homogeneous. Several other stations in the same area receive more than 900 mm per year.

Stations along the west coast receive less than 800 mm on an annual basis.

5.7.7 Precipitation (mm), County of South Jutland, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06110	Skrydstrup Airbase	62	41	50	43	56	67	77	76	84	91	91	73	**811**
06119	Kegnæs Lighthouse	49	30	39	40	46	50	63	59	55	53	63	49	**595**
26020	Rødding	75	48	59	49	53	67	72	83	89	101	104	87	**889**
26050	Oksenvad	72	45	56	47	54	69	77	75	82	95	100	83	**857**
26060	Stepping	67	44	52	45	52	62	77	75	79	92	93	77	**815**
26070	Christiansfeld	76	50	62	51	57	62	78	75	79	94	102	88	**874**
26080	Hajstrup	59	38	46	41	46	53	67	64	65	72	76	64	**692**
26130	Kongsmark	59	37	47	41	43	54	64	71	79	92	91	73	**752**
26140	Brøns	65	40	50	42	50	68	73	82	86	98	93	75	**820**
26170	Arrild	72	44	57	49	56	69	83	85	92	102	103	87	**898**
26190	Toftlund	79	48	62	51	59	71	90	86	92	103	105	91	**936**
26210	Rangstrup	74	46	59	48	55	69	84	84	88	95	99	83	**884**
26240	Åbenrå	76	48	62	50	60	68	78	82	85	96	101	83	**889**
26321	Løgumkloster SV	73	45	57	49	55	68	83	86	89	96	101	82	**885**
26340	Bredebro	70	45	57	45	52	70	77	86	91	102	104	83	**881**
26358	Emmerlev Klev	57	34	45	38	44	54	68	75	81	89	89	68	**741**
26380	Tønder	67	39	52	44	51	67	81	82	89	98	97	74	**840**
26390	Rens	74	44	59	49	57	69	84	84	93	101	102	79	**895**
26400	Store Jyndevad	70	42	57	47	56	67	78	82	89	97	98	77	**859**
26410	Gårdeby	71	43	59	50	56	68	80	85	84	95	101	81	**873**
26420	Bov	75	46	58	49	54	68	85	81	79	94	103	81	**874**
26430	Broager Midtskov	61	38	48	45	52	58	71	69	76	72	84	63	**738**
26440	Gråsten	62	38	50	44	51	57	74	69	76	79	86	66	**752**
26450	Nordborg Lighthouse	52	35	41	39	46	51	60	60	62	64	69	57	**635**
26460	Frederiksgård	54	38	45	41	45	53	68	63	67	65	75	60	**674**
26470	Rønhave	58	38	46	43	50	55	68	65	68	67	78	61	**697**
26480	Sønderborg v/v	53	34	42	43	48	53	67	66	69	64	74	55	**668**

The central part of the county is also the wettest, with more than 900 mm per year observed at 26190 Toftlund.

The driest part of the county is represented by 06119 Kegnæs Lighthouse in the southeastern corner of the county. This lighthouse station was overprotected, however, (shelter D, cf. Appendix 1) at the end of 1990, so the observed provisory normal value is not representative for the area as such.

5.7.8 Precipitation (mm), County of Funen, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06111	Bågø Lighthouse	57	24	31	30	39	44	59	55	47	56	53	46	**542**
06120	Odense Airport	44	32	37	36	45	50	58	58	55	58	60	51	**583**
06139	Keldsnor Lighthouse	42	33	34	37	40	44	55	46	44	41	49	41	**505**
28050	Martofte	47	33	36	36	46	51	56	51	52	52	55	52	**568**
28070	Hofmansgave	44	32	35	34	45	49	56	56	56	55	58	52	**572**
28110	Båring	47	33	39	33	47	51	63	57	60	62	63	55	**611**
28150	Gribsvad	57	39	46	40	50	57	65	70	65	72	76	69	**706**
28160	Sasserod	53	36	45	37	48	53	68	64	62	70	71	62	**669**
28170	Dalum	57	39	44	39	47	55	62	62	64	64	73	64	**670**
28190	Agedrup	51	35	39	37	45	51	56	62	57	57	62	56	**609**
28200	Lundsgård	46	33	38	38	47	53	57	57	55	54	60	51	**590**
28240	Vindinge	64	45	49	46	51	58	64	59	61	64	80	71	**713**
28260	Herrested	56	40	41	43	48	52	63	54	58	65	73	61	**656**
28280	Årslev	49	35	39	37	46	53	61	59	56	61	71	55	**624**
28310	Nørre Broby	58	40	46	39	47	55	62	68	64	70	75	65	**689**
28320	Bellinge	57	38	45	40	51	57	64	65	67	69	76	66	**696**
28340	Frøbjerg	52	35	44	38	50	58	66	69	66	72	71	60	**682**
28360	Assens	53	35	40	37	47	52	63	59	59	66	67	57	**634**
28390	Håstrup	54	36	43	41	46	59	62	64	61	66	69	60	**661**
28400	Korinth	59	43	49	43	49	55	69	71	68	73	79	70	**729**
28420	Egeskov	60	41	46	44	49	54	67	64	66	71	77	68	**708**
28430	Rygård	60	40	46	42	45	51	63	57	61	63	76	67	**672**
28440	Gudbjerg	55	38	43	42	45	51	65	62	64	64	77	64	**672**
28460	Svendborg	56	39	42	42	45	51	65	64	62	64	73	62	**667**
28500	Vindeballe	41	30	34	36	42	48	61	55	54	51	56	44	**552**
28510	Marstal	44	32	37	37	41	47	59	52	52	49	58	46	**554**
28520	Drejø	45	33	37	36	39	44	58	55	52	51	62	49	**561**
28570	Havbølle	44	29	35	34	40	46	60	55	53	48	60	46	**550**
28590	Rudkøbing	44	31	34	34	41	50	58	53	55	55	63	47	**564**
28600	Korsebølle	51	37	39	42	45	49	64	57	59	56	70	56	**624**

The high-lying stations in the central parts of the island receive more than 700 mm per year, whereas the driest stations along the coasts receive less than 550 mm per year.

5.7.9 Precipitation (mm), County of West Zealand, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06151	Omø Lighthouse	43	30	33	33	39	46	60	46	50	46	53	47	**525**
06159	Røsnæs Lighthouse	45	24	32	31	39	39	46	51	39	42	43	41	**473**
29020	Kollekolle	44	28	36	36	43	54	66	62	56	54	57	53	**589**
29040	Holbæk v/v	42	27	34	32	40	50	62	55	53	51	51	50	**547**
29070	Svinninge	52	33	40	37	44	48	66	60	57	60	63	63	**622**
29075	Avdebo PS	44	29	36	35	39	49	59	59	54	55	56	54	**569**
29080	Ingerby	44	28	37	37	42	52	61	65	54	53	56	54	**584**
29090	Sejerby	41	28	36	33	40	43	53	53	49	49	51	48	**525**
29100	Sejerø V	41	27	36	32	38	42	52	55	43	48	47	46	**506**
29162	Rørby	39	26	32	34	41	47	52	57	48	52	53	50	**529**
29170	Gammel Svebølle	46	31	41	38	47	53	69	73	61	64	62	58	**643**
29180	Hallebygård	44	28	39	36	43	52	65	62	57	59	59	56	**601**
29185	Vedde	47	30	40	37	43	52	68	62	60	58	59	59	**615**
29210	Allindelille	52	34	42	38	43	53	66	60	59	59	65	62	**635**
29220	Stavedsbro	48	30	39	40	45	56	67	62	61	59	65	57	**628**
29250	Bregentved	53	37	42	42	47	53	70	65	65	65	70	60	**669**
29260	Haslev	56	37	44	39	47	52	67	62	63	61	71	65	**665**
29270	Alstedgård	47	34	43	39	45	53	63	64	63	62	69	61	**644**
29290	Sorø	54	36	45	40	47	52	68	66	62	64	70	65	**668**
29300	Gudum	44	27	38	32	42	49	61	59	57	54	59	52	**574**
29310	Havrebjerg	47	30	39	36	45	51	59	59	59	56	61	55	**597**
29320	Tjørnelunde Mark	46	29	37	36	42	50	62	62	59	59	60	55	**598**
29330	Gørlev	43	28	38	37	44	49	61	61	57	57	61	53	**589**
29360	Antvorskov	49	32	40	37	47	52	63	62	63	59	62	57	**625**
29400	Korsør	43	29	36	34	43	45	58	53	53	47	53	49	**543**
29410	Krusesminde	38	25	31	31	41	42	54	52	49	44	50	45	**503**
29439	Tystofte II	46	28	35	34	43	48	55	55	54	51	51	51	**551**
29470	Næblerødgård	45	28	39	37	46	50	67	66	61	55	61	54	**610**

The high-lying stations in the southeastern part of the county receive well over 650 mm per year, with maxima observed at 29250 Bregentved and 29290 Sorø.

The northern part of the Great Belt region is traditionally considered the driest part of the country. The station 06159 Røsnæs Lighthouse has an extremely low value of 473 mm per year, but as this station is located on a promontory and heavily exposed to strong winds from all directions, the absolute value of 473 mm should be treated with caution.

5.7.10 Precipitation (mm), The Counties of Frederiksborg, Copenhagen and Roskilde, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06160	Værløse Airbase	43	30	38	36	40	53	68	61	59	53	57	56	**596**
06180	Kastrup Airport	36	24	34	35	40	45	57	55	53	47	52	47	**525**
30010	Nakkehoved Lighthouse	40	25	36	37	38	56	69	63	59	52	59	50	**585**
30019	Hornbæk RA	46	31	42	40	41	57	71	66	61	58	64	56	**634**
30030	Kronborg Lighthouse	42	29	39	37	40	51	71	65	58	54	62	54	**603**
30050	Langstrup	45	29	41	39	43	54	72	70	65	56	67	55	**633**
30070	Gribskov	54	35	47	42	45	58	76	72	69	65	71	64	**697**
30089	Tibirke	46	30	40	39	42	55	72	68	62	58	64	58	**633**
30105	Frederiksværk	41	27	36	36	39	50	63	64	62	55	56	52	**581**
30110	Spodsbjerg Lighthouse	40	28	36	36	40	49	57	59	54	51	55	50	**554**
30122	Kyndby	44	29	37	36	43	52	66	62	55	56	57	56	**591**
30130	Frederikssund	46	28	37	37	43	51	67	67	57	54	58	55	**599**
30140	Gørløse	41	26	37	37	43	52	70	64	59	55	57	52	**593**
30150	Meløse	42	26	39	36	39	53	68	60	57	53	58	54	**585**
30170	Lille Dyrehavegård	47	31	42	41	41	56	71	69	64	58	63	58	**642**
30180	Hillerød SØ	56	37	49	46	45	61	77	71	69	61	68	64	**705**
30190	Rude Skov	56	35	45	44	45	56	79	72	69	63	69	65	**698**
30200	Rungsted Kyst	56	33	45	44	48	52	74	69	67	61	69	65	**684**
30220	Virum	48	29	41	39	46	53	73	62	64	58	67	58	**638**
30230	Store Hareskov	57	36	47	44	47	57	77	65	67	62	69	66	**693**
30240	Søndersø	46	30	39	40	43	55	69	62	62	57	60	56	**619**
30250	Bogøgård	45	29	38	39	43	54	70	63	62	56	60	56	**613**
30290	Marbjerg	39	25	34	36	41	47	65	62	56	52	54	48	**560**
30300	Nybølle	44	28	39	38	43	52	68	65	59	54	58	52	**600**
30310	Islevbro	52	34	43	41	45	55	74	65	63	57	66	60	**656**
30320	Tinghøj	53	33	43	42	45	55	74	61	62	58	65	61	**653**
30330	Fabrikken Øresund	43	27	38	37	39	48	63	54	55	48	54	52	**558**
30370	The Botanical Garden	49	31	41	41	43	51	67	60	59	55	62	57	**616**
30380	Landbohøjskolen (RVAU*)	51	32	42	42	43	54	69	62	61	56	62	59	**633**
30390	Torsbro II	44	28	36	36	42	50	65	66	62	53	58	53	**593**
30410	Roskilde S	45	28	36	36	41	51	65	63	57	52	57	53	**584**
30430	Lejre	42	26	35	33	41	49	62	60	55	52	56	50	**560**
30450	Viby S.	51	34	42	40	44	50	68	62	63	60	65	62	**642**
30470	Regnemark	47	31	41	37	43	50	62	66	63	60	67	60	**627**
30480	Køge Harbour	48	32	39	39	39	47	60	60	58	53	59	54	**588**

* RVAU, The Royal Veterinary and Agricultural University

The wettest part is represented by several forest stations in northeast Zealand receiving nearly 700 mm per year. The coastal stations generally receive less than 600 mm per year.

5.7.11 Precipitation (mm), County of Storstrøm, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06179	Møn Lighthouse	36	25	31	34	40	45	56	52	50	40	52	40	**501**
31010	Gjorslev	47	29	35	37	38	47	62	57	50	50	55	49	**558**
31050	Stevns Lighthouse	40	25	33	35	39	47	57	52	50	48	53	46	**524**
31095	Vivede Overdrev	51	32	39	40	44	47	67	60	56	55	64	57	**611**
31110	Tureby	50	34	41	43	47	54	67	65	62	57	66	59	**646**
31160	Rislev	48	31	40	38	43	50	64	61	59	59	64	57	**614**
31170	Karrebæksminde	42	28	34	34	42	45	57	58	52	48	53	48	**542**
31210	Evensølund	51	35	42	43	45	48	65	61	62	57	68	61	**639**
31230	Vordingborg	47	35	37	40	47	52	61	62	55	49	61	57	**603**
31240	Petersværft	48	34	39	39	44	47	62	63	57	50	64	54	**601**
31260	Holme	45	34	38	39	45	52	60	60	54	49	60	51	**586**
31270	Stege	44	31	36	38	42	45	60	59	51	46	63	51	**566**
31290	Næsgård	44	31	36	38	43	50	62	57	58	45	64	52	**580**
31310	Orehoved	45	31	35	39	43	50	63	59	53	47	60	51	**576**
31340	Askø	42	30	35	38	40	46	62	55	54	45	60	47	**554**
31350	Abed	48	36	40	44	43	50	68	61	57	49	64	53	**614**
31380	Frederiksdal	46	33	36	38	39	46	59	51	54	48	63	52	**565**
31390	Løjtofte	45	30	34	37	41	47	68	57	55	48	60	51	**573**
31410	Stensø	40	28	32	35	41	47	61	54	53	45	58	48	**542**
31420	Græshave	47	35	39	41	44	50	68	56	58	49	66	54	**608**
31440	Maribo Power Station	51	36	40	42	43	50	76	55	59	51	72	58	**633**
31450	Sakskøbing S/F	47	33	37	42	43	52	68	59	57	50	71	57	**615**
31480	Ønslev	49	34	40	43	46	51	69	59	56	50	65	55	**617**
31500	Ulslev	47	33	37	42	48	55	65	56	54	48	59	49	**594**
31520	Nykøbing F. S/F	49	34	37	42	44	50	63	53	56	50	68	54	**599**
31530	Fuglsang	49	34	38	40	44	53	65	55	55	49	68	55	**603**
31540	Ettehave Rode	45	32	34	37	44	50	69	58	60	49	62	49	**587**
31620	Gedser Lighthouse	41	32	35	37	46	53	61	54	49	43	51	45	**548**

The central parts of Zealand (31110 Tureby and 31210 Evensølund) and Lolland (31450 Sakskøbing) receive more than 600 mm per year, as compared to the east coasts of Zealand (31050 Stevns Lighthouse) and Møn (06179 Møn Lighthouse), which receive less than 550 mm per year.

5.7.12 Precipitation (mm), Kattegat Region, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
27010	Vesterø Harbour	52	33	41	37	42	45	55	60	63	67	63	58	**615**
27020	Anholt	48	32	39	38	43	42	58	61	61	67	62	52	**603**
27030	Hesselø	33	25	32	31	37	47	50	56	53	46	51	45	**506**
27040	Tunø	43	30	36	34	41	43	51	54	51	48	48	47	**525**
27050	Issehoved	37	25	32	32	41	42	55	55	55	48	50	42	**513**
27070	Langør	44	29	37	36	42	50	61	59	58	53	55	50	**575**
27080	Tranebjerg	41	29	35	35	42	47	53	57	53	50	51	47	**541**
27090	Brattingsborg	45	31	37	35	45	48	55	57	55	51	57	51	**565**
27100	Vesborg Lighthouse	42	31	36	33	43	46	50	52	47	47	50	47	**524**

The northern islands of Læsø and Anholt receive more than 600 mm per year, as compared with the northern Great Belt region which receives less than 550 mm per year.

5.7.13 Precipitation (mm), County of Bornholm, 1961-90

Stat. No	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
06190	Rønne Airport	40	22	30	32	31	38	46	50	52	47	58	43	**489**
06191	Christiansø Lighthouse	34	22	29	27	29	37	41	42	48	45	52	46	**452**
06193	Hammerodde Lighthouse	45	29	36	34	34	39	50	50	56	51	64	56	**545**
32050	Rø Lynggård	56	32	43	39	38	43	59	59	69	65	82	68	**654**
32070	Gudhjem	48	28	40	37	36	42	53	53	60	58	75	60	**590**
32160	Bastemosehus	58	36	42	42	39	45	60	58	68	72	85	70	**676**
32180	Østermarie	65	41	50	43	41	46	60	60	69	70	90	80	**715**
32190	Brændesgård	52	33	40	38	37	39	52	52	63	60	79	63	**608**
32210	Elisegård	54	32	41	38	39	44	59	55	65	63	80	65	**637**
32240	Åkirkeby	52	33	40	37	36	41	56	55	64	60	77	64	**614**
32280	Rispebjerg	48	29	37	34	36	41	52	51	60	54	68	57	**568**

The central part of Bornholm receives more than 700 mm per year, which is in marked contrast to the isolated station 06191 Christiansø, which gets less than 500 mm per year. Although Bornholm and Christiansø are traditionally excluded from the national average, the extreme minimum at Christiansø (452 mm per year) should qualify it for consideration as the driest spot in Denmark.

6.0 DISCUSSION

A data set (MONTHLY) of monthly precipitation totals from 300 Danish stations has been constructed. The series were carefully selected to provide good spatial coverage over the period 1961-90. All missing values have been interpolated. All series have been homogeneity tested and labelled according to the test results. In many cases, it was possible to confirm detected breaks and trends by using available station history information. Relocations and growing trees were quite often the problem.

Standard normal values and provisory normal values of precipitation for the period 1961-90 have been included in this report as a separate data set (NORMAL). Maps of annual and seasonal totals have been constructed by visual interpolation.

Based on series of daily observations from 40 Danish stations, the number of days with precipitation exceeding 0.1, 1 and 10 mm per day has been calculated for each month and annual maps have been drawn. The maximum daily totals have been extracted for each month and the highest maxima plotted.

The overall pattern of precipitation in Denmark has remained largely unchanged, as compared with the previous standard normal period, fig. 5, although an increase has been observed in the western part of the country. Large areas of central and western Jutland have experienced an increase of 10 to 20 percent in observed precipitation. Similar increases have been observed in southwestern Sweden and western Norway (Førland et al., 1996a). It has been discussed (Frich, 1994) whether this increase, which is confined mainly to the period October to March, is attributable to natural or anthropogenic causes.

Figure 5. Percentage change in annual precipitation from 1931-60 to 1961-90. The map is based on data from about 200 stations and produced by visual interpolation.

One factor which may influence the amount of precipitation observed, is the improvements made with respect to wind shelter around the gauges. Such improvements will reduce the wind speed at gauge orifice level, leading to less deflection of precipitation particles when passing the gauge. Improved shelter can be provided

by growing trees around the gauge or by erecting buildings near the gauge. This effect will lead to improved catch efficiency and be most discernible during autumn and winter, when wind speeds are generally higher. It is presently unknown whether this effect plays the dominant role in the increase observed.

Other factors of some importance in this respect, relate to well known changes in landuse, such as irrigation and forest growth. These factors however remains to be investigated further before any firm conclusions can be made.

It is possible that our climate has changed to a more maritime regime, with larger proportions of observed precipitation coming from advective processes. This would explain the observed increase in the western part of Jutland, which is confined mainly to the winter half. On the other hand, a higher degree of maritime influence would also explain the reduced amount of precipitation during July and August (c.f. Frich, 1990).

It is concluded that the spatial pattern of precipitation in Denmark is quite stable, with an observed maximum in central and southwestern Jutland (> 900 mm per year) and a minimum in the northern Great Belt region (< 500 mm per year). This distribution reflects both the dominant advection of moist air masses from a west-southwesterly direction and the topography of the country. Precipitation falling in the western part of the country is mainly released by frontal lifting of air masses in combination with orographic lifting. Coastal convergence may also contribute to the pattern observed. During the summer season, the whole country, principally the eastern part is also influenced by convective precipitation.

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Appendix 1 Station catalogue

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
6030	Aalborg Airport	57	6	N	9	51	E	3	C	H
6041	Skagen Lighthouse	57	44	N	10	38	E	2	C	H
6052	Thyborøn	56	42	N	8	13	E	2	C	I
6060	Karup Airbase	56	18	N	9	7	E	51	C	T
6070	Tirstrup Airbase	56	18	N	10	37	E	23	C	I
6071	Fornæs Lighthouse	56	27	N	10	58	E	8	B	H
6080	Esbjerg Airport	55	32	N	8	34	E	24	C	I
6089	Sædenstrand Lighthouse	55	30	N	8	24	E	11	B	T
6110	Skrydstrup Airbase	55	14	N	9	16	E	40	C	T
6111	Bågø Lighthouse	55	18	N	9	48	E	2	B	H
6119	Kegnæs Lighthouse	54	51	N	9	59	E	17	D	T
6120	Odense Airport	55	29	N	10	20	E	15	C	H
6139	Keldsnor Lighthouse	54	44	N	10	43	E	9	C	I
6151	Omø Lighthouse	55	10	N	11	8	E	1	B	H
6159	Røsnæs Lighthouse	55	45	N	10	52	E	13	C	H
6160	Værløse Airbase	55	46	N	12	20	E	23	B	I
6179	Møn Lighthouse	54	57	N	12	32	E	13	B	H
6180	Kastrup Airport	55	37	N	12	39	E	4	C	H
6190	Rønne Airport	55	4	N	14	45	E	14	C	H
6191	Christiansø Lighthouse	55	19	N	15	11	E	13	B	H
6193	Hammerodde Lighthouse	55	18	N	14	47	E	11	A	H
20030	Uggerby	57	34	N	10	7	E	4	A	T
20050	Hirtshals Lighthouse	57	35	N	9	57	E	27	C	H
20060	Hjørring	57	26	N	10	1	E	25	A	T
20100	Frederikshavn	57	28	N	10	30	E	10	A	H
20110	Hirsholm Lighthouse	57	29	N	10	38	E	3	B	H
20140	Kirkholt	57	18	N	10	11	E	80	A	H
20150	Hellum	57	16	N	10	13	E	79	A	I
20195	Pandrup	57	13	N	9	39	E	10	B	T
20210	Tylstrup	57	11	N	9	57	E	13	C	I
20270	Hals	57	0	N	10	19	E	2	A	I
20280	Dokkedal	56	56	N	10	16	E	7	A	H
20300	Klarup	57	2	N	10	4	E	2	B	H
20320	Sønder Økse	57	5	N	9	35	E	1	B	H
20350	Hjortdal	57	8	N	9	22	E	37	B	I
20360	Fjerritslev	57	5	N	9	16	E	12	A	H
20390	Gøttrup	57	3	N	9	13	E	7	A	T
20400	Aggersund	57	1	N	9	17	E	8	B	I
20430	Skarp Salling	56	57	N	9	22	E	26	B	H
20440	Farstrup	56	59	N	9	28	E	18	A	H
20470	Støvring Hede	56	55	N	9	50	E	60	B	T
20480	Veggerby	56	54	N	9	38	E	48	B	H
20510	Myrhøj	56	48	N	9	13	E	26	A	H
20540	Års	56	48	N	9	30	E	38	B	T
20560	Nørager	56	41	N	9	39	E	42	B	H
20590	Skørping	56	50	N	9	53	E	62	A	H
20610	Terndrup	56	48	N	10	3	E	24	B	H
20630	Stenstrupgård	56	44	N	9	53	E	79	B	H
20670	Havnø	56	43	N	10	10	E	2	A	H
21030	Frøstrup	57	5	N	9	0	E	15	A	I
21060	Silstrup	56	56	N	8	39	E	41	C	H
21080	Vorupør	56	57	N	8	23	E	19	D	H

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
21090	Lodbjerg Lighthouse	56	49	N	8	16	E	20	A	H
21100	Vestervig	56	46	N	8	19	E	18	A	T
21110	Hørdum	56	50	N	8	29	E	15	B	I
21120	Erslev	56	50	N	8	44	E	26	A	T
21130	Øster Assels	56	42	N	8	42	E	10	A	H
21160	Junget	56	46	N	9	6	E	22	B	H
21170	Oddense	56	39	N	8	56	E	38	A	H
21180	Øster Lyby	56	38	N	9	3	E	28	B	H
21200	Søvang	56	33	N	9	6	E	1	B	H
21220	Løgstrup	56	31	N	9	21	E	46	B	H
21230	Ulbjerg	56	38	N	9	21	E	31	A	H
21240	Ålestrup	56	42	N	9	29	E	27	B	H
21260	Vester Bjerregrav	56	35	N	9	30	E	5	B	H
21270	Klejtrup	56	36	N	9	38	E	10	B	H
21280	Tjele	56	31	N	9	37	E	45	D	H
21310	Stanghede	56	23	N	9	19	E	62	B	I
21420	Astrup	56	17	N	9	30	E	60	B	H
21430	Grønbæk	56	17	N	9	37	E	25	A	H
21440	Tange	56	21	N	9	36	E	13	A	H
22020	Hald	56	33	N	10	7	E	92	B	H
22030	Svenstrup	56	36	N	9	57	E	35	A	I
22055	Stevnstrup	56	26	N	9	58	E	3	B	H
22070	Auning	56	26	N	10	24	E	23	B	H
22090	Meilgaard	56	30	N	10	39	E	21	B	H
22140	Lyngdal	56	21	N	10	49	E	33	A	H
22150	Ebeltoft	56	13	N	10	41	E	4	B	H
22230	Ødum	56	18	N	10	8	E	61	C	T
22260	Hammel	56	16	N	9	53	E	73	B	H
22280	Lading	56	13	N	10	0	E	72	B	H
22320	Elsted	56	15	N	10	14	E	56	B	H
22360	Viby J.	56	7	N	10	11	E	53	A	H
22421	Silkeborg V/V	56	10	N	9	34	E	25	B	I
22460	Velling Bryrup	56	2	N	9	31	E	102	B	I
22510	Ry	56	5	N	9	46	E	32	A	H
22540	Skanderborg	56	3	N	9	55	E	73	B	H
22600	Hov	55	55	N	10	15	E	2	B	T
23030	Hampen	56	2	N	9	21	E	77	A	H
23050	Nørre Snede	55	58	N	9	24	E	119	A	I
23090	Hårup	55	55	N	9	36	E	71	B	I
23095	Løndal	56	3	N	9	35	E	53	A	H
23100	Vestbirk	55	59	N	9	42	E	44	B	H
23120	Tvingstrup	55	55	N	9	56	E	61	A	I
23140	Bygholm	55	52	N	9	47	E	31	A	T
23180	Tørring	55	52	N	9	30	E	68	B	T
23220	Give	55	51	N	9	14	E	82	B	H
23250	Bredsten	55	42	N	9	23	E	77	A	H
23260	Vejle Grejsdal	55	44	N	9	32	E	8	D	I
23270	Børkop	55	38	N	9	38	E	58	B	I
23310	Brakker S	55	35	N	9	24	E	58	C	I
23320	Harte	55	30	N	9	26	E	50	A	H
23330	Sønder Stenderup	55	27	N	9	36	E	20	B	H
23340	Vamdrup	55	26	N	9	17	E	38	B	H
24020	Bovbjerg	56	31	N	8	7	E	41	C	T
24030	Nørmark	56	33	N	8	18	E	25	A	T
24060	Sevel	56	27	N	8	53	E	35	A	T

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
24070	Mogenstrup	56	28	N	8	58	E	11	B	T
24105	Nørre Felding	56	20	N	8	37	E	28	B	T
24110	Fruerhøj	56	27	N	8	25	E	27	D	T
24120	Møborg N.	56	26	N	8	22	E	14	D	H
24130	Nørre Vosborg	56	20	N	8	21	E	7	B	H
24140	Staby	56	16	N	8	15	E	11	B	I
24170	Grønbjerg	56	11	N	8	28	E	36	A	H
24180	Røddinglund	56	13	N	8	42	E	63	B	H
24200	Ørre	56	14	N	8	52	E	31	B	H
24240	Ilskov	56	14	N	9	5	E	51	B	T
24270	Bodholt	56	8	N	9	16	E	78	A	I
24290	Herning	56	9	N	9	0	E	47	A	H
24310	Videbæk	56	5	N	8	37	E	44	B	T
24320	Velling	56	2	N	8	19	E	2	A	T
24330	Ringkøbing v/v	56	6	N	8	15	E	2	B	H
24350	Tipperne	55	54	N	8	13	E	2	C	T
24380	Borris	55	57	N	8	38	E	25	B	T
24400	Harreskov	56	2	N	8	54	E	48	A	T
24470	Brande Power Station	55	58	N	9	7	E	48	B	T
24500	Påbøl	55	49	N	8	45	E	22	A	H
25030	Grindsted L/s	55	46	N	8	55	E	40	B	I
25040	Åsted	55	46	N	8	25	E	23	B	H
25060	Henne Kirkeby	55	44	N	8	14	E	8	B	H
25110	Blåvand	55	33	N	8	7	E	6	B	H
25140	Nordby	55	26	N	8	24	E	5	A	T
25180	Varde	55	38	N	8	29	E	17	B	T
25190	Karlsgårde	55	39	N	8	35	E	6	B	H
25200	Agerbæk	56	36	N	8	49	E	30	B	T
25220	Hovborg	55	36	N	8	57	E	43	B	H
25250	Slauggård	55	39	N	9	6	E	70	A	T
25260	Veerst	55	34	N	9	14	E	57	A	H
25270	Askov	55	28	N	9	7	E	62	B	I
25300	Stilde	55	32	N	8	59	E	47	A	H
25320	Bramming	55	29	N	8	42	E	5	B	H
25330	Tobøl	55	25	N	8	54	E	16	A	H
25339	Ribe R/A	55	20	N	8	45	E	3	C	T
25350	Hviding	55	16	N	8	42	E	8	B	H
25360	Spandet	55	15	N	8	55	E	44	B	I
26020	Rødding	55	22	N	9	3	E	43	B	T
26050	Oksenvad	55	19	N	9	15	E	36	B	H
26060	Stepping	55	21	N	9	22	E	49	B	H
26070	Christiansfeld	55	21	N	9	29	E	13	B	H
26080	Hajstrup	55	15	N	9	40	E	24	B	T
26130	Kongsmark	55	8	N	8	33	E	5	A	I
26140	Brøns	55	12	N	8	45	E	5	B	T
26170	Arrild	55	9	N	8	58	E	32	B	I
26190	Toftlund	55	11	N	9	4	E	52	B	T
26210	Rangstrup	55	9	N	9	12	E	50	B	H
26240	Åbenrå	55	2	N	9	24	E	23	B	I
26321	Løgumkloster SV	55	3	N	8	57	E	11	B	T
26340	Bredebro	55	3	N	8	50	E	6	B	T
26358	Emmerlev Klev	54	59	N	8	40	E	8	B	H
26380	Tønder	54	57	N	8	52	E	2	B	T
26390	Rens	54	53	N	9	5	E	11	A	H
26400	Store Jyndevad	54	54	N	9	8	E	15	B	H

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
26410	Gårdeby	54	54	N	9	15	E	22	A	T
26420	Bov	54	50	N	9	22	E	51	B	T
26430	Broager Midtskov	54	52	N	9	39	E	25	B	T
26440	Gråsten	54	56	N	9	36	E	18	B	H
26450	Nordborg Lighthouse	55	5	N	9	43	E	9	A	H
26460	Frederiksgård	55	0	N	9	57	E	42	B	H
26470	Rønhave	54	57	N	9	46	E	18	C	T
26480	Sønderborg v/v	54	55	N	9	48	E	7	B	H
27010	Vesterø Harbour	57	18	N	10	56	E	7	D	H
27020	Anholt	56	42	N	11	33	E	8	B	I
27030	Hesselø	56	12	N	11	43	E	7	A	I
27040	Tunø	55	57	N	10	27	E	8	A	H
27050	Issehoved	55	59	N	10	34	E	30	B	H
27070	Langør	55	55	N	10	38	E	2	B	T
27080	Tranebjerg	55	51	N	10	36	E	11	B	I
27090	Brattingsborg	55	47	N	10	35	E	6	B	T
27100	Vesborg Lighthouse	55	46	N	10	33	E	18	B	T
28050	Martofte	55	33	N	10	40	E	12	A	H
28070	Hofmansgave	55	32	N	10	29	E	3	B	T
28110	Båring	55	30	N	9	54	E	65	B	I
28150	Gribsvad	55	25	N	10	4	E	77	D	I
28160	Sasserod	55	27	N	10	8	E	53	B	T
28170	Dalum	55	22	N	10	24	E	23	B	I
28190	Agedrup	55	36	N	10	30	E	4	B	I
28200	Lundsgård	55	27	N	10	41	E	21	B	H
28240	Vindinge	55	19	N	10	45	E	14	B	I
28260	Herrested	55	17	N	10	37	E	59	A	I
28280	Årslev	55	19	N	10	26	E	49	C	T
28310	Nørre Broby	55	15	N	10	14	E	24	B	T
28320	Bellinge	55	20	N	10	19	E	27	B	I
28340	Frøbjerg	55	20	N	10	6	E	63	A	I
28360	Assens	55	16	N	9	54	E	2	B	I
28390	Håstrup	55	10	N	10	12	E	63	B	H
28400	Korinth	55	9	N	10	21	E	46	B	I
28420	Egeskov	55	10	N	10	29	E	61	A	H
28430	Rygård	55	12	N	10	44	E	48	A	H
28440	Gudbjerg	55	9	N	10	41	E	71	D	H
28460	Svendborg	55	4	N	10	37	E	38	A	I
28500	Vindeballe	54	53	N	10	21	E	53	B	H
28510	Marstal	54	51	N	10	30	E	15	B	T
28520	Drejø	54	58	N	10	25	E	8	B	H
28570	Havbølle	54	51	N	10	42	E	17	B	H
28590	Rudkøbing	54	57	N	10	43	E	10	A	T
28600	Korsebølle	55	1	N	10	51	E	11	B	T
29020	Kollekolle	55	52	N	11	36	E	30	B	H
29040	Holbæk v/v	55	42	N	11	43	E	19	B	H
29070	Svinninge	55	43	N	11	27	E	8	B	H
29075	Avdebo PS	55	46	N	11	38	E	1	B	I
29080	Ingerby	55	48	N	11	28	E	-2	B	I
29090	Sejerby	55	53	N	11	9	E	9	B	H
29100	Sejerø V	55	55	N	11	5	E	3	A	I
29162	Rørby	55	39	N	11	10	E	20	D	T
29170	Gammel Svebølle	55	38	N	11	19	E	21	B	T
29180	Hallebygård	55	36	N	11	19	E	5	B	H
29185	Vedde	55	32	N	11	33	E	40	B	H

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
29210	Allindelille	55	32	N	11	46	E	53	C	H
29220	Stavedsbro	55	29	N	11	50	E	27	B	H
29250	Bregentved	55	18	N	12	0	E	56	B	T
29260	Haslev	55	19	N	11	59	E	56	A	I
29270	Alstedgård	55	24	N	11	40	E	47	B	T
29290	Sorø	55	27	N	11	34	E	45	B	H
29300	Gudum	55	26	N	11	23	E	26	B	I
29310	Havrebjerg	55	27	N	11	18	E	23	B	H
29320	Tjørnelunde Mark	55	31	N	11	22	E	43	A	H
29330	Gørlev	55	32	N	11	14	E	11	B	H
29360	Antvorskov	55	23	N	11	22	E	55	B	H
29400	Korsør	55	19	N	11	9	E	4	B	H
29410	Krusesminde	55	21	N	11	7	E	5	B	H
29439	Tystofte II	55	15	N	11	20	E	12	C	H
29470	Næblerødgård	55	20	N	11	32	E	45	A	T
30010	Nakkehoved Lighthouse	56	7	N	12	21	E	37	B	I
30019	Hornbæk RA	56	6	N	12	28	E	4	B	H
30030	Kronborg Lighthouse	56	2	N	12	38	E	3	B	H
30050	Langstrup	55	58	N	12	30	E	23	B	H
30070	Gribskov	56	1	N	12	19	E	47	B	H
30089	Tibirke	56	2	N	12	6	E	10	B	T
30105	Frederiksværk	55	58	N	12	2	E	35	B	T
30110	Spodsbjerg Lighthouse	55	59	N	11	51	E	34	B	H
30122	Kyndby	55	48	N	11	55	E	30	A	H
30130	Frederikssund	55	51	N	12	3	E	2	B	H
30140	Gørløse	55	52	N	12	12	E	20	B	T
30150	Meløse	55	56	N	12	9	E	11	B	T
30170	Ll. Dyrehavegård	55	56	N	12	18	E	36	B	H
30180	Hillerød SØ	55	56	N	12	20	E	63	A	I
30190	Rude Skov	55	51	N	12	27	E	47	B	H
30200	Rungsted Kyst	55	54	N	12	32	E	5	A	I
30220	Virum	55	47	N	12	30	E	31	B	I
30230	Store Hareskov	55	46	N	12	26	E	48	A	H
30240	Søndersø	55	46	N	12	21	E	15	B	H
30250	Bogøgård	55	47	N	12	18	E	8	A	H
30290	Marbjerg	55	40	N	12	8	E	18	B	H
30300	Nybølle	55	42	N	12	16	E	13	B	T
30310	Islevbro	55	42	N	12	27	E	10	A	T
30320	Tinghøj	55	44	N	12	30	E	48	B	H
30330	Fabrikken Øresund	55	42	N	12	35	E	3	A	H
30370	The Botanical Garden	55	41	N	12	35	E	6	B	H
30380	Landbohøjskolen (RVAU*)	55	41	N	12	32	E	9	B	T
30390	Torsbro II	55	37	N	12	16	E	16	C	H
30410	Roskilde S	55	37	N	12	3	E	41	B	H
30430	Lejre	55	37	N	11	58	E	10	B	H
30450	Viby S.	55	34	N	12	1	E	36	B	I
30470	Regnemark	55	28	N	12	0	E	26	B	H
30480	Køge Harbour	55	27	N	12	11	E	1	B	I
31010	Gjorslev	55	21	N	12	23	E	22	B	H
31050	Stevns Lighthouse	55	17	N	12	27	E	40	A	H
31095	Vivede Overdrev	55	16	N	12	11	E	20	B	T

* RVAU, The Royal Veterinary and Agricultural University

Stat. No	Station	Lat_Deg	Lat_Min	N_S	Lon_Deg	Lon_Min	E_W	Elev_M	Shelter	Quality
31110	Tureby	55	22	N	12	3	E	34	A	T
31160	Rislev	55	17	N	11	45	E	9	A	H
31170	Karrebæksminde	55	11	N	11	39	E	1	B	T
31210	Evensølund	55	8	N	12	1	E	17	C	H
31230	Vordingborg	55	1	N	11	54	E	12	A	H
31240	Petersværft	54	58	N	12	5	E	3	B	H
31260	Holme	55	0	N	12	27	E	2	D	H
31270	Stege	54	59	N	12	17	E	2	B	H
31290	Næsgård	54	52	N	12	7	E	15	B	H
31310	Orehoved	54	57	N	11	52	E	3	A	T
31340	Askø	54	54	N	11	30	E	3	B	H
31350	Abed	54	50	N	11	20	E	8	B	T
31380	Frederiksdal	54	54	N	11	3	E	4	B	H
31390	Løjtofte	54	53	N	11	11	E	9	B	I
31410	Stensø	54	49	N	11	7	E	3	B	H
31420	Græshave	54	46	N	11	13	E	2	B	T
31440	Maribo Power Station	54	47	N	11	30	E	10	B	I
31450	Sakskøbing S/F	54	48	N	11	39	E	3	B	H
31480	Ønslev	54	51	N	11	50	E	5	B	H
31500	Ulslev	54	44	N	12	0	E	6	B	H
31520	Nykøbing F. SF	54	46	N	11	52	E	2	B	H
31530	Fuglsang	54	43	N	11	48	E	4	B	T
31540	Ettehave Rode	54	45	N	11	38	E	15	B	T
31620	Gedser Lighthouse	54	34	N	11	58	E	8	B	T
32050	Rø Lynggård	55	13	N	14	52	E	96	A	H
32070	Gudhjem	55	12	N	14	58	E	70	A	H
32160	Bastemosehus	55	8	N	14	56	E	113	B	H
32180	Østermarie	55	8	N	15	1	E	103	B	H
32190	Brændesgård	55	8	N	15	7	E	40	B	H
32210	Elisegård	55	4	N	15	5	E	43	B	H
32240	Åkirkeby	55	4	N	14	54	E	70	B	H
32280	Rispebjerg	55	1	N	15	1	E	17	B	H

Appendix 2 Contents of 3.5" HD disk

Introduction

This 3.5" HD disk contains 4 files in fixed ASCII format and one file in Microsoft Word format (**README.DOC**). Data from this 3.5" HD disk may only be used with proper reference to the accompanying report (Frich, P., Rosenørn, S., Madsen, H. & Jensen, J.J., 1997: Observed Precipitation in Denmark, 1961-90. DMI Technical Report 97-8).

Station File

The station catalogue (**STATION.DAT**) describes the number, name, position, elevation and quality of 300 Danish stations at the end of 1990. Each record of the file contains information about one station. The file is sorted by station number and has the following layout:

Position	Format	Description
1-5	I5	Station number
6-8	A3	Country code (always DK)
9-28	A20	Name of station at the end of 1990
29-30	I2	Latitude (degrees)
31-32	I2	Latitude (minutes)
33-33	A1	Northern (N) or Southern (S) hemisphere
34-36	I3	Longitude (degrees)
37-38	I2	Longitude (minutes)
39-39	A1	East (E) or West (W) of Greenwich
40-43	I4	Elevation above mean sea level in metres
44-44	A1	Quality of shelter (A = best, D = worst, cf. Table 1 in report)
45-45	A1	Quality of time series (c.f. Section 5, Results and description below)

Quality code	Description
H	Homogeneous, rigorously tested and possibly adjusted
T	Tested, possibly adjusted but not perfectly homogeneous
I	Inhomogeneous series which is presently unadjustable

Appendix 2 Contents of 3.5" HD disk (continued)

Normal File

Normal values for the standard normal period 1961-90 are contained in one file (**NORMAL.DAT**). The file contains normal values from 300 Danish stations, described in the Station Catalogue. The file is sorted by station number. Each record of the file contains monthly and annual values from one station in the following format:

Position	Format	Description
1-5	I5	Station number (see Appendix 1, Station Catalogue)
6-12	I6	Period (always 1961-90)
13-17	I5	January normal value (mm)
18-22	I5	February normal value (mm)
23-27	I5	March normal value (mm)
28-32	I5	April normal value (mm)
33-37	I5	May normal value (mm)
38-42	I5	June normal value (mm)
43-47	I5	July normal value (mm)
48-52	I5	August normal value (mm)
53-57	I5	September normal value (mm)
58-62	I5	October normal value (mm)
63-67	I5	November normal value (mm)
68-72	I5	December normal value (mm)
73-77	I5	Annual normal value (mm)

Appendix 2 Contents of 3.5" HD disk (continued)

Monthly File

Time series for the standard normal period 1961-90 are contained in one file (**MONTHLY.DAT**). The file contains monthly values from 300 Danish stations, described in the Station Catalogue. The file is sorted by county, station number and year. Each record of the file contains monthly values from one station and year in the following format:

Position	Format	Description	
1-5	I5	Station number (see Appendix 1, Station Catalogue)	
6-8	I3	Element number (always 601, cf. Frich et al. 1996)	
9-12	I4	Year	
13-17	I5	January value	(0.1 mm)
18-22	I5	February value	(0.1 mm)
23-27	I5	March value	(0.1 mm)
28-32	I5	April value	(0.1 mm)
33-37	I5	May value	(0.1 mm)
38-42	I5	June value	(0.1 mm)
43-47	I5	July value	(0.1 mm)
48-52	I5	August value	(0.1 mm)
53-57	I5	September value	(0.1 mm)
58-62	I5	October value	(0.1 mm)
63-67	I5	November value	(0.1 mm)
68-72	I5	December value	(0.1 mm)
73-75	A3	County code	(first 3 letters in County name)